Stockholm Convention
on Persistent Organic Pollutants (POPs)

Swiss National Implementation Plan

To be submitted to the Conference of the Parties to the Stockholm Convention

First Edition
Berne, April 2006

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Foreword

Switzerland was one of some ninety countries that signed the POPs (persistent organic pollutants) Convention in Stockholm on 22 May 2001. The Swiss parliament subsequently discussed its ratification, and the second chamber agreed to it in the summer session of 2003. In July of the same year Switzerland deposited its letter of ratification, and on 17 May 2004 the Convention came into force.

Article 7 of the Stockholm POPs Convention obliges the Parties to draw up National Implementation Plans (NIPs) addressing the country's future compliance with the Convention's requirements. The individual countries' NIPs have to be submitted to the Conference of the Parties (COP) within two years of the date on which the Convention entered into force in their country.

Thus, the Swiss NIP has to be ready by 17 May 2006, which is why the present document has been prepared. It was begun in 2002 with the help of a consultant and under the guidance of the Swiss Federal Office for the Environment (FOEN). There, the Substances, Soil and Biotechnology Division was place in charge and given the responsibility of involving the other federal offices and agencies concerned as well as interested non-governmental organisations and, if applicable, the Cantons.

If a document addressing environmental and general developments of public interest is prepared in the course of several years, its contents risk being continuously overtaken by more recent events, findings, or statistics. This became manifest in the course of the hearings and discussions accompanying the revision of the present NIP. Thus, changes were as far as possible taken into consideration up to August 2005. In particular, the new Swiss Federal Act on Chemicals, which came into force on 1 August 2005, and its related ordinances had an impact on the assessments presented, as well as the actions planned. This new legislation fundamentally reorganises Switzerland's approach to chemical risk management. On the one hand, it addresses some of the few remaining issues relating to POPs, and on the other, it is defines a new priority, namely the integration and implementation of a large number of new definitions, rules, and procedures.

The present final version of Switzerland's NIP was accepted after hearings and reviews involving the agencies and organisations cited in the annex.

It is with pleasure and with sincere gratitude to those who prepared the document that I endorse the present plan. This plan is certainly is one of the most important elements of Switzerland's full compliance with the Stockholm POP's Convention, and it represents a small, but still significant contribution to the general Swiss efforts to protect our global environment.

Berne, 26 April 2006

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Acronyms and Abbreviations

2,3,7,8 TCDD	2,3,7,8-tetrachloro-dibenzodioxin
ADI	Acceptable daily intake
BAT	Best available technology
BEP	Best environmental practice
CAS	Chemical abstracts system
ChemO	Ordinance on Chemicals
ChemPICO	PIC Ordinance
COP	Conference of the Parties (to the SC)
CSO	Contaminated Sites Ordinance
DDT	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
DEA	Department of Economic Affairs
Dept.	Department
DETEC	Department of the Environment, Transport, Energy and Communications
DHA	Department of Home Affairs
EAWAG	Engl.: Swiss Federal Institute for Aquatic Science and Technology
EF	Equivalence factor
EG	(engl. EC) European Community
EMDET	Emission details (a FOEN-internal file)
EMPA	Engl.: Swiss Federal Laboratories for Materials Testing and Research
EU	European Union
EWG	(engl. EEC) European Economic Community
FA	Federal Act
FAO	Food and Agriculture Organisation (of the UN)
fg	Femtogram
FOAG	Federal Office for Agriculture
FOEN	Federal Office for the Environment (until 2005: Swiss Agency for the Environment, Forests and Landscape (SAEFL))
FOPH	Federal Office of Public Health
FVO	Federal Veterinary Office
GDP	Gross domestic product
GEF	Global Environment Facility
GNP	Gross national product
HCB	Hexachlorobenzene
HPLC/MS	High performance liquid chromatography / mass spectrometry
INC	Intergovernmental Negotiation Committee
IOMC	Inter-organisation program for the sound management of chemicals
I-TEQ	International toxicity equivalent
LEA	Engl.: Air emissions from combustion of waste
EPA	Federal Act on the Protection of the Environment
MAK	Engl.: Occupational exposure limit, OEL
MAO	Ordinance on Protection against Major Accidents
MSDS	Material safety data sheet
NABEL	National Air Pollution Monitoring Network
NABO	National Soil Monitoring Network
NADUF	National River Monitoring and Survey Programme
NAQUA	National Groundwater Quality Monitoring Network
NCC	National Coordinating Committee
ng	Nanogram
NGO	Non-governmental organisation

NIP	National Implementation Plan
NPC	National Project Coordinator
OAPC	Ordinance on Air Pollution Control
OBP	Ordinance on Biocide Products
OCRC	Ordinance on the Charge for the Remediation of Contaminated Sites
OECD	Organization for Economic Co-operation and Development
OEL	Occupational exposure limit
OHS	Ordinance on Hazardous Substances (no longer in force)
OMW	Ordinance on Movements of Waste
OPPP	Ordinance on Plant Protection Products
Ord.	Ordinance
ORDEA	Ordinance on the Return, the Taking back and the Disposal of Electrical and Electronic Appliances
ORRChem	Ordinance on Risk Reduction related to Chemical Products
PARCHEM	*Projekt Ausführungsrecht Chemikaliengesetz* = project enacting legislation regarding the law on chemicals
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-dioxin
PCDF	Polychlorinated dibenzo-furan
PET	Polyethylene-terphthalate
pg	Picogram
PIC	Prior informed consent
POPs	Persistent organic pollutants
PRTR	Pollutants Release and Transfer Register
PTS	Persistent toxic substances
R+D	Research and development
REACH	Registration, Evaluation and Authorisation of Chemicals (proposed new system for the chemicals legislation in the EC)
SC	Stockholm Convention
SDC	Swiss Agency for Development and Cooperation
seco (SECO)	State Secretariat for Economic Affairs
SR	Systematic register (regarding federal legislation)
SSCI	Swiss Society of Chemical Industries
Subst.	Substance
SUVA	Swiss National Accident Insurance Fund
TCDD	See: 2,3,7,8 TCDD
TEF	Toxicity equivalence factor
TEQ	Toxicity equivalent
TOC	Total organic carbon
TOW	Technical Ordinance on Waste
UN ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNITAR	United Nations Institute for Training and Research
WHO	World Health Organisation
WPO	Water Protection Ordinance

Executive Summary

I Scope of the Present National Implementation Plan (NIP)

It is within the scope of the present plan to ensure

- that Switzerland is and remains in compliance with the stringent obligations of the Stockholm Convention (SC) [1] on Persistent Organic Pollutants (POPs) and
- that it follows the SC's recommendations wherever possible and reasonable.

One of these stringent obligations is the preparation and timely submission to the Conference of the Parties (COP) to the SC of a so-called National Implementation Plan (NIP). Art. 7 of the SC states the clear expectations that

- the stakeholders be consulted in the preparation of the NIP and
- the NIP is integrated in the national sustainable development strategy.

Switzerland's compliance with these expectations is addressed in the subsequent chapters of this executive summary as well as, for example, chapter 1.2 of the present document.

A final point of importance in view of the scope of this NIP is addressed by the following quotation from the dispatch on the SC to the Swiss parliament [2]:

"For Switzerland the main point is not the resolution of internal problems, but rather the consequent continuation of its foreign policy commitment to generally sustainable development and the resolution of environmental problems."

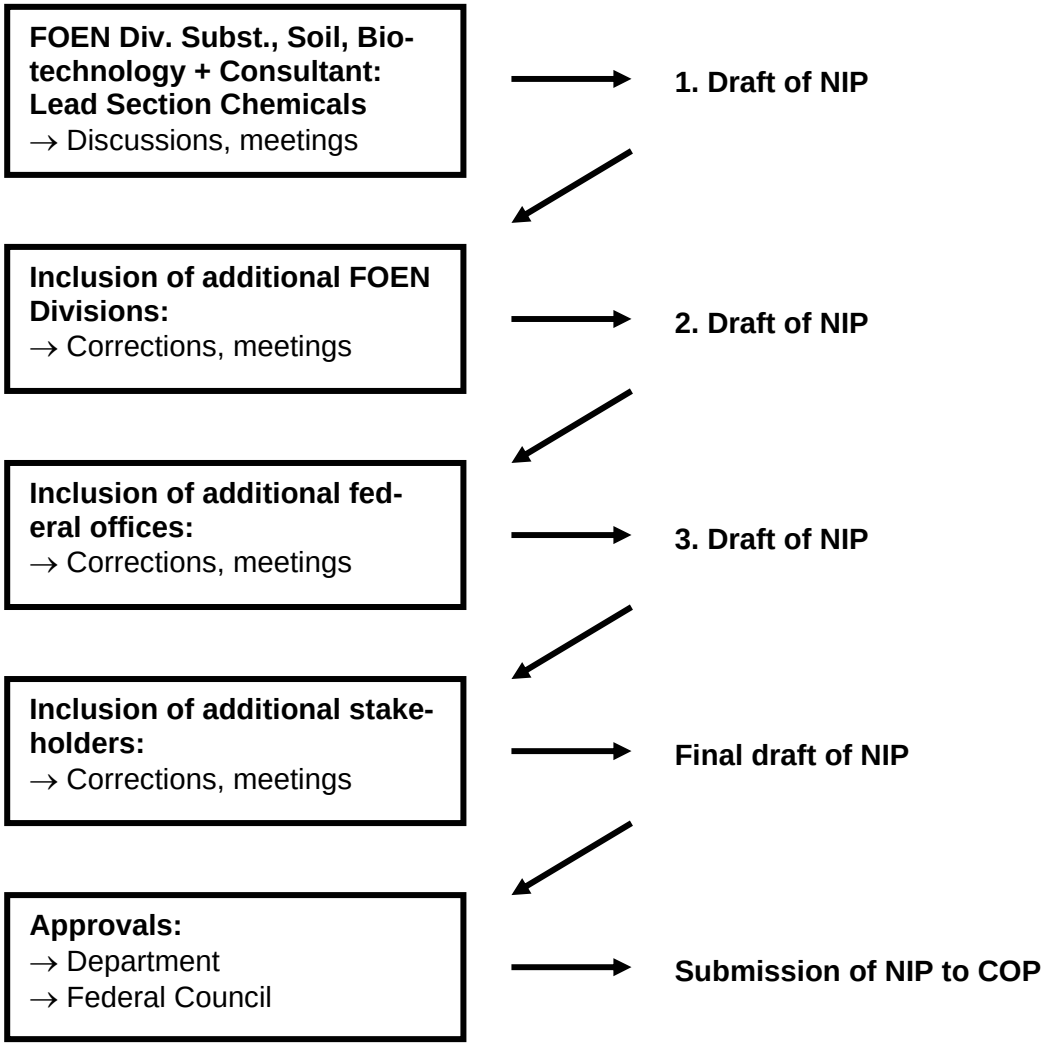
On this basis Switzerland ratified the SC in July 2003 and consequently has to **submit its NIP to the COP by 17 May 2006**.

II Methodology of the Swiss Approach to the NIP

A stringent obligation of the SC relates to the identification of a **National Focal Point** in charge of the exchange of information connected with the convention (SC Art. 9). In Switzerland, this role is assumed by the head of the Substances, Soil and Biotechnology Division of the Swiss Federal Office for the Environment (FOEN). This was one of the reasons for entrusting this FOEN Division with taking the lead in the preparation of Switzerland's NIP.

Consequently, the Substances, Soil and Biotechnology Division of FOEN became the **Lead Agency** and its head also assumed the role of **National Project Coordinator (NPC)**, using the terminology of the "Guidance for developing a National Implementation Plan for the Stockholm Convention" edited by UNEP Chemicals [3]. The NPC then entrusted the Head of the Industrial Chemicals Section within his Division with the formation of the **National Coordination Committee (NCC)** and allowed for the hiring of a consultant and a gradual expansion of the NCC. This latter point reflects the procedure normally applied in developing, for example, new federal legislation.

The following diagram illustrates the essentials of the chosen procedure for preparing the Swiss NIP:



III Structure of the Swiss NIP

Though the following chapters will show that the importance of different aspects of the SC differs significantly when considering the Swiss situation, it was decided to adhere as closely as possible to the "Guidance for developing a National Implementation Plan for the Stockholm Convention" edited by UNEP Chemicals [3]. This decision was taken in view of the comparability of the NIPs to be submitted to the COP and in view of the comprehensiveness of the present plan.

IV Summarising the Current Situation and Key Action Items to be Addressed

Overview

All the aspects of the SC have already been addressed by Switzerland, and all of the SC's stringent obligations have in essence been met. Therefore, the focus of the Swiss NIP and of this chapter IV may be described as follows:

- Building on the establishment of a POPs inventory.
- Fostering and ensuring continuity of awareness of the POPs issue.
- Completing the elimination from products and equipment in use of POPs or POPs-containing materials according to Annex A of the SC.
- Contributing to the mitigation of the use and worldwide distribution of POPs according to Annex B of the SC.
- Perfecting the suppression of the unintentional production of POPs according to Annex C of the SC.
- Enhancing the transparency of the measures taken or to be taken, respectively.
- Corroborating the efficacy of these measures.
- Ensuring sustainability of the POPs-related measures taken and to be taken, respectively.

Building on the establishment of a POPs inventory

A very significant part, chapter 2.3, of the present NIP is dedicated to the establishment of a POPs inventory. It contains many figures. Nevertheless, this executive summary will in essence characterise the inventory in qualitative statements and with very few figures – particularly because of the significant uncertainties encountered:

- There is a certain low level of countrywide diffuse POPs pesticide and PCB pollution.
- There are no POPs stockpiles or hotspots, but there are some contaminated sites which might contain minor amounts of (diluted) POPs.
- There are still some smaller pieces of equipment in use that contain PCBs.
- PCBs are in addition contained in some older joint sealants and paints.
- The total annual release into air of PCDDs/PCDFs is below 100 g I-TEQs.
- The total annual generation of solid PCDDs/PCDFs that are disposed off in a professional and environmentally friendly manner is probably somewhat larger than the amount emitted into air.
- The complete pool of anthropogenic PCDDs/PCDFs in the upper soil and sediments is roughly estimated to be between 3 and 6 kg I-TEQs.

Fostering and ensuring continuity of the awareness of the POPs issue

Four events in particular contributed to the significant public awareness the POPs issue received in Switzerland from the 1970's to 1990's:

- the Seveso accident in a newly acquired subsidiary of a Swiss company (1976),
- the odyssey across Europe of the barrels with the remnants from the Seveso reactor (early 1980's),

- the enactment of the Ordinance on Hazardous Substances (OHS) in 1986 and the resulting understanding of the risks presented by persistent pesticides, and
- the replacement and environment-friendly disposal of the coolant of all the large PCB-containing transformers and of a large percentage of the related capacitors (1980's to 1990's).

Today, it has to be said that these early events are no longer uppermost in the minds of the public, even though Switzerland's ratification of the SC received reasonable press coverage, which again highlighted the issues. It is certainly fair to say that the public awareness of the POPs issue has to be reactivated. Thereby a particular **focus** has to be

- on the role of the service sector, which contributes approximately 65% of Switzerland's GNP and on the role of the private sector (e.g. the illegal burning of waste in chimneys),
- on the need to still improve the BAT- (best available technology) and BEP- (best environmental practice) approaches at an industrial level (e.g. in waste incineration plants), and
- on the global dimension of the POPs issue and on Switzerland's political will to contribute to the solving of related problems in developing countries.

Completing the elimination of POPs or POPs-containing materials from products and equipment in use according to Annex A of the SC

Here, the main issue relates to Annex A, Part II, i.e. pieces of equipment still in use that contain smaller amounts of PCBs (< 1 kg) or diluted PCBs. It is estimated that the related figure still reaches an order of magnitude of a few thousand (cf. chapter 2.3.2). Thus, the recognition of the relevant pieces of equipment and their disposal requires **particular attention** and continuous efforts by the authorities concerned as well as the continuation of their collaboration with the organisations collecting used electrical and electronic equipment.

Contributing to the mitigation of the use and worldwide distribution of POPs according to Annex B of the SC

It can with a high degree of certainty be said that POPs pesticides/insecticides according to Annex B of the SC are no longer used in Switzerland (cf. chapter 2.3.3). This holds for households as well as agriculture. In addition, the Swiss chemical industry has long since discontinued its production and distribution of corresponding POPs (particularly DDT). Therefore, the **focus** has in this respect to be

- on stimulating further research into the underlying properties (persistence and toxicity) which created the POPs issue and
- on promoting the development of internationally applicable sustainable and environmentally-friendly alternatives.

Perfecting the suppression of the unintentional production of POPs according to Annex C of the SC

Art. 5 of the SC defines what is essentially an open-ended target. Therefore, there is room for improvement even though Switzerland may be regarded as advanced in terms of suppressing the formation and emission of PCDDs and PCDFs, i.e. in spite of the fact that BAT and BEP requirements have already been met in many instances and that completely outdated technologies are no longer in use (cf. chapter 2.3.4).

In this situation the logical **approach** to compliance with the SC consists in

- establishing the priority of the remaining issues,
- drawing up a corresponding priority list of measures, and
- implementing these measures.

This sounds straightforward, and the key measures have obviously to involve waste management in the first place – with the inclusion of the above-mentioned illegal burning in chimneys and the like. But the following subchapters as well as the chapter 2.3.5 show that the this approach still presents considerable challenges.

Enhancing the transparency of the measures taken or to be taken

This subchapter addresses one of the characteristics of modern civilizations, i.e. their complexity, and one of the specifics of the Swiss federal democracy, i.e. its delegation of authority from the Confederation to the Cantons and from the Cantons to the communes. Taken together, this results in some uncertainty regarding the currently implemented technological state-of-the-art and the nationwide level of compliance.

The above-mentioned uncertainty has been a problem when having to report details at federal level on the basis of an international convention. In addition, there were significant restrictions in the Confederation's legal means of controlling the Cantons' implementation of federal acts, ordinances, or guidelines.

Fortunately, this is a more theoretical than practical concern, which is also abating, because

- the Confederation's far-reaching power to issue guidelines has to some extent always implied a right of control,
- in addition, the Confederation's right of control and/or the Cantons' obligation to report has been explicitly strengthened in the context of the recent enactment of the new Federal Act on Chemicals and parallel amendments to the Federal Act on the Protection of the Environment, and
- there is a joint interest at federal and cantonal level in sharing information and in coordinating the measures.

Nevertheless, the reporting obligation of the SC (Art. 9 and 15) stipulates the **question** of whether

- the actual, partly voluntary procedures of exchanging information among the Cantons and the Confederation are sufficient,
- the actual procedures have to be strengthened in view of the SC,
- the procedures have to be generally strengthened, or
- the procedures have to be at least more precisely defined.

This is a complex question, of course, and it may not be completely answered by the time this NIP becomes effective. But it remains a fact that the enactment of the new Federal Act on Chemicals (SR 813.1) marked a step in the direction of coordination. This coordination has to be developed and shaped in order to enhance the precision of Switzerland's future reports on progress regarding compliance with the SC, while it will be shown in the subsequent subchapter as well as elsewhere in this NIP (cf. e.g. chapter 2.3.7) that the procedures applied up so far have already allowed for reasonable estimates.

Corroborating the efficacy of the measures taken in view of the SC

This present subchapter in particular addresses Art. 16 of the SC, i.e. the forward-orientated decision to determine the efficacy of the measures taken. This same point is addressed in chapters 3.4.3 to 3.4.7. Nevertheless, the following should be stressed at this stage:

- Switzerland's countrywide level of environmentally relevant infrastructure of communes and industries is developing at a quite coherent rate. For example, it took no more than twenty years to raise the number of households linked to waste water treatment plants from < 50% to > 90% and no more than ten years to eliminate > 90% of all the large PCB-containing transformers.
- The Swiss Federal Institutes of Technology, the Federal Research Institutes, and the technical colleges ensure a sufficiently coherent assessment of the general environmental situation.
- And finally, the cantonal laboratories collaborate closely both on a voluntary basis and in some cases on the basis of formal collaboration agreements.

Therefore, there is a reasonably reliable and comparable basis for extrapolating the results of a restricted number of sufficiently precise measurements and reaching an adequately precise assessment of the situation of the whole country. Nevertheless, there is no doubt that the following activities are **important**:

- Available measurements, like the ones of the so-called biomonitoring program mentioned in chapter 2.3.1 to 2.3.4, should be periodically repeated.
- The range of results to be gained, e.g., from some of the so-called NABO- and NABEL stations (cf. chapter 2.3.10) should be supplemented by means of specific POPs determinations.
- Significant assessments of the global effects of the SC require international collaboration and monitoring efforts. This underlines, for example, the importance of the MONARPOP program (cf. chapter 2.2.3), which integrates the specific aspect of POPs in the whole Alpine region.

Ensuring sustainability of the POPs-related measures taken and to be taken

Sustainability is a first priority requirement mentioned in the SC's NIP-related Art. 7 as well as its development aid-related Art. 13. Thus, it is evident that sustainability will be the number one guiding principle when deciding on **national as well as development aid-related priorities**.

This means at a national level that priority must be given to future POPs-related programs that include the broader picture of sound chemicals management and general environmental protection. This applies for example with regard to the remarks addressing waste management in general and the remediation of Kölliken and Bonfol in particular.

At the level of supporting countries in development, it means that priority must be given to POPs-related programs with an adequate parallel capacity building.

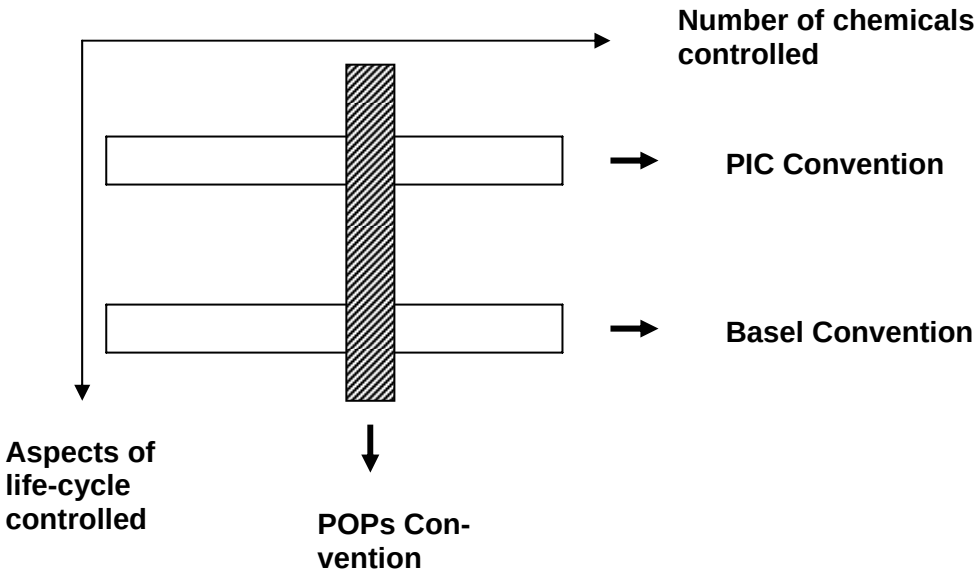
1. Introduction

1.1. The Stockholm POPs Convention and its Article 7

The Stockholm POPs Convention [1] (SC) was signed by more than 90 countries, including Switzerland, and the EU (the European Union) in May 2001 in Stockholm. It became the third important international agreement in the so-called "chemical cluster" which also includes the Basel Convention (dealing with the transboundary movement of hazardous chemical waste) and the Rotterdam PIC Convention (controlling imports and exports of hazardous chemicals).

Unlike the two other agreements mentioned, the SC (Stockholm POPs Convention) addresses only a limited number of chemicals. But these chemicals are highly relevant because of their persistence, toxicity, and world-wide translocation, and the SC has a more in-depth impact than the Basel and the Rotterdam Convention in the sense that it covers the whole life-cycle of the products in question, and that it aims at eliminating them completely or at least to a far reaching extent. The following figure (**Fig. 1**) illustrates this point.

Figure 1: Impact of the main conventions of the "chemical cluster"



The edition of the present Swiss National Implementation Plan (NIP) regarding the SC is based on this convention's Article 7 which reads as follows:

Implementation plans

1. Each Party shall:

   (a) Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;
   (b) Transmit its implementation plan to the Conference of the Parties within two years of the date on which this Convention enters into force for it; and
   (c) Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties.

2. The Parties shall, where appropriate, cooperate directly or through global, regional and subregional organisations and consult their national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.

3. The Parties shall endeavour to utilize and, where necessary, establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate.

This article 7 has been the basis for significant international collaboration since the early phases of intergovernmental negotiations regarding the SC. It not only addresses the parties' obligations, i.e. the elimination or mitigation of the use of the specific persistent organic pollutants as defined by the convention, but it in addition requests that the measures to be taken be, where appropriate, integrated into sustainable development strategies. This means in practical terms that article 7 became a motor for national capacity building in many countries and for international collaboration and solidarity regarding the sound management of hazardous chemicals.

Switzerland contributed to the mentioned efforts – inter alia by supporting the drafting of a guidance document on the development of National Implementation Plans (NIPs) [3]. This endeavour followed the early edition of a GEF guidance paper [4] and was carried out by several international organisations, including UNEP, the World Bank, and the GEF, and by a small number of countries. It had the continuous support of the intergovernmental negotiation conferences (INCs) [5] engaged in the development and the implementation of the Stockholm POP's convention.

Of course, the guidance document [3] on the development of NIPs mainly addresses developing countries and countries with economies in transition, because the GEF to which Switzerland contributes provides significant support to many of these countries in the preparation of their NIP (with up to US $ 500 000.- per country). This support cannot simply be intended to enable the preparation of a paper plan, but it is meant to enable flanking measures as well, such as the facilitation of interministerial coordination, the exchange of information, the preparation of POPs inventories, the identification and registration of facilities unintentionally releasing POPs into the environment, and so on. Thus, there was certainly a need to define the related activities more precisely and to assist countries in their planning.

In addition, the guidance document will result in a significant alignment of the different countries' NIPs, which will facilitate the COP's assessment of these plans and was Switzerland's reason to adhere to the guidance as far as possible.

1.2. The Approach to Preparing Switzerland's NIP

Besides contributing to the INC process and the development of a NIP guidance paper, Switzerland decided early on to start preparing its own NIP. Therefore, the POPs convention focal point, the Head of the Substances, Soil and Biotechnology Division of the Swiss Federal Office for the Environment (FOEN)[6], entrusted the Chemicals Section within the division[7] with this responsibility and contracted a consultant[8] for the process.

A FOEN internal working group convened on 11 March 2003, i.e. even before INC-7 and before Switzerland ratified the Convention in July 2003. This group outlined a general work plan for the preparation of the Swiss NIP as illustrated in **table 1**. The plan is presented in detail here in order to allow the parties to the convention to thoroughly understand and assess the process.

Table 1: General work-plan for the preparation of the Swiss NIP

Step	Action	Aims	Completion
1	Initiation of the NIP process, analysis of the mission, and decision on the approach.	FOEN-internal meeting based on the initiative of the Swiss Focal point (phase 1 according to the guidance document [3]: Establishment of Coordinating Mechanism and Process Organisation).	11 March 2003
2	First draft (gap version) issued on the basis of sources available from FOEN and circulation among participants of the first meeting; broader FOEN-internal review (Waste and Raw Materials Division, Air Pollution Control and NIR Division)	Collaboration of consultant and Industrial Chemicals Section (phase 1, first compilation and assessment of phase 2 (establishment of POPs inventories and assessment of national infrastructure and capacity, preliminary proposal on phase 3 (priority assessment and objective setting, acc. to guidance document [3]). Focus: current status of POPs inventory and identification of information gaps and approaches to filling these gaps.	2nd half 2004
3	Second draft issued	Preconsultation of Federal Offices specifically concerned: FOPH and FOAG. Agreement on approach, assessment of the inventory, and priority setting (finalisation of phase 1, approaching completion of phase 2, and pursuing phase 3 acc. to the guidance document [3]).	August 2005
4	Third draft issued	Hearing of all Federal Departments including Federal Offices specifically concerned.	29 January 2006
5	Final NIP issued and approval by the Federal Council	Amendment of 3rd draft according to comments received in step 4. Focus: agreement on priorities and the action plan to be pursued (completion of phase 3 acc. to the guidance document [3]). Conciliation of differing views (initiation of phase 4 (formulation of NIP, acc. to the guidance document [3]). Finalization of NIP and approval by the Federal Council	26 April 2006
6	Submission of NIP to the COP		17 May 2006

1.3. NIP structure and targets according to the Guidance Document

The development of an NIP Guidance Document and the issue of corresponding drafts were already initiated in view of INC-6, the sixth meeting of the Intergovernmental Negotiating Committee, taking place in Geneva in 2002. This process was then provisionally completed by INC-7, the seventh meeting of the Inter-governmental Negotiating Committee, which recommended that the parties use this tool, while still underlining that it was meant to be a living document.

The details of the proposed NIP structure as contained in the earlier drafts for some time represented a “moving target”, while the essence remained unchanged. Since 2004, the NIP Guidance Document (today available on the Internet via http://www.pops.int → NIPs submitted → Background → Guidance → National Implementation Plans) is no longer called a draft, which is why Switzerland, where appropriate, used that version as a guide – at least for part 2 of this NIP.

The essential target of the NIP consists, of course, in ensuring compliance with the requirements of the Stockholm POPs Convention. They were summarised as Annex 6 in the CD version of the Draft Guidance for developing a National Implementation Plan for the Stockholm Convention as prepared in view of INC-7, and they are cited here in spite of the fact that the respective annex is no longer found in the current Internet version of the same document:

Excerpt from the CD draft NIP guidance document prepared for INC-7 [3]:

15. ANNEX 6

Convention Requirement Check List

This checklist is provided as an *aide memoire* and does not substitute for a legal interpretation of the Convention.

The Stockholm Convention includes a number of major provisions that obligate its Parties to:

- Prohibit and/or take legal and administrative action necessary to eliminate production and use of Annex A chemicals (aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene and PCBs) – Article 3.1(a);
- Restrict production and use of Annex B Chemicals (DDT) - Article 3.1(b);
- Ensure that chemicals listed in Annex A or Annex B are imported only for the purpose environmentally sound disposal or for a use permitted for the Party under either annex – Article 3.2(a);
- Ensure that chemicals listed in Annex A or Annex B are exported only for the purpose of environmentally sound disposal, to a Party that has a permitted use of the chemical under either of the annexes or to a non-Party that certifies that it is committed to comply with certain provision of the Stockholm Convention – Article 3.2(b);
- Take measures under existing regulatory and assessment schemes to prevent the production and use of new pesticides and industrial chemicals exhibiting the characteristics of POPs and take the criteria for identification of POPs into consideration in such schemes - Article 3.3, Article 3.4
- Register specific exemptions to Annex A or Annex B if needed and upon becoming a Party and, if an extension such a registration is to be requested, provide a suitable justification report for the extension - Article 4.3?, Article 4.6;
- Develop and implement an action plan on a national, sub-regional or regional basis, as appropriate, for the reduction of total releases of Annex C chemicals (PCDD, PCDF, HCB, PCB) from anthropogenic sources within two years of becoming a Party – Article 5;
- Manage POPs stockpiles and wastes in a manner protective of human health and the environment including developing strategies for their identification, and application of environmentally sound handling, collection, transport and disposal measures - Article 6.1;

• Prohibit disposal of POPs stockpiles and wastes involving or leading to recovery, recycling, reclamation, direct use or alternative use - Article 6.1 (d) (iii);
• Regulate transboundary movement of POPs stockpiles and waste POPs in accordance with international rules, standards and guidelines - Article 6.1 (d) (iv)
• Submit a national implementation plan to the Conference of the Parties within two years of becoming a Party and review the plan on a periodic basis - Article 7.1;
• Designate a national focal point for exchange of information on POPs - Article 9;
• Exchange information with other Parties related to reduction or elimination of production, use and release of POPs and alternatives to POPs - Article 9;
• Provide the public with access to current information on POPs including information relating to health and safety of humans and the environment - Article 10.2.
• Provide technical assistance, if a developed country, to developing countries Parties and Parties with economies in transition - Article 12.1, Article 12.2;
• Provide financial support and incentives for national activities intended to achieve the objective of the Convention - Article 13.1;
• Provide financial support, if a developed country, to developing country Parties and Parties with economies in transition for agreed incremental costs associated with meeting their obligations under the Convention - Article 13.2;
• Provide periodic reports to the Secretariat on implementation of Convention provisions including statistical data on production, import and export of Annex A and Annex B chemicals - Article 15.1, Article 15.2**.**
• A more extensive description of the Convention provisions that create obligations on Parties is contained in Annex Z.

1.4. NIPs in Developed Countries

In June 2004, Switzerland hosted an international workshop dealing with the implementation of the SC in developed countries and particularly covering the role and status of their NIPs. This workshop took place in Neuchâtel, was organised by UNEP Chemicals under the auspices of IOMC, and was financed by the GEF with co-financing from the governments of Sweden and Switzerland. It was attended by representatives of 12 developed countries and of the European Commission as well as participants from several developing countries and delegates from around 10 international organisations and NGOs.

Though the SC does not in its Art. 7 on NIPs differentiate between the requirements for developed and developing countries, the workshop made it clear that developed countries share certain common features in this respect[9]:

- They are interested in the countries' NIPs in order to assess the effectiveness of the SC.
- They expect the planning horizon to cover about 5 years.
- They see the NIPs in the first place as an instrument for helping countries prioritise their national and (to the individually desirable extent) international POPs-related actions.
- They see the NIP as a dynamic planning process and not a one-off activity.
- They see the stringent requirements in the SC's Art. 7 as binding, but interpret the guidance on the preparation of NIPs in essence as a supporting tool.
- They operate at the high end of BAT/BEP techniques and have the responsibility for continuously reviewing and developing the related technologies.
- They expect the NIP process to be complex and to depend to some extent on the individual countries' requirements.
- They are confronted with a rather long history of POPs-related measurements which are not completely comparable.

- Therefore, they should attempt to achieve a sufficiently credible POPs-inventory and to demonstrate the reduction of POPs through
  1. actual measurements and
  2. proof of application of BAT/BEP.

The last of the above-mentioned points is comparatively easy in Switzerland if one wants to rely simply on legal requirements, but because of the Cantons' individual responsibility it is quite difficult if one attempts to obtain the latest detailed information.

2. Country Baseline

2.1. Country Profile

It is often useful to start planning activities by considering the broader framework – and that is the purpose of the present chapter. It starts with a short general overview that also covers the Swiss geography and population. Then it addresses the political and economic situation and subsequently the profiles of the individual economic sectors. Finally, it presents an environmental overview.

Here, reference is made to the first Swiss National Profile Assessing the National Infrastructure for Management of Chemicals [10] issued in 2000. It was written in adherence to UNITAR's related guidance paper [11], and it was mostly based on statistical information from the years 1995 – 1996. Therefore, a number of updated figures are presented below. However, the general situation has not changed since the issue of the National Profile where it was summarised as follows:

Switzerland has no access to the seas of this world, but the rivers originating in its Alps become streams, travel through many countries, and end up in the Northern Atlantic, the Mediterranean, or the Black Sea. These waters have become a source of wealth by providing many opportunities for hydroelectric power stations as well as logical sites for the development of industrial agglomerations - and the Alps which used to divide Europe have increasingly come to channel and attract traffic. This special situation has contributed to Switzerland's becoming an independent and stable multi-lingual and multi-cultural federal nation with an advanced democracy – and it defines a special responsibility with regard to international collaboration and protection of the environment.

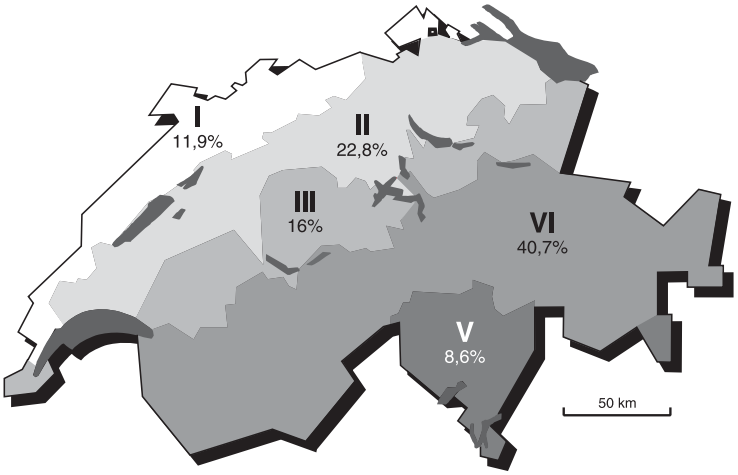
2.1.1. Geography and Population

The Swiss National Profile [10] presents Switzerland's **geographic regions** as shown in the following figure (**Fig. 2**):

Figure 2: Geographic regions

Switzerland is divided into five main geographic **regions**:
Jura (I, 11.9%),
Plateau (II, German: Mittelland, 22.8%),
Pre-Alps (III, 16%),
Alps (IV, 40.7%), and
South of the Alps (V, 8.6%).

That means that 77.2% of the country's total surface is covered by mountain-chains and the relatively narrow valleys between them.



It should be added that Switzerland is located in the heart of Europe, i.e. between around 6° and 10°30' east and between about 46° and 47°30' north. It therefore lies mainly in the mod-

erate climate zone, with its elevation above sea-level ranging from some 200 m to more than 4600 m. This results in significant local climate differences and also has an impact on the distribution and deposit of air-born pollutants like POP's.

The following **key figures** characterise Switzerland's geography and population (cf. "Statistisches Jahrbuch der Schweiz 2005 [12]):

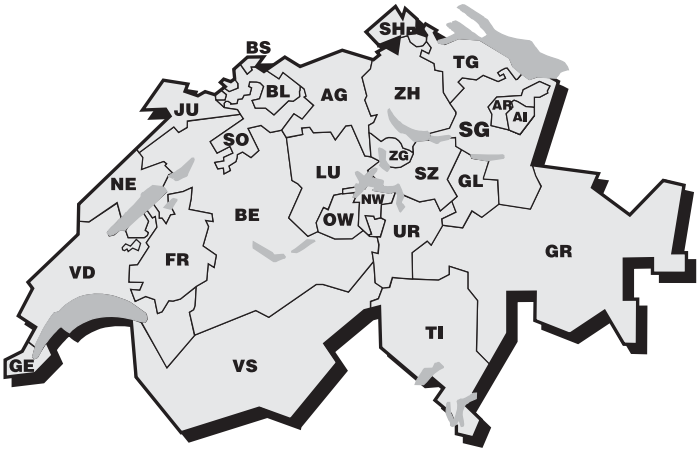
- Area of the Country: **41 284 km^2 .**
- Surface coverage: 36.9% agriculture area,
  30.8% forests and forest-like vegetation,
  25.5% non-productive vegetation or no vegetation at all (including about 4.2% rivers and lakes),
  6.8% building zones (including streets and railroads).
- Official Languages: **German** 63.7%, **French** 20.4%, **Italian** 6.5%, **Romansh** 0.5% (basis for distribution = 2000).
- Total Population: **7.36 Mio.**
- Urban Population: **73%** living in urban areas or towns/cities with more than 10 000 inhabitants.
- Rural Population: **27%** living outside the urban areas or towns/cities with more than 10 000 inhabitants.
- Average Age of the Population: **39.8 years** (basis = 2001)**.**
- Population of Working Age (20 – 64 years): **62.0%.**
- Birth Rate: **11.0 born alive per year and 1000 inhabitants.**
- Life Expectancy at birth: **Male → 77.6 years, female → 83.0 years.**
- Average Education Level (basis: total population ≥ 25 years of age)
  24% obligatory school (primary level)
  52% secondary school (secondary level, including professional schools)
  8% higher education (tertiary level, excluding university)
  15% university.
- Unemployment rate **3.7%** (in 2003; 3.5% in July 2005 [13]).
- % Women Employed Outside the Home: **50%.**

2.1.2. Political and Economic Profile

In addressing Switzerland's political and economic profile reference is again be made to the National Profile [10] (cf. **Fig. 3**). There, one reads the following about Switzerland's **political structure**:

Switzerland consists of 26 Cantons of which 6 are so-called half-cantons with somewhat less of a say in the Federation. All these Cantons have their own legislative, executive, and legal authorities, all are based on communes as the next lower administrative level, and all rely on the principle of the so-called direct democracy, which also applies with regard to federal matters. Thus, Swiss citizens not only pay taxes and elect representatives, but also vote on legislative changes or factual decisions at three levels, i.e. at federal level, in one of the 26 Cantons, and in one of the around 2900 communes.

Figure 3: The 26 Cantons



See **table 2** for the meaning of the abbreviations used above.

In addition, Switzerland is a democratic confederation of states. The latter, the Cantons, form the country's administrative backbone and have their own governments and parliaments as well as a significant level of independence. For example, they are in most cases responsible for implementing chemicals-related legislation, while the Federation defines the related principles, which the Cantons may neither reduce nor amend.

Finally, the Federal Constitution assigns a number of specific responsibilities to the federal government. These include defence, foreign affairs and the control of imports and exports (incl. taxation), and the last is of course, important in the light of chemicals-related regulations.

The Swiss **economic profile** as presented in the following is based on the "Statistisches Jahrbuch" [12] and relates in essence the years 2002 to 2004. It is first addressed in terms of the economic importance of the Cantons as based on their compounded per capita income (cf. **table 2**).

Table 2: Economic importance of the Cantons (basis 2002) [12]

Abbreviation and name of the Canton	Compounded per capita income [million CHF]	Per capita income [CHF]	Population	Area [km^2]
ZH: Zurich	77 009	61 164	1 257 900	1 728.9
BE: Bern	40 524	42 275	955 400	5 959.2
VD: Vaud	31 151	48 490	640 800	3 211.7
AG: Aargau	26 761	48 308	553 400	1 403.6
GE: Geneva	22 016	52 074	422 200	282.3
SG: St. Gallen	19 815	43 517	455 500	2 025.7
LU: Lucerne	14 708	41 847	351 400	1 493.5
BS: Basel-Stadt	13 781	72 186	190 500	37.0
BL: Basel-Landschaft	13 338	51 140	261 100	517.6
TI: Ticino	11 645	37 242	313 000	2 812.3
SO: Solothurn	10 802	44 168	244 800	790.6
VS: Valais	10 254	36 830	278 800	5 224.5
TG: Thurgau	9 915	43 167	229 300	991.0
FR: Fribourg	9 429	38 677	245 200	1 670.6
GR: Graubünden	8 205	43 323	190 100	7 105.3
ZG: Zug	7 905	77 428	101 900	238.7
NE: Neuchâtel	7 096	42 281	167 600	802.9
SZ: Schwyz	6 720	50 870	131 700	908.2
SH: Schaffhausen	3 728	50 596	73 700	298.5
JU: Jura	2 438	36 071	67 800	838.5
AR: Appenzell A. Rh.	2 319	43 890	52 700	242.8
NW: Nidwalden	2 187	57 683	38 100	275.9
GL: Glarus	2 019	52 992	38 200	685.0
UR: Uri	1 551	45 344	34 500	1 076.8
OW: Obwalden	1 198	36 483	32 800	490.6
AI: Appenzell I. Rh.	615	41 804	14 00	172.5
Total average:	**357 128^p**	**48 840**	**7 343 000**	**41 284.2**

In order to obtain a complete overview of the Swiss economic profile, the above table is supplemented by the following figures, also relating to 2002:

- Total Swiss output of goods and services: CHF 816 712 million^p
- Total Swiss imports of goods and services: CHF 160 806 million
- Thereof imports of goods: CHF 132 866 million
- Total Swiss exports of goods and services CHF 190 118 million
- Thereof exports of goods: CHF 138 028 million
- Gross National Product at market value (GNP): CHF 431 064 million (2003: 433 366)

→ The superscript “p” in the above figures means “provisional”.

The GNP may be allocated to the general economic sectors as follows (estimate) [12, 14]:

- Agriculture and forestry 1.3%
- Mining 0.2%
- Industry producing goods 25 %
- Energy- and water-supply 3 %
- Construction 6 %

- Services incl. traffic 64.5%

Taken together, the above figures naturally lead to certain conclusions. They are presented here in order to provide a summary only. However, for the sake of precision one remark should be added. It relates to the difference as observed when comparing the total compounded per capita income (the population's total income) shown in table 2 and the GNP cited thereafter. This difference is due to a number of corrections made when translating the first figure into the second, i.e.

the addition of

-	production-related and import taxes	+ CHF	30 664 million
-	depreciation	+ CHF	77 194 million
-	export of capital and work-income to foreign countries	+ CHF	49 465 million

and the deduction of

-	subsidies	- CHF	18 190 million
-	import of capital and work income from foreign countries	- CHF	65 196 million

But now to some conclusions and additional remarks which are relevant in the present context:

- The Swiss economic profile is characterised by distinct differences from region to region and Canton to Canton. However, this does not imply that the differences in the per capita income as shown in table 2 are fully reflected in corresponding differences regarding the average standard of living, because the latter is described by private consumption rather than per capita income.
- The consumption of all private households (including pertinent non-profit organisations) amounted to CHF 260 065 million in 2002 (262 868 million in 2003) [12].
- There is a high average spending in private households, and there are some regional differences in that respect.
- The service sector contributes the bulk of the GNP.
- All this means that the Swiss household activities and the so-called third sector are very relevant when judging environmental impact.
- The industry producing goods (excluding mining, construction and production or distribution of energy) is the second largest contributor to the GNP. Taking account of the above-mentioned estimate and the fact that only 17.1% of the total working population belonged to that sector in 2002, the resultant estimated per capita contribution to the GNP by this industry amounts to ≈ CHF 151 000. This was significantly higher than the contribution of the service sector (70.7% of the total working population with an estimated per capita contribution of ≈ CHF 94 000) – and is obviously the consequence of a highly specialised and internationally represented industry.
- The working population in agriculture and forestry (4.2% of the total) in 2002 contributed less than 1.5% to the GNP, whereby the large percentage of part-time employees in this sector has to be acknowledged.
- The **workforce** has since 2002 decreased in agriculture and forestry, mining, industry, and construction. This was more than compensated for by the increase in the energy and water-supply and service sectors. Thus, the workforce allocations in 2004 were the following (total = 4.185 million incl. part-time employees) [12]:

  - Agriculture and forestry (sector 1) 3.8%
  - Mining (part of sector 2) 0.1%
  - Industry producing goods (part of sector 2) 16.0%
  - Energy and water supply (part of sector 2) 0.6%
  - Construction (part of sector 2) 6.9%
  - Service sector (sector 3) 72.6%

2.1.3. Profiles of Economic Sectors

Agriculture and forestry:

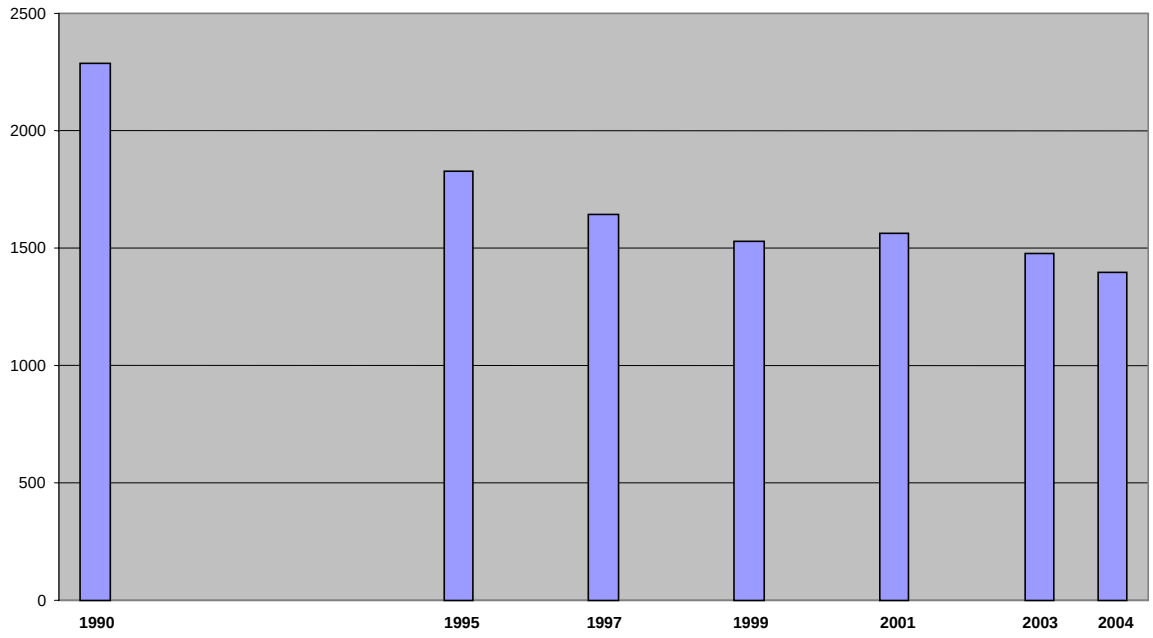
In 2002, national agriculture produced about 60% of the food consumed in Switzerland. Thereby the domestic production covered[12]

- milk 97%
- potaes 89%
- butter 89%
- meat 80%
- high fat cheese 77%
- vegetables 62%
- sugar 49%
- cereals 48%
- eggs 37%
- fruits 31%
- vegetable fats 22%

In 2003 farms employed 193 179 people (incl. owners – only 46.9% of the total full-time). This figure is not absolutely comparable with the one on the previous page regarding sector 1 in 2004, because the latter shows mid-year counts. The area occupied by farms was 10 670 km^2 (of which 26.6% was cultivated arable land – whereby the additional approximately 4500 km^2 of Alps, essentially all grassland, are not considered).

The use of pesticides is of specific interest in the present context. It has decreased steadily over the past ten years in terms of value (about 5%) to about CHF 120 million (125.6 in 2000 [15]) and more distinctly in terms of volume (cf. **Fig. 4**) [16]:

Figure 4: Use of pesticides in Switzerland (tons) 1990 - 2004



The above tonnages relate to the active ingredients used. Their allocation to the various uses in 2004 was as follows:

- Fungicides	44.9%
- Herbicides	44.4%
- Insecticides	8.1%
- Growth regulators	1.3%
- Rodenticides	0.1%

Here, it should be added that the tonnages shown do not include house- and garden usage, which is estimated to amount to less than 5% of the values shown [10].

The sums spent on fertilisers (CHF 142.5 million in 2000) are slightly higher than those relating to pesticides, while the volumes of fertilizers used, of course, significantly exceed the latter (≈ 200 times or ≈ 70 times, respectively, if only considering the active ingredients).

It has to be underlined that the decrease in the use of pesticides is due to a number of factors. They particularly include a steady increase in the area of land used for organic production (to 10.2% of the surface area excl. Alps in 2003) and a still growing importance of the so-called integrated production (97% of the surface excl. Alps were in 2003 cultivated in line with so-called ecological performance criteria).

Finally, it should be added that POPs pesticides have not been used for many years, that no pesticides are used in forestry, and that forests cover a total surface area of 12 716 km^2.

Mining (basis 2002):

Mining contributes around 0.2% to the GNP. Nevertheless, gravel which is an important material in the production of cement or concrete, is an important mining product. About 30 million m^3 of gravel are used every year, and 90% of this amount comes from domestic production.

The gravel is either used as such or processed into cement (3.8 million tons in 2002 [17]) or concrete (more than 2 million m^3 per year). Accordingly this has an environmental impact – in spite of the fact that mining represents a very small economic sector and despite the strong efforts made to reduce the emissions and the energy consumption of the respective downstream processing. For example, these efforts resulted in the best cement producing facility in powder charges of the oven exhaust air of less than 10% of the tolerated limit of 50 mg/m^3 [18].

Industry:

As already mentioned, the part of the industrial economic sector that produces goods contributes approximately 25% to the GNP. Its structure is discussed below. **Table 3** compares employment and production details relating to economic sector 2 for the years 1995 and 2003 and includes the combined sectors 1 and 3 for comparison [12].

Table 3: Details on economic sector 2 – workforce and turnover

Entry	Economic sector	Workforce 1995 in 1000's	Workforce 2003 in 1000's	Turnover index 2003 1995 = 100%
A – P	Total	**3 960**	**4 177**	
A – B	Sector 1 (agriculture, forestry)	**179**	**173**	
C – E	Sector 2 excl. construction	**799**	**708**	**114.1**
C	Mining	6	5	**110.3**
D	Industry	**766**	**678**	**114.5**
DA	Food, beverages, tobacco	70	63	101.3
DB	Textiles	36	19	78.5
DC	Leather goods	5	2	62.4
DD	Wood excl. furniture	45	37	107.8
DE	Paper, printing, editing	84	66	91.5
DF/DG	Coke, mineral oil	1	1	155.3
DG	Chemicals	68	65	172.8
DH	Rubber, plastics	24	24	113.7
DI	Glass, concrete, ceramics	22	18	166.4
DJ	Metals	110	98	110.2
DK	Machineries	115	104	100.5
DL	Electronic and precision instruments	139	132	105.5
DM	Vehicles	13	18	85.7
DN	Other industries producing goods	34	30	100.1
E	Energy- and water-supply	27	25	109.9
F	Construction	**345**	**292**	
G – P	Sector 3 (services)	**2 637**	**3 003**	

The following table summarises absolute 2002 turnover figures of the main Swiss industries [12].

Table 4: Provisional 2002 turnover of main Swiss industries in million CHF

Industry	Turnover	Cost of goods and materials
Food and beverages	24 191	14 919
Textiles excl. clothes	2 646	1 168
Wood excl. furniture	6 744	2 979
Paper, cardboards, printing, editing	15 713	5 964
Chemicals	47 045	22 245
Rubber and plastic goods	6 139	2 938
Other non-metal goods	4 852	1 854
Metals and metallic goods	19 681	7 763
Machineries	29 694	14 814
Equipment re. power generation	14 137	6 338
Communication systems	6 685	3 379
Precision instruments incl. medical and watches	26 756	12 581
Cars, trailers, other vehicles, related equipment	4 677	2 361
Furniture, jewellery, toys, sports goods	5 567	2 564
Recycling	1 293	573
Energy and water supply	24 413	16 327
Construction	47 683	17 342

The combined tables 3 and 4 lead to the following conclusions:

- The total employment in the industrial sector is lower now than in 1995.
- The entire industrial sector 2 has over the past eight years been shrinking by almost 13% in terms of personnel.
- The workforce in the industries producing goods decreased by about 11%, while increasing its average productivity by about 14.5%.
- It appears that industry's %-age contribution to the GNP has been slightly decreasing over the period discussed – and this is actually a continuation of a trend already observed before 1995. One arrives at this conclusion by comparing the GNP for the years 2003 and 1995 (CHF 433 366 million versus 364 562 million) and the mentioned increase in productivity.
- A quick look at the 2003 figures in table 3 reveals the following:
    - Some industries (food, beverages, tobacco; chemicals; machineries and vehicles; instruments and watches) have maintained or increased their %-age regarding personnel in this sector, while others (textiles, leather, paper and paper products incl. printing) have reduced it significantly.
    - Textiles as well as clothing, leather, and paper incl. printing in addition reduced their output (%-age), while other industries increased it significantly. The latter relates particularly to chemicals and the segment for glass, concrete, and ceramics.
- It is difficult to make an overall assessment of the environmental impact of the above. Nevertheless, one may tentatively conclude that some industries of high environmental impact have either reduced the %-age of their output and their personnel (textiles) or essentially maintained it with regard to output and personnel (e.g. food) – and this could be plausibly interpreted as a sign of the rising value consumers are attributing to ecological and health-related principles. On the other hand, the chemical industry, for example, just about maintained its personnel levels, while it increased its output %-age, and this could mean that even as early as 1995 this industry was at an advanced level with regard to controlling its environmental impact.

Services as compared to the other economic sectors:

The service sector is by far the most important contributor to the GNP, and it has continued to grow over the past nine years. It is discussed here along with the other sectors. But it should be underlined first that at least part of the growth in the service sector is due to industry's increased outsourcing of activities not considered as core competences.

The total number of working people (employees and owners) was 4.185 million in 2004 as compared to 3.960 million in 1995. It would appear that the total number has increased over the nine year period. However, this may at least in part be a consequence of differences relating to a not entirely comparable statistical basis. These employees (plus owners) were allocated as follows to the different sectors (**table 5**):

Table 5: Allocation of workforce to economic sectors with details regarding sector 3

Economic sector	**2004 in 1000's (%)** [12]	**1995 in 1000's (%)** [12]
Total	**4 185**	3 960
Agriculture and forestry	**159**	179
Mining	**5**	6
Industry producing goods	**668**	766
Energy- and water-supply	**26**	27
Construction	**289**	345
Total of sector 3:	**3 037 (100.0)**	2 637 (100.0)
- Trade / repair of consumer goods	**655 (21.6)**	652 (24.7)
- Restaurants and hotels	**244 (8.0)**	247 (9.4)
- Traffic / communications	**276 (9.1)**	249 (9.4)
- Banking / insurance	**219 (7.2)**	205 (7.8)
- Business support	**490 (16.1)**	344 (13.1)
- Public administration	**171 (5.6)**	147 (5.6)
- Teaching / Education	**274 (9.0)**	220 (8.3)
- Health / social services	**470 (15.5)**	370 (14.0)
- Other public and private services	**180 (5.9)**	155 (5.9)
- Private households	**58 (1.9)**	48 (1.8)

Here, part-time work is fully considered and includes as little as one hour of work per week. However, it is possible that the percentage of such work that is declared has increased over the period discussed.

The following conclusions relating to the service sector may be drawn in spite of the statistical uncertainties:

- The growth in the service sector continued over the period considered. This holds in relative and in absolute terms.
- About 72.5% of the total working population are found in the service sector.
- The percentage of part-time employment increased over the period discussed.

These conclusions may be revised in light of the following observations:

- The elderly, "inactive" population represents a growing %-age of the total, which may support the conclusion that the strictly comparable workforce did actually decrease over the five year period considered. This trend may be influenced in the future by measures arising from current political discussions (increasing the general retirement age) – and their outcome may have minor, but non-negligible environmental repercussions.
- When inspecting the services-related figures in the table above that concern activities involving the consumption and moving of goods, and if one includes generation and distribution of energy plus water supply as well as construction of buildings etc., one realises that the workforce in these fields actually decreased in its percentage and in some cases also in absolute terms. This relates to
    - energy- and water-supply
    - construction of buildings etc.
    - trade / repair of consumer goods (incl. fuel stations)
    - restaurants and hotels
    - traffic / communications

- The above observation is partly due to automation, but it probably also reflects a relatively slow development of these sub-sectors, and one would expect its environmental impact to be favourable, rather than unfavourable overall.
- The automation mentioned certainly had an impact on the whole service sector. It was strongly driven by further computerisation in many fields, and the environmental impact of the rapid turnover in hardware and software is probably non-negligible – in spite of the general awareness of and adherence to the respective guidelines (recycling and controlled waste-disposal).
- Finally, research and development (R+D) are found in part in the service sector, hidden in more than one subsector, as well as within sector 2. Altogether, this results in a very considerable R+D capacity, especially in the field of chemistry, but also in the medical field, in electronics, and in machinery.

2.1.4. Waste Management and Corresponding Impact on the Economic Sectors [19]

It certainly makes sense to in this NIP consider waste management as a specific aspect of the Swiss economy. Waste management is therefore regarded as part of the service sector.

The Swiss Confederation introduced subsidies for waste treatment installations in 1973, and it has since then spent about CHF 1 billion on this purpose. The target has all along been sustainable and self-sufficient waste management, and this target may be regarded as almost met today. In 1986 the Confederation published guiding principles regarding waste management and declared that its policy was to incinerate all the combustible waste. This decision was based on the observation of the main problems encountered with dumping: contamination of groundwater and release of volatile pollutants into the atmosphere. Thus, the dumping of household garbage in disposal sites has been formally prohibited since 2001.

In 1989 the Switzerland enacted the Ordinance on Movements of Special Waste (OMW), and in 1990 the Technical Ordinance on Waste (TOW). In 1991/2 there was a first thorough investigation of the composition of household garbage led by FOEN and in 2001/2 a second survey was carried out. In addition, FOEN in collaboration with the Cantons and the representatives of the waste incineration plants has since 1992 regularly issued waste statistics and coordinated development and capacity planning. Finally, in 1997 the principle of minimising the generation of waste at source was included in the Federal Act on the Protection of the Environment (EPA), and in 2003 it was decided (with an amendment to the Ordinance on Hazardous Substances, OHS) to prohibit the distribution of sewage sludge on agricultural surfaces as from 2006.

Today, Swiss waste management is pursuing the following main policies:

- Reduction of the amounts of waste at source.
- Recycling of reusable waste through adequately separated collection (relates particularly to paper, glass, PET, batteries, and electrical/electronic equipment).
- Incineration of all combustible waste.
- Exploitation of the energy gained in the combustion of waste.
- Keeping waste treatment-related emissions to an absolute minimum.

If one now considers these policies in view of their relevance to POPs and in view of the role of the economic sectors as discussed in the previous chapter, one arrives at the following main conclusions:

The **reduction of the amounts of waste at the source** has a significant effect – particularly in the chemical industry and particularly thanks to the incentive tax on volatile organic compounds (the related ordinance dates back to 1997), which reduced the consumption of chlo-

rine-containing solvents and the danger of the formation of PCDDs/PCDFs through inadequate incineration.

The **recycling of re-usable waste through adequately separated collection** has a significant effect as well – e.g. by eliminating from garbage a significant part of the metals contained in batteries and known to act as catalysts of the unintentional formation of PCDDs/PCDFs in the incineration of garbage containing chlorinated organic material. In addition, the separate collection of paper reduces the consumption and transformation of wood by the paper industry – and it has to be added here that the heavy bleaching requirements of the conversion of used into white paper are avoided by promoting paper which is off-white or grey, and especially by using collected paper in the production of cardboard boxes.

The **incineration of all combustible waste** eliminates, of course, the formation and migration into the groundwater of POPs formed in dumping sites as mentioned above.

The **exploitation of the energy gained in the combustion of waste** increasingly contributes to the general production of heat and electricity (6217 GWh/yr in 2002, which is ≈ 2.6% of the total Swiss consumption of energy). This is not dramatically interesting in view of the cost of the energy obtained, partly due to the treatment of flue gases and residues that is required, but it is saving on the consumption of valuable fossil fuels. In addition, a non-negligible part (≈ 20%) of dried sewage sludge is used in cement producing plants – of course, in taking account of the respective limits (e.g. < 50 ppm for total PCBs).

Finally, the principle of **keeping waste treatment-related emissions to an absolute minimum** is, of course, a must, when pursuing sustainable incineration-based waste management. Therefore, Swiss waste incineration plants have from the outset been equipped with flue gas filters, and they are not only well maintained, but also continuously reviewed in terms of BAT (best available technology) and BEP (best environmental practice) procedures.

The above may be put in perspective with regard to POPs by citing the following figures: Private households must today be regarded as the main Swiss source of PCDDs/PCDFs by contributing ≈ 41% as compared to ≈ 23% from waste management, ≈ 16% from the industry treating metals, and 13% from other industries and manufacturing (basis: year 2000) [19].

This chapter concludes with an overview table addressing waste management in Switzerland also based on the year 2000 [20, 21, 22].

Table 6: Waste management in Switzerland

Type of waste	Annual amount	Disposal
Construction demolition / excavation	6.4 million tons	> 95% landfills
Mixed municipal garbage	2.6 million tons	> 95% incineration
Glass, PET, paper…. as separately collected by private households	1.9 million tons	Recycling: paper ~ 64%, PET ~ 72%, glass ~ 94%
Special waste	0.97 million tons	34% incineration, 27% physical treatment, 23% surface disposal
Sewage sludge (dry weight)	0.20 million tons	~ 75% incineration

2.1.5. Environmental Overview

The Swiss environmental situation is assessed annually in the “statistical yearbook” (Statistisches Jahrbuch), the compilation of statistical data characterising the country’s development. Therefore, the most recent edition [12] of this publication was one of the sources used in

the preparation of the following assessment. In addition, the environmental situation is continuously monitored by FOEN, which also edits a large number of publications on individual topics [23]. Finally, it has been assessed in the context of the preparation of the National Profile [10] and has also been recently evaluated by the OECD [24].

Generally speaking, one may say that Switzerland is taking care of its environment. 95.4% of the waste water from the entire private and public sectors passes through waste water treatment stations (basis 2000[12]); all the Cantons routinely inspect all the heating systems that exist within their territories; insulation of buildings is generally at a high level, which reduces the consumption of energy and the generation of greenhouse gases; fuel-driven vehicles are (with negligible exceptions) all equipped with catalytic converters; leaded fuel has disappeared; industrial emissions are strictly controlled; farmers increasingly produce organic products and take account of the principles of integrated production (resulting in reduction of the use of agrochemicals); and recycling is well developed in industry, households, and the public and business sector.

The Swiss public spending on environmental protection was CHF 3.5 billion in 2002 [12], of which

- 17% was at federal level,
- 17% was at cantonal level, and
- 66% was at communal level.

These figures include, for example, subsidies for the preservation of nature and the countryside.

Nevertheless, awareness has to be kept at a high level, and further action is still needed in order to maintain the sustainability of the measures taken, to achieve the CO_2 levels agreed to in ratifying the Kyoto Protocol in July 2003 (reduction of the total output by 8%), and to deal with pending issues like the remediation of contaminated sites as recently addressed in a FOEN-publication [25].

Finally, there is a growing eco-industry engaged, for example, in the production of environmentally-friendly installations. As early as 1998, this industry provided employment for some 50 000 employees [15].

Thus, Switzerland may be regarded as advanced due to the above-mentioned points – and the fact that it signed (in 1979) the UN ECE Convention on Long-range Transboundary Air Pollution as well as its 1998 Protocol on POPs, i.e. a kind of closely related regional predecessor of the Stockholm POP's Convention, is one of the reasons allowing for this current assessment. Nevertheless, the group initiating the Swiss NIP process decided to use the guidance document relating to the development of NIP's[3] as a means of control and of ensuring full compliance with the obligations of the Convention.

2.2. Institutional, Policy and Regulatory Framework

The focus of this chapter is on chemicals-related issues in general and on POPs-related topics in particular.

2.2.1. Environmental Policy, Sustainable Development Policy and General Legislative Framework

Environment and sustainable development are both mentioned in the Swiss Federal Constitution – explicitly and implicitly. Art. 2 highlights sustainability as a principle to be pursued, and Art. 73 more clearly defines sustainability in terms of the maintenance of the equilibrium between nature's regeneration capacity and its exploitation by man. A number of constitutional articles then address the environment and the various dimensions to be protected (air, water, and soil as well as all the aspects of the biosphere, i.e. human beings, animals, and plants) and the relevant risks.

These constitutional articles are the cornerstones on which the federal legislation relevant in the present context are built. They are summarised below – along with the most relevant acts and related ordinances (cf. **Table 7**).

Table 7: Constitutional articles and federal legislation relevant in the context of the Swiss NIP

Relevant Constitutional Articles	Remarks, important federal acts and related ordinances (SR-numbers)
Art. 2[2]: (The Swiss Confederation) promotes the common welfare, sustainable development, internal cohesion and cultural diversity of the country.	⇒ Several other constitutional articles are based on this general principle.
Art. 54[2]: The Confederation (in view of international matters)…. promotes the conservation of natural resources.	⇒ Basis for the Confederation entering into related pertinent agreements (the respective powers of the Federal Council and of the two parliamentary chambers are addressed in Art. 166[2], and the possibility of a referendum in Arts. 140[1(b)] and 141[1(d)]).
Art. 64[3]: (The Confederation) may establish, take over or run research institutes.	⇒ Basis for the Confederation meeting its related obligations, e.g. under international agreements.
Art. 65[1]: The Confederation compiles the required statistical data on the status and the development of …. the environment in Switzerland.	⇒ Basis for the collection of monitoring data.
Art 73: Sustainability – The Confederation and the Cantons must endeavour to achieve a balanced and sustainable relationship between nature and its capacity to renew itself and the demands placed on it by the population.	⇒ Definition of sustainability in terms of the interaction between mankind and nature.
Art. 74[1]: The Confederation legislates on the protection of the population and its natural environment against damage or nuisance.	Federal Act on the Protection of the Environment (SR 814.01) and Federal Act on Chemicals (SR 813.1) with related ordinances.

Art. 74[2]: ….. The costs of avoiding or eliminating such damage or nuisance shall be borne by those responsible therefor.	⇒ "Polluter pays principle" in the Federal Act on the Protection of the Enviroment.
Art. 74[3]: The Cantons are responsible for the implementation of the relevant federal regulations, provided the law does not reserve this duty for the Confederation.	⇒ Allocation of responsibilities to either the Confederation or the Cantons.

Table 7 (continued) Constitutional articles and federal legislation relevant in the context of the Swiss NIP

Relevant Constitutional Articles	Remarks, important Federal Acts and derived key ordinances (SR-numbers)
Art. 75[1]: The Confederation lays down principles on spatial planning. These principles are binding on the Cantons and serve to ensure the appropriate and economical use of the land and its properly ordered settlement	**Federal Act on Spatial Planning** (SR 700) ⇒ Art. 75[1] explicitly addresses soil in the context of Art. 73 and 74.
Art. 76[3]: (The Confederation) legislates on water protection ….	**Federal Act on the Protection of Water against Pollution** (SR 814.20) ⇒ Highlights waters in the context of the environment.
Art. 77[2]: (The Confederation lays down principles on the protection of the forests.	**Federal Act on the Forests** (SR 921.0)
Art. 78[4]: (The Confederation) legislates on the protection of animal and plant life and for the preservation of their natural habitats in their diversity.	**Federal Act on the Protection of Nature and the Cultural Heritage** (SR 451)
Art. 94[4]: Any divergence from the principle of economic freedom, and in particular measures designed to restrain competition, are permitted only if they are provided for in the Federal Constitution or based on cantonal sovereign law.	⇒ Limits the restriction of economic freedom to the required and defined cases.
Art. 104[1]: The Confederation ensures that agriculture, by means of a sustainable and market oriented production policy, makes an essential contribution towards: …. (b) the conservation of natural resources ….	**Federal Act on Agriculture** (910.1).
Art. 104[3(d)]: (The Confederation) protects the environment against the detrimental effects of the excessive use of fertilisers, chemicals and other auxiliary agents.	**Ordinance on the Introduction of Fertilisers** (SR 916.171), **Federal Act on Chemicals** (SR 813.1), **Ordinance on Plant Protection Products** (SR 916.161) and **Compendium of Agricultural Auxiliary Materials** (SR 916.052) with related ordinances.
Art. 118[2]: (The Confederation) legislates on (a) the use of foodstuffs as well as therapeutic products, narcotics, organisms, chemicals and items that may be dangerous to health.	**Federal Act on Foodstuffs and Utility Articles** (SR 817.0), **Federal Act on Therapeutic Products** (SR 812.21), **Federal Act on Narcotics and Psychotropic Substances** (SR 812.121) and **Federal Act on Chemicals** (SR 813.1) with related ordinances.

Remarks relating to table 7 above:

- The constitutional articles cited are all contained in the revised Federal Constitution as accepted in a popular vote in April 1999 and as it has been in force since 1 January 2000.
- This totally revised version of the Federal Constitution maintains all the main principles of its predecessor, which had been in force since 1874 and been amended many times. Therefore, the revision represented an evolutionary rather than a revolutionary process. Nevertheless, it was useful in the sense that it re-grouped environment-related aspects in a logical fashion and that it introduced a number of provisions that make it easier to deal with modern risks.
- The abovementioned federal acts were (like all new federal legislation) subject to an optional referendum.
- The important related ordinances were all subject to a consultation procedure identical to the one described above for the introduction of new legislatorial principles.
- Finally, the bulk of the legislation mentioned has in the meantime been implemented in the related acts and ordinances of the 26 Cantons, which are essentially always responsible for implementing the principles and regulating the implementation details.
- Thus, the legislation compiled in table 6 is generally based on broad democratic acceptance and on extensive discussions and hearings that form part of the legislatorial process.

Remarks on the new Federal Act on Chemicals:

This Act, which came into force on 1 August 2005, is a cornerstone of the development of sound chemicals management in Switzerland and is an important step towards harmonisation with EU legislation[26] . In addition, it initiated a transition period of a couple of years, which is expected to be characterized by new awareness, change, and improvements.

In fact, the Federal Act on Chemicals had passed the parliamentary hurdles in 2000, and the Federal Council itself had in view of the relevance of the changes in the related ordinances opened the respective hearing procedures in March 2003 and delegated responsibility to the Department of Home Affairs. But the further developments were still slow for two main reasons: the significance of the change, and the uncertainty as to the precise results of the rlated legislative process in the EU.

Today, one may say that Switzerland is well on its way to a more integrated and EU-conform approach to managing chemical and related risks. Thus, the PARCHEM-group (PARCHEM = *Projekt Ausführungsrecht Chemikaliengesetz,* i.e. “Project on implementing legislation for the Chemicals Act”) did more than simply replace the Federal Act on Poisons and the ordinances on toxic substances and on environmentally hazardous substances by one new set of legislation based on the new law on chemicals. It also initiated new modes of inter-departmental coordination and ensured a more coherent and effective management of the risks – all in all a true paradigm change (cf. **Fig. 5**).

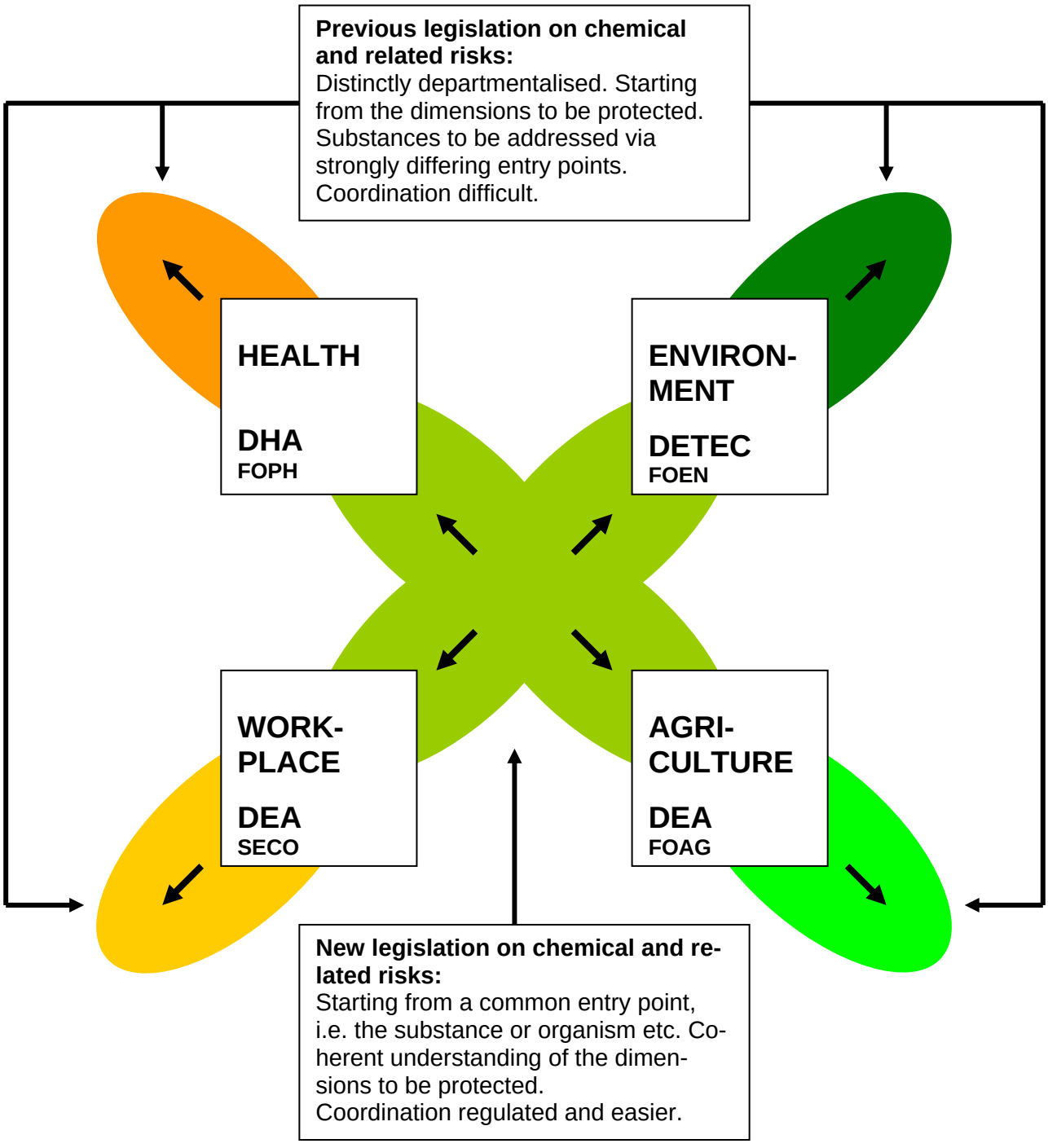
That this was possible was due to the commitment of the individuals, agencies, and organisations involved as well as, of course, to the fact that Switzerland already had a tradition of formal and voluntary consultation and collaboration among different organisational bodies and federal agencies.

Here, it has to be mentioned that a whole set of ordinances regarding the new federal legislation on chemicals has recently been enacted or is currently being prepared[27]. These ordinances are built on three main pillars, i.e. the Federal Acts on Chemicals (SR 813.1, dated 2000), on Technical Barriers to Trade (from 1995), and on the Protection of the Environment (SR 814.01, dated 1983), and are considering a fourth, i.e. the Federal Act on Agriculture

(SR 910.1, dated 1998). But there are additional fields, of course, which are affected by this legislation – and the issue of the "Ordinance on the Suspension and Amendment of Ordinances in the Context of the Enactment of the Chemicals Act" (AS 2695) reflects the complexity of the endeavour.

Finally, the new legislation certainly has major advantages, such as a simplification of the procedures for professional permits or the registration of chemicals by a joint approval procedure (plant protection products still forming an exception) and due to a joint strategy involving the departments of home affairs (DHA), economic affairs (DEA), and environment, transport, energy and communication (DETEC).

Figure 5: Paradigm change in Swiss legislation on chemicals



2.2.2. Roles and Responsibilities of Departments, Agencies and other Governmental Institutions involved in POPs Life Cycles (from source to disposal, environmental fate and health monitoring)

There is no specific Swiss set of laws or institutions and agencies etc. that address the POPs alone, but there are laws and institutions or agencies etc. that address the environmental and use-related dimensions which are relevant to the POPs issue. The related measures are based on a few relevant principles which are cited first and also be mentioned subsequently in **table 8** along with the related responsibilities and organisational approaches. These principles are

- sustainability (ensuring ecological and economic feasibility - **I**),
- precautionary approach (preventing damage rather than repairing - **II**),
- fighting pollution at the source (**III**), and
- polluter pays (linking liability and dues for preventive or corrective measures to causative action - **IV**).

Table 8: Control of POPs in the light of their life cycle

Aspect of life cycle	Responsible bodies	Responsibilities	Principle
Imports	Federal Customs Administration upon request of the FOPH, FOAG or FOEN	- Control of imported goods - Notification of canton of destination and of the FOPH - Prevention of illegal imports - Implementing the ChemO (SR 813.11), ORRChem (SR 814.81), ChemPICO (SR 814.82), OBP (SR 813.12), and the international agreements of the “chemical cluster”	**III**
	Canton of destination and Federal Customs Administration, depending on the case	- Control of addressee’s approval for handling the goods in question - Implementing the ChemO and ORRChem	**III, IV**
	FOPH, FOEN, FOAG	- Determining banned and/or restricted substances through revising/enforcing the ChemO, ORRChem, ChemPICO, OBP and OPPP (SR 916.161)	**II**
	Company receiving the goods	- Dealing with the substances in question in line with the legal requirements (incl. professional permits) - Due diligence	**IV**
	SECO	- Ensuring adequacy of restrictions in the light of free trade principles - Enforcing the Federal Act on Technical Barriers to Trade (SR 946.51)	**I**

Table 8 (continued) Control of POPs in the light of their life cycle

Aspect of life cycle	Responsible bodies	Responsibilities	Principle
Production and/or chemical transformation.	Canton to which the producing/ transforming company belongs	- Checking the environmental impact assessment - approving the operation in question - Implementing the ChemO, ORRChem, and OBP as well as the ordinances on emissions etc.	**II, III**
	FOEN	- Coordinating the implementation of the Ordinance on Environmental Impact Assessment (SR 814.011) - Coordinating the implementation of the Ordinance on Air Pollution Control (SR 814.318.142.1), Soil Pollutants (SR 814.12), and Water Protection (SR 814.201) - Coordinating the implementation of the Ordinance on Protection against Major Accidents (SR 814.012)	**II, III, IV**
	SECO	- Coordinating the implementation of the Federal Act on Employment in Business, Trade and Industry (SR 822.11)	**II**
	Board of the Swiss National Accident Insurance Fund	- Ensuring (through inspections) precautionary measures on occupational health - Defining max. workplace Concentrations	**II**
	Manufacturer/Importer	- Adherence to the legal requirements - Due diligence	**II, III, IV**
Storage	Cantons, FOEN, etc. as above for “production”	- Analogous responsibilities as for production - Additional implementation of the Ordinance on the Protection of Water against Pollutant Liquids (SR 814.202)	**II, III**
Transport	Federal Office for Civil Aviation FOCA	- Regulating corresponding transport of dangerous goods - Enforcing the regulations - Respecting the pertinent international agreements	**II**

Table 8 (continued) Control of POPs in the light of their life cycle

Aspect of life cycle	Responsible bodies	Responsibilities	Principle
	Federal Office for Road Transport	- Regulating corresponding transport of dangerous goods - Respecting the pertinent international agreements	**II**
	Federal Office for Rail Transport	- Regulating corresponding transport of dangerous goods - Respecting the pertinent international agreements	**II**
	FOEN	- Coordinating the implementation of the Ordinance on Protection against Major Accidents	**II**
	Cantons	- Implementing the above-mentioned regulations re. street transport through periodical police controls	**II, III**
	Swiss Federal Railways	- Implementing the above-mentioned regulations based on the respective contract with the Confederation	**II, III, IV**
Use / Distribution	FOPH	- Protection of life and health of humans	**I, II, III**
	FOEN	- Protection of the environment and, indirectly, human health	**I, II, III**
	SECO	- Protection of workers - Ensuring adequacy of restrictions in the light of free trade principles	**I, II, III**
	FOPH with the Approval Function re. Chemicals (operating under the auspices of a directorate representing FOPH, FOAG, FOEN, and SECO)	- Chemicals including biocides: Classification, approval and listing of components and products containing dangerous chemicals (Ordinance on Classification and Labelling of Substances (SR 813.112.12) - Guidance re. restrictions of use and distribution as well as MSDSs (material safety data sheets) and labelling	**II, III**
	FOAG	- Agricultural production: Approval of pesticides and other plant protection products (positive list)	**III**
	FVO	- Protection of animals - particularly in the context of biocides	**III**

Table 8 (continued) Control of POPs in the light of their life cycle

Aspect of life cycle	Responsible bodies	Responsibilities	Principle
	Cantonal chemical laboratories	- Checking samples of food, drinking water, consumer goods - Enforcing corrective actions, if applicable, or prohibiting distribution etc.	**III, IV**
	Manufacturer/Importer	- Ensuring adequate quality control and/or certification of compliance etc. - Due diligence	**I, II**
	Swiss Toxicology Information Centre	- Providing information on intoxications	**I**
Monitoring	FOEN	- Monitoring pollution of air (NABEL), soil (NABO – in collaboration with the Agroscope agricultural research centres), rivers (NADUF – together with the Swiss Federal Institute of Aquatic Science and Technology and the Swiss Federal Institute for Forest, Snow and Landscape Research) and groundwater (NAQUA –)	**I**
	FOPH	- Monitoring imports of goods containing toxic substances (based on information from the Federal Customs Administration)	**II**
	Federal Institutes of Technology, Faculties of Environmental Science	- Developing and improving monitoring techniques - Basic research	**I, II, III**
	Swiss Toxicology Information Centre	- Accumulating data on phenomenology of intoxications - Providing corresponding data to MDs etc.	**I, II**
	Cantonal chemical laboratories	- Documentation of analytical results obtained with samples as mentioned above - Monitoring emissions in the context of the control of industrial operations	**I, III, IV**
	Communal water supply stations	- Continuous monitoring of water quality according to differing protocols	**I, III**
	Communal waste water purification stations	- Continuous monitoring of pollution according to differing protocols	**I**
	Private laboratories	- Specific monitoring in view of specific needs	**III**

Table 8 (continued) Control of POPs in the light of their life cycle

Aspect of life cycle	Responsible bodies	Responsibilities	Principle
Exports	Federal Customs Administration	- Control of exports in the light of the ChemO, ChemPICO and the applicable international agreements	**I**
	FOEN	- Defining banned and/or restricted exports through enforcing the ChemO and ChemPICO as well as implementing other applicable international agreements	**II**
	SECO	- Ensuring adequacy of restrictions in the light of free trade principles	**I**
Disposal	FOEN	- Enforcing the Ordinance on chemicals and the Ordinance on Water Protection, related regulations, and the Ordinance on Movements of Special Waste	**II, III**
	Cantons	- Implementing the above-mentioned ordinances	**II, III**
	Federal Customs Administration	- Enforcing the regulations re. exports of wastes (Basel convention)	**I, II**

Remarks on table 8 above:

- The responsibilities as described relate to toxic or hazardous chemicals in general, rather than just the POPs.
- All the POPs are banned by the Chemicals Ordinance, and none are on the positive list of approved pesticides This essentially means that the cited authorities' responsibility regarding intentionally used or produced POPs simply consists in verifying the absence of the products in question.
- The above-described situation regarding pesticides and industrial chemicals containing POPs implies that there are no POPs-specific health monitoring programs, while there still is very significant statistical material regarding causes of illnesses and mortality, of course [12]. But the practical absence of POPs purposely used or produced and the low levels of POPs unintentionally generated makes it impossible to link exposure to POPs to health-related statistics.
- Finally, it has to be mentioned that the cited monitoring activities are not yet at the level required to obtain a thorough and reliable picture of the traces of POPs still remaining or existing in the Swiss environment. For example, only 2 of the 16 federal NABEL stations actually monitor halogenated products, and the continuous checking of the drinking water supply is in many cases restricted to a simple bio-assay (while some communes continuously measure TOC, i.e. total organic carbon, which would pick up POPs, but of course along with all kinds of other pollutants).
- The acronyms for federal offices are explained in Annex 2, and those for ordinances in part also in table 10.

2.2.3. Relevant International Commitments and Obligations

Switzerland not only had an early start in terms of protecting its natural environment, it also has a long tradition of international activities in this field. **Table 9** illustrates this point and focuses in particular on commitments and agreements relevant in the context of POPs.

Table 9: Commitments and obligations relevant to POPs

Agreements, programmes or organisations	Comments
UN membership	Since 2002.
OECD membership	Org. for Economic Cooperation and Development (defining the state-of-the-art in view of many environmental issues; participation since 1948 – at that time still OEEC, i.e. Org. for Europ. Economic Coop.).
Bilateral treaties with EU	With regard to chemicals only the verification of GLP compliance is part of the bilateral agreement. The adaptation of a number of federal acts to EU standards (e.g., the new Federal Act on Chemicals) has taken place on a voluntary basis.
UN/ECE protocol on transboundary air pollution control	Regional POPs Convention (ratified by Switzerland in 2000; cf. the remark under Aarhus below). In addition to the 12 POPs covered by the Stockholm POPs-Convention, chlordecon, hexabromo-biphenyl, hexachloro-cyclohexanes, and polycyclic aromatic hydrocarbons are regulated.
Stockholm POPs Convention	Ratified in July 2003.
Basel Convention	On the transboundary movement of wastes containing hazardous chemicals and incl. POPs (in force since 1992).
Rotterdam PIC Convention	On Prior Informed Consent Procedure for Certain Chemicals and Pesticides in International Trade (ratified in 2002).
Montreal Protocol	Addressing volatile, mainly halogenated products endangering the ozone layer (in force since 1989).
Aarhus Convention	Addressing the public right to know and regarding environmental justice etc. (signed in 1998). At the same conference a protocol on POPs was also signed by Switzerland and 35 other states.
Kiev Protocol	Addressing PRTRs (pollutant release and transfer registers). Signed in 2003 in a follow-up to the Aarhus conference.
FAO Code of conduct	Voluntary agreement signed by SSCI.
MONARPOP	EU program on the Monitoring Network in the Alpine Region for POPs, to which Switzerland contributes (initiated in 2000).

2.2.4. Description of Existing Legislation and Regulations addressing POPs (manufactured and unintentionally produced)

The general framework of legislation addressing the environment as well as POPs has already been discussed in chapter 2.2.1 above, and some directly POPs-related ordinances were cited in chapter 2.2.2. Therefore, the following **table 10** concentrates on agreements or ordinances that directly or indirectly mention persistent organic pollutants or the actual list of POPs.

Table 10: Ordinances and agreements mentioning some or all POPs

Ordinance or signed agreement	Mention of POPs
ChemO (SR 813.11)	Ordinance on Chemicals, in force since 1 Aug. 2005. Combines the general requirements for substances with hazardous physicochemical properties (e.g. explosive), properties dangerous to health and/or properties dangerous to the environment. Defines the dangers as well as the precautionary measures, particularly by referring to the EU directive 67/548/EC. Includes the requirements and procedures on the testing, assessment and registration of new and existing substances or preparations. Harmonises them with the corresponding EU procedures. Integrates the main aspects of the now suspended former ordinances relating to environmentally hazardous and toxic substances. Establishes a new body responsible for coordinating the enforcement activities for industrial chemicals.. Defines the role of the Swiss Toxicology Information Center.
ORRChem (SR 814.81)	**Ordinance on risk reduction related to the Use of certain particularly dangerous Substances, Preparations and Articles (*ORRChem)***, in force since 1 Aug 2005. Based on the Federal Acts on Chemicals (SR 813.1), the Protection of the Environment (SR 814.01), Water Protection (SR 814.20), Foodstuffs (SR 817.0), and Technical Barriers to Trade (SR 946.51). Prohibits and/or restricts the handling of particularly dangerous substances, preparations, and articles and in this sense replaces the now suspended ordinances on prohibited toxic substances and environmentally hazardous substances. In particular, prohibits in Annex 1 the manufacture, placing on the market, import and use of the so-called intentionally produced POPs (aldrin, CAS 309-00-2, chlordane, CAS 57-74-9, dieldrin, CAS 60-57-1, endrin, CAS 72-20-8, heptachlor, CAS 76-44-8, hexachlorobenzene, CAS 118-74-1, mirex, CAS 2385-85-5, toxaphene, CAS 8001-35-2, halogenated biphenyls PCB, DDT, CAS 50-29-3). In addition, in this Annex 1 prohibits a whole series of related substances, like DDE and DDD or dicofol, CAS 115-32-2, halogenated terphenyls and naphthalines, or e.g., isodrin, CAS 465-73-6. Finally, limits or prohibits in further annexes many other substances (e.g. products depleting the ozone layer) and regulates many types of application. Thereby, e.g., limiting PCDDs/Fs in fertilizers to 20 ng I-TEQ/kg (dry subst.).

Table 10 (continued): Ordinances and agreements mentioning some or all POPs

Ordinance or signed agreement	Mention of POPs
OBP (SR 813.12)	Ordinance on Biocide Products, enacted on 1 Aug. 2005. Regulates the approval procedure with exclusion of plant protection products, feed, food, and drugs. Defines types of approval and corresponding requirements. Refers to EU lists 98/8/EG Annex I, 98/8/EC Annex IA, 98/8/EC Annex IB, and Commission Regulation (EC) No. 2032/2003. Relation to POPs implicit, but important in the sense that POPs are not on the positive list and that, based on the regulation and assessment scheme, measures can be taken to prevent the marketing and use of new biocides exhibiting characteristics of POPs..
OPPP (SR 916.161)	Ordinance on Plant Protection Products. Regulates the approval procedure for plant protection products. Competent authority: FOAG. Relation to POPs implicit, but important in the sense that POPs are not on the positive list and that, based on the regulation and assessment scheme, measures can be taken to prevent the marketing and use of new active ingredients exhibiting characteristics of POPs.
Ordinance on the Suspension and Change of Ordinances in the Context of the Enactment of the Law on Chemicals (AS 2695)	Suspends the ordinances as mentioned in the first two entries of this table. Changes or amends additional ordinances – particularly the PIC Ordinance listing substances which are prohibited in Switzerland and mentioning the main intentional POPs. Confirms the limits for amounts of PCDDs/Fs of the MAO.
OAPC (SR 814.318.142.1)	Ordinance on Air Pollution Control. Mentions POPs implicitly – PCBs explicitly. Addresses traditional air pollutants in the first place and also some green-house gases. Deals with emissions limit values for stationary sources, including combustion installations, as well as related processing equipment and defines, e.g., TOC (total organic carbon) limits in mg/m^3 (generally depending on material flux and heating capacity). Also regulates immission control, strict control of all pertinent equipment (incl. approval of types), and types of fuels/oils or wastes to be burnt. Thus, e.g., - emissions from municipal waste incineration $\rightarrow$ TOC < 20 mg/m^3 - emissions of carcinogenic materials from incineration of special waste (class 1) $\rightarrow$ TOC < 0.1 mg/m^3 - emissions (non-burnt material) from heating systems based on oil extra light $\rightarrow$ none - contents in “other types of liquid fuels” ($\neq$ oil extra light) of polychlorinated aromatic hydrocarbons (e.g. PCB) $\rightarrow$ < 1mg/kg. Finally, there is the explicit requirement that the incineration of materials which may contain or produce environmentally very hazardous substances be experimentally studied and approved by the authorities.

Table 10 (continued): Ordinances and agreements mentioning some or all POPs

Ordinance or signed agreement	Mention of POPs
OPS (SR 814.12)	Ordinance on the Pollution of Soil. Defines the NABO program (monitoring of soil). Also defines norm, investigation, and remediation values for polluted soil (in function of the depth). Sets the PCDD/F norm at 5 ng I-TEQ/kg (or per litre, depending on humidity), investigation-value at 20 ng I-TEQ/kg and remediation-value at 100 – 1000 ng I-TEQ/kg. Accordingly, sets for PCBs the norm value at 0.1 mg/kg and the remediation value at 3 mg/kg.
TOW (SR 814.600)	Technical Ordinance on Waste. Regulates the deposit, incineration, and composting of waste. Excludes mixing of different types of waste (e.g. special and other waste). Mentions POPs implicitly: Contents of high boiling lipohilic chlorinated products < 10 mg /kg dry substance in material for final deposit (cf. the Ordinance on Air Pollution Control re. incineration).
OMW (SR 814.610)	Ordinance on Movements of Waste. Defines special wastes. Mentions chlorinated products – PCBs, specifically. Special classification (+ code) for PCB-containing oils, if contents > 50 ppm. Defines control (need for permits) of delivery, transport, and acceptance of special wastes. Prohibits dilution.
ORDEA (SR 814.620)	Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances. Mentions PCBs in electrical equipment, particularly in pre-switches of lamps and in capacitors. Requires retailers to take back appliances they normally sell and requies them to guarantee that the disposal is carried out in an environmentally tolerable way.
OWWD (SR 814.225.21)	Ordinance on Waste Water Discharge. Implicit mention of POPs. Definition of limits in mg/L for the waters themselves (I) as well as for the discharge into running waters (II) and drainage linked to waste water treatment (III). Values for I: - 2 mg/L of dissolved organic carbon - 0.0005 mg/L of chlorine (total value of organochloro- pesticides; ≈ 0.5 ppb) Values for II: - 10 mg/L of dissolved organic carbon - limits for organochloro-pesticides defined on a case by case basis by the authorities in charge for the environment.

Table 10 (continued): Ordinances and agreements mentioning some or all POPs

Ordinance or signed agreement	Mention of POPs
ORPS (SR 814.680)	Ordinance on the Remediation of Polluted Sites. Specifically mentions chlorinated benzenes and phenols as well as PCBs. Also defines the establishment of the register of polluted sites as well as procedures for their remediation.
MAO (SR 814.012)	Ordinance on Protection against Major Accidents. Defines measures for the prevention of and remediation after major accidents as well as amounts of stored / accumulated hazardous chemicals, which result in compulsory measures and controls by the authorities. Makes reference to the Ordinance on Environmentally Hazardous Substances and the Ordinance on Movements of Special Wastes. Explicit mention of pesticides and herbicides as well as PCBs.
OVOC (SR 814.018)	Ordinance on Incentive Taxes on Volatile Organic Compounds. Indirectly addresses POPs by including a long list of consumer goods, preparations, and POPs-like substances or precursors in the list of products to be taxed.
OEIA (SR 814.011)	Ordinance on Environmental Impact Assessment. Defines types of installations and general approaches to minimizing emissions and dangers. Implicit definition of BAT/BEP (best available technologies and best environmental practices, respectively).
ChemPICO (SR 814.82)	PIC Ordinance addressing the implementation of the Rotterdam Convention on prior informed consent. Cf. above: Ordinance on the Suspension and Change of Ordinances in the Context of the Enactment of the Law on Chemicals.
Stockholm POPs Convention	Addresses the twelve products (without exception): Aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, PCBs, DDT, PCDDs and PCDFs.
Rotterdam PIC Convention	Controls international trade (prior informed consent) with hazardous substances. Explicitly includes the main POPs pesticides (aldrin, chlordane, dieldrin, heptachlor, hexachlorobenzene, DDT) as well as lindane and the PCBs.
Basel Convention on the control of the transboundary movement and disposal of dangerous waste	Controls the transboundary movement in hazardous wastes. Explicitly mentions PCBs as well as PCDDs and PCDFs. Also covers other organic halogenated substances. Specifically defines the ecotoxicological effect of bioaccumulation.
Protocol on POPs of the UN/ECE Convention on Long-range Transboundary Air Pollution	Controls the twelve POPs plus additional four related products: Chlordecon, lindane, hexabromobiphenyl and polycyclic aromatic hydrocarbons (PAHs).

2.2.5. Key Approaches and Procedures for POPs Chemical and Pesticide Management including Enforcement and Monitoring Requirements

The above subchapters 2.2.1 to 2.2.4 illustrate how Switzerland is preparing its NIP in an environment which has essentially already eliminated or strongly mitigated the POPs. Therefore, this present subchapter will

- very briefly summarise subchapters 2.2.1 to 2.2.4,

- address the POPs issue in the broader context of persistent toxic substances, and
- present a first and very general overview of future steps this NIP will include.

Summary of the current situation regarding POPs:

Today all the intentionally produced POPs are totally banned in Switzerland.

As early as December 1971, nine out of the ten intentionally produced POPs covered by Art. 3 of the POPs Convention were severely restricted. Based on the Ordinance on prohibited toxic substances, the use of Aldrin, Dieldrin, DDT, Endrin, Chlordane, Toxaphene, Heptachlor, Hexachlorbenzene and PCBs was prohibited in products for public use and in commercial products as well. At this time, however, the use in closed systems (capacitors and transformers) was still tolerated, and for toxaphene and hexachlorobenzene, some pesticide applications were still permitted.

In January 1985 the Federal Act on the Protection of the Environment came into force. It delegates to the Federal Council the power to enact strict regulations governing substances, which, due to their properties, method of use or quantities used, may present a danger to the environment or indirectly endanger persons. The competence refers particularly to substances or their derivatives, which can accumulate in the environment. In 1986 the Federal Council enacted the Ordinance on Environmentally Hazardous Substances (OSubst). Based on the OSubst, the manufacture, supply, import and use of all substances listed above was prohibited. Also the supply and import of capacitors and transformers containing PCBs and related substances was prohibited, as well as the import of some additional articles (textiles and leather goods) containing POPs.

As already mentioned in chapter 2.2, the Swiss legislation on chemicals was completely restructured, and harmonized with the relevant EC legislation in 2005. Within this context, the bans and restrictions of the former OSubst were transferred into the Ordinance on Risk Reduction related to Chemical Products (*ORRChem)*. Mirex, which had hitherto not been officially banned but which had obviously never been on the Swiss market, was added to the list of prohibited substances. Given the fact that all intentionally produced POPs named in the Convention are totally banned, Switzerland did not notify any registration in the list of specific exemptions established under Article 4 of the convention.,

Addressing POPs in the context of persistent toxic substances:

Switzerland’s Constitution emphasizes sustainability and defines it in terms of the equilibrium of the natural environment and its exploitation by man. This equilibrium can obviously be disturbed by anthropogenic production or accumulation of highly persistent materials – and the accumulation of extremely persistent materials in the biosphere *per se* constitutes a significant risk that toxicity will occur at some point or another in the food chain. Therefore, highly persistent materials entering the biosphere fundamentally endanger sustainability, and they became an environmental concern not only in Switzerland.

But Switzerland from early on paid attention to persistence and especially to persistence coupled to proven toxicity. Thus, it supported the UN programs on persistent toxic substances (PTS) from the very beginning, it has included heavy metals such as mercury or copper in its NABO-program for many years, and it collaborated actively in all the INCs (Inter-governmental Negotiation Conferences) which finally led to the Stockholm POPs Convention. There is no question, therefore, that Switzerland is pleased with the outcome of these efforts.

Future steps:

The above mentioned situation raises a number of questions and challenges for research and also addresses some points of imminent practical significance. This furthermore leads to the following very general conclusions for the future:

- Further research has to address the mechanisms of accumulation as well as the levels of persistence and toxicity of the current twelve POPs.
- Monitoring current levels in environmental compartments and exploiting new as well as historical scientific data on POPs have to be used to enable a comprehensive and precise assessment of the efficacy of the POPs Convention.
- The inclusion of new POPs into the Annexes of the Stockholm Convention has to be judged in the light of the aforementioned assessment and of the risk/benefit-analysis relating to these new candidates and the sustainability of their use.
- All this means that it will be important to obtain a global picture by combining data from developed countries which have for a long time reduced or eliminated the use of the POPs and from developing countries which have only recently initiated comparable efforts.
- Thus, it will be worthwhile carrying out further work to complete the Swiss inventory of POPs and their elimination.
- This is of specific importance to the two large chemical waste deposition sites where the emissions are under control today, while further very costly remediation (incineration) work is needed to avoid the release of POPs which may have been dumped or have a high chance of being formed in the future (cf. chapter 2.3.5).
- Finally, it is obvious that the most immediately effective steps will involve the remediation of situations of uses and inadequately stored stockpiles of POPs in developing countries – and Switzerland is living up to its obligations regarding the support of these efforts.

2.2.6. Toxicity and Toxicity Equivalents (TEQs)

PCDDs and PCDFs represent groups of related chemical substances, and the same holds for PCBs, of course. In dealing with their toxicity one faces the problem of having to judge groups of products of differing composition. However, there is a large amount of literature that addresses that problem and in part reports on findings with purified or pure individual representatives of the respective chemical classes of products.

The approach to dealing with that problem is described, i.a., in the aforementioned FOEN compilation [20]. It is based on toxicity equivalence factors (TEQ factors, TEF), which allow the toxicity of other PCDDs to be expressed in terms of weights of 2,3,7,8-TCDD displaying the same toxicity.

Any such procedure involves an approximation. Nevertheless, this is now internationally standardised quite well, and one finds for PCDDs / PCDFs mainly the so-called I-TEQs (international toxicity equivalents identical with the NATO/CCMS-equivalents also used in this NIP). They are normally given in ng (10^{-9} g) or pg (10^{-12} g) or occasionally in fg (10^{-15} g), while the WHO defined in 1990 a tolerated nutritional daily intake of 10 pg 2,3,7,8-TCDD (which would under normal circumstances correspond to a much higher intake in terms of pg I-TEQs, because the exposure is rarely limited to this single congener, and the other relevant congeners have TEQ-factors, TEFs, of 0.1 to 0.001).

Today, many states are discussing working with guiding values for an upper acceptable daily intake (ADI) of PCDDs / PCDFs of the order of magnitude of 1 – 10 pg I-TEQ/kg body weight, and the precautionary target value envisaged for Switzerland is 1 pg I-TEQ/kg [20].

This limit would not be met for breast-fed babies with an intake of about 100 pg I-TEQ/kg. But that is not regarded as an argument against breast-feeding in view of its generally very favourable effects.

Here, it should be added that PCBs are analogously judged in terms of a number of their so-called planar congeners. This is logical in view of the intercalation-dependent biological (carcinogenic) mechanism of action generally accepted for PCBs as well as PCDDs / PCDFs.

Finally, this chapter on the regulatory framework should be concluded by stressing that there is neither an accepted and officially tolerated limit for PCDDs/PCDFs nor for PCBs, while there is an official precautionary target value of 1 pg I-TEQ/kg for the former.

2.3. Assessment of the POPs Issue in Switzerland

2.3.1. Assessment with respect to Annex A Part I Chemicals (POPs pesticides)

2.3.1.1. History of POPs pesticides in Switzerland and current monitoring needs

Some of the POPs pesticides were actually produced by the Swiss chemical industry as far back as the first half of the last century. This production was to a large extent export-orientated, but POPs pesticides were also used in Swiss agriculture. Discontinuation of this practice started early in the second half of the last century, i.e. with the introduction of the Federal Act on the Promotion of Agriculture and the Farming Profession in 1951 and the Federal Act on Trade in Toxic Chemicals in the late 1960's. Along with these early environmental sustainability-orientated steps came the chemical industry's research targeting much more specific and less ecologically harmful plant protection products.

The final discontinuation of the use of POPs pesticides in agriculture came with the issue of the Compendium of Agricultural Processing Aids / Pesticides in 1977 and the implementation of the UN ECE protocol [29] from 1978. Finally, from 1986 the elimination of the POPs pesticides was extended to gardening on the basis of the introduction of the OHS.

The above-mentioned historical developments imply that the use of POPs pesticides in Switzerland was in essence discontinued before the development of analytical techniques allowed for the reliable detection of residues remaining after their use, for example, in the soil. This makes it difficult to determine the base-line contamination. In addition, the available data at this point does not allow for a precise assessment of the history of the cultivation of the individual agricultural areas – and there was extended adherence to the changing fields approach over long periods of time as well as very intensive exploitation of the agricultural areas during World War II, i.e. at the time of the so-called Wahlen plan [30].

Nevertheless, it can be said that grassland, the raising of cattle, and the production of milk have always been of key importance in Swiss agriculture – and there was no pesticide treatment of the land, of course, while the large amounts of dung coming with such exploitation still had (and have) an environmental impact. But the latter point is not the topic of this NIP.

Finally, there were never extended mono-cultures of wheat or corn, for example. On the contrary, there was always very small-scale ownership and usage of land – and this still holds true today with an average size of farms of no more than around 14 ha (in spite of the continuing decrease in the total number of farming operations and an essentially constant agricultural area).

In conclusion, there are hardly any relevant hot spots due to substantial early use of POPs pesticides, while there is a certain diffuse contamination. Estimating its magnitude is difficult [31]. But reference may here be made to two types of information:

- **Limit values** as applicable to reuse of soil in the context of construction work [32]: Soil is regarded as “non-contaminated” or “tolerable” for reuse, respectively, if it contains less than 0.1 mg/kg of PCBs.

  Although no limit values for POPs pesticides in soil are defined, one may assume that the diffuse contamination of agricultural soil due to POPs pesticides is lower than 0.1 mg/kg at least for most of the agricultural soil surface.

- **Biomonitoring** as, for example, pursued in a program on lichens: This addresses air rather than soil, because lichens may be regarded as “natural air filters” that preserve the history of air pollution. Thus, a related program [33] included 33 monitoring sites of different character (with some typical rural locations), and it provided a large amount of data. It yielded some indications of above background pollution at the agricultural as opposed to the background sites, but it also presented quite surprising local differences (cf. chapter 2.3.3. on DDT). Here, it should be added, that the ratios of the different pesticides determined varied as follows:
  DDT mostly ≈ 35 – 70% of the total (in exceptional cases ≈ 0 – 25%)
  Aldrin mostly ≈ 5 – 10% (in exceptional cases as low as 2%)
  Dieldrin ≈ 5 – 25%
  Endrin ≈ 1 – 5% (exceptionally ≈ 30%)
  Heptachlor ≈ 0 – 5%
  Lindane ≈ 20 – 45% (exceptionally as little as 12 and as much as 80%)
  Combined ≈ 15 – 120 μg/kg dry substance.

In conclusion it should be stated that **further work is needed to obtain to a better understanding of so-called diffuse POPs pesticide contamination – especially of the soil**. Corresponding steps will be addressed in part 3 of this NIP, while it should be mentioned here already that the efforts will have to involve further refining and intensifying of the NABO and NAQUA measurements as well as targeted investigations into the cultivation history of selected surfaces.

Finally, it will be crucial to better understand the fate of the different POPs in the different compartments of the environment (air, waters, soil, plants, etc.). This also includes the need to understand the slower and faster transitions of the POPs from one such compartment to the other and the ways in which human activities influence them (cf. chapter 2.3.3. addressing DDT).

Of course, Switzerland cannot on its own resolve all the questions related to the mid-term fate of relatively low concentrations of POPs pesticides in environmental compartments like soil. But it goes without saying that additional efforts in this direction have to and will be made.

2.3.1.2. Current and projected future production, use, import and export of POPs pesticides

The **use**-related aspect of this sub-chapter is obviously the most relevant with regard to the present and the future position of POPs pesticides in Switzerland. Therefore, this short discussion is started by citing Messrs. Roch (former Director of FOEN) and Burger (former Di-

rector of the Federal Office of Agriculture) who recently wrote the following [34]: “In recent years there has been a revolution in Swiss agricultural policy. Society’s mission for farmers has been basically reworded. It now reads: efficient quality, safeguarding the environment, and maintaining the fertility of the soil as well as the diversity in biology and landscapes.”

Production, import, and export: The ratification of the POPs Convention has no effect on production, import and export, because the substances in question have already been completely eliminated.Thus, representatives of the Swiss chemical industry were involved in the course of the INC process (inter-governmental negotiation conferences) leading to the Stockholm POPs Convention. In addition, the Swiss Society of Chemical Industries (SSCI) was contacted in the hearings that accompanied the preparation of the parliamentary debate on ratification, and its only reservation was that it will want to be involved again in the planned additions to the list of the current twelve POPs [35].

2.3.1.3. Regulatory and policy framework on POPs pesticides

The regulatory and policy framework on POPs pesticides has already been extensively addressed in the preceding chapters. Therefore, it should simply be said that this framework is perfectly sufficient for the complete elimination of the **use, production, import, and export** of POPs pesticides (Stockholm Convention Annex A, Part I chemicals).

With regard to **monitoring,** the situation concerning the regulatory and policy framework was slightly different until recently, due to Switzerland’s federal structure. Thus, there were ample legal provisions allowing the Swiss Confederation to pursue activities like the NABEL-, NABO, or NAQUA measurements, but there were no stringent laws enabling the Confederation to force individual Cantons to share the results of all their measurements with the others or to report them back to FOEN.

At first sight this looks like a major drawback. However, the political reality was better than what may have been expected on the basis of the law, because there has always been mutual interest, of course, at the level of the Confederation and the Cantons in an open exchange of relevant information – and in some cases there had already been a clear reporting obligation for some time (e.g. regarding special solutions for the discharge into running waters – cf. the corresponding Ordinance). Nevertheless, part 3 of this NIP will have to consider the need for a possible adaptation of the related legal principles or at least a practical interpretation of the new Federal Act on Chemicals with regard to bringing about the centralisation and integration of results in the interest of optimum compliance with Art. 9 – 11 of the SC and in the interest of scientific progress and efficiency.

Finally, two **details** deserve a mention. They regard the terms “use” and “production” in the chemical industry:

The first term (use) does not, of course, include the degradation or destruction of POPs – and this will remain the case for as long as these processes continue to create significant costs rather than profit. However, it is not totally inconceivable, at least in theory, that future technological inventions may lead to processes that combine the environmentally sound disposal of stockpiles of POPs within the meaning of Art. 6.2.(a) with the generation of profit or, for example, of valuable transformed (non-POP) products. Here, it should be said that such processes would still be considered as “environmentally sound disposal” rather than “use”, should they actually become reality one day.- Part 3 of this NIP will comment on the need for a discussion with legal experts and/or with industry on this point and on possible further steps to be taken.

The second term (production) is normally interpreted in the chemical industry as “preparing a commercial product to be unloaded at the end of an apparatus line”. It is normally also used

when “preparing a non-commercial intermediate, even if it is not unloaded, but in a given phase of the production process represents the bulk of the relevant contents of an apparatus in the line”. It is quite clear that the latter type of “closed production” is regarded as allowed, provided the required measures to protect humans and the environment are taken and provided the Secretariat to the Convention is notified.

Nevertheless, part 3 of this NIP will provide for a check on the chemical industry’s precise interpretation of that point.

2.3.2. Assessment with regard to Annex A, Part II Chemicals (PCBs)

2.3.2.1. History of PCBs in Switzerland and current monitoring needs

In the past PCBs were extensively used in Switzerland, though they were never produced by the Swiss chemical industry. Their open use was banned in 1972, and they were, of course, included in the UN/ECE agreement and later in the OHS (enacted in 1986). Thus, the second half of the 1980’s and the 1990’s were characterised by the nationwide elimination of **electrical equipment** (transformers and large capacitors) containing PCBs. According to the guidance documents on the implementation of annex 4.8 of the OHS[37] (actually annex 2.14 ORRChem) the cantonal authorities made considerable efforts to seize the PCB-containing transformers and large capacitors systematically and implement their adequate disposal. The status of completion of the respective program is the subject of a report issued by FOEN in 1999 and based on a related inquiry with the Swiss Cantons [36].

The results as presented in the 1999 report were as follows:

- Transformers filled with technical mixtures of PCBs ⇒ More than 99% of initial appliances identified and disposed of
- Transformers filled with PCB-contaminated mineral oil ⇒ 80 - 90% of initial appliances identified and disposed of
- Large capacitors (> 1kg) containing technical mixtures of PCBs ⇒ About 70% of initial appliances identified and disposed of

Transformers filled with technical mixtures of PCBs have been completely eliminated. However, as estimated in 1999, some hundred mineral oil transformers containing PCBs as a contaminant in the concentration range between 20 mg/kg up to thousands of mg/kg oil as well as some hundred to some thousand PCB-containing large power capacitors (> 1kg weight) may still be in operation. It must be mentioned that the identification of PCB-containing capacitors is difficult because they are used for a variety of different purposes (e.g. in power factor correction, to achieve more efficient operation of AC induction motors, furnaces and other inductive loads; as starting aids for single phase motors; as surge protection for both electronic and power equipment such as large motors; for voltage regulation for power lines), they may be found in various locations within a building and their containment may vary considerably in size and form. Apart from their use as dielectric fluids in large capacitors PCBs were used also in small capacitors (< 1kg weight). Lamp ballasts for fluorescent and high intensity discharge light sources were the most important application.

Transformers and electrical capacitors are not the only objects which contain or have contained relevant amounts of PCBs. Besides the use in these closed systems, PCBs have been used extensively in so called open applications, e. g. as flame-retardants in paints, as anti-corrosive coatings and as softeners in joint sealants. The related sources of PCBs in the

environment were estimated and discussed in a FOEN report [31a], but certain applications of PCBs, e. g. anti-corrosive coatings and joint sealants have been underestimated in this report due to limited data. Investigations of the occurrence of PCBs in anti-corrosive coatings (e. g. in storage tanks for petroleum products and chemicals, bridges, high voltage transmission line pylons) and joint sealants in concrete buildings erected between 1955 and 1975 [31c] in recent years have revealed higher amounts of PCBs in these applications than reported earlier. Therefore, Switzerland published guidance documents [38, 40, 40a, 41] to reinforce the assessment and elimination of PCBs contained in and being emitted from these sources.

In a nationwide investigation [31c], initiated by FOEN, 1348 samples of joint sealants and 160 indoor air samples from concrete buildings erected between 1950 and 1980 were analysed for PCBs. The results of the study revealed that 48% of the samples contained PCBs. In 21% of the samples, PCB concentrations of 10 g/kg and more were detected, and concentrations of 100 g/kg of PCB or more were found in 9.6% of the samples. This data indicates that PCB were widely used as plasticizers in joint sealants in Switzerland. In buildings constructed between 1966 and 1971, one-third of all joint sealants investigated contained more than 10 g/kg of PCB. PCB concentrations exceeding the limit of 0.050 g/kg, above which material is required to be treated as PCB bulk product waste, were reached by 568 samples (42%). In 42 rooms (26% of all investigated) in buildings where joint sealants containing PCB were present, clearly elevated PCB indoor air concentrations above 1 µg/m^3 were encountered. In eight cases (5%), levels were higher than 3 µg/m^3. The Swiss tentative guideline value of 6 µg/m^3 (based on a daily exposure of 8 h) for PCB in indoor air was exceeded in one case (0.6%). Typical PCB congeners in indoor air include PCB 28, PCB 52, and PCB 101. Concentrations of coplanar (dioxin-like) PCBs in indoor air have been determined in six different buildings [39a]. The most abundant coplanar PCB congener in indoor air is PCB 118, followed by PCB 105, PCB 123, and PCB 77 in various orders. Levels of coplanar PCB, expressed as toxicity equivalents (TEQ), correlate well with the total indoor air PCB concentration: a total PCB level of 1000 ng/m^3 corresponds to a concentration of coplanar PCB of 1.2 pg TEQ/m^3. Based on this correlation and on an indoor air PCB level of 6000 ng/m^3 (tentative guideline value), the maximum daily intake of coplanar PCB via indoor air was estimated to be 0.6 pg TEQ/kg body weight.

The range of PCB concentrations encountered in buildings where joint sealants containing PCB are present may easily span up to 2 orders of magnitude. But the presence of joint sealants containing PCB does not usually lead to PCB indoor air concentrations close to or above the tolerance limit of 6 µg/m^3 (based on a daily exposure of 8 h). The impact of the presence of these materials on indoor air quality is, among other factors, dependent on the air-exchange rate of the room. Other parameters affecting the resulting indoor air PCB concentrations include the type of PCB mixture present in the joint sealants, the surface area of joint sealants present in the room which is in contact with the indoor air, the temperature of the construction material adjacent to the joint sealants, and the room temperature. [31c]

Joint sealants represent long-term diffuse sources for PCBs. The PCB inventory present in these materials is large enough to sustain elevated levels of PCB in indoor air for a very long period of time. [31c]

Joint sealants in concrete buildings erected between 1955 and 1975 and anti-corrosive coatings in large steel constructions (e. g. bridges, storage tanks, masts of high volume transmission lines) represent major inventories of PCBs in open systems. Removal and appropriate disposal of old joint sealants, coatings and paints from construction materials is crucial to prevent significant amounts of PCB being released into the environment and, eventually, incorporated in biota along the food chain. This aspect is addressed also in chapter 2.3.5.

The pollution of river water (suspended fine particles), sediments, biota, sewage sludge, and soil with PCBs in Switzerland has been measured within several environmental monitoring

programs [42, 42a]. PCBs have been detected in all environmental compartments. The reported concentration ranges are summarised in following table.

Environmental compartment / biota	Sampling time period	Concentrations	Comments
Suspended fine particulates in River Rhine; sampling location Weil am Rhein	1995 - 2003	30 – 150 µg/kg dw (total PCBs)	No time-dependent trend
Surface sediments of river estuaries in Lake Geneva	1982, 1990	25 – 200 µg/kg dw (total PCBs)	No common time-dependent trend for all sites
Surface sediments in Lake Geneva	1978, 1979, 1983	20 – 540 µg/kg dw (total PCBs)	---
Fish from Lake Geneva: burbot (*Lota lota*) and perch (*Perca fluviatilis*)	1973 - 1993	20 – 300 µg/kg fw (total PCBs)	Decreasing concentrations since the end of the 1970s
Different fish species from various rivers all over Switzerland	1989	40 µg – 8 mg/kg fw (total PCBs)	---
Water-living birds from Lake Lugano and Lake Maggiore	1990s	3 µg – 10 mg/kg fw (total PCBs)	---
Bird eggs, various species	1976/77, 1979, 1982-87	0.2 – 40 mg/kg lipid weight (total PCBs)	No common time-dependent trend; the PCB contents depend on the species and site
Sewage sludge from various sewage treatment plants	1980, 1982, 1989-94	200 µg – 2.9 mg/kg dw (total PCBs)	Decreasing concentrations since the 1980s
Soil samples from various locations (sampling sites of the national soil monitoring network and soil monitoring projects of the cantons Aargau, Bern and Solothurn)	1990, 1992, 1994-96	0.2 – 215 µg/kg dw (Σ PCB 28, 52, 101, 118, 138, 180)	---

Results of a biomonitoring study in 1995 with the foliose lichen species *Parmelia sulcata* show that lichens sampled near industrial sites are exposed to 5-10 times higher PCB concentrations than lichens from any other location (urban and rural) [33]. The highest PCB concentration was found in lichens located in the vicinity of a metal scrap treatment plant, which also processed transformers. The analysis of age-dependent subsamples at this site showed that the PCB burden of the lichens had declined by a factor of 2-3 after processing of PCB-containing transformers was halted.

The available monitoring data suggests that PCB contamination of environmental compartments is caused mainly by diffuse emissions from the above described stockpiles in open systems and by long-range atmospheric transport. PCBs that are formed unintentionally, e.g. as by-product in industrial processes or from precursor substances in thermal processes and

combustion, have hitherto not been considered to be a relevant source of PCBs in the environment.

2.3.2.2. Current and projected future production, use, import and export of PCBs

The legal situation and the control mechanisms in place make it highly unlikely that there could be any intentional current or future **use** of PCBs in Switzerland, while some objects or installations emitting minor amounts of PCBs are probably still in use.

All in all, this is very satisfactory, given that between 1975 and 1984 some 590 tons were used and remained in the country (mainly for the production of transformers and electrical capacitors) and given that between 1959 and 1980 an estimated amount of around 1000 tons were used in fluorescent lamps alone.

With regard to **production, import, and export** it should be reiterated that PCBs were never produced in Switzerland. In addition, there is no planned future production, import, or export.

This is again satisfactory, if considering that between 1975 and 1984

- around 840 tons of PCBs were imported (as such and in electrical equipment) and
- around 310 tons were exported (in electrical equipment) [31a].

2.3.2.3. Regulatory and policy framework regarding PCBs

The regulatory and policy framework regarding PCBs in Switzerland is very clear: PCBs are prohibited, and extensive efforts to eliminate them entirely have been and are being undertaken. Here FOEN has the clear mission to guide the process, and there is a number of very relevant ordinances regulating PCBs in view of all the stations of their life-cycle (cf. table 10 in chapter 2.2.4). The remaining diffuse sources are the subject of FOEN publications [31a, 31c], and guidance documents [38, 40, 40a, 41].

This short sub-chapter concludes by referring to chapter 2.3.5.2 below, where the Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances (ORDEA, SR-814.016) and the respective guidelines are addressed in the context of waste management in general.

2.3.3. Assessment with respect to Annex B Chemicals (DDT)

2.3.3.1. History of DDT in Switzerland and current monitoring needs

DDT has been prohibited in Switzerland with the OHS as enforced since 1986.

The monitoring needs are similar to those discussed in chapter 2.3.1.1, and a better understanding of the results will also in this case require a careful analysis of the local history of the use of DDT. But DDT is still special in several respects. Thus, a number of specific points should be discussed:

- **Biomonitoring:** The study with lichens already mentioned in chapter 2.3.1.a) [33] showed results which still cannot be easily explained, namely surprisingly high DDT values in some urban environments (Rorschach, St. Gallen and Basel) and in comparison very low DDT values in others (Bern,

Lugano). In addition, the values in rural or background environments were consistently low to very low. A reliable interpretation of that finding cannot be given here (cf. **Fig. 6** below).

The study with lichens, besides DDT, also determined DDD and DDE, i.e. degradation products of DDT. In this connection, the following is worth mentioning:

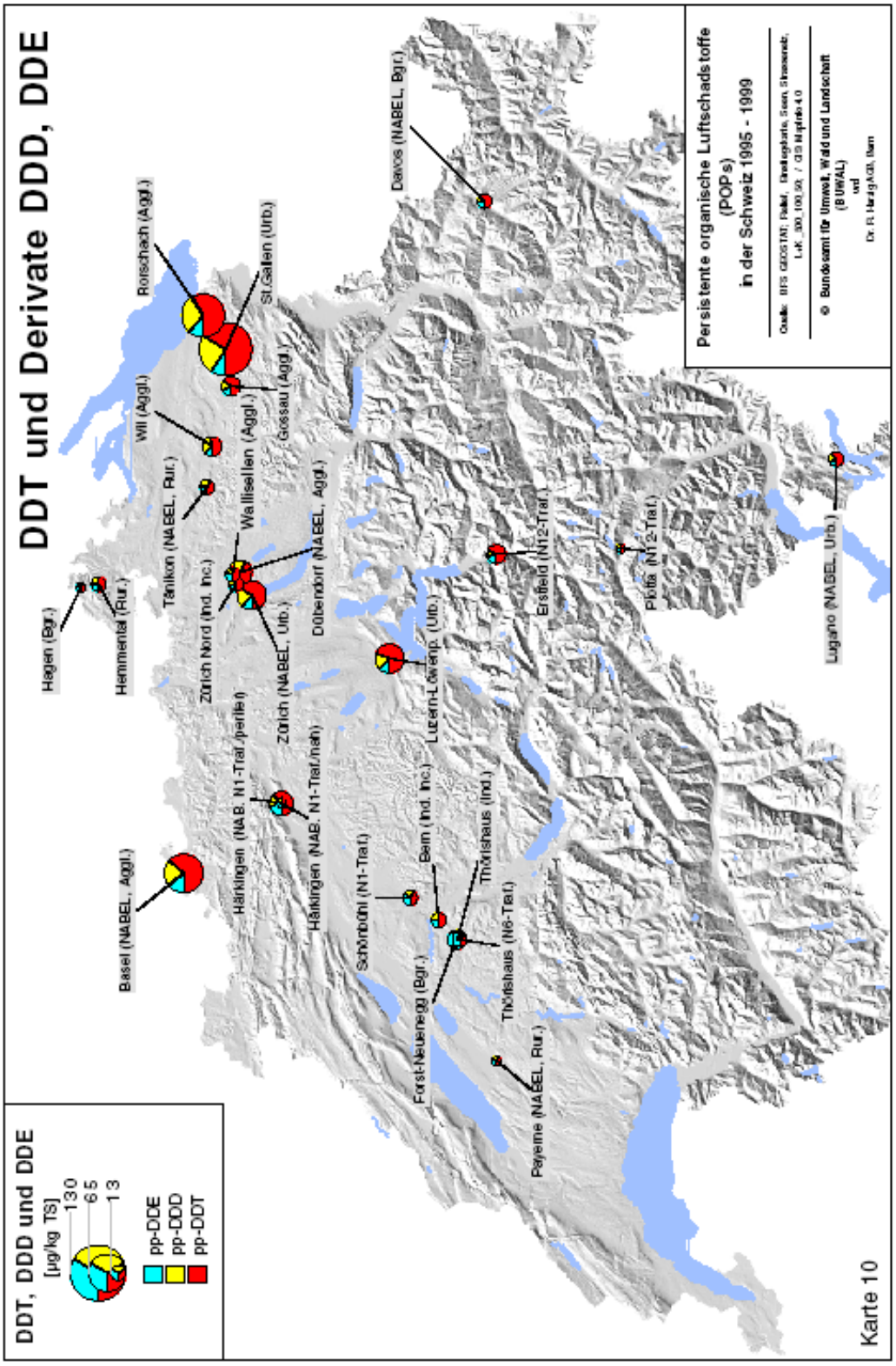
- The relation DDT : DDD : DDE was relatively constant.
- There was a trend towards higher relative DDT values at the sites with higher total amounts (up to about 65% DDT).
- There also was a trend towards lower relative DDT values at the sites with low total amounts (down to about 40% DDT).
- The values of DDE (2nd degradation step) were the highest (up to about 55%) where DDT was the lowest.
- The absolute total values found for DDT + DDD + DDE varied between about 5 – 130 μg/kg of dry substance (lichens).

- **World-wide translocation:** This is an often cited and broadly accepted property of POPs. But its contribution in comparison to local sources of POPs contamination remains unknown in detail. It depends in addition on the individual POP under consideration.

- **Sorption of DDT to soil:** It is well known that POPs migrate into soil, and there is a substantial volume of literature on this point. For example, a recent publication by G. Vassilyeva and V. Shatalov [43] on related model calculations also presents a compilation of findings on POPs content in soil and mentions DDT values of up to 70 mg/kg (very high compared to the Swiss values cited below), while the highest values found for hexachlorocyclohexane were about 1 mg/kg, and the following recent DDT values were found in Switzerland [42]:
  - 6 – 8 μg/kg dry weight in soil,
  - up to 50 μg/kg dry weight in sediments and suspended matter (Lake Geneva and Rhine),
  - up to 376 μg/kg dry weight in sewage sludge from communal stations, and
  - up to 1030 μg/kg dry weight in sewage sludge from industrial stations.

  Here, the following remarks should be added:
  - The DDT washed out into the waters is bioconcentrated in fish. High exposure was found in Lake Maggiore (average values of the sum of p,p'- and o,p'-isomers of DDT, DDD and DDE in 1993: 631 μg/kg fresh weight (fw)) compared to Lake Lugano (24 μg/kg fw). This was due to contamination of the lake from an Italian DDT producing plant. In some areas DDT exposure decreased between 1984 and 1993: p,p'-DDE in Lake Geneva perch (*P. fluviatilis*) 1984-87: average 7-11 μg/kg fw; 1991-93: median 1-2 μg/kg fw and burbot (*L. lota*) 1984-87: average 10-16 μg/kg fw; 1991-93: median 1-3 μg/kg fw. In general, the situation in Switzerland in 1999 can be described as follows: The degree of DDT exposure is dependent on the fish species: shad (*Alosa fallax lacustris*), charr (*Salvelinus alpinus*) and eel (*Anguilla anguilla*) showing the highest concentrations; there are great geographical variations and in some regions (Lake Geneva, High-Rhine and Upper-Rhine) decreasing levels may be found.

Figure 6: DDT distribution as determined by the lichens study



Although the biomonitoring study with lichens sampled in 1995 provides some information about the amounts of POPs deposition in the period 1990-1995 and the variation in concentrations between locations (e. g. urban, rural, industrial, traffic-exposed), the contributions of long-range transport and local sources to the measured environmental contamination with POPs cannot be distinguished. Further investigations need to be conducted to address the questions about sources and fate of POPs in the environment.

2.3.3.2. Current and planned future production, use, import and export of DDT

There is no current or planned future production, use, import or export of DDT in Switzerland.

2.3.3.3. Regulatory and policy framework for DDT

The regulatory and policy framework for DDT in Switzerland is very clear: DDT is prohibited in agricultural, industrial, and consumer products. Thus, there is also no intention of making an exception under the Stockholm POPs Convention – while the further study of DDT in research or its incineration in safe special ovens remains reserved, of course.

2.3.4. Assessment of Releases from Unintentional Production of Annex C Chemicals: PCDDs, PCDFs, HCB and PCBs

The focus of this chapter is on the unintentional production of PCDDs and PCDFs (polychlorinated dibenzodioxins and polychlorinated dibenzofurans), because unintentional production and release of HCB and PCBs play a minor role compared to intentional use of these substances (cf. chapter 2.3.2).- Here, it has to be added that the FOEN published an in-depth assessment of PCDDs and PCDFs in 1997 [20].

2.3.4.1. History of unintentionally released POPs in Switzerland and current monitoring needs

PCDDs and PCDFs as natural products:

PCDDs and PCDFs have never been intentionally produced, while they are (and always have been) formed from materials containing chlorine when burned. Thus, they have existed since prehistoric times and may almost be regarded as natural products.

Anthropogenic PCDDs and PCDFs:

As mentioned, PCDDs and PCDFs are and always were formed in fires, because the burning of wood results in fly ash that contains them in trace amounts…. and human beings have been burning wood since prehistoric times. In addition, large amounts of wood are still burned today, which, therefore, is an anthropogenic source of PCDDs and PCDFs in Switzerland like everywhere else. But recent developments have resulted in significant additional PCDD and PCDF sources. They included in particular

- open garbage incineration,
- burning fuels with chlorine containing additives in cars, and
- chemical reactions.

Most of these newer sources of PCDDs and PCDFs were recognised in the late 1970's. At least, that was the time when they received a lot of public attention. The reason was in part

the famous 1976 chemical accident in Seveso, Italy. This was not the first 2,3,7,8-TCDD-event, but certainly the one that was given the most media-coverage. In addition, the same accident raised public awareness again when the barrels containing the critical remnants from the plant disappeared and their odyssey across Europe made headlines for weeks. This was especially true in Switzerland, because a Swiss industry group, Roche, had actually bought the concerned Icmesa factory in Seveso shortly before the infamous accident.

These developments had multiple and far-reaching consequences in Switzerland:

- They facilitated the enactment of the Federal Act on the Protection of the Environment.
- They raised a strong public “dioxin-awareness”.
- They resulted in a quantum leap for PCDD-analysis.
- They also resulted in a quantum leap for waste incineration technology.
- They promoted the investigation of other dioxin sources and ultimately led to more environmentally-friendly fuel for cars.
- And finally, they had a strong impact upon the chemical industry’s planning of their production processes (avoiding reactions delivering trace amounts of “dioxin-by-products” or of larger amounts of “dioxin” in case of a failure of the systems controlling the reactors).

Thus, one is on safe ground in claiming that the PCDD- and PCDF-pollution started to decrease again in the 1980’s – even though there are not too many details to substantiate this. However, there is accompanying evidence, e.g.,

- the reduction of hydrogen chloride emissions since the 1980’s [10],
- the observation of decreasing PCDD and PCDF concentrations in cows’ and mothers’ milk or blood, and
- the results of measurements comparing older and younger sediments [20].

Biomonitoring:

The lichen program already discussed in the context of other POPs also addressed PCDDs and PCDFs [33]. It yielded the following results:

- The highest contents in tetra to hexachloro-dibenzodioxins were found in industrial environments (up to ~ 50 ng/kg dry substance)
- The lowest values (~ 5 ng/kg dry substance) were measured in rural environments.
- Urban environments delivered intermediate results (~ 25 ng/kg).
- The 2,3,7,8-TCDD alone did not completely match the pattern observed for the total tetra to hexa-PCDDs, but the values determined were still correlated – with maximum 2,3,7,8-TCDD results for industrial and urban environments with waste incineration plants (values of all environments varying from 0.16 to 1.6 ng/kg dry substance).
- The highest I-TEQ value of 43 ng was again found in an industrial environment with a waste incineration plant, and the I-TEQ-pattern correlated well with the one found for the tetra- to hexa-PCDDs.
- The results taken together confirm the rough approximation of an average TEF of the total PCDD-/F-congeners of 0.01 (cf. the discussion in chapter 2 2 6).
- A significant role of traffic cannot be deduced from the trends cited.

Monitoring needs:

The general monitoring needs as stated in chapter 2.3.1.1 also apply to PCDDs and PCDFs. Thus, it will be of interest to perform a more in-depth investigation into the age-dependent PCDD- / PCF-accumulation in lichens [33]. In addition, more work will be required to reliably differentiate PCBs and HCB-releases from intentional and unintentional production. Never-

theless, it should be mentioned here that the HCB-contents found in the lichens-study (up to about 30 μg/kg dry substance) were high in comparison to the PCDDs and PCDFs, but low in comparison to the PCBs (cf. chapter 2.3.2.1).

2.3.4.2. Current and projected future release of PCDDs / PCDFs in Switzerland

Assessment edited in 1997:

It has been mentioned above that progress has been made since the 1980's which were the peak emission years for many pollutants, including PCDDs / PCDFs [20]. This is illustrated in the following **table 11** along with some expected values for the future (2000- and 2010-values representing extrapolations). The subsequent subchapter compares these expected values with newer findings and includes a number of comments. The values presented in table 11 relate to **air emissions**.

Table 11: Current and future PCDD- / PCDF-release in Switzerland (g I-TEQ/year)

PCDD-/PCDF-sources	1960	1980	1990	2000	2010
Households:	**11.9**	**19.5**	**27.4**	**29.8**	**36.7**
Burning waste	2.5	18.3	26.8	29.4	36.3
Heating	9.4	1.2	0.6	0.4	0.4
Waste management:	**134.6**	**365.4**	**152.3**	**16.2**	**11.1**
Waste incineration	22.8	248.0	120.0	9.9	9.9
Special waste incineration	4.1	37.1	11.8	4.9	0.5
Sewage sludge incineration	0.0	0.3	0.3	0.0	0.0
Burning on garbage dumps	21.7	38.4	19.9	1.2	0.4
Slow burning of cable insulations	86.1	41.6	0.1	0.0	0.0
Shredders	0.0	0.1	0.1	0.2	0.2
Construction business:	**1.5**	**20.5**	**22.9**	**4.0**	**2.1**
Burning waste from constructions	0.9	17.3	19.9	1.6	0.4
Use of wood protection products	0.6	3.2	3.0	2.4	1.7
Metal industry:	**20.0**	**64.1**	**20.7**	**11.6**	**13.0**
Steel-works	16.5	25.0	12.2	8.4	9.4
Non-iron foundries	0.0	13.3	6.4	1.9	2.1
Iron-foundries	0.7	24.5	1.3	1.3	1.5
Galvanization	2.0	0.7	0.1	0.1	0.1
Remelting aluminium	0.8	0.7	0.7	0.0	0.0
Other manufacturing / industries:	**6.7**	**11.4**	**16.7**	**9.7**	**2.8**
Industrial heating systems	2.0	1.3	1.0	1.1	1.1
Incineration of hospital waste	2.3	8.3	13.8	6.9	0.0
Cement ovens	1.2	0.9	0.8	0.7	0.7
Smoking meat	0.3	0.4	0.4	0.3	0.2
Cremation	0.1	0.3	0.4	0.5	0.5
Producing matchboards	0.0	0.2	0.2	0.2	0.3
Others	0.8	0.1	0.1	0.1	0.1
Traffic:	**1.2**	**2.7**	**1.9**	**0.3**	**0.2**
Cars without catalyst	0.8	2.7	1.8	0.2	0.0

Agriculture and forestry:	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Total anthropogenic emissions	**176**	**484**	**242**	**72**	**66**

Newer assessment based on figures from the year 2002:

This subchapter opens with a discussion of the **methods** used in assessing PCDD/PCDF-emissions. Obviously, it is not possible to obtain integrated countrywide emission results from analyses covering a narrow enough network. Therefore, one has to refer to analyses of types of set-ups and focus on major sources releasing PCDDs and PCDFs, and one has to then use statistics in order to obtain a summation. This has in essence been done in drawing up table 11 above and has again been done in compiling the results presented in **table 12** below. This approach corresponds to the one UNEP Chemicals used in elaborating its toolkit. [44] FOEN continuously considers new findings and assessments and up-dates its corresponding handbook compiled in 1995 [45].

The following **table 12** illustrates the abovementioned approach and provides some details and adds some comments with regard to the results presented in table 11 above. It relates to 2002, where not otherwise indicated.

Table 12: Newer results and comments relating to PCDD/PCDF-emission sources and emission factors (EFs in I-TEQs per weight – basis 2002)

PCDD-/PCDF-sources	Comments
Households	
Burning waste	Emission factor assumed to be identical to the one for open burning on disposal sites: **300 +/- 200 µg/t**. Amount estimated as ≈ 1% of total household garbage, i.e. 1% of 2.5 million t. → ≈ 8 g release into air + ≈ 16g in residues, if one works with the above EFs in line with UNEP's toolkit. This corresponds about to the value presented in table 11. → However, the values in table 11 were meant to be air emissions and were actually calculated with a ≈ 3-fold EF. → Reduction of the emission due to a less pessimistic EF!
Heating	More than 80% of private homes are heated with high quality fossil fuels (light oil or gas) with an EF of ≈ **23 ng/t** according to UNEP's toolkit. → ≈ 0.1 g release into air. An about 10 to 20-fold EF is assumed for the remaining systems (particularly coal and wood – very minor contribution from electric heating) resulting in ≈ 0.3 g total release into air.
Public waste management	
Burning municipal waste in waste incineration plants	EFs for release into air estimated to be up to 1000 times lower than in open burning – currently being re-assessed (project LEA). The figure in table 11 corresponds to a total release of ≈ 4 µg/t, i.e. ≈ ¼ of the respective value according to UNEP's toolkit for high technology combustion with sophisticated air pollution control (reduction of the fly ash to < 0.4% as opposed to ≈ 1 – 2% according to the toolkit). But the true value is today

	estimated to be ≈ **2 µg/t**. Cp. table 13 with regard to the technologies applied in Swiss waste incineration plants.

<u>Table 12</u> (continued) Newer results and comments regarding PCDD-/PCDF-emission sources and emission factors (EFs in I-TEQs per weight – basis 2002)

PCDD-/PCDF-sources	**Comments**
Special waste incineration	Table 14 (chapter 2.3.5) compiles the composition of the total annual amount of special waste of 970 000 t (basis 1997 – 2001). Of this ≈ 37% are incinerated. The EF delivering the figure in the above table 11 corresponds to ≈ **15 µg/t**, which again implies a reduction of the fly ash as compared to the value in UNEP's toolkit (30 µg/t).
Burning on garbage dumps	Dumping household garbage on disposal sites has been prohibited since 2001, other than in the case of capacity bottlenecks relating to the capacity of waste incineration plants.. In 2006 there is sufficient incineration capacity available and dumping does not take place anymore.
Shredders	Countrywide there are 5 installations for the destruction of scrapped cars. These installations are closed and equipped with cyclone and Venturi fluid separator. EF **0.4 µg/t** (air emission would be = 0.2 µg/t according to UNEP's toolkit). Total release into air in 2002 ≈ 0.2 g.
Construction business	
Burning waste from constructions	346 000 t of combustible waste from construction (erection of new buildings and demolition) probably containing ≈ 15% of waste from households were delivered to waste incineration plants. 8 000 t were dumped. Working with the EF for household garbage (**2 µg/t**) results in a total release of ≈ 0.7 g in 2002.
Use of wood protection products	The figure in table 11 (release of ≈ 2.4 g in 2000) is an estimate addressing wood protection products applied many years ago. They contained some PCDDs/PCDFs which are still slowly released into the air [20].
Metal industry	
General remark	The figures as given below for 2002 are significantly lower than the older estimates as presented for the year 2000 in table 11 above. The difference is higher than the conceivable progress achieved in 2 years and this has more than one reason. Generally, the figures below must be regarded as more reliable (they are i.a. based on the so-called EMDET [45]). In addition, some steel works were closed in the considered period of time.
Steel-works	Countrywide there are 3 installations. They are equipped with a coke oven jet injector and rapid cooling of the exhaust of the thermal gas purification. EF = **0.3 µg/t** of steel, which resulted in a total release into air of 0.34 g in 2002.
Electrical oven foundries	Ovens equipped with electrical and tissue filters resulting in a EF = **0.13 µg/t** of cast iron and a total release of 0.005 g in 2002 according to the Association of Metal Industries.

Table 12 (continued) More recent results and comments relating to PCDD-/PCDF-emission sources and emission factors (EFs in I-TEQs per weight – basis 2002)

PCDD-/PCDF-sources	Comments
Other foundries	EF = **1.3 µg/t** resulting in a total release of 0.14 g in 2002 according to the Association of Metal Industries. 2/3 of the emissions from foundries equipped exclusively with tissue filters.
Non-iron foundries	EF = **30 µg/t** resp. **4.9 µg/t** for foundries just equipped with tissue filters and foundries equipped with tissue filters and afterburners, respectively. Total release > 0.3 g (no exact amounts available).
Galvanization	EF = **0.7 µg/t** of galvanized material. Total emission in 2002 < 0.1 mg.
Other manufacturing / industries	
Industrial heating systems	The related figure presented in table 11 for the year 2000 is high in comparison to the one for heating of households. It reflects an about 10 to 20-fold EF, i.e. an average of **250 to 400 ng/t** for industrial heating, which is mainly due to the use of some permitted lower quality fuels. This EF is probably higher than the true figure for the year 2000.
Incineration of hospital waste	Hospital waste is now incinerated with other waste in waste incineration plants, which essentially eliminates the 6.9 g mentioned in table 11.
Cement ovens	Production of ≈ 3 million t of lime per year. EF **< 10 ng/t** resulting in a annual release of < 0.003 g – again an exceedingly low figure in comparison to the older estimate as presented in table 11 above. The EF used here corresponds to 1/7 of the value given in UNEP's toolkit for high tech dust abatement procedures.
Cremation	15 of the 59 Swiss crematoria have been upgraded to an EF of **1 µg/cremation**. The remaining 44 are at about **10 µg/cremation**. This results in a total of ≈ 0.3 g as compared to 0.5 g mentioned for the year 2000 in table 11.

Comparing the 1997 and the 2002 assessments:

The figures in table 12 above lead to the conclusion that the expected values as published in 1997 were too pessimistic, because table 12 adds up to annual air emissions of **no more than about 23 g I-TEQ**. The main reason is that some of the newer figures are based on new reported industry assessments, while the 1997 assessment used a UNEP toolkit-type approach and judged the installed technologies in a very careful manner (using high EF's). But one is still on the careful side and in line with UNEP's toolkit if it is assumed that **the 2010 target of PCDD-/PCDF air emissions of ≤ 66 g I-TEQ/year was reached in 2002**.

The above conclusion is rewarding, but certainly no argument against further corroborating measurements and assessments. In addition, it has to be taken with a pinch of salt, because

- no figures are currently available for a number of minor or uncontrollable PCDD-/PCDF-sources, and
- the uncertainty regarding EFs is very considerable.

PCDD-/PCDF-emissions, fluxes and pools:

Table 11 above displays the Swiss anthropogenic PCDD / PCDF air emissions over 50 years and shows, together with table 12, that emission values comparable to the ones of the 1950's, i.e. of about 34 g I-TEQ (?) will be approached again after 2010 [20]or possibly earlier. This is certainly satisfactory. However, the devising of a complete analysis of the situation cannot be based just on the changes due to annual anthropogenic air emissions. It rather has to consider the following additional elements:

- the import into the country of air-borne PCDDs and PCDFs,
- the export of air-borne PCDDs and PCDFs,
- the export of PCDDs and PCDFs in running waters (there is no corresponding import, if disregarding lakes and rivers at borders), and
- the pool of PCDDs and PCDFs deposited and still present in the different environmental compartments, i.e. mainly in soil, in sediments, and in the biosphere.

Unfortunately, the current availability of data does not permit more than a very rough estimate of the mentioned elements. Nevertheless, some available figures and estimates shall now be used to get an approximate total picture, i.e. a kind of inventory and an estimate of the turnover of PCDDs and PCDFs [46].

Import of air-borne PCDDs / PCDFs: This import may be approximately defined as the amount of PCDDs/Fs deposited by rain and dust carried over long distances by winds – corrected by the re-deposition of locally produced PCDDs/Fs. The corresponding figures cited in the FOEN publication on dioxins and furans [20] are 2.5 – 8 pg I-TEQ/m^2 • day (measurements done in 1997). If one now assumes that the lower value could hold for all of Switzerland and essentially reflect imports, while the higher one includes re-deposition (because one of the measuring sites was close to an urban area), one obtains

~ 41 • 10^9 • 365 • 2.5 pg I-TEQ ≈ 37 500 • 10^9 pg I-TEQ = **37.5 g I-TEQ per year**.

Thus, one ends up with an import value corresponding approximately to the estimated total 1950 air emission. However, one has to add a word of caution here: The recent study of PCDD-/F-levels in milk (cf. Table 15, chapter 2.3.7) clearly shows that there has been a decrease over the past two decades of the PCDD-/F-deposition for rural locations as well (cf. the quotient Q in table 15), which suggests that the above import value might be unfairly high.

Furthermore assuming that around 20% of the country's surface could show as much as the higher of the two reported deposition values, one would have to add another 24 g I-TEQ per year from internal re-deposition, and one would obtain

37.5 + 24 = 61.5 g I-TEQ per year.

This total would be just a little less than the total emission given in table 11 for the year 2000 (72 g I-TEQ) – and would confirm the less pessimistic values as presented in table 12.

Export of air-borne PCDDs / PCDFs: As PCDDs/Fs are essentially re-deposited locally, one may in view of the present, very rough estimate assume that no more than 20% of the PCDDs/Fs emitted into air are exported. If then assuming that the 24 g I-TEQ per year mentioned in the previous paragraph actually represents 80% of the (direct and indirect) Swiss emissions into air, the result is exports via air of about **6 g I-TEQ per year**.

In addition, it must be concluded that just about half of the total emissions presented for the year 2010 in table 11 would actually deliver air-borne PCDDs/Fs, which would all in all result in a significant (about 6-fold) excess of imports over exports via air.

Export of PCDDs / PCDFs in running water: Waters (lakes and rivers) cover 4.2% of the total surface area of Switerland. They constantly feed into neighbouring countries and are constantly replenished by rain. If it is now assumed that at least 67% of the total rain (or snow) leaves the country again in rivers and if one assumes in addition that this water carries about 5 ppm of sediment [47], i.e. solid particles, one ends up with

~ 30 • 5 • 10^3 tons of sediment carried out of the country per year.

If in addition considering the total PCDD- / PPCDF-values determined for some Swiss lakes, which were 1000 – 1700 ng/kg, one calculates for the lower value that

~ 30 • 5 • 10^6 • 1000 ng total PCDDs/Fs

are exported via rivers, this would correspond to

~ 150 • 10^9 • 0.01 ng I-TEQ = **1.5 g I-TEQ per year**,

if working with an average TEQ-factor (TEF) of 0.01.

Here, it has to be added that no washing out into running water of PCDDs / PCDFs from non-air emissions is considered in this figure.

PCDD / PCDF-pool deposited in sediments and soil: Considering just the upper (wet) 20 cm of sediments and working with the above-mentioned PCDDs/Fs-contents of about 1000 ng/kg dry weight would result in a pool of

~ 10^{11} • 1000 ng total PCDDs/Fs deposited in lakes,

which, if again using a TEF of 0.01, would correspond to

~ 10^{14} • 0.01 ng I-TEQ = 1000 g I-TEQ deposited in the upper sediments of Swiss lakes.

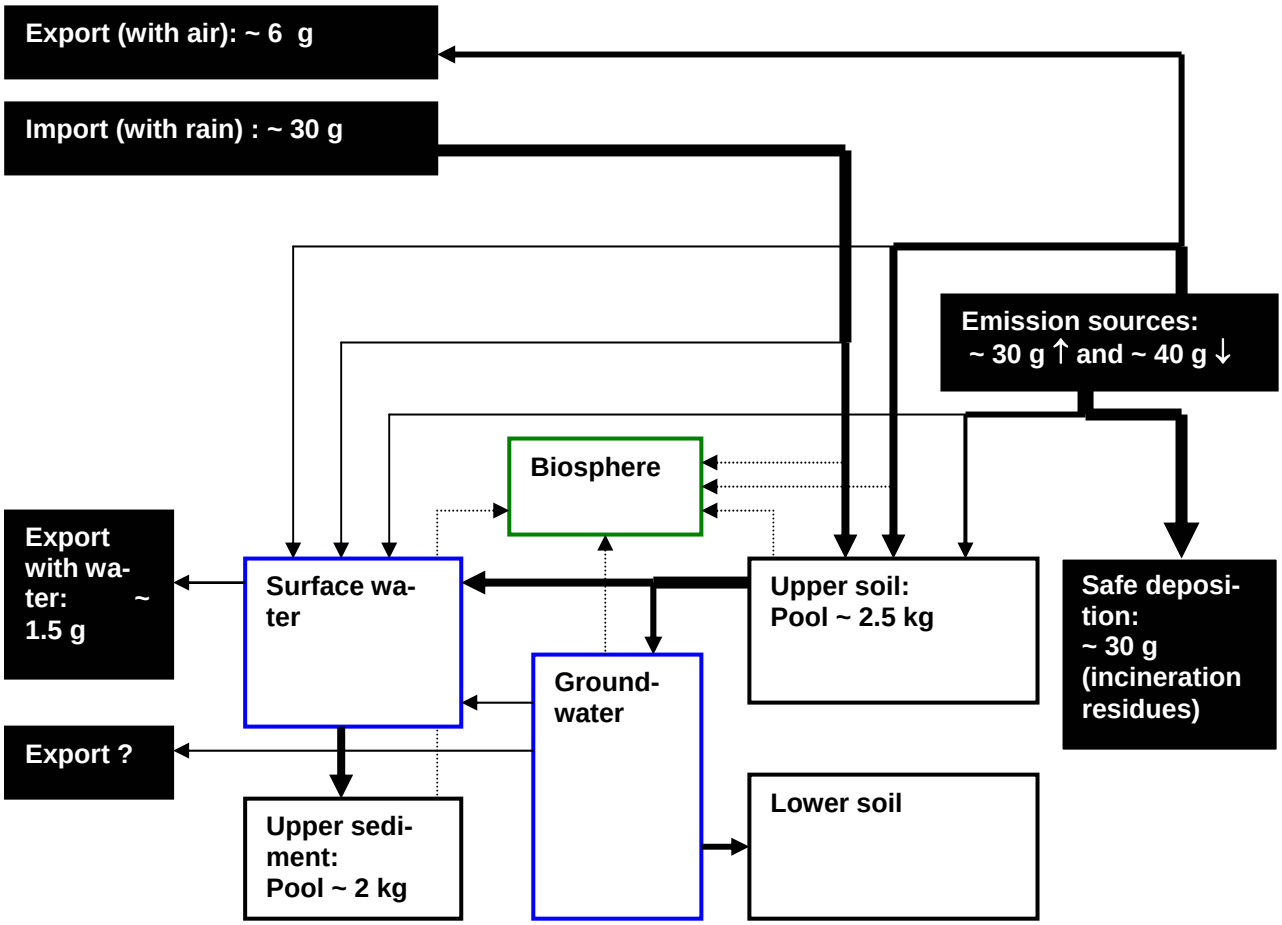
Considering an average of ~ 1 ng I-TEQ/kg soil and assuming that the PCDDs/Fs are essentially concentrated in the upper 10 cm layer yields an additional pool of PCDDs/Fs of

~ 30 • 10^{11} • 0.7 • 1 ng I-TEQ ≈ 21 • 10^{11} ng I-TEQ = 2100 g I-TEQ.

Thus, the combined PCDD- / PCDF-pool (sediments and soil) would be estimated at about **3 - 6 kg I-TEQ**, whereby the second figure (6 kg) is based on the upper averages reported [20].

The **conclusions** of all these approximate calculations are summarised in **Fig. 7** below, in which the boldness of the arrows represents the quantitative importance of the respective fluxes.

Figure 7: Roughly estimated PCDD- / PCDF-fluxes and -pools (g I-TEQ per year)



The **conclusions** from all these considerations are the following:

- The environmental imports and exports of PCDDs/Fs via air are small in comparison to the available pool (≈ 1% and ≈ 0.2%, respectively, if using the lower figure for the pool). They are relevant and not insignificant in comparison with the total annual Swiss air emissions according to table 11 (≈ 50% and ≈ 10%, respectively). It must however be stressed that the approximation used to determine the imported PCDDs/Fs may have delivered an unfairly high value.
- The environmental export of PCDDs/Fs in water is not completely negligible, but small in comparison to the annual total anthropogenic release into air (~ 2%) and very small in comparison to the total available pool in upper sediments and soil (~ 0.05%).
- The estimated total deposition in the upper layers of sediments and soil correlates quite well with the accumulated anthropogenic emissions of the past 50 years as presented in table 11.
- Release into running water from solid PCDD/PCDF-waste is not considered in the above discussion and may “at best” have a local effect. However, this effect could become more important one day, should old, non-remediated dumping sites start to result in more widespread pollution.
- The accumulation in the biosphere remains the main point of concern, and it is most important, relatively speaking, for the environmental compartment “lakes” and for the organisms in the food chain.

- The mentioned concern may be reduced one day when newer sediments start covering the ones with relatively high PCDD-/F-contents, because this will result in a slower up-take into the biosphere of the respective substances.
- Finally, it must be underlined again that this discussion addresses exclusively environmental (i.e. “natural”) movements of POPs, and that it disregards, for example, the deliberate “anthropogenic” movements of waste, and that the figures presented are no more than very rough estimates.

2.3.4.3. Regulatory and policy framework on PCDDs and PCDFs

This short chapter opens with the remark that the regulations addressing the release of PCDDs and PCDFs have, of course, a quite analogous effect on the release of HCB and PCBs, though the “unintentional” release of the latter very probably plays a minor role in comparison to the impact of their earlier intentional use.

The focus of the regulations addressing the reduction of the PCDD- / PCDF-release is two-fold:

- on the avoidance of precursors and
- on the equipment or processes in which the pollutants could be formed.

These regulations are in general terms addressed in chapter 2.2.4. above.

Avoiding precursors:

Annex 3.1 of the OSubst prohibited the manufacture, marketing, import and use of a number of halogenated substances which may be contaminated by PCDD / PCDF when manufactured or which are known to be-precursors for the formation of PCDD/PCDF when incinerated, i.a.

- hexachlorobenzene (HCB),
- halogenated biphenyls, terphenyls, naphthalines, and diaryl-alkanes,
- trichlorophenoxy fatty acids and derivatives,
- polychlorinated phenols and derivatives (penta- and tetrachlorophenols).

In 2005, the ORRChem superseded the OSubst, and polybrominated biphenylethers were added to the list of prohibited substances.

The OHS prohibited and the ORRChem prohibits the use of liquid organic halogenated substances like dichloromethane, trichloro-ethylene and perchloro-ethylene as components in

- detergents for textiles and
- cleansers.

The OHS prohibited and the ORRChem prohibits the mixing of halogenated waste solvents like dichloromethane, dichloro ethane, or chloroform with other waste or waste solvents. Reserved is the mixing for the direct purpose of state-of-the-art incineration in appropriate ovens.

The Ordinance on Air Pollution Control and a series of ordinances relating to vehicles prohibit leaded fuel, which also eliminates the need for chlorinated scavengers and reduces the traffic-related formation of PCDDs and PCDFs.

Finally, there are a number of guidelines that support the implementation of the above-mentioned ordinances. They may not be regarded as part of the regulatory framework in the strict sense of the word, but they still have a significant impact.

Regulations addressing potential PCDD / PCDF-forming processes and systems:

There is a large number of laws and ordinances addressing heating and incineration processes. They all are geared towards ensuring a high performance of the combustion, which also limits the formation of PCDDs/Fs. For example, there is the obligation of the Cantons to submit all private heating installations to regular checks (based on the Ordinance on Air Pollution Control), and there is the obligation of annual exhaust checks for motor vehicles.

The regulations relating to waste incineration plants require, for example, the limitation of the nitrogen content in flue gases to $\leq$ 80 mg/m^3 nitrogen oxides, which indirectly ensures a dioxin-limit of 0.1 ng/m^3 exhaust gas [20].

Also important in this context is the installation of catalytic converters in cars, in Switzerland mandatory for new vehicles since 1989.

Finally, the Federal Act on the Protection of the Environment provides the means for authorities to take action in the case of other processes or systems that potentially release PCDDs/Fs into the air. Analogous regulations based on the Federal Act on the Water Protection allow the authorities to take action to prevent pollution of waters. The Cantons implement the respective measures and regulating the details.

2.3.5. Information on the State of Knowledge on Stockpiles, Contaminated Sites and Wastes, Identification, Likely Numbers, Relevant Regulations, Guidance, Remediation Measures and Data on Releases from Sites

UNEP's guide to developing an NIP for the Stockholm Convention [3b] has the above title and firstly addresses known POPs hot spots in the country under discussion. There are no such specific POPs hot spots in Switzerland. This has been mentioned in the preceding chapters on POPs pesticides, PCBs, DDT, and unintentionally released POPs.

However, there are contaminated sites containing an abundance of problematic products. They are commented on in the following subchapter, while waste management in general is again addressed in the subsequent one.

2.3.5.1. Contaminated sites

The older the contaminated sites, the more limited the knowledge about the products they contain. There are about 40 000 to 50 000 known sites potentially containing significantly above background concentrations of hazardous materials, and there is an estimated number of 3000 sites requiring remediation. Of course, these are not POPs deposition sites but they are in some cases sites where POPs could potentially be formed or have possibly been dumped in the past. They are listed in related reports by the Cantons. The Canton Zug was the first to complete its register of polluted sites [48].

Monitoring needs:

The Cantons have been required compile their register of polluted sites – and the expected submission date was actually December 2003 [49]. However, there have been significant de-

lays, because some 15 000 of the estimated total of 50 000 sites [50] have required more in-depth evaluations. They were in the first place identified by referring to existing reports, media communications, and permits etc., and the corresponding results define monitoring needs which will keep the Cantons busy for the short to medium-term future.

Priorities and planned remediation measures:

It will be possible to remedy most of the above-mentioned 3000 sites at costs of less than CHF 1 million per site [50]. But there are two sites, Bonfol (JU) and Kölliken (AG), which served as chemical waste disposal sites for years. The first was operational from 1961 to 1976 and the second from 1978 to 1985. They contain around 114 000 and 350 000 tons, respectively, of special waste, and they most probably also contain POPs chemicals at least in traces – besides precursors which could form POPs over time. It has been decided, therefore, that a definite remediation of Bonfol and Kölliken is a must, a decision which is also economically viable because the remediation, though requiring enormous financial resources, is still cheaper than the sites' long-range state-of-the-art maintenance, which at today's values already costs several million CHF per year [51].

The maintenance costs are accumulating because the waste has been deposited in all kinds of containers and packages as well as in the form of sludge and because it was thought when planning the Kölliken site that the special geology of the ground (clay) would result in an extremely slow release of the chemicals in question. This assumption turned out to be inaccurate, due i.a. to reactions among the chemicals themselves, reactions with their surrounding material, and the formation of gases. Thus, the water leaking from the disposal site has to be collected and purified, as do the gases emitted into the air, which create a significant odour problem.

The current estimate is that the now initiated full remediation (including on-site incineration in a high tech oven) will require some CHF 200 and about 500 million for Bonfol and Kölliken, respectively. The costs incurred in this remarkable project will thereby be shared for Kölliken, mainly by the two Cantons (ZH and AG) and the chemicals companies that own the site.

Here, it has to be mentioned that the exact amount of POPs chemicals sitting in the Bonfol and the Kölliken waste disposal sites is still unknown – and that the two sites will probably be among the first large disposal sites of this nature in the world to undergo full remediation.

Relevant regulations and guidance:

Two important Federal Ordinances deal with the remediation of polluted sites: the Ordinance on the Remediation of Contaminated Sites (Contaminated Sites Ordinance, CSO, SR 814.680) and the Ordinance on the Charge for the Remediation of Contaminated Sites, OCRC, SR 814.681).

The CSO first of all defines contaminated sites as sites whose pollution originates from waste, and that are restricted in area. It furthermore defines sites in need of remediation as contaminated sites which lead to harmful effects or nuisances or as sites presenting a substantial danger of such effects arising. Then, the CSO defines the register of contaminated sites, to be maintined by the Cantons, and the monitoring, prioritisation and remediation needs. Finally, it delegates the implementation of the Ordinance in essence to the Cantons, while obliging them to adhere to a number of key precautionary principles.

The OCRC defines a fee to be paid on depositing waste, and it defines financial support that may require to be paid by the Confederation in order to ensure a thorough remediation. In addition, it specifically mentions environmentally hazardous substances and the sustainability of the measures to be taken as well as analytical procedures and specific classes of sub-

stances. Amongst the latter one finds specific PCDD-/F-precursors (chlorinated phenols) as well as chlorinated benzenes and PCBs.

Finally, there are a number of guidelines dealing with the remediation of contaminated sites. They address the problem in technical as well as financial terms [50, 52].

2.3.5.2. General aspects of waste management [19]

Waste management has already been extensively addressed in this NIP, mainly in chapters 2.1.4 and 2.3.4.2. Therefore, this present chapter focuses on aspects which have not yet been considered in detail, and in particular on technical aspects of waste incineration plants, special wastes, and some regulatory aspects.

Switzerland has a long-standing tradition of separating wastes and a declared policy of pursuing an export-independent waste management policy. This policy favors recycling or incineration, wherever possible – and it goes without saying that the respective incineration has to be state-of-the-art in order to, e.g., avoid the unintentional formation of POPs. Thus, there is a high probability that today's professional waste incinerators create fewer PCDDs/Fs than the illegal private combustion of waste in chimneys and the like – in spite of the fact that about 2.5 million tons per year are professionally incinerated [19], while the amount of waste combusted illegally is much smaller (≈ 1%??).

Technical aspects of waste incineration:

These aspects are illustrated by **table 13** below [19]. This table addresses the plants incinerating 97% (≈ 2.5 million t) of the household waste, essentially all of the hospital waste, a significant part of the around 200 000 t (dry weight) of sewage sludge generated per year as well as around 400 000 t of combustible construction waste. As one sees from this table and the one above (table 12), the technological standard of these waste incineration plants may on average be regarded as very high.

Table 13: General characteristics of waste incineration plants and technologies applied:

Number	Description / characteristics
Plants:	
31	Operational waste incineration plants
Thereof 50%	Treating > 100 000 t/year
3 135 000 t/year	Total capacity of waste incineration plants available in 2003
2 973 753 t/year	Total amount of waste treated in the plants in 2003
61 000 t	Total amount of imported waste treated in the plants in 2003
10 225 GWh/year	Total energy produced by waste incineration plants in 2002
4 066 GWh/year	Total amount of the energy utilised in in 2002
1 426 GWh/year	= 35% of 4066 GWh: Electricity produced in 2002
996 GWh	= 70% of 1426 GWh: Electricity sold in 2002 (rest = internal use)
2 640 GWh/year	= 65% of 4066 GWh: Heat produced in 2002
2 240 GWh	= 85% of 2640 GWh: Heat sold in 2002 (rest = internal use)

Ovens:	
64	Total number of ovens in the considered 31 plants
14.5 years	Average age of ovens since commissioning / total renovation
Re. type: 63	Ovens with grate
Re. type: 1	Oven with rotating tube
Re. utilization: 64	Ovens linked to production of utilised electricity
Re. utilization: 51	Ovens linked in addition to production of utilised heat
Re. filtration: 62	Ovens equipped with electrical filters
Re. filtration: 2	Ovens equipped with tissue filters only
Re. flue gas: 60	"WRR-system wet" (extended flue gas purification)
Re. flue gas: 3	"WRR-system semi-dry" (extended flue gas purification)
Re. flue gas: 46	DENOX-system SCR (selective catalytic reduction)
Re. flue gas: 18	DENOX-system SNCR (selective non-catalytic reduction)
Re. waste water: 3	Flocculation only
Re. waste water: 3	Precipitation only
Re. waste water: 37	Flocculation + precipitation
Re. waste water: 3	Precipitation + filtration
Re. waste water: 6	Precipitation + evaporation
Re. waste water: 2	Neutralization + evaporation
Re. waste water: 2	Flocculation + precipitation + filtration
Re. waste water: 6	Neutralization + flocculation + precipitation
Re. waste water: 2	Information not available
Re. residues: 21	No treatment
Re. residues: 13	Neutral wash or so-called IVR process
Re. residues: 16	Neutral wash + solidification
Re. residues: 8	Acidic wash
Re. residues: 4	Acidic wash + solidification
Re. residues: 2	Information not available
Re. slags: 22	Work-up in the plant
Re. slags: 9	Work-up externally

Special waste:

The main types of special waste are detailed in **table 14** [21].

Table 14: Main types of special waste in Switzerland

Type of special waste	**Yearly amount (tons)**
Contaminated soil from the remediation of contaminated sites	198 000
Oil and petrol trap residues	76 000
Sludge from street gutters	70 000
Filter ashes from municipal waste incinerators	49 000
Mixtures of mineral oil, waste oil	48 000
Non-metallic shredder waste (residues from car demolition)	44 000
Reject batches, faulty products and by-products from organic synthesis	43 000
Non-halogenated or weakly halogenated solvents (Cl-contents < 1%)	39 000
Cl-free solvent mixtures (incl. heavily contaminated)	31 000
Dusts, superfine particles, fly ash	28 000
Total	626 000
Overall total for special wastes	970 000

The above-cited figures relate to the years 1997 to 2001. The methods of disposal of special waste (table 11) include exports. The latter amounted to ≈ 124 000 tons in 1997 and to slightly less, i.e. ≈ 122 000 tons, in 2002. About 78% of these exports went to Germany [19].

Incineration residues:

The export of waste is regulated in the Basel convention, and there is the declared policy to incinerate a maximum of waste in an environmentally sound way, avoiding exportation wherever possible [21]. But the incineration still produces residues resulting from the filtration and washing of flue gases. These residues, containing unintentionally formed POPs, are either deposited in underground disposal sites (disused salt mines in Germany) or stabilised with cement and deposited in landfills equipped with leachate drainage systems and linings (geologically impermeable materials or impermeable liners from clay, asphalt and geotextiles).

Sewage sludge:

Sewage sludge is not included in the types of special waste mentioned above. The total amount of respective dry mass produced in 2002 was ≈199 500 tons [19]. Of this,

- 152 829 tons were incinerated, i.e.
  - 76 001 tons in special sewage sludge incinerators,
  - 38 892 tons in cement plants, and
  - 26 173 tons in waste incineration plants,
- 4 459 tons were deposited, and
- 42 210 tons were used as fertilisers in agriculture.

The third one of the above three uses will be prohibited as from 2006. It is conceivable that this will result in a slow improvement of the diffuse POPs contamination discussed particularly in chapter 2.3.2.1.

Landfills from construction waste, debris and excavation material:

Waste related to construction work represents by far the largest volume of waste generated in Switzerland year by year. It amounts to about 6.4 million tons per year. A special guideline [32] addresses the handling of this enormous amount of waste, which, by the way, is mostly harmless. But the recognition of, for example, non-innocent excavation material is not trivial. It depends to a large extent on knowledge of the history of the site in question. Fortunately, this knowledge is normally available – in some cases thanks to the very precise land register entries that have existed for generations. Nevertheless, it would be rather optimistic to claim that dubious situations will not occur.

A limiting value is thereby defined just for PCBs (the congeners 28,52,101,138,153, and 180) and set at 0.1 mg/kg [32]. That this cannot in every case be analytically controlled is obvious, when considering the enormous amounts involved.

Electrical and electronic appliances:

PCBs are the main POPs of interest in the context of electrical and electronic appliances. This has been mentioned above (chapter 2.3.2.3). But electrical and electronic appliances may contain other environmentally relevant materials such as heavy metals or ozone layer depleting substances. Therefore, the waste in question requires special handling as regulated by the Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances (ORDEA – SR 814.016). This ordinance ensures, inter alia, that suppliers have to take back equipment they have delivered as well as comparable items. Thus,

there is a reliable guarantee that such problems will be handled with the required expertise and in line with the corresponding guidelines [53].

Relevant regulations and guidelines:

The following Federal Ordinances not already mentioned in chapter 2.3.5.1 are of interest in the present context: the above-mentioned Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Appliances (ORDEA – SR 814.016), the Ordinance on Waste Water Discharge, SR 814.225.21 (cf. table 10 in chapter 2.2.4) and the Ordinance on Movements of Special Wastes, OMSW, SR 814.610. The latter two deal with discharging waste into surface waters and with general movements of special wastes, respectively.

Finally, there are several guidance papers from the FOEN, which deserve to be mentioned here: The “Guidelines on the Disposal of Wastes in Cement Plants” [54] and the “Fact-sheet on Limiting Emissions in Incineration Plants for Municipal and Special Wastes” [55]. Both these guidelines refer to the ordinances cited above, and both are also based on the Ordinance on Air Pollution Control. Therefore, they have an impact on the main elements influencing the sound management of waste, i.e. the control of

- the waste’s composition,
- the limiting concentrations relating to specifically hazardous substances in the waste,
- the separation of specific components at the source or later,
- the incineration conditions,
- the treatment and disposal of residues,
- the emissions of the process (into air and water), and consequently
- the incentive to limit the generation of waste at the source.

2.3.6. Summary of Future Production, Use and Releases of POPs – Requirements for Exemptions

There is neither a planned future production of POPs, nor is there a requirement for exemptions. The only release faced for the future regards unintentionally produced PCDDs and PCDFs in amounts estimated to be below 50 g I-TEQ per year for the whole country (air emissions).

Nevertheless, reference should be made here to the last two paragraphs in chapter 2.3.1.3, which address a conceivable, though today still purely speculative possibility of a profitable and yet environmentally acceptable elimination of POPs.

2.3.7. Existing Programs for Monitoring Releases and Environmental and Human Health Impacts, including Findings

This chapter opens by referring to the Swiss National Profile[10] as well as to chapter 2.2.2. above. They both mention the obligations of the different authorities, and they underline the role the Cantons play in Switzerland. Thus, the Cantons are in charge of

- implementing the national legislation,
- controlling the emissions within their boundaries as well as their combined effect,
- controlling their agriculture,
- controlling their feed, food, and waters,
- controlling their health system, and
- establishing their register of contaminated sites.

This defines quite a number of **monitoring and controlling activities**, and the Cantons have the legal basis as well as the means to take care of their obligations – whereby they specialise and collaborate to some extent.

In addition, the Confederation has the right (as mentioned in chapter 2.3.1.3) to pursue its own monitoring activities, and it pursues them in a number of ways, thus supplementing and in part guiding the cantonal efforts through:

- the NABO, NABEL, NADUF, and NAQUA programs,
- the research and application programs conducted by the Swiss Agricultural Research Institutes,
- the research programs as executed by the faculties of environmental science and technology and other faculties of the federal universities (the Swiss Federal Institutes of Technology in Zurich and Lausanne),
- the research and application programs conducted by the annex institutes to the federal universities, e.g. the Swiss Federal Laboratories for Materials Testing and Research or the Swiss Federal Institute for Environmental Science and Technology,
- the specific research programs as initiated and/or subsidised by FOEN,
- the specific research programs as initiated and/or subsidised by the FOPH,
- the specific research programs as initiated and/or subsidised by SUVA (the Swiss National Accident Insurance Fund),
- the pertinent research programs supported by the Swiss National Fund and
- international collaboration.

Obviously, this list of programs and sponsors of programs is much too large to be commented on in a comprehensive way. Still, it should be mentioned that the number of programs with indirect relevance to the POPs issue is certainly much larger than the number of strictly POPs-orientated ones.

This discussion concludes with a short reference to international programs. The first to be mentioned is the MONARPOP program to which Switzerland contributes and which has already been addressed in table 9 (chapter 2.2.3.) above. The focus of this EU program is on a Monitoring Network in the Alpine Region for POPs (initiated in 2000). Furthermore, there are a number of capacity building programs in developing countries supported by DEZA (= SDC, the Swiss Agency for Development and Cooperation), which could become relevant in the light of the need to establish international reference standards.

Finally a few words about findings regarding the environment as well as human health:

The **environment-related findings** have already been quite extensively addressed in the preceding chapters. Therefore, only two additional programs are mentioned here.

The first relates to environmental modelling and the specific role of the Alps as “cold traps” accumulating POPs – comparable to the role of the Arctic region. These modelling activities have provided quite interesting results [56], and it will be worth the effort to further check their practical relevance.

The second relates to a recent publication [57] on the PCDD/PCDF levels in cow’s milk, i.e. the fat part. The study compared samples from different locations (rural and close to industrial point sources) and from industrial milk processing, whereby samples were taken at the same sites (altogether 30) in 1984, 1990, and 2001. The results are compiled in **table 15**.

Table 15: Temporal and local trends in PCDD-/F-levels in cow’s milk [57]

Source of milk (location)	1984 ng I-TEQ/kg	1990 ng I-TEQ/kg	2001 ng I-TEQ/kg	Q (84):(01)	Q (90):(01)
Close to point source	8.5 +/- 3.0	3.0 +/- 0.87	0.63 +/- 0.26	13.5	4.8
Rural / Alpine	1.8	1.1 +/- 0.74	0.36 +/- 0.097	5.0	3.1
Milk processing	1.9	1.3 +/-0.23	0.51 +/- 0.19	3.7	2.5

These results demonstrate a significant decrease over the years (84 → 90 → 01), a significant impact on nearby point sources, and a significantly better improvement for the milk from locations with nearby point sources, i.e. the efficacy of measures taken (cf. also chapter 2.3.4.2).

The **human health-related findings** have not been considered in detail in any of the preceding chapters. Therefore, they are addressed rather more in-depth here. Reference is thereby made to the already mentioned FOEN publications on endocrine disruptors [42] and on dioxins and furans [20]. Thus, there are a number of points of possible importance:

- There are no official up-take limits regarding PCDDs/Fs or PCBs, though the Swiss authorities are considering the value of ~1 pg TEQ/kg body weight for these groups of POPs.
- It may be assumed that the average exposure of human beings corresponds to the one found in other developed countries, i.e. to the mentioned 1 pg TEQ/kg.
- The exposure of breast-fed babies is clearly much higher, while this has no apparent health impact.
- The concentration of PCDDs/Fs in mothers' milk has clearly been decreasing over the past years.
- The PCDD/F content in food is expected to correspond to that reported for south-west Germany, which results in the following estimated daily up-take in pg I-TEQ:

  - Milk 7.1 [20] (newer for EU = 0.32 – 2.1, for Switzerland 0.28 – 0.89) [57]
  - Cheese 3.8
  - Butter 11.2
  - Beef 5.8
  - Pork 7
  - Chicken 4
  - Eggs 5.5
  - Fish 8
  - Fruit 2
  - Vegetables 3.7
  - Miscellaneous 7
  - Total 65.1 ≈ 0.9 per kg body weight

- There have not been systematic Swiss studies on the PCDD/F contents of fish, so no pertinent conclusions can be drawn[20]. But the results on emissions and composition of sediments [20] suggest that one would have found declining values in this case as well, while this trend is documented for PCBs as well as some POPs pesticides [42]. The same holds for beef and for animal-derived products like milk or butter.
- A number of observations relating to wildlife have a reasonable probability of being indicative in view of human health-related POP issues. Worth mentioning are the following [42]:
  - There have since the 1980's been clearly declining yields of fish caught in Swiss lakes.
  - Fish with damaged organs have been observed in recent times.
  - The populations of several types of birds (e.g. falcons and hawks) decreased over the same period of time, though the trend was reversed in the late 1970's.

- The otter disappeared from the Switzerland towards the end of the 1980's, and it is speculated that PCBs played a role in this development.

The role for human health of the last observations mentioned above cannot yet be interpreted in detail, because one is obviously faced with multi-factorial interdependences. In addition, the POPs are just a part of the whole series of products with probably significant endocrinological (hormonal) effects in the environment.

Nevertheless, one may conclude that **endocrinological and gene transscription-related effects** of POPs in the environment could have or have had an impact upon human fertility, and possibly on the formation of certain types of cancer. Thus, it would be desirable to obtain more systematic epidemiological studies linking exposure figures and, for example, the sperm count and sperm quality in men.

It is interesting in the present context that the above-mentioned observations regarding wildlife reveal that the relevant events were (are) not completely synchronous. This might, of course, reflect exposure to different anthropogenic substances, but it might in addition be a consequence of the differing ecotoxicological modes of action of the substances in question. In other words: a synchronous appearance of almost immediate hormonal effects, of a hormone-based reduction of fertility and of reprotoxicological effects manifesting themselves no earlier than in follow-up generations should not be expected.

Of interest in this context are programs like the FOEN-supported and recently completed "Fischnetz" ("Fishnet" www.fischnetz.ch) [60]. This program included EAWAG (the Swiss Federal Institute for Aquatic Science and Technology) as well as many Cantons and professional associations. Its final report highlights the role of global warming, but it also considers chemicals as one of the factors which led to the observed decrease of many populations of fish in Swiss lakes and rivers.

2.3.8. Current Level of Information, Awareness and Education among Target Groups; Existing Systems for communicating such Information to the Various Groups; Mechanism for Information Exchange with other Parties to the Convention

The level of information and general POPs awareness in Switzerland is high – especially with regard to chemicals in electrical and electronic appliances. The main reason is that stores recently began to charge a recycling fee when selling such equipment. Of course, the awareness is also high among personnel at these stores.

At a much less advanced level is the awareness of the significant PCDD/F contribution to the overall Swiss output of POPs of the illegal combustion of waste in chimneys and the like. Here, a promotional campaign is planned, and it is all the more important, because most Swiss communes charging a fee for the collection of municipal waste, so the temptation for citizens find alternative methods of waste disposal is increased.

Finally, there is, of course, international collaboration at the level of universities and industries as well as on the basis of the agreements and programs mentioned in chapter 2.2.3. above.

2.3.9. Relevant Activities of Non-governmental Stakeholders

It was mentioned in chapter 2.1.4. above that there is a significant eco-industry in Switzerland. This industry certainly contributes to the reduction of, for example, PCDD/F-emissions

by continuously developing energy-saving devices and alternatives to the traditional power generation approaches. This has been paralleled by continuing energy-saving programs in industry as promoted, for example, by the CO_2-legislation [61].

Other activities that play a role are carried out, for example, by environmental and professional associations as well as universities and technical colleges, and a significant role in targeting the avoidance of potential POPs is certainly played by consumer organisations that encourage a transparent labelling policy relating to the organic production of food.

In conclusion, it may again be said that the POPs-reducing impact of non-governmental organisations is today indirect rather than direct.

2.3.10. Overview of Technical Infrastructure for POPs Assessment, Measurement, Analysis, Alternatives and Prevention Measures, Management, Research and Development – Linkage to International Programs and Projects

The occurrence or release of POPs in the environment and in materials for industrial or daily use may be assessed in several ways:

- indirectly on the basis of managerial information on the history or status of the environmental compartment or material in question,
- indirectly by characterising the type of process applied,
- indirectly by analysing the precursors and catalysts available in the compartment or material,
- indirectly by analysing the by-products formed in the process, or
- directly by analysing the contents in the material and/or the residues or gases released.

Thus, there are managerial, technical, and analytical approaches to assessing POPs. They are listed in general terms here.

Managerial approaches:

Managerial information on the technical status or the history of the relevant environmental compartments, materials, business activities etc. may be found with the following bodies:

- Federal offices or agencies responsible for the environment, health, agriculture, science, statistics, traffic and transport, finance (federal taxes), customs, workers' protection, and economy,
- cantonal offices or agencies dealing with the same issues,
- federal research institutions dealing with the environment, materials, agriculture, and toxicology,
- the Swiss National Insurance Fund and its committees,
- communes,
- federal and cantonal universities and cantonal technical colleges,
- cantonal business – and property registration offices,
- cantonal waste treatment stations,
- professional – and industrial associations,
- other associations dealing with the environment, with technical inspections, or with consumer protection, and
- companies dealing with environment-friendly technologies and, e.g., with the recycling or incineration of waste.

This list, though long, may still not be complete. But it certainly illustrates that there are many approaches to obtaining indirect information on the status of pollution-related problems, while none of these institutions or bodies has an exclusive focus on POPs.

Technical approaches:

Some details about technical approaches to optimising the functioning of ovens, filters, and catalysts and to assessing emissions in general may be obtained from most of the above-mentioned institutions. Thus, the following short list is certainly not comprehensive:

- the Federal Office for the Environment, and the Swiss Federal Roads Authority,
- the engineering and environmental science faculties of the Swiss Federal Institutes of Technology,
- the Swiss Federal Laboratories for Materials Testing and Research,
- the environmental protection agencies of the Cantons,
- professional associations such as the Association of Technical Inspectors and others dealing, e.g., with Cleaner Production, and
- the relevant industrial associations such as the Swiss Society of Chemical Industries (SSCI) or the Metal and Engines Manufacturers, or even the association combining the Swiss industries (Economiesuisse).

Again, none of these organisational bodies simply focuses on POPs, of course, but they are all interested in environment-friendly technologies.

Analytical approaches:

There are hundreds of laboratories in Switzerland with sophisticated installations (like HPLC/MS or single ion detection techniques) theoretically capable of solving POPs-related analytical problems. But there is probably not more than a handful of laboratories that actually specialise in this kind of problem and are actually equipped with a broad set of corresponding reference samples. Therefore, this generic overview simply refers to

- the chemical laboratories of the Cantons (which to some extent specialise and collaborate),
- the laboratories of the environmental science faculties of the Swiss Federal Institutes of Technology,
- the laboratories of the Federal Agricultural Research Institutes (especially that in Reckenholz),
- the Swiss Federal Laboratories for Materials Testing and Research,
- the Swiss Federal Institute for Environmental Science and Technology,
- the laboratories of the large waste incineration plants,
- the environmental protection laboratories of the large plants of the chemical industry,
- industrial laboratories, especially the ones involved in agricultural research, and
- the Association of Swiss Analytical Service Laboratories.

These labs are not all equipped with sophisticated sets of reference samples, but they all collaborate in one way or another, and they all have relevant know-how.

Finally, there are federal monitoring programs which provide some results that are also relevant to POPs, though this aspect may have to be strengthened in the future. These are

- NABEL i.e. National Air Pollution Monitoring Network ("Nationales Beobachtungsnetz für Luftfremdstoffe"): Continuous monitoring of air pollution; 16 stations. This program was initiated in the 1980's based on a decision of the Federal

Council. It consumes about SFr. 2 mio per year from FOEN's budget as well as considerable means provided by the Swiss federal laboratories for materials testing and research.
In addition, there are large networks operated by the Cantons. The main focus is on basic data concerning, e.g., ozone and fine particles, but non-routine measurements include parameters like VOCs or poly-aromatic hydrocarbons.

- NABO i.e. National Soil Monitoring Network ("Nationales Bodenbeobachtungsnetz"):
  Monitoring of status and changes in pollution; 5 year intervals. This program consumes about SFr. 0.7 mio per year of federal origin as well as very significant means at the level of the Cantons (mainly for the investigation of polluted sites). It is carried jointly by FOEN and FOA.
- NADUF i.e. National River Monitoring and Survey Programme ("Nationales Programm für die analytische Daueruntersuchung der schweizerischen Fliessgewässer"):
  Continuous monitoring of river waters; 18 stations. About SFr. 2 mio per year are dedicated to this program carried by FOEN, by the Swiss federal institute for environmental science and technology, and by the Swiss federal research institute for research on forests, snow and avalanches in Birmensdorf. The mentioned amount is neither including special measuring campaigns nor the very significant effort of the Cantons (estimated to consume approximately SFr. 20 mio per year).
  Not actually part of NADUF, but important in this context are the commissions dealing with rivers and lakes at the national borders, like the Rhine, the lake of Constance, or the lake of Geneva. E.g., Switzerland contributes about SFr. 0.5 mio per year to the station in Weil, which is operated jointly with the German state of Baden-Württemberg (measuring i.a. pesticides). Finally, DDT is also occasionally determined in the Lago Maggiore (Canton Ticino).
- NAQUA i.e. National Groundwater Quality Monitoring Network ("Nationales Netz zur Qualitätsbeobachtung des Grundwassers"):
  National groundwater monitoring programme being built; will involve 50 sites or more to be operated by the Confederation. A current yearly budget of about SFr. 2.4 mio at the federal level and of about twice as much at the level of the Cantons is spent on this purpose, a modest amount, if considering the technical effort required. Mainly determined are nitrates and a number of pollutants, while POPs are not in the foreground at this point in time.

Final remarks:

Generating a comprehensive compilation of a given technical capability in a developed country would be a very laborious task and would considerably expand the scope of this NIP – especially if the international interactions of all the organisations involved were to be included. This may be illustrated by referring to already cited references [38, 39] and to the round robin studies mentioned there. But facilitating the interaction of all the above-mentioned organisational bodies or laboratories could be one of the targets of the present NIP. This point will be addressed again in section 3.

2.3.11. Identification of Impacted Populations or Environments, Estimated Scale and Magnitude of Threats to Public Health and Environmental Quality and Social Implications for Workers and Local Communities

This short chapter opens by listing potential threats. Its second part will then attempt to assess these threats and to draw conclusions, if applicable, with a view to taking action.

Thus, the following segments of the population and the environment may be regarded as exposed or potentially exposed:

- breast-fed babies (cf. the POPs-contents in mothers' milk),
- workers in waste incineration plants – especially when changing filter elements and the like,
- workers involved in the remediation of chemical waste disposal sites,
- workers involved in the disposal of contaminated sewage sludge or residues,
- workers involved in the recycling of electrical and electronic appliances,
- workers involved in the demolition of buildings,
- workers in the chemical industry preparing products which could form POP by-products,
- the immediate vicinity of old chemical waste disposal sites,
- the immediate vicinity of waste incineration plants,
- the segments of moving waters taking up contamination from waste water treatment plants, and
- the immediate vicinity of streets or roads with very heavy traffic.

Farmers handling pesticides have not been mentioned, because no POPs-pesticides are in use anymore – and future candidate POPs are not considered in this present discussion.

But now to the discussion of the above-mentioned threats:

- Breast-fed babies are exposed, and one will for quite some time to come just have to periodically re-address the related risk/benefit-analysis.
- All the risks involving workers exposed to heavily contaminated materials can be and are controlled. Here, it is important that related training and the implementation of the protective measures are periodically checked and strictly enforced. But the dangers are so obvious and so well understood that there is actually no need for new interventions.
- The highest risk, therefore, concerns workers exposed to threats which usually approach no more than background levels, because it may become difficult in these cases to really enforce protective measures. This could be the case for workers dealing with the recycling of electrical and electronic appliances and possibly for workers demolishing buildings. Here, training and know-how are especially important, and one might in this NIP consider a more thorough analysis of the situation or a campaign to increase awareness.
- Analogously, "true hot spots" in the environment, like former chemical waste disposal sites, are so obvious that there is no need for further awareness raising – while the financing of remediation might still lead to discussions, of course.
- However, the threats presented by minor contaminated sites will be the ones precipitating discussions, and one will have to carefully weigh up spending on local or country-internal perfectionism versus spending on global actions. This discussion will be facilitated by a better understanding of the local versus global dimensions of the POPs issue in general.
- The waters fed from waste water treatment and the immediate neighbourhoods of waste incineration plants present a similar problem of balancing local and broader concerns. Here it appears logical to

- limit the relevant emissions in such a way as to guarantee that upper tolerable limits are not exceeded anywhere and
- avoid using waters with above background contamination as a source of drinking water.

To our knowledge both these requirements are currently fulfilled everywhere in Switzerland.

- Finally, there is the problem of the immediate vicinity of major streets and roads, again a situation where the POPs-related threats are just slightly above background level. Nevertheless, it has to be said that Switzerland has too many of these situations anyway. Therefore, this is a general concern relating to environmental protection, spatial planning and socio-economic issues, and there is no need to address it under the umbrella of the POPs Convention.

In conclusion, it may be said that Switzerland has some real threats which also have a POPs dimension, but that the POPs issue may in most cases still be regarded as quite negligible in comparison to the more fundamental consequences of the high population and communication density in parts of the country…. But this by no means implies that POPs should be neglected.

2.3.12. Details of a Relevant System for the Assessment and Listing of New Chemicals

There are a number of Swiss procedures for addressing new chemicals. They were listed not too long ago in the National Profile[10], but have been changed in the meantime. Therefore, **table 16** details the current types of chemicals and the authorities involved in their listing and registering.

Table 16: Listing and registering new chemicals

Type of chemical	Authorities involved and remarks
New chemical substance	FOPH: Registration as potentially toxic or ecotoxic product (in collaboration with FOEN, FOAG, and SECO)
Fertilizer etc. with new chemical	FOAG: Registration
Pesticide with new chemical	FOAG: Registration
Anti-fouling, wood-protectant with new chemical	FOPH: Registration as potentially toxic or ecotoxic product (in collaboration with FOEN, FOAG, and SECO)
Textile-/dish-washing product with new chemical	FOPH: Registration as potentially toxic or ecotoxic product (in collaboration with FOEN, FOAG, and SECO)
Food additive or cosmetic product with new chemical	FOPH: Registration as potentially toxic or ecotoxic product (in collaboration with FOEN, FOAG, and SECO)
Drug with new chemical	SwissMedic: Registration

A re-registration may become necessary if new relevant information on an already introduced product is obtained. In addition, it must be mentioned that the registration of new chemicals has been harmonised with the EU and reorganised in the context of the enactment of the new federal legislation on chemicals. Therefore, the absence of a product in the corresponding EU-lists may lead to withdrawal or re-registration. The registration and the Confederation's related function (carried out by the FOPH for all non-agricultural products) is also addressed in chapter 2.2.1. Finally, introducing the REACH system [62] is currently being discussed in the context of the harmonisation with the EU.

2.3.13. Details of any Relevant System for the Assessment and Regulation of Chemicals already in the Market

As mentioned, chemicals already in the market may have to be re-registered if new relevant information regarding their toxicological or pharmacological properties becomes available. in such a case, the process would normally be initiated by the producer, but the agency concerned might also take this step. A new registration or listing would have to take place, if a new type of use of a known and approved chemical were considered.

Furthermore chemicals introduced may be mentioned in various lists, e.g., besides the EU-lists, in the so-called MAK list (= OEL-list) as edited by the Swiss National Insurance Fund (SUVA), the list of substances to be controlled under the OAPC (Ordinance on .Air Pollution Control), or the Ordinance on Protection against Major Accidents.

Finally, all the substances that become part of a commercial product used to be listed and classified by the FOPH in terms of the list of toxic substances [10]. This list is now being discontinued, along with the so-called toxicity classes, but relevant parts, particularly the data relating to the so-called toxicity classes 1 – 3, will be saved and will re-appear in new EU-conformant lists.

3. Strategy and Action Plan Elements of the National Implementation Plan

3.1. Introductory Remark

The structure of part 2 of this NIP essentially corresponds to that of UNEP's guidance paper 3. Part 3, however, is more individually adapted to the Swiss needs. Nevertheless, it contains the relevant elements as required according to UNEP's guidance.

3.2. Summary of the Swiss Situation regarding POPs

Table 17 summarises the assessments as described in detail in part 2 of this NIP, and **table 18** compiles a number of questions arising when reviewing these assessments.

Table 17: Overview assessment of POPs as existing or generated in Switzerland

Type of POPs	Import, export, production and use	Elimination or reduction of release	Remaining steps to be taken
Pesticides incl. DDT	Prohibited	Advanced	Contaminated sites incl. 2 large chem. waste disposal sites possibly containing some POPs to be remediated.
PCBs	Prohibited	Advanced	Large capacitors: Identification of PCB-containing appliances and safe disposal in high-temperature incineration plants to be completed Small and medium size capacitors (up to 1 kg): Separation of PCB-containing c. from bulk scrap and safe disposal in high-temperature incineration plants to be improved Joint sealants and paints containing PCBs: Promotion of sound remediation techniques to be improved
PCCDs/Fs	Not applicable	Advanced	Illegal burning of waste producing PCDDs/Fs still to be better controlled.

Table 18: Overview of questions with possible relevance regarding POPs

Aspect of life-cycle or topic	POPs mainly concerned	Questions to be addressed
Pollution of surface waters	DDT, PCBs, PCDDs/Fs	Is there sufficient specific monitoring of POPs or Cl-containing products? Is there sufficient knowledge of mobilisation of materials (incl. POPs) from sediments? Uptake into fish?
Pollution of groundwaters	All	Is there sufficient specific monitoring of POPs or Cl-containing products? Contents and role of endocrinologically active products?

Table 18: Overview of open questions with possible relevance regarding POPs (continued)

Aspect of life-cycle or topic	POPs mainly concerned	Questions to be addressed
Pollution of soil	All	Is there sufficient specific monitoring of POPs or Cl-containing products? Is there or has there been an impact of POPs on the bio-diversity of micro-organisms? Biodegradation?
Air pollution	All	Is there sufficient specific monitoring of POPs or Cl-containing products? Differentiation of local and long-range translocation? Role of traffic?
Persistence	All	Is there sufficient understanding of its characteristics to guide the future approval of products or the judgement of new POP-candidates?
Health	All	Are there ways and means to reduce the exposure of breast-fed babies? Is there a need for general exposure limits?
In-door exposure	PCBs	Does the currently available data allow for an assess-ment of the role of PCBs within the combined in-door ex-posure?
Import, export	All	Are the controls carried out today effective enough?
Production, use	All	Would the existing regulations allow for an economically and ecologically beneficial transformation of existing stockpiles, if that were invented? Is the unintentional formation of POPs or POP-like sub-stances as by-products sufficiently controlled?
Waste manage-ment	All, PCDDs/Fs	Is the final disposal of PCDD-/F-containing residues from waste incineration sufficiently sustainable? Is there a limiting PCDD-/F-and generally POPs-content of sewage sludge etc. warranting the safe use in fertiliz-ers etc.?
National ex-change of infor-mation	All	Is the exchange of information among Cantons and be-tween the Cantons and the Confederation sufficiently regulated or organised to guarantee the establishment of an adequately precise inventory and adequate monitor-ing of the progress achieved or the effectiveness of measures?
International ex-change of infor-mation	All	Are the development aid programs sufficiently exploited in view of getting reference data with regard to develop-ments that can no longer be obtained in Switzerland be-cause of the fact that POPs were banned a long time ago? Is sufficient account taken of new findings on clean proc-esses and technologies in development aid programs? Is there enough coordination with neighbouring states in view of POPs assessments and the continuation of run-ning programs?

3.3. Swiss Strategies regarding POPs

The strategies to be pursued will have to consider the following dimensions:

National versus international activities:

Where will the priority be, if considering the fact (cf.table 13 above) that the control of POPs in Switzerland is generally at an advanced level?

⇒ There will be a strong focus on international and especially development aid-related activities – in line with the Dispatch (government report on legislation) submitted to the Swiss parliamentary chambers with a view to the ratification of the Stockholm POPs Convention [2].

Specific focus on the twelve POPs versus general focus on PTS:

Switzerland is already very far advanced in the elimination of the Stockholm Convention POPs, so that in addition to eliminating sources of unintentionally produced POPs an effort to reduce other persistent, bioaccumulative and toxic substances (PBTs) should be made:

⇒ The Stockholm POPs Convention provides the unique advantage that a number of chemicals will be simultaneously and globally controlled, reduced, and eliminated. This will not only result in an environmental improvement, but also provide focused and probably very tangible experience of the effect of this type of international agreement. It is therefore important to gain as much experience as possible with a view to exploiting it to define the most effective approach to controlling other PBTs.

⇒ Global and comprehensive monitoring of the twelve POPs in the relevant environmental compartments is therefore an important aspect of the Stockholm POPs Convention, and Switzerland will accordingly have to adapt some of its tools.

⇒ Identification and elimination of other PBTs not regulated in the Stockholm Convention should also be a goal both in the scientific as well as the regulatory domain.

Specific focus on the twelve POPs versus focus on their role as an example in integrated ecosystems:

There are ecosystems and environmental concerns in which the POPs simply act as one of a number of substances or effects resulting in an undesirable development. One might, therefore, ask whether the focus should be on the specific role of the twelve POPs or on the holistic and most effective way of protecting the ecosystem in question and of eliminating this concern.

⇒ It is obvious that ecosystem protection has a very high priority.
And the Stockholm Convention certainly suggests that a reasonable effort should be made to determine the role the elimination of POPs might play in protecting the ecosystem.

⇒ It may therefore in the future be advisable to include POPs (monitoring, modeling, effect studies of new POPs) in ecosystem studies.

Harmonization and consistency versus efficiency and effectiveness:

The Stockholm POPs Convention contains provisions on the harmonisation of approaches (e.g. in Art. 16-2a relating to effectiveness evaluation), while making allowances for differences between regions. This requires a specific strategy to be devised.

⇒ Harmonization and consistency, e.g. with regard to monitoring, should be pursued where this doesn't get in the way of speed and efficiency in implementing the main principles of the Convention.

Centralisation versus decentralisation:

The Swiss Confederation delegates quite significant legislative power to its Cantons. This has advantages and drawbacks – the latter especially when attempting to comply with the detailed procedures of an international convention. Therefore, there is a need to ensure an adequate level of harmonisation, for example, with regard to monitoring and reporting of information – and a need to define a strategy on the allocation of rights and duties to the Cantons.

⇒ The Confederation implements the legislation enacted by its parliament, and the essence of this legislation may neither be amended nor be reduced by the Cantons. In addition, the administrative authorities, such as the FOEN, may ensure consistency of implementation by issuing related guidelines that reflect the intentions of the parliament. Therefore, an attractive strategy for implementing the Stockholm POPs Convention would involve the issuing of guidelines to ensure that the Convention is sufficiently considered in the future implementation of the ORRChem (Ordinance on Risk Reduction related to Chemical Products) and the ordinances regarding the remediation of contaminated sites .

⇒ Such guidelines may contain mandatory procedures as well as recommendations, and the latter will be used to achieve consistency in cases which are not covered by specific legislation. Experience shows that such recommendations are generally well received and taken into account by the Cantons.

⇒ It makes sense to comply with the monitoring and reporting requirements of the Stockholm POPs Convention firstly by strengthening and adapting the national monitoring networks (NABEL, NABO, NADUF, NAQUA) and secondly by collaborating with the Cantons. Here it will be important, as generally required by parliament, to pursue a cost-effective solution and to avoid unnecessary monitoring perfectionism.

3.4. Action Plans

3.4.1. Introduction

The following action plans conform to the current legal position in Switzerland. They illustrate the fact that Switzerland is already in compliance with the SC's stringent obligations and that it also makes an effort to fulfil responsibilities imposed by those articles of the Convention that leave room for interpretation. These action plans will be periodically reviewed and updated as agreed by the first COP in Punta del Este, Uruguay, in May 2005 (point 7 of decision 1/12) [63].

3.4.2. Fostering and Ensuring Continuity of the Awareness of the POPs issue

Table 19: Public awareness

Program	Lead	Other bodies involved	Remarks (incl. timing)
Reduction of illegal burning of waste **(1)**	FOEN	Selected Cantons	a) Determine whether the assumption (1% of total = illegal waste incineration) is correct (1 year). b) Assess the total PCDD/F load (1/2 year). c) Publish the findings and involve the Cantons in a corresponding campaign (2 years).
Exploit assessment of waste incineration plants **(2)**	FOEN	All bodies involved in the LEA study [64]	a) Complete current study FOEN + Cantons (about 1 year). b) Publish the resulting EFs to stimulate/accelerate improvements of less advanced plants.
Publicity re. chemicals-related development programs **(3)**	FOEN	SADC	Press coverage of selected programs in countries supported by Switzerland: Highlight POPs issue and success of programs in question (1 year).

3.4.3. Completing the Elimination from Products and Equipment in Use of POPs or POPs-containing Materials according to Annex A of the SC

Table 20: Programs regarding the elimination of annex A chemicals

Program	Lead	Other bodies involved	Remarks (incl. timing)
Re-assess and improve the situation re. PCBs **(4)**	FOEN	Cantons and private companies either implementing ORDEA or belonging to the economic sector "construction"	The last joint assessment carried out by the Cantons and the Confederation related to larger pieces of equipment, particularly transformers, and confirmed their elimination. The remaining challenge relates to two main topics: - pieces of equipment which cannot "prima vista" be recognised as sources of PCB, and - parts of buildings containing PCBs which could be released into the environment when the buildings are demolished. These aspects will be reconsidered and underlined when re-issuing the federal guideline on avoiding diffuse PCB pollution. (≈ 2 years).

Table 20: Programs regarding the elimination of annex A chemicals (continued)

Program	Lead	Other bodies involved	Remarks (incl. timing)
Demolition of buildings **(5)**	FOEN	Selected Cantons, construction business	a) Monitoring selected demolition projects through PCB-orientated risk assessments and possible measurements. b) Assessing the general risk. c) If applicable, awareness raising amongst Cantons and the business sector involved. The program should build on earlier work on joint sealants (≈ 2 – 4 years; cf. chapter 2.3.2.1).

3.4.4. Contributing to the Mitigation of the Use and Worldwide Distribution of POPs in accordance with Annex B of the SC

Table 21: Mitigation of worldwide distribution of POPs

Program	Lead	Other bodies involved	Remarks (incl. timing)
Stimulating research **(6)**	FOEN	SECO, FOPH, FOA, Group for Science and Research, Agricultural Research Institutes, SSCI, industry	Fostering awareness of POPs, such as DDT, particularly by continued commitment to studies to show their relevance by demonstrating their accumulation in glaciers in the Alps [56]. These "cold traps" may be qualitatively compared with the polar regions where a significant accumulation of POPs can be observed. (on-going)
GEF-, UNEP- and UNITAR-programs **(7)**	FOEN	SDC	Continue the existing commitment to capacity building re. POPs (Annex A and B of the SC) and re. sound management of chemicals in developing countries in general. (on-going)

3.4.5. Perfectioning the Suppression of the Unintentional Production of POPs according to Annex C of the SC

Table 22: Suppressing the unintentional production of PCDDs / PCDFs

Program	Lead	Other bodies involved	Remarks (incl. timing)
Exploit assessment of waste incineration plants **(8)**	FOEN	All bodies involved in the LEA study [64]	Cp. **(2)** in table 19! a) Continuation of the current program and improvement of the waste incineration plants in consideration of technical priorities. (on-going [19]). b) In this context considering the establishment and definition in the OAPC of a limiting PCDD/F value of 0.1 ng/m^3 gas (standard conditions). (≈ 1 year)
Reduce illegal burning of waste **(9)**	FOEN	Cantons	Enforce measures as defined in the course of the program **(1)** in table 19 (≈ 1 – 2 years depending on the outcome of the assessment).
Addressing remaining PCDD/F-issues **(10)**	FOEN	SECO, FOPH (re. list of poisons), selected Cantons → all Cantons, industry	a) Encouraging the collection of information regarding BAT / BEP in industries on which there is currently not much information available at the level of the Confederation, while they still have a possible relevance in Switzerland (cf. Annex C Part II and Part III of the SC). This relates in particular to the following: → Pulp production using chemicals which might be generating elemental chlorine. → Open burning of waste (cf. program **(1)** in table 19). → Residential combustion sources. → Industrial boilers. → Firing installations for wood and other biomass fuels. → Specific chemical production processes, especially production of chlorophenols and chloranils (whereby the latter are not produced according to FOEN's knowledge). → Destruction of animal carcasses (mainly happening sustainably in cement production). → Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) b) Establish a priority list of actions in collaboration with SECO and the Cantons and in consideration of industry hearings. c) Implement the priority list with help of the Cantons. (a) + b): ≈ 2 years, c) ≈ 5 years)

Here with regard to action plan 10, it must be added that some of the processes addressed in Annex C Part II and Part III of the SC do not exist in Switzerland, e.g., certain thermal

metallurgical processes, sinter plants, secondary aluminium recycling, use of low quality or impure oils in residential combustion, and refining of waste oils.

3.4.6. Corroborating the Efficacy of the Measures taken in view of the SC

This chapter details all the monitoring-related programs. It includes those which cannot be regarded as directly related to measures of the recent past.

Table 23: Corroborating the efficacy of measures and general monitoring efforts

Program	Lead	Other bodies involved	Remarks (incl. timing)
Supplement NABO and NABEL and possibly NADUF and NAQUA measurements **(11)**	FOEN	Selected Cantons	Include specific POPs determinations in the measurements of selected NABO and NABEL(and possibly also NADUF and NAQUA) stations. Where possible, include the history of the agricultural exploitation (incl. use of pesticides) of the surface in question, e.g. by referring to the so-called compilation of national data on the environment. (≈ 3 years).
Biomonitoring **(12)**	FOEN	EMPA	Periodically repeat and amend the measurements as described in the cited references [33, 57], in order particularly to monitor the trends re. DDT, PCB, and PCDD/PCDF pollution, and publish the results (periods of 5 – 10 years).
International collaboration re. monitoring **(13)**	FOEN	---	Continue the MONARPOP collaboration (ongoing; cf. Chapter 2.2.3).

3.4.7. Ensuring Sustainability of the POPs-related Measures taken and to be taken, respectively

It goes without saying that sustainability must be taken into account in the implementation of all the programs mentioned in the preceding chapters 3.4.2 to 3.4.6. Nevertheless, the program **(14)** is suitable for underlining that POPs related problems must be solved with a holistic and sustainability-orientated view.

Table 25: Sustainability

Program	Lead	Other bodies involved	Remarks (incl. timing)
Considering POPs in the remediation of large and small former mixed waste deposition sites **(14)**	FOEN	Concerned Cantons and companies	Ensure that the POPs issue is considered specifically and in a holistic way in the remediation of these sites (contact FOEN Section Chemicals ↔ task forces; holds for the full duration of > 5 years of the projects in question and appears to be well under control at present – at least with regard to the larger sites).
More precisely and coherently defining industry's duty to report on POPs- or PTS-intermediates handled in closed systems **(15)**	FOEN	SECO, Cantons, industry	Ensure that the corresponding aspects of the new legislation on chemicals are coherently and reasonably implemented, e.g. in view of waste treatment and the mastering of accidents (≈ 2 years).
Promoting sustainability in POPs-related interactions **(16)**	FOEN	DFA	Including the POPs Focal Point in the corresponding international interactions or in their preparation as implied by Art. 9[3] of the SC. (on-going)
Promoting a focus on POPs in customs control activities **(17)**	FOEN	DF	Foster the collaboration of FOEN and the customs authorities. (on-going).

3.5. Financial Implications

The following (freely translated) passages from the Dispatch to the Swiss parliament regarding the ratification of the SC describe the general picture [2]:

The POPs-Convention will have personnel-related and financial implications… Around one full-time position will be needed, as well as adaptations to some of the administration's duties… The full-time position relates in particular to the action plans and their implementation, including reports and participation in conferences and technical committees… About CHF 0.6 million per year will be required for membership fees… The POPs-related GEF-replenishment is the subject of a separate parliamentary agenda item.

This statement is confirmed by the present NIP which may be implemented without changes in the current budgetary projections.

3.6. Endorsement of the NIP

The process of drafting the NIP was initiated by the head of the Substances, Soil, Biotechnology Division within the Federal Office for the Environment (FOEN) as the National Focal Point for the Stockholm Convention.

Broad participation within the Office was assured by holding meetings and circulating drafts of the NIP; subsequently other federal offices (FOPH, FOAG) specifically concerned with POPs-issues were involved. In a final step a wide range of federal departments and offices were heard and were given the chance to comment on the NIP.

The directors of the FOEN accepted the NIP in February 2006.

The Federal Council endorsed the National Implementation Plan by Switzerland in its session of 26 April 2006 and decided to forward it to the Conference of the Parties of the Stockholm Convention.

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