Repackaging of Obsolete Pesticides in Kakheti Region, Georgia

August 4th, 2008

Tauw

Reference R001-4578106GLR-sbb-V01-NL

Responsibility

Title	Repackaging of Obsolete Pesticides in Kakheti Region, Georgia
Client	Milieukontakt International
Project Manager	Boudewijn Fokke
Author(s)	Gabor Raska, Matthijs Bouwknegt and Boudewijn Fokke
Project number	4578106
Number of pages	64 (excluding appendices)
Date	August 4th, 2008
Signature	

Colophon

Tauw bv
Industries, Soil & Groundwater department
P.O. Box 133
7400 AC Deventer
The Netherlands
Telephone +31 (0)570 69 99 11
Fax number +31 (0)570 69 96 66

List of Abbreviations

ADI	Acceptable daily intake
ASP	Africa Stockpiles Programme
BAT	Best Available Technique
BEP	Best Environmental Practice
CAH	Christelijke Agrarische Hogeschool
DDT	Dichloro-diphenyl-trichloroethane
EECCA	Eastern Europe, Caucasus and Central Asia
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
ICC	Intermediate Collection Centre
IHPA	International HCH and Pesticides Association
MKI	Milieukontakt International
NGO	Non Governmental Organization
NIP	National Implementation Plan
OECD	Organisation for Economic Co-operation and Development
PAN	Pesticide Action Network
PCBs	Polichlorinated biphenils
PCDDs	Polychlorinated dibenzodioxines
PCDFs	Polychlorinated dibenzofuranes
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US	United States
WHO	World Health Organization
WWF	World Wide Fund for Nature

Contents

Appendices

1. Map of Georgia with the project area
2. Locations of the sites/stores in Kakheti region
3. POP field test identification tool

Summary

The use of pesticides became part of the everyday technique of agricultural practice. In the 1960-70`s the use of these chemicals reached a peak, their use is in constant decrease since, but their presence is still more than worrying.
Persistent Organic Pollutants (POPs) are considered to be one of the most hazardous chemical formulations for nature and human kind. Their production, trade, use, disposal and recording is regulated by three international conventions, the Basel, Rotterdam and Stockholm Conventions. 12 chemicals - mostly pesticides -, the so called Dirty Dozen are namely regulated in all three Conventions.
The Georgian repackaging project took place in the frame of the three Conventions with the scope of repackaging 205 tones of obsolete pesticides, training local citizens to be able to implement the work, and establish a network, that is able to control and organize the necessary phases of the project. This project is part of the project 'Elimination of Obsolete Pesticides from Moldova, Georgia and Armenia.

Milieukontakt International and Tauw organized and conducted the project, where the repackaging phase took place from 18th April - 4th May 2008.
During the repackaging the work that has been carried out was assessed from environmental, health and safety aspects.
The influences of the repackaging of obsolete pesticides on rural development will be discussed and elaborated to convince competent authorities and funding organizations to invest in similar projects because it is serving multiple goals: not just cleaning the environment from the hazardous POPs substances, but also raising the awareness of the local society, inhibiting the obsolete stocks from being used and entering the food chain, and local capacity building.

1 Introduction

1.1 General

The Repackaging Campaign in Georgia (see map in Appendix 1.) is part of the Milieukontakt International (MKI) project: 'Elimination of Obsolete Pesticides in Moldova, Georgia and Armenia', a project funded by the Government of the Netherlands and the Stichting Doen (funds available from the Dutch State Lotery).

These three countries were chosen by MKI because the Organization had good connections both with local NGOs and competent authorities in these countries. Due to the organizational difficulties in Armenia, that the project had to cope with during the preparation phase, Armenia was replaced with Kyrgyzstan later on.

In this project MKI is the project leader and Tauw has the technical consultant role during the inventory and repackaging phases.

There are multiple purposes of the project. These are: knowledge transfer, local capacity building, awareness raising, and it is a pilot for repackaging 205 tones of obsolete pesticides in Georgia, Kakheti region, 100 tones in Moldova and 100 tones in Kyrgyzstan.

Knowledge transfer: although there are a lot of knowledgeable persons in the field of plant protection who are well aware of the effects of the substances on plants, and the symptoms of the various plant diseases, when the preparations are needed, they are not aware of (or under estimate) the human health effects of the pesticides, that can occur when not using the Personal Protective Equipment (PPE) when handling these hazardous substances.

The knowledge transfer means the training of the local teams on the hazards of the chemicals, and the proper approach on how to avoid possible accidents and exposure.

Local capacity building: the campaign is based on the training and involvement of local persons as much as possible. The project being a pilot, it has the purpose to show the local authorities, the international organizations and funding agencies, that it is possible to eliminate obsolete pesticides on local scale with the available resources. With the trained 'expert' team the government or other competent authorities can expand the project to the whole territory of the country.

Awareness raising: as mentioned before, the plant protection specialists do not seem to be aware of the risks of the agrochemicals on humans and the environment, the case is even worse among the members of the rural community. With different campaigns and advertisements, that are using the mass media, and with the involvement of the local NGOs the level of the public awareness has to be raised. The emphasis is put on the harm of the diverse chemical formulations and on their effects, when not being properly taken care of.

Repackaging: the results of the Inventory showed, that there are more than 300 tones of obsolete pesticides, contaminated soil, and contaminated packaging material to be found in the region of Kakheti.

Connected to the capacity building and the field training, the inventoried 205 tones of hazardous chemicals on the priority sites will be gathered and safeguarded. The final elimination of the repacked obsolete pesticides from the environment is not part of the project due to the limited financial resources. In Moldova the already repacked 100 tones are sent to Europe for incineration. The repackaging in Kyrgyzstan starts in September 2008.
The most important phase of the campaign is the repackaging and proper storage (from the aspect of environment protection), it is also the shortest in time. Before the clean up/repackaging could start, several months of active involvement were needed to find the suitable personnel for the trainings, to raise the awareness of the locals on the threat of the (obsolete) pesticides, to train the selected team members on the theoretical and practical aspects of the work and to select an Intermediate Collection Centre (ICC).

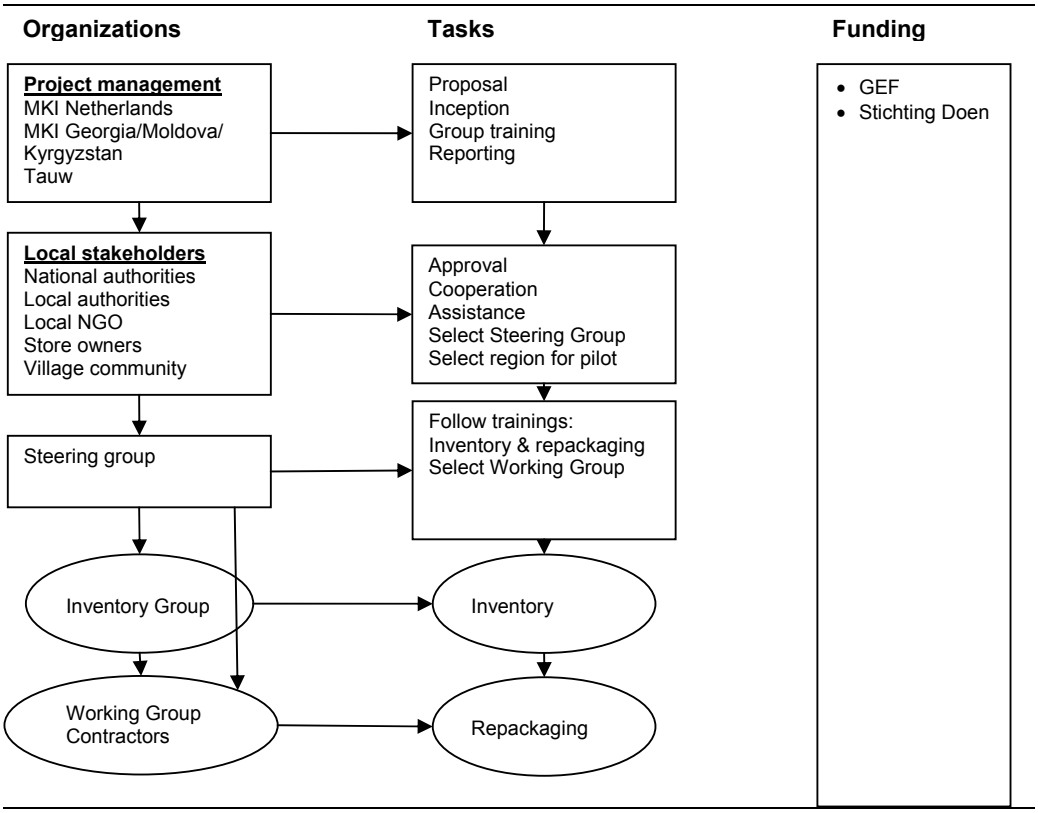
Each elimination campaign is made up from the following main phases:
- Inception mission
- Inventory training
- Repackaging training
- Follow up

For more details about the organization and tasks see figure 1.1.

1.2 Content of report

In this report the introduction is given in Chapter 1. Chapter 2 describes the background of the project with the relevant international conventions and the worldwide situation on POPs is explained in Chapter 3. Chapter 4 gives an overview of the regulated substances. The results of the inventory are described in Chapter 5, while the detailed steps of the repackaging are listed in Chapter 6. The next chapter, chapter 7 gives an explanation about the field testing tool and process.
In Chapter 8 the answers are tackled for the research questions. In Chapter 9 the reader can find the conclusions and recommendations based on the findings during the repackaging and the research, Chapter 10 contains the list of references.

1.3 Organization



Figuur 1.1 Management and tasks scheme

1.4 Inception mission

After the project proposal was accepted and approved by the competent authorities and funding agencies, a visit was paid to Kakheti region in Georgia. During this official visit negotiations were made in order to assure the assistance of the local stakeholders, and to find information about the situation on obsolete pesticides in the area. Based on the discussion with the Focal Point for Obsolete Pesticides at the Ministry of Environmental Affairs in Tbilisi, the Kakheti Region was selected as the where the problems with the obsolete pesticides are the most acute.
Also a local Steering Group was selected by the authorities, to implement the project (inventory, training, repackaging and storage) itself, under the supervision of the technical consultant team.

1.5 Inventory training

The inventory training was held from 14-18 March 2006 in Telavi, Kakheti. Participants were selected from both the Steering Group, NGO community as well as form Government representatives. In total 20 participants were present during the training days.
Three days of classroom training, discussions and presentations (inventory process, hazards, health and safety risks, etc.) were followed by two intensive field visits to various sites, where the gained theoretical knowledge was put in practice.
The inventory training was carried out according to the Standard Inventory Training as conducted by the Food and Agriculture Organization (FAO) of the United Nations. Standard FAO Field Inventory Forms were translated to Georgian language and used in the field.
The 'Inventory Team' was selected based on discussions, questionnaires and on the observations of the MKI and Tauw consultants and the local stakeholders during the training. The 'Inventory Group' together with the Tauw consultants visited 11 sites, which were known to contain obsolete pesticides. During the inventory fieldwork, 15 other sites were discovered, that made the total number of known sites with obsolete pesticides in Kakheti Region 26.

1.6 Repackaging training

The Steering Group selected 9 workers for the Working Group. The selection was based on an application letter, a CV and an interview with representatives of the Steering Group.
Just as it happened at the Inventory training, the first phase was classroom training, followed by intensive field training on repackaging. The local Working Group was carrying out the repackaging phase under constant supervision of the technical consultants, the team leader, and the local MKI project leader during the first two weeks. The repacked materials were transported to the ICC, for proper storage awaiting for environmentally sound elimination.
After the first two weeks of repackaging, the local working group is trained to carry out the repackaging under the supervision of a selected team leader. The repackaging of 205 tones (the planned amount) takes about 4 weeks. The last amounts were collected by the local team under the guidance of the team leader and the local MKI project. The Tauw consultant visited the last week of the repackaging to check the work of the Working Group, and to assure the safe storage of the repacked materials in the ICC.

1.7 Follow up of the pilot

With reference to the work executed by the POPs project of the Ministry of Environment Protection and Natural Resources of Georgia, so far some 46 different sites have been identified containing obsolete pesticides. Reportedly, the preliminary inventory of these sites shows an estimated total amount of suspected hazardous obsolete pesticides of about 357.000 tones for solid and liquid substances respectively. Besides these 46 sites, one dumpsite exists, reportedly containing 2.700.000 kg of obsolete pesticides in the country.

The elimination of these obsolete pesticides is more feasible, because with the pilot we have demonstrated, that repackaging and safeguarding of obsolete pesticides with local available resources is possible.

The aim of this study is to give answers on the below mentioned questions related to the elimination of the obsolete pesticides stocks in Georgia.

1.8 Main questions

Are there any effects of the obsolete pesticides repackaging project on rural development?

Sub questions

1. What are the effects of the project on the use of the stores and sites
2. What are the effects of the ICC on the surrounding area, community
3. Does the cleanup have any effect on the quality of the enviroment (human health, crops, livestock and drinking water) in the area
4. Does the project initiate other initiatives in the country or region
5. What are the effects of the project on local awareness and capacity building

2 Background

2.1 The Aarhus Convention

The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters was adopted on 25th June 1998 in the Danish city of Aarhus at the Fourth Ministerial Conference in the 'Environment for Europe' process.

The Aarhus Convention is a new kind of environmental agreement; it links environmental rights and human rights and acknowledges that we owe an obligation to future generations.

It establishes that sustainable development can be achieved only through the involvement of all stakeholders.

It links government accountability and environmental protection; focuses on interactions between the public and public authorities in a democratic context and forging a new process for public participation in the negotiation and implementation of international agreements. The subject of the Aarhus Convention goes to the heart of the relationship between people and governments. The Convention is not only an environmental agreement, it is also a Convention about government accountability, transparency and responsiveness.

The Aarhus Convention grants the public rights and imposes on Parties and public authorities' obligations regarding access to information and public participation and access to justice.[1]

2.2 The Hazardous Chemicals and Wastes Conventions of the UNEP[2]

Three conventions were developed under United Nations Environment Programme (UNEP) auspices together to provide an international framework governing the environmentally sound management of hazardous chemicals throughout their lifecycles.

- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- The Stockholm Convention on Persistent Organic Pollutants

UNEP provides the secretariats for the Basel and Stockholm Conventions in Geneva. UNEP and FAO jointly provide the Rotterdam secretariat, which is located in Geneva and in Rome.

[1] http://en.wikipedia.org/wiki/Aarhus_convention
[2] http://www.pops.int/documents/background/hcwc.pdf

2.2.1 The Basel Convention

The Basel Convention was adopted in 1989 in response to concerns about toxic waste from industrialized countries being dumped in developing countries and countries with economies in transition. During the first decade, the Convention's principal focus was the elaboration of controls on the transboundary movement of hazardous wastes - that is the movement of such wastes across international frontiers - and the development of criteria for environmentally sound management of the wastes. More recently the work of the Convention has emphasized full implementation of treaty commitments and minimization of hazardous waste generation. As of 1st October 2003, there were 158 parties to the Basel Convention.

2.2.2 The Rotterdam Convention

The Rotterdam Convention was adopted in 1998. Dramatic growth in chemicals production and trade during the past three decades had highlighted the potential risks posed by hazardous chemicals and pesticides. Countries lacking adequate infrastructure to monitor the import and use of such substances were particularly vulnerable. In the 1980s, UNEP and FAO developed voluntary codes of conduct and information exchange systems, culminating in the Prior Informed Consent (PIC) Procedure introduced in 1989. As of 1st October 2003, the Rotterdam Convention had 73 signatories and 49 Parties.

2.2.3 The Stockholm Convention

The Stockholm Convention on POPs is a global treaty to protect human health and the environment from Persistent Organic Pollutants. POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, Governments are taking measures to eliminate or reduce the release of POPs into the environment.
The Convention was adopted and opened for signature at a Conference of Plenipotentiaries held on 22-23 May 2001 in Stockholm, Sweden. Over 150 countries signed the Convention and it entered into force, on 17 May 2004, 90 days after the ratification by the fiftieth country.

The Stockholm Convention focuses on eliminating or reducing releases of 12 POPs, the so-called 'Dirty Dozen'. It sets up a system for tackling additional chemicals identified as unacceptably hazardous. It recognizes that a special effort may sometimes be needed to phase out certain chemicals for certain uses and seeks to ensure that this effort is made. It also channels resources into cleaning up the existing stockpiles and dumps of POPs that litter the world's landscape. Ultimately, the Convention points the way to a future free of dangerous POPs and promises to reshape our economy's reliance on toxic chemicals.

The Stockholm Convention is perhaps best understood as having five essential aims:

- Eliminate dangerous POPs, starting with the 12 worst
- Support the transition to safer alternatives
- Target additional POPs for action
- Cleanup old stockpiles and equipment containing POPs
- Work together for a POPs-free future

The Global Environmental Facility (GEF) is the designated interim financial mechanism for the Stockholm Convention.

Together the Basel, Rotterdam and Stockholm Conventions cover key elements of 'cradle-to-grave' management of hazardous chemicals, most comprehensively in the case of POPs, which are covered by all three treaties.

Existing chemicals

The **Rotterdam Convention** obliges Parties to notify the secretariat of final regulatory actions taken to ban or severely restrict chemicals, for the information of other Parties and possible listing under the Convention. Developing countries and countries with economies in transition may also propose the listing of severely hazardous pesticide formulations. The **Stockholm Convention** requires Parties with regulatory and assessment schemes to take into consideration the POPs screening criteria set out in Annex D of the Convention when assessing pesticides or industrial chemicals currently in use. Parties must eliminate from production and use certain chemicals already listed in the Convention.

New chemicals.

The **Stockholm Convention** requires Parties with regulatory and assessment schemes to regulate with the aim of preventing the production and use of new pesticides or new industrial chemicals which exhibit the characteristics of POPs.

Import/export controls

The original PIC procedure of the **Basel Convention** was strengthened by Parties' subsequent decisions to prohibit the export of hazardous wastes from OECD (**O**rganization for **E**conomic **C**o-operation and **D**evelopment) to non-OECD countries. The Basel Convention imposes strict conditions on the transboundary movement of hazardous wastes. Trade with non-parties is generally not permitted. The **Rotterdam Convention** established a PIC procedure based on the earlier voluntary guidelines. The **Stockholm Convention** restricts the import and export of POPs to cases where, for example, the purpose is environmentally sound disposal. It also requires that POPs are not transported across international boundaries without taking into account relevant international rules and guidelines.

Waste management

The **Basel Convention** requires each Party to minimize waste generation and to ensure, to the extent possible, the availability of disposal facilities within its own territory. The objective of environmentally sound management of hazardous wastes underpins the Convention. At its fifth meeting in December 1999, the Conference of the Parties adopted the Basel Declaration on Environmentally Sound Management. The **Stockholm Convention** obliges Parties to develop strategies for identifying POPs wastes, and to manage these in an environmentally sound manner. The POPs content of wastes is generally to be destroyed or irreversibly transformed. The Basel Convention Technical Working Group is developing technical guidelines on POPs wastes as part of its work programme and at the request of the Conference of Plenipotentiaries that adopted the Stockholm Convention.

Environmental releases

The **Stockholm Convention** requires the Parties to take measures to reduce or eliminate releases of POPs from intentional production and use, unintentional production and stockpiles and wastes. Concepts of Best Available Techniques (BAT) and Best Environmental Practices (BEP) are to be further elaborated by the Conference of the Parties.

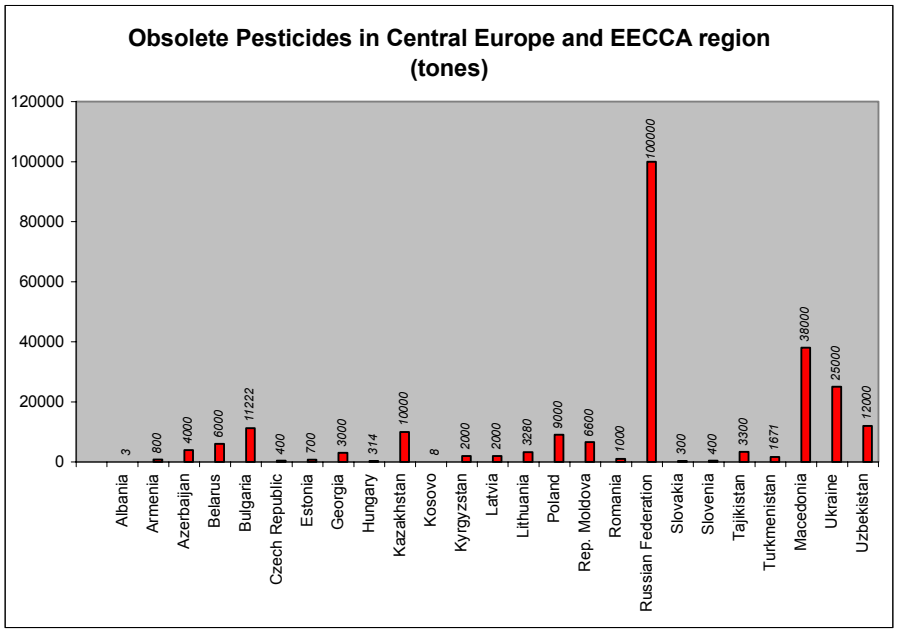
All three Conventions cover the POPs substances, mentioned as the ‘Dirty Dozen’.

3 The Pops situation worldwide

The International HCH & Pesticides Association (IHPA) is an independent and non-political network of committed individuals that wants to draw international attention on the world-wide problems stemming from the production and use of hexachlorocyclohexane (HCH) and other (obsolete) pesticides and its dangers for human health and the environment.

The IHPA has made its full commitment to use all its strength and know how to contribute actively to the solution of problems stemming from the production and use of HCH and other pesticides in Central Europe and **E**astern **E**uropean, **C**aucasus and **C**entral **A**sia (EECCA) countries.

According to the estimations of the IHPA, there are more than 240.000 tones of obsolete pesticides in Central Europe and EECCA countries.[3] See figure 3.1.



Figuur 3.1 Quantity of obsolete pesticides in Central Europe and EECCA region (data source: John Vijgen, www. Ihpa.info; table by author)

[3] Vijgen, John, www.ihpa.info

Another program, the Africa Stockpiles Programme (ASP) is dealing with the situation in Africa. In 2000 the Pesticide Action Network (PAN) and World Wide Fund for Nature (WWF) proposed an initiative to address to the accumulation of obsolete pesticide stockpiles across the African continent, at the same time negotiations for the Stockholm Convention on Persistent Organic Pollutants (POPs) were coming to a close. African countries were requesting assistance with their POPs pesticides, recognizing they pose serious threats to the health of both rural and urban populations, especially the poorest of the poor, and contribute to land and water degradation. The scope of the ASP is 10-15 years, implemented over a series of projects, at an estimated total clean-up and prevention cost of US $ 250 million. Project 1 consists of 7 countries: Ethiopia, Mali, Morocco, Nigeria, South Africa, Tanzania, and Tunisia. Planning and preparatory activities for 8 priority countries to participate in project 2 are underway.[4]

The scope of the ASP is 10-15 years, implemented over a series of projects, at an estimated total clean-up and prevention cost of US $ 250 million. Project 1 consists of 7 countries: Ethiopia, Mali, Morocco, Nigeria, South Africa, Tanzania, and Tunisia. Planning and preparatory activities for 8 priority countries to participate in project 2 are underway.[5]

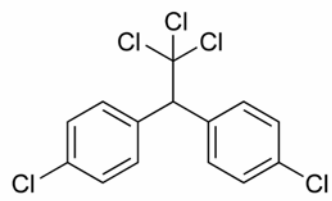
[4] http://africastockpiles.net/about
[5] http://africastockpiles.net/about

4 Persistent Organic Pollutants

4.1 The 'Dirty Dozen'

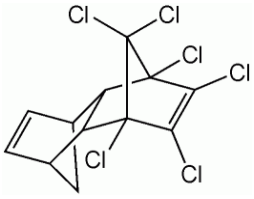
The chemical characteristics and the biological effects of the twelve POPs compounds mentioned by the Conventions are listed below.

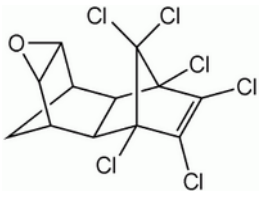
DDTs

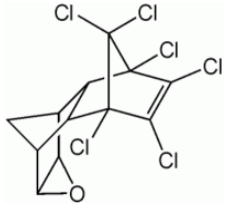


DDT, or p,p´-DDT (1,1,1-trichloro-2,2-bis (p-chlorophenyl) ethane) respectively was identified as an effective insecticide in 1939. Its production and use at large began around 1944, and, the worldwide production was estimated to 2 million tones until the beginning of the 1970's. Developed countries began to ban the use of DDT for both the plant and agricultural products protection in the 1970's. Generally, it can be stated, that DDT and its metabolites are very stable, low volatile substances of the lipophilic nature with the low water solubility and in the contrast, with a significant ability to accumulate in the fatty tissue of organisms and with the ability to adsorb at the surface of solid particles. These properties predetermine DDT and its metabolites to the long persistence in the environment and to the penetration to the food chains. The rate of DDT disappearance in various ecosystems can be described by first order kinetics with the half-life of 8-15 years, whereas the DDT is decomposed either chemically (by hydrolysis or photolysis) or biochemically by living organisms in water and in the soil.
DDT is classified as moderately toxic and moderately hazardous. Long lasting exposure can result in malignant tumors, asthma, liver and kidney damage.[6]

Aldrin, dieldrin, endrin



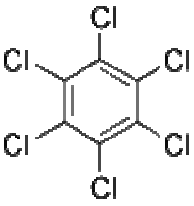




These chlorinated hydrocarbons are effective insecticides against ticks, moths, termites and other insects. To the lesser extent they were also used for seed treatment. Dieldrin is toxic even for mammals, and it was even used as a rodenticide in the past.
In case of an acute poisoning they are affecting the nerve system. Aldrin itself is carcinogen and mutagen. The production and utilization of these substances for agricultural and food products were terminated at the end of the 1970's and at the beginning of the 1980's.[7]

[6] Tomlin, C. D. S. - The Pesticide Manual, p. 282-284

Hexachlorobenzene (HCB)



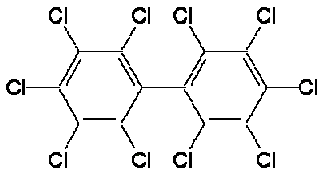
HCB is used as a fungicide, disinfectant and as a raw material or a by-product in the production of several chemicals (pentachlorophenol, several chlorinated aromatic hydrocarbon). Its fungicidal properties are utilized in the wheat, onion, and seed treatments.

HCB is a very stable, low volatile substance of the lipophilic nature with low water solubility and, on the contrary, with a significant ability to accumulate in the fatty tissues of organisms and to adsorb on the surface of solid particles. It decomposes very slowly in the environment; chlorinated phenols are mentioned in the literature as its decomposition products. These properties predetermine HCB to the long persistence in the environment and to the penetration into food chains.

HCB is classified as possibly carcinogen to humans. Chronic oral exposure in humans has been shown to cause liver disease, kidney damage, skin lesions, thyroid effects, bone effects and loss of hair. In case of exposure during pregnancy, it transfers with breast milk and accumulates in the body of the infants.[8]

HCH and HCB look almost the same at the first look, but they are very different. The basic component of HCH is an alicyclic hydrocarbon, cyclohaexane, with only single bonds between the individual carbon atoms in the ring. The basic compound of HCB is benzene, an aromatic hydrocarbon, with an aromatic ring in the middle of the six carbon atoms containing ring.

Polychlorinated biphenyls (PCBs)



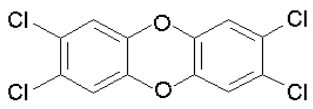
Polychlorinated biphenyls (PCBs) fall within the group of toxic and health hazardous substances, whose adverse effects on living organisms can take effects even in relatively low concentrations. They are organic compounds, whose hydrogen atoms of the biphenyl skeleton are substituted to a various degree by the atoms of the chlorine.

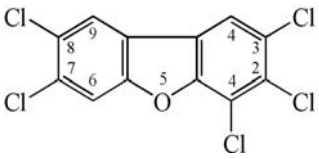
PCBs are oily to waxy substances with excellent technical properties, such as chemical and physical stability even under high temperatures, incombustibility, immiscibility with water and high electrical resistance. These properties made PCBs a suitable material in many technical domains and resulted into their widespread use. The toxic character of PCBs even in very low concentrations was not definitely proven until the 1970's, moreover, it was also verified that the danger of the PCBs presence in the environment and in food chains is multiplied by the PCBs capability to accumulate especially in the fatty tissue of organisms. The production and use of PCBs in many countries of the world was then significantly limited and gradually completely terminated.

[7] Montgomery, John H. - Agrochemicals, p.14-16., p. 171-173., p. 207-208
[8] Tomlin, C. D. S. - The pesticide Manual, p. 565-566

PCBs belong to the group of persistent organic pollutants with a strong lipophilic nature creating a significant bioaccumulation. This fact multiplies their hazardous toxic properties, as they can accumulate in the fatty tissues and organs of humans and animals. A higher PCBs content is often accompanied by the presence of polychlorinated dibenzo-p-dioxins and dibenzofuranes, i.e. substances that are several orders more toxically hazardous than PCBs alone. PCBs are determined to be probably carcinogen to humans.[9]

Polychlorinated dibenzo-p-dioxins and dibenzofuranes (PCDDs/Fs)

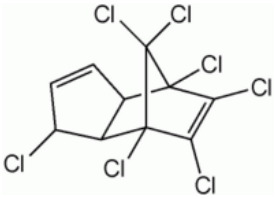




Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofuranes (PCDFs) are to a different extent chlorinated tricyclic, aromatic hydrocarbons, whose presence in the environment is considered a significant problem due to the very high toxicity of some of their representatives. The non-expert literature, publications and other media have adopted the abbreviated term 'dioxins' and their findings in various components of the environment and especially in foods have repeatedly received a nation-wide interest.

PCDDs/Fs are classified as typical POPs due to their physical and chemical properties. They have a very low solubility in water (especially those more chlorinated), low volatility, they are easily adsorbed to the surface of solid particles, and they only slowly undergo the decomposition. These properties predetermine that PCDDs/Fs, are found, of components of the hydrosphere, mainly in soil, silts and sediments, and, in a very limited amount, they are also found dissolved in the surface or other waters. They are able to bioaccumulate in the fatty tissue of animals and of humans.

Dioxins are reported to be probable carcinogen. The harm effects in humans are thyroid disorders, damage to the immune system, diabetes. Recent studies have shown that exposure to dioxins changes the ratio of male to female among a population such that more females are born than males.[10]



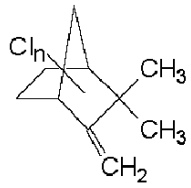
Heptachlor

Heptachlor is an organochlorinated insecticide used primarily for the extermination of soil pests and ants. It was also partly used for the extermination of insects found in households, agricultural and seed treatment areas. It is usually applied directly into the soil, sometimes even onto the leaves.

[9] National Implementation Plan of the Czech Republic, p. 119
[10] National Implementation Plan of the Czech Republic, p. 120-121

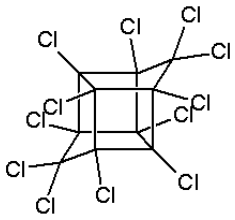
Its insecticidal effects were described at the beginning of the 1950's, after its isolation from the technical chlordane.
Heptachlor is a stable, low volatile compound of the lipophilic nature with a low solubility in water and, on the contrary, with the ability to cumulate in fatty tissue of organisms and to adsorb onto the surface of solid particles. These properties predetermine heptachlor to a certain persistence in the environment, and to the penetration into the food chains. Experiments on mice and rats proved certain carcinogenic effects of heptachlorine.[11]

Toxaphene



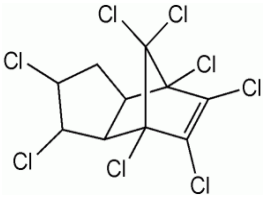
Toxaphene is a mixture of several hundred of individual compounds that significantly complicates its identification and quantification. It is a pesticide which had been used in the treatment of cotton, was also used to treat mange in cattle, although there were reports of cattle deaths following spraying with toxaphene.
Toxaphene is highly toxic. When inhaled or ingested, sufficient quantities can damage the lungs, nervous system, kidneys, and may cause death.[12]

Mirex



Mirex is an insecticide used for exterminating ants and insects feeding on the green parts of agricultural plants. Mirex is still used in the USA mainly as a flame-retardant in plastics, rubber, paint, paper and electronics. It has also been used to combat leaf cutters in South America, harvester termites in South Africa, mealy bug of pineapple in Hawaii.
Effects on organisms combined with its persistence suggest that mirex presents a long-term hazard for the environment. Mirex induces pervasive chronic physiological and biochemical disorders in various vertebrates. Aquatic crustaceans show extreme sensitivity to the compound, game birds and fish feeding close to manufacturing plants accumulate enough mirex to constitute a health hazard. No acceptable daily intake (ADI) was has been advised by FAO/WHO. It has carcinogenic risk to humans.[13]

Chlordane



Technical chlordane is a mixture of mainly two isomers called alpha- and gamma-chlordane mixed with many production side products. It was used as a pesticide on crops like corn, citrus and on home lawns and gardens. Chevron (one of the main producers) marketed it as an ant killer.

[11] Montgomery, John H. - Agrochemicals, p. 245-247
[12] Montgomery, John H. - Agrochemicals, p. 415-416
[13] http://en.wikipedia.org/wiki/Mirex

Chlordane sticks strongly to soil particles at the surface; it is not likely to enter the groundwater, so as a result it can stay in the soil for over twenty years and breaks down very slowly. It does not dissolve in water easily.
Chlordane affects the nervous system, the digestive system and the liver in humans and animals. Headaches, irritability, confusion, vision problems, diarrhea and jaundice have occurred in people, who breathed air containing high concentrations of chlordane or accidentally swallowed small amounts. Recent human studies have linked chlordane exposure with prostate and breast cancers.[14]

4.2 New Chemicals under the consideration of the Stockholm Convention

Starting with 2005, new chemicals were proposed to enter the list of regulated hazardous compounds. These compounds are:[15]

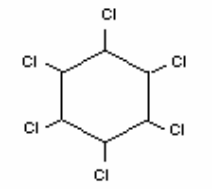
Year	Chemical
2005	PBDE (Pentabromodiphenylether)
	HBB (Hexabromobiphenyl)
	Chlordecone
	γ-HCH (Lindane)
	PFOS (Perfluorooctane sulfonate+derivatives)
2006	OBDE (Octabromodiphenylether)
	PeCB (Pentachlorobenzene)
	SCCPs (Short chained chlorinated paraffins)
	α-HCH
	β-HCH
2007	Endosulfan

Figuur 4.1 The new substances under consideration of the POPs Review Committee of the Stockholm Convention (table made by author)

These compounds are mostly organochlorinated pesticides (yellow color in the above table) and flame retardants (orange color in the above table). Probably the most important among them in the HCHs group.

[14] Tomlin, C. D. S. - The Pesticide Manual, p. 161-162
[15] http://www.unu.edu/esd/manage/event/symposium2007slides/shibata.pdf

Hexachlorocyclohexanes (HCHs)



Hexachlorocyclohexane was produced due to its insecticidal effects and was used in the agriculture as preparation for the extermination of animal and human parasites as well as for the treatment of the forests and other vegetation. γ-HCH (Lindane) is considered to be the most efficient insecticide out of five stereoisomers formed by the chlorination of the benzene.

Lindane is, in comparison with a number of other persistent organic pollutants (for example DDT, Aldrin, Heptachlor and others), more water soluble and it has a relatively higher mobility in both atmospheric and aquatic environments. Lindane is a neurotoxin. In humans it primarily affects the nervous system, liver and kidneys, and may be a carcinogen and/or endocrine disruptor.[16]
Technical grade HCH is containing a varying mixture of at least 5 isomers, with a minimum of 40 % gamma isomer. Typical isomer distribution is as follows (% by wt):*gamma*, 40-45; *delta*, 20-22; *alpha*, 18-22; *beta*, 4; *epsilon* and inerts, 1.[17]
For each produced ton of Lindane ca. 6-12 tons of residuals were created that could not be used and became later hazardous wastes. The total production of Lindane until 1993 was 720.000 tons. This means that the total HCH residuals reach the amount of 3-7 million tons that are all hazardous materials.[18]

[16] Tomlin, C. D. S. - The Pesticide Manual, p. 561-563
[17] http://www.inchem.org/documents/pims/chemical/pim257.htm#3.1%20Origin%20of%20the%20substance
[18] http://www.cec.org/programs_projects/pollutants_health/smoc/presentations/Alaska/12Feb/John-Vijgen_en.pdf

5 Results of the inventory mission in Kakheti, Georgia [19]

5.1 Introduction

The stockpiles remained in Georgia from Soviet times and have accumulated in worn and destroyed warehouses of former 'Soplkimia' ('rural chemistry'), 'Sovkhozes' and 'Kolkhozes'.[20]
The Inventory Group discovered in total 26 sites containing one or more of the categories of obsolete pesticides. (The FAO distinguishes 9 different categories of obsolete pesticides. Amongst these are the pure chemicals, damaged and degraded products, empty packaging materials, unknown products, contaminated soil, etc.)
At all sites, the storage quality and conditions for storage are below usually applied standards for storage of hazardous chemicals. At one of the sites, the Inventory Group discovered a store, where obsolete pesticides had been buried under the storage floor in the past. Currently the floor became damaged and the bags of buried obsolete pesticides appeared on the surface.
During the inventory, the Inventory Group registered a number of environmental parameters. Based on these parameters, it can be concluded, that most of the stores in the region showed high environmental risks.
Several sites consist of only some remnants of walls with relative small amounts of uncovered and unpacked obsolete pesticides in the open air.

5.2 Total amount

The total amount of observed obsolete pesticides in Kakheti Region was 304.850 kg plus 24 m^3 and 240 liters. The 24 m^3 consisted mainly of empty packaging materials. Liquid agents were found in three sites, at two stores a total of 240 liters of Intrathion, and at a third site an unknown quantity (mostly crystallized) in old steel drums.
It should be noticed, that the exact amounts of contaminated soil to be removed, can only be estimated through detailed soil research.
Most of the observed obsolete pesticides are in decayed packaging or not properly packed or not even packed, their names and chemical composition in most cases could not be determined.

[19] Betlem, Jan - Obsolete Pesticides in Georgia, p. 36-69
[20] KUC, Wieslaw Stefan - Caution Dangerous Chemicals - Obsolete Pesticides, p. 254

5.3 Prioritization

After the inventory mission the Tauw team conducted a training related to site prioritization and selection of an ICC. All Inventory Group members participated in this training. During the training the results of the inventory of Kakheti Region were used and analyzed.

Based on the toxicity of the observed chemicals, the condition of the packaging materials (if any), and the total quantity of the observed obsolete pesticides, and following the FAO Environmental Toolkit recommendations, for each site, the internal (store) risk factor (F_{in} a relative subjective risk factor) was calculated. Also for each site, an environmental risk factor (F_{env}) was calculated.
Sites with both a high F_{env} and F_{in} are sites to be considered as priority sites, which need urgent and first attention.
The following sites have been earmarked as priority sites: Saqobo, Kvareli, Achinebuli, Qvemo Alvani and Vachnadziani (see map in Appendix 2).
The five priority sites together have a total estimated amount of obsolete pesticides of about 202 tones.

5.4 Priority sites

5.4.1 Achinebuli

This site used to function as a huge agrochemicals and agricultural machinery distribution and repair center. It used to have several buildings and stores, only the office - and service building is still standing. This distribution center was supplying the farmers in the region of Telavi. On this site were five individual contaminated locations.

Location 1
The first location was a small building (which collapsed by the time of the repackaging) with 40 rusted metal drums (volume 100-200 L-s) containing unknown liquid chemical substances, approximately 16 tones of obsolete pesticides (torn plastic bags, broken packaging, loose powder) and 5 cubic meters of contaminated packaging materials, partly filled with obsolete pesticides.

Location 2
This construction used to be the second biggest construction on the site. It was functioning as fertilizers store; it has a long concrete loading platform that used to be connected with the railways network (no rails can be found any more). The building is completely demolished; the reusable building materials were taken away. Still a relative big amount of fertilizers can be found on the surface.

Location 3
Remnants of a large concrete structure (distribution centre for fertilizers and pesticides?) showed large amounts (about 100 tones) of unknown pesticides. Scattered smaller amounts of yellowish pesticides could be seen at various places, with remnants of cardboard and metal packaging materials. Building material collection and metal collection for scrap has taken place on large scale.

Location 4
The biggest storage facility; almost completely demolished; only the concrete frame (reinforced concrete columns and rafters) are still standing, meaning danger to the persons staying near to it. Still relatively big amounts of pesticides and fertilizers can be found on the surface of the old floor.

Location 5
Not far from the 2nd location, a mixture of ash, burned and partially burned unknown light yellowish substance was found. The building, that used to stand near this location, was burned down, the ashes and the burned pesticides were dumped here from the building.

The site is situated about 200 m from a river, and is surrounded by vineyards of the nearby wine producing plant.

5.4.2 Saqobo
Remnants of a large concrete structure (distribution center for fertilizers and pesticides?) next to a village, and a village waste dumpsite.
The site is open for public, cattle were observed grazing between the rubble. At one side domestic houses are bordering the site. At two places, burned heaps of bags with white unknown chemical(s) are stored without any shelter or protection. One corner showed about 30 tones of unknown material(s), the other one around 6 tones with the same material(s).
One of the Inventory Team members investigated the heap and found labels of benzoic acid. Another spot contained of some 6 tones of unknown mixed chemicals. Labels were found showing that Ridonil was one of the various obsolete pesticides. Total estimated amount of various chemicals, probably obsolete pesticides was quantified as 42 tones plus 5 cubic meters of empty contaminated packaging materials.

5.4.3 Sagarejo
The site showed a large store containing remnants of amounts of obsolete pesticides. The floor was severely contaminated, the storage walls were heavily corroded by pesticides. Some compartments of the buildings remained in a relative good shape; the building was the one of the possible location for an ICC. During the inventory 18 Methyl Bromide cylinders were found among other obsolete pesticides; this fact had an important role in classifying the site as a priority site.

5.4.4 Qvemo Alvani

The site consists of several small buildings, which are in very bad shape; cattle were grazing around the store. Inside several different obsolete pesticides were observed; some 8 tones of unknown powders, partly packed in bags; 1.5 tones of unknown powders packed in rusted metal containers; 300 glass bottles containing an average of 0.75 kg of liquid labeled Intrathion from 1967. Another building - also in very bad shape-, contained 4 tones of obsolete pesticides, mixed with soil.
(The site is private property; the current owner was planning to bury the pesticides, as no institution could offer any other assistance).

5.4.5 Vachanidziani

The site contained several heaps of contaminated soil with torn bags of pesticides on the surface. Several colors were observed indicating probably the existence of several chemicals. Strong pesticide smell was observed during the visit.
The site is surrounded by vineyards.
Some 80 tones of contaminates soil was considered to be removed.

5.5 Intermediate Collection Center (ICC) [21]

One of the focuses of the campaign is the repackaging and elimination of the obsolete pesticides and the other contaminated materials. It is very important to have a facility that is big and safe enough to store the repacked hazardous substances for the time between the repackaging and transportation to the incineration/treatment plant. FAO prepared a guideline[22], to standardize the various requirements of an ICC. In accordance with the guidelines, the ICC should be located on a site, that is:

- Far from human dwellings. (Each country has its own regulations and the minimal distance of the ICC should be in accordance with the regulations)
- Far from rivers, lakes, reservoirs, wells and other water bodies. (To reduce the chance of polluting the surface water due to spillage in or around the ICC, the ICC should be located in such a way, that the water bodies are protected)
- Above floodplains and high water tables. (To reduce the chance of polluting the surface and groundwater, the ICC should be located above floodplains and the highest (ground) water table. The data concerning the highest levels of (ground) water table should be collected and reviewed before the final decision using a site to build/use as an ICC)
- Reasonable distance from other hazardous establishments carrying a risk of major hazard accident: explosion, fire. (Each country has its own regulations and the minimal distance of the ICC should be in accordance with the regulations)

[21] http://www.fao.org/docrep/V8966E/V8966e.htm#1

- Far from landslide zones (The location of the ICC should not be vulnerable for erosion. The location and its surroundings should be assessed for the erodibility. If a selected location is vulnerable and erosion control measures (planting trees, terracing and improvement of surface drainage) will protect the ICC, the control measures should be part of the area lay-out
- The ICC should have good access for emergency services and the truck transporting the repacked hazardous substances. The ICC should also have easy access to the highway network

These points are only being mentioned to give an overview to the reader, what kind of requirements an ICC has to fulfill. The above points are only describing the properties of the area of the ICC, but there are several other requirements, that are less important in this present case.

The selection of the ICC was done by the Working Group; the Tauw consultant team provided technical back-stopping. The Working Group members made a list containing potentially suitable and available storage sites for the storage of the repacked obsolete pesticides in the region of Kakheti. Together with the Tauw consultant team, these sites were visited and assessed according to the Decision Taking Matrixes of the FAO Environmental Toolkit.
Based on drums and pallet capacities (200 kg/drum, 4 drums on a pallet of 1.96 m^2, approximately 800 kg per BigBag), approximately the space of 250 pallets of 1.96 m^2 was needed to be available in the ICC. Taking into consideration that 60 % of free space should be kept in the store to enable moving and inspection, a storage capacity of approximately 1250 m^2 was needed for Kakheti Region. Depending on the form and shape of the area, one should consider an area of 1250 m^2, +/- 15 %.

Two sites turned out to be suitable: Badiauri and Sagaredjo. The best store was the store in Sagaredjo, because it is easily accessible, has a long loading platform, is large and was used to store pesticides in the past. But also this store needed improvement to reduce the potential risks for the neighboring population and environment. The store in Sagaredjo was privatized and the owner did not wan to rent his store for the storage of repacked obsolete pesticides. The owner has cleaned the store on his own initiative and he is intending to start a poultry farm in this former pesticide store. He cleaned the store and dumped the obsolete pesticides somewhere on his land. The empty packaging, the contaminated pallets and the Methyl Bromide cylinders were not present at the site during our visit. It is unknown how the owner disposed of this hazardous waste. Most important renovation works at the future store at Sagaredjo were reroofing with tar paper, removing all the separating, non supporting internal walls, removing the wooden floor of several rooms and installing concrete floor, closure of doors and partly the windows with masonry and installing window frames with mess wires and mosquito nets. For proper storage two additional lockable entrance gates and one emergency door was constructed. Warning signs were also placed both inside and outside the facility.

6 Repackaging

6.1 Introduction

Repackaging phase under Tauw - MKI supervision: 18th April 2008 - 4th May 2008.
After having all the data - that was collected during the Inventory mission - assessed, five priority sites were chosen for cleanup with the use of the FAO Environmental Toolkit. The assumed amount of obsolete pesticides and contaminated soil coming from the five sites could be fit in the target amount of the project: elimination of 205 tones of obsolete pesticides.

6.2 Preparation

During the first two phases of the project (inception and inventory) the local Steering Group was established. The Steering Group selected the Inventory Team and the Working Group. The Inventory Team was trained on how to carry out the inventory mission, when all the possible contaminated locations were visited, investigated and assessed. The Working Group, whose members were selected to carry out the repackaging on the field, followed classroom trainings, where the human and environmental risks of the different chemical agents were presented, along with the safe implementation of the repackaging works and the proper use of the PPE.

6.3 Training aspects

The Tauw experts joined the field crew to show the safe process of the work: the use of the: PPE, repackaging materials, documentation sheets; the storage of the newly repacked obsolete pesticides in the ICC, and the safe way of loading and offloading the truck.
After the days of joint ‘presentation’ of the proper process of the implementation of the work, the Tauw experts took the observer role, and were constantly monitoring the safety of the working process, the use of the PPE and the recording of the data of the collected, repacked and stored obsolete pesticides.

6.4 Difficulties of the Repackaging

Management
It was a real challenge to have the project implemented with the use of the local manpower and the available materials and equipment. Some of the materials, that were available in the near of the region were not sufficient to the standards, all these goods were transported from the Netherlands (coveralls, masks, protective glasses, protective gloves, UN approved BigBags). The continuous supply was hard to organize due to the big distance.

Transport
The repacked hazardous substances - according to the FAO standards - should not be transported in open trucks. Because of the ICC did not had a loading platform, the truck should have been equipped with a closed trailer with a lift ramp. There were only trucks fulfilling these requirements, which were used for food transportation, so a loading platform had to be built at the ICC.

Local manpower
The attitude of the Working Group in the beginning was unprofessional. Without supervision they constantly took off the PPE. Though they were educated on the hazards of the found substances, because of the low level of awareness, they did not pay attention to safety. It was really hard to make them understand the reason of the use of the PPE and make them use it constantly. The work process of course would be easier without the PPE: it is hard to breathe in the mask, the boots, the coverall and the gloves are all too hot wear in the sunny, warm weather.
Making the group understand, that drinking alcohol is not allowed during work was also hard, constant supervision was needed to avoid such behavior.

Weather
The training on the repackaging took place in the second part of April-2008. The weather in that time was already very hot, what was not expected during the planning phase. Because of the hot weather, the daily plan had to be changed; the Working Group had three shifts per day with resting time in between and constant water supply.

Roles
The regulation and organization of the group was very hard, until the consultant group pointed out one member of the Working Group to be the leader. After restructuring the Group, all the handling of the group became much easier. The leader person had all the responsibilities for the proper working process.

7 Field Testing

One of the tasks during the preparation and the repackaging was to develop a field testing tool to be able to determine the chemical quality of the found substances.
It is always hard to tell about substances on the site, what they really are. During the Repackaging Campaigns several former pesticide stores were in so bad condition, that they could not preserve the pesticides as they were stored in. In these cases all the packaging of the obsolete pesticides was badly damaged, the labels were blurred to an unidentifyable state, or even missing.
To collect samples and send them to analysing laboratoies and have them analysed is always very time- and cost consuming. The best and easiest way - if it is possible - is to try to identify the samples on the site. This way the work can go on without any extra costs or extra waiting time. Besause of the tight financial resources, it is very important to repack only the hazardous substances, and leave the non hazardous ones or just transport them to special waste depos. The repackaging and elimination of one ton of obsolete pesticide or contaminated materials costs around € 2,000.00; that is why the technical consultants always have to be sure, that the substances, that are to be repacked, are not fertilizers or other non hazardous compounds.
The field testing tool was developed during the Georgian repackaging mission; with the help of this tool the project saved € 130,000.00 on identifying non hazardous substances (e.g. fertilisers, benzoic acid) and not repackaging them.
The approach intended to organize several field tests in such a way that a substance could quickly be classified. First, the unknown substance is checked for solubility in water. If (partially) soluble, the electrical conductivity of the solution is measured. Following these results, the unknown substance can be put in one of three categories: 1) soluble substances that give a rise in EC (i.e. salts, acids: substances that dissociate into ions), 2) soluble substances that do not give a rise in EC (i.e. substances that do not dissociate into ions in a watery solution; for example urea, sugars, organic compounds), 3) insoluble substances (insoluble inorganic or organic compounds)[23].
Following this categorization into three main categories of substances, further steps were proposed as detailed in the diagram (see Appendix 3).

At the site, a lab set-up was made with available materials. Preferably, the lab is protected from wind as this makes weighing a sample impossible, and this is a precondition for safe operation. Next, samples are collected in resealable sampling tubes with a unique code and the origin of the sample clearly noted. Following this, the tests can start as given in the approach or in a specific way if gathering answers to specific questions is desired.

[23] Bouwknegt, Matthijs - The Use of Field Test During a Repackaging Campaign of Obsolete pesticides, p. 2-4

Picture 7.1 On site lab set-up

Picture 7.2 Water solubility test of the collected samples

During the repackaging the test tool was very useful in separating the found substances to hazardous and non hazardous ones. The hazardous ones were repacked, the others were transported to waste dumps. Having the test done in an earlier state of the project results in more accurate numbers in the planning, and also contributes to risk reduction. If the inventory results show large amount of identical substances, specific field tests can be developed to certainly identify the materials and decide in advance about the further fate of them. Including the testing in the inventory phase saves time and makes the planning easier.

8 Effects on rural development

In this chapter, the possible effects of the repackaging are discussedi.

During the inventory process three categories were created to describe the general state of the locations. These three categories are: stores, sites, lost sites.

Stores
In most of the cases, there are old stores to be found as environmental hotspots, containing different volumes of obsolete pesticides and/or contaminated soil, packaging materials. The buildings were used for decades to store - sometimes even for mixing - pesticides. After years of abandonement the condition of the buildings turns really bad, resulting in leaking roofs, aged inlets, that can not be locked any more, cracks and holes appear on the walls. In some cases animals were found grasing around, children were playing inside the contaminated buildings or even feedstuff was stored next to the piles of obsolete pesticides.
After the cleanup, the threat is that the buildings, that are private owned, will be used by the owners for all kinds of purposes. The problem is that the buildings are also highly contaminated, and it is completely not adviseable to use these buildings for other purposes than further storage of agrochemicals.

Sites
It happened many times during the Georgian Camapaign, that the team came across such sites, where the former buildings were completely demolished and the brick or concrete rubble was reused by the local residents as building material for their family houses. In these cases the word ‘site’ is used, rather than ‘store’. Sometimes there are still relative big amounts of pesticides present, but usually mixed with different amounts of rubble.

Lost sites
At those sites, where we did not identify any obsolete pesticides or a storage building, the term ‘lost site’ had to be introduced. This category only indicates that there are no obsolete pesticides present for repackaging and we did not identify hot spots of contaminated soil during the inspection. However, pesticides were stored, but the storage buildings are completely demolished and there are no visible traces of pesticides left. Pesticides may have washed away and contaminated the soil in the past.[24]

[24] Fokke, Boudewijn - Obsolete Pesticides in in Kyrgyzstan, p. 29

8.1 Achinebuli (site)

What are the effects of the project on the use of the store/site?

In general it can be told, that all five locations on the site were cleaned form the pesticides. The project only had resources to cover the expenses of the collection and repackaging of the pesticides, the contaminated soil could not have been collected in large amounts. This means that though the primary contamination sources - the obsolete pesticides - are not present in the environment any more on these spots, the soil is still contaminated, and the contaminated soil is still a risk factor for the future use of the site.
Because of this reason any kind of plant production activity should be prohibited on the territory of the site.
The local people saw the members of the Working Group working on the site in full PPE and loaded trucks leaving the site. Unless it is made clear for them, that the soil is still contaminated they consider the area to be safe and be suitable for all kind of purposes of further use.

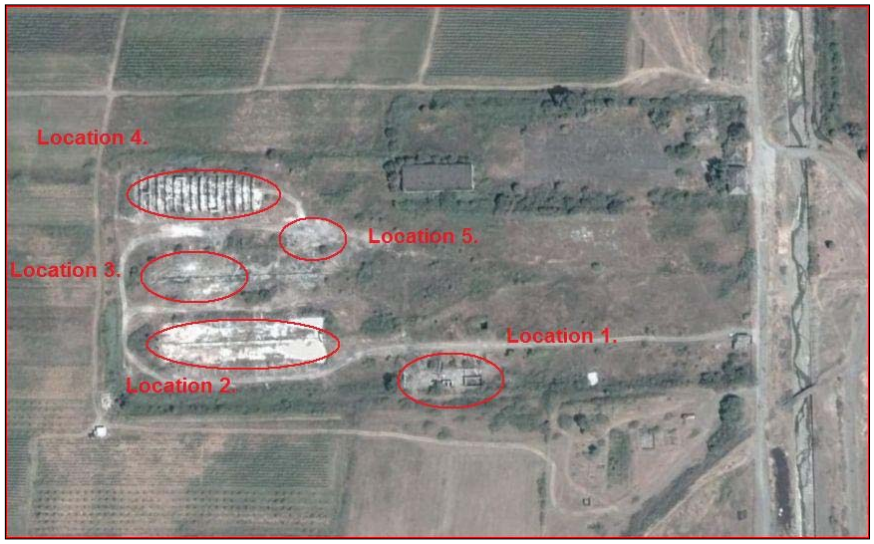


Figure 8.1 Satellite image of Achinebuli site with the different locations (source: Google Earth)

Does the cleanup have any effect on the quality of the environment?

Drinking water
The site is situated at the edge of an industrial area. The whole area is connected to the local water network. Because of this reason, the cleanup is not likely to affect the quality of the drinking water.

Crops
The site is situated next to big vineyards. The wine production is happening on a large scale in the area, in fact in the whole Kakheti Region. In some cases during the time between the inventory and the repackaging, some of the inventoried stocks have disappeared, the people, who knew about the presence of these obsolete pesticides after the inventory, might have taken parts of the stocks for their own farm production purposes. As a result of the cleanup the remaining obsolete pesticides will not appear any more in the agricultural production, this way they are not going to enter the food chain.
In case of restriction of the purposes of use of the site, even the probably contaminated soil can not mean any harm for the crops.

Livestock
While the repackaging was taking place, suddenly a herdsman appeared with a drove of cattle, and rode the cattle on the territory of the contaminated site to let the cows graze.
Even the scenery of the Working Group in full PPE did not scare him away from letting the cattle graze around.
The cleanup has a positive effect in the sense that it is not possible any more for the animals to get in touch with the substances directly. The grass is probably contaminated around the hotspots, so just as all kind of plant production activities should be prohibited, all livestock presence should not be allowed on the site.

Human health
Because of the cleanup, the primary contamination source is not present any more, no further contamination can occur. The site is not fenced or guarded; it is easily accessible for people who have the intention to enter. With the cleanup, the chance of direct human exposure has decreased to a minimum level.

8.2 Saqobo (site)

What are the effects of the project on the use of the store/site?

Just as Achinebuli, this site was also functioning as a regional distribution center for different agrochemicals, and it had a very similar condition to the former stores at Achinebuli. The biggest amounts of unknown chemicals were identified as Benzoic Acid, which are not toxic, but hazardous substances were also found.
The site is situated right next to a village, even now after the cleanup it is not advisable to allow any kind of activity that is dealing with chemicals. The surface of the site has been cleaned; the Benzoic Acid was transported to a hazardous waste dump site, the rest of the contaminants were repacked and transported to the ICC.
After major investments in reconstructing the site it can have a new function, but just as at the Achinebuli site, the soil here is also probably contaminated around the formers stores; the further purpose of use has to be determined accordingly.

Picture 8.2 Donkey with the pile of Benzoic Acid in the background

Picture 8.3 Piles of obsolete pesticides at Saqobo site (estimated 6000 kgs

Does the cleanup have any effect on the quality of the environment?

Drinking water
There are no wells situated on or near the site, the cleanup does not have any affect on the quality of the drinking water.

Crops
The site is on the border of the residential and industrial part of the small town Tsnori. It is not likely to have any kind of plant production activities on the territory of the site, but it also has to be avoided to happen. With the elimination of the chemicals from the site, their further use by local farmers is impossible.

Livestock
During the repackaging there were a couple of donkeys and cattke grazing on the site. With the cleanup the direct exposure can not occur any more, but the contaminated grass can negatively affect the health of the animals. The grazing of the domestic animals has to be prohibited on the site.

Human health
Behind the biggest heap of Benzoic Acid, at one of the corners of the site, there is a family house. Two children out of the three kids in the family were born with locomotor disorder. It is very likely that their disability was caused by the ongoing activities in the past on the site next to their house. At the moment the family is receiving a government support because of the contamination of the site being the probable cause of the disability of the children.
The cleanup has a positive effect on human health, because of the elimination of the substances from the environment prevents further exposure. Public accessibility must be strictly limited.

8.3 Sagarejo (store)

What are the effects of the project on the use of the store/site?

This store is also very similar to the sites Achnebuli and Saqobo, with the difference that the storage buildings are still in quite good condition. It also used to be a distribution center for pesticides and fertilizers. There is a village very close to it, and it also has connection to the railway network.
The property is now private owned. The owner dumped everything out from the store by himself, and did not tell where he took it. The reason why he 'cleaned' the store is that he wanted to start a poultry farm in the building. During the cleanup, only 8 m^3 of contaminated materials were found in the vicinity of the buildings. All the walls are heavily contaminated, saturated with the formerly stored pesticides.
Though the inventoried amount have not been found, at least the consultant group could convince the owner to not to run a poultry farm in the highly contaminated building.
To avoid any exposure in the building, the whole structure should be demolished, and all the rubble shuold have to be transported to a hazardous waste dump site.
(During the inventory some 38 pieces of 100 and 200 L metal cylinders were found in the store, containing Methyl Bromide. This compound was used as fumigant against funghi, rodents and insects. It is also highly toxic to humans. During the cleanup none of the barrels were present, just as the estimted 20 cubic meters of other inventoried obsolete pesticides and contaminated packagings have also disappeared).

Picture 8.4 Methyl Bromide cylinders in the store

Picture 8.5 Unidentified obsolete pesticides at Sagarejo

Does the cleanup have any effect on the quality of the environment?

This is a special store in the comparison because it was the owner, who collected the hazardous substances, not the Working Group. In this case the collection of the chemicals can not be called as cleanup, because the owner disposed of the from the stocks in an unknown matter. This way it is hard to break down the effects to the above used structure. In general it can be stated, that the area (including all environmental media), where the hazardous substances were disposed of by the owner, suffers a serious environmental load in every mean.

8.4 Qvemo Alvani (store)

What are the effects of the project on the use of the store/site?

This is a private owned farm with several small store buildings, each containing different amounts of obsolete pesticides. All the buildings were cleaned but still strong pesticide smell was present due to heavy contamination of the buildings.
Most of the buildings were in bad condition, further use is only possible with serious repairements. Due to the fact that the buildings are highly contaminated, all of them should be demolished and the rubble should be transported to a hazardous waste dump site.

Picture 8.6 Cattle grazing outside one of the stores

Picture 8.7 Obsolete pesticides inside one of the stores

Does the cleanup have any effect on the quality of the environment?

Drinking water
The farm is situated near a small village. There were no wells seen around the stores, but probably the water supply is solved by wells. Most of the POPs compounds have bad water solubility, so they only mean threat to the water supply, if the wells are close to the contaminated spots. Here were no wells next to the small stores, that is why the cleanup probably was not affecting the quality of the drinking water.

Crops
The fram is surrounded with large agricultural lands. The collected compounds are not available for further use; they are not going to enter the food chain. Because of possible soil contamination around the stores, crop production should be restricted on the land around the stores, at least not in the 20 m circle around the store even in case of future demolition of the buildings.

Livestock
During the inventory and repackaging several cows were observed grazing around the stores and on the nearby lands. Eliminating the hazardous compounds mean no more chance to get in touch with the animals or contaminate their feedstuff.

Human health
The stores are on private land on a relatively remote area. In general it is only the owner family, who can enter or go near these stores. Though the stores were in bad condition, they still were functioning well in the sense of keeping away unwanted persons to expose themselves to the hazards. After the cleanup the chance is big that the family will use the contaminated stores, because the buildings can be easily renovated.

8.5 Vachnadziani (site)

What are the effects of the project on the use of the store/site?

The site is at the edges of several vineyards and orchards, situated next to a dirt road. Several heaps of soils mixed with obsolete pesticides were recorded during the inventory visit. There were no labels found, but during the cleanup even some medical waste turned out from the soil (different ampoules, syringes). The site was not used for agricultural purposes; probably it will remain like that after the cleanup also, because it is a very narrow segment between two minor dirt roads. Because of this, probably the cleanup is not affecting the use of the site, it was out of use before and remains out of use after the project.

Picture 8.8 Different buried contaminants

Picture 8.9 Excavation of the contaminated media

Does the cleanup have any effect on the quality of the environment?

Drinking water
The area is only used for fruit production, there are no human dwellings in the near. There is no water usage originated from the site for human or domestic animal consumption.

Crops
Because of the site was out of agricultural use, probably it will remain like that after the cleanup also. It is a hardly cultivateable corner of a small field. In case of any further use it still should be considered as possibly contaminated because only the hotspots were excavated and heaps of contaminates soil remained at the site.

Livestock
There were no animals seen neither during the inventroy nor during the cleanup. Because of the horticultural use of the area, it is most likely to not to have any effects on the livestock.

Human health
With the collection and repackaging of the hazardous materials the chance of human exposure decreased to a minimum level, but the soil can still be a contamination source both for humans and the environment.

Sites	Effects of the project on				
	Drinking water	Crops	Livestock	Human health	Use
Achinebuli	+/-	+	+	+	+
Saqobo	+/-	+	+	+	+
Sagarejo*					
Qvemo Alvani	+/-	+	+	+	+/-
Vachnadziani	+/-	+/-	+/-		+/-

Figuur 8.10 The effects of the repackaging project per site

* This site was not assessed because the store was cleaned by the owner

+ Positive effect

+/- No effect

- Negative effect

8.6 What are the effects of the ICC on the surrounding area, community?

Use of the building

In the present case, a former office building is used as an ICC. The problem with this is, that in fact the activity is contaminating a formerly non contaminated building. The use as an ICC determins the further use of the building, it should not be used for other purposes, than storing agrochemicals.

The future fate of the building also has to be mentioned. The repairement of the building takes away a lot of money from the budget of the whole project. The roof has to be waterproof, lockable tough doors have to be installed, the windows have to be equipped with dense bars, avoiding to enter any kind of animals and the floor has to be strenghtened with a new, flat layer of concrete. After transporting the repacked materials to the place of incineration or environmentaly sound elimination, the nitely renewed building will be standing empty. The contaminated building should be restricted from the public because of its contamination; it could be used as regional agrochemicals distribution centre.

Picture 8.11 The entrance of the ICC with one of the store keepers in the front

Figuur 8.12 Work inside the ICC with the UN Big Bags

Ecological
The ICC can turn into a threat to the local citizens. Though it was repaired according to the FAO standards, it is still an additional risk factor for the citizens living in the close area.
The ICC in Kakheti is on top of a hill; in case of any structural damage, the hazardous substances can contaminate the soil and groundwater of the settlements in the valley, or in case of a fire, hazardous fumes can risk the health of the citizens living in the area.

Social
The ICC has a constant crew of two persons. The two so called 'store keepers' are responsible for the off loading of the trucks, that are transporting the repacked materials, the safe storage of the stocks, keeping the recordings and data up to date and the overall safety of the stocks and the store. The two store keepers both followed classroom trainings, and both of them were trained on the practical side also during the repackaging training: how to fulfill their duties safely and accurately. After the training, their work was assessed by the technical consultants and the representatives of MKI, and the mistakes were made clear for them to avoid any futher risk originated from human factor.
With their involvement, being local citizens with several relatives and connections in the area, they contributed to the awareness of the risks of the chemicals and the store among the local community.

8.7 Does the project initiate other initiatives in the country or region

1. Incineration of the repacked obsolete pesticides is solution for elimination purposes, but it is nowhere close to the Best Available Technique. The incineration requires repackaging, that makes the transportation safe and expensive transport that means extra organizational difficulties because of the transboundary transport of the hazardous substances. Even the incinerators with the best available technologies have high emission values that mean extra environmental load caused by the elimination of the hazardous obsolete pesticides.
   During the progress of the project, an additional task was to look for alternative technologies that are capable of degrading the POPs and other hazardous compounds on an environmentally sound way. This search led the MKI Tauw team to a Japanese company, who invented a so called Ball Mill that can degrade a whole variety of hazardous chemicals simply with mechanical power.
   Recently is a new project proposal is under preparation, to contract the Japanese company (Radical Planet Research Institute Ltd.) and have the Ball Mill transported to Georgia, and to have a test run of the machine to see how it works in real circumstances, and to check the feasibility of the alternative new technology.
   This machine would be transported near the ICC, and the repacked obsolete pesticides would be the trial material to test the new technology

2. If the technology proofs to be a reasonable alternative to the incineration, the next initiated effect is to propose another pilot project to clean the central hazardous waste dump site that contains 2.700 tones of obsolete pesticides and other mixed hazardous and toxic chemicals. This project is already being considered, the implementation depends on the outcome of the trial run of the Ball Mill on degrading the repacked stocks of the ICC in Badiauri

3. The repackaging project is already acknowledged by the World Bank and by the Ministry of Environment as a successful effort on the cleanup of Kakheti Region in Georgia. The project - being a pilot - is handed over to the Georgian Government after finishing the repackaging of the planned 205 tones. In case of a successful reduction of expenses via the use of the Ball Mill, the elimination effort of obsolete pesticides is expected to be expanded to the whole territory of the country

8.8 What are the effects of the project on local awareness and capacity building?

The efforts are jointly done by Milieukontakt International and local NGOs that are official partners during the project.
Through mass media, website, leaflets and educational materials for citizens and special information for youth and children, a nation-wide campaign was launched to raise awareness on the risks of obsolete pesticides and how to deal with them.
The target groups should know how they can recognise a pesticides storage site, and what to do when they have one in the vicinity of their home.
During the campaign on awareness raising citizens are encouraged to give information about locations where they suspect obsolete pesticides to be stored.

It is very important to involve the local citizens in the project. Deep involvement and personal contribution can be made only by being a member in one of the organizational units of the project, but the citizens have to know what is happening around them, and with informing them, they can pursue the local authorities to make further steps in the field of POPs.
If the local people only see the Working Group members working in ‘Moon-suits’ and masks, they will not know, what is happening and won’t have the intention to participate in the effort to clean their environment.
As a result of the efforts to inform the public on the different aspects of the repackaging campaign, local individuals handed in more than 1.200 kg of obsolete pesticides kept in their households.

With the help of the members of the Steering Group, Inventory Team and Working Group, training them on the different aspects of the risks of obsolete pesticides, the relatives and circle of friends of the unit members were informed by first hand, raising their interest in the topic.

8.9 Overall conclusions on the environment and use of the sites/stores

As the result of the cleanup all the prioritized hotspots were eliminated. Several tons of pesticides are taken out from the environment prohibiting the hazardous substances to contaminate the crops and meat products and to enter the food chain.
The drinking water only seems to be affected by the repackaging, if the water supply is solved by wells that are situated near or on the contaminated area.
The locations, where the cleanup has taken place are now considered to be safe and free to use by the local community, although they still can mean a risk. At these locations land use should be strictly limited.

9 Conclusions/Recommendations

During the repackaging mission to Georgia and during the preparation of the study the possible positive and negative effects of the repackaging of obsolete pesticides on rural development were investigated.
The examination was made location by location breaking it down to effects on drinking water, crops, livestock, human health and use of the stores or sites.

After the assessment of the effects on the quality of environment and use of the sites/stores the next conclusions can be stated.

During the different phases an expert team and an effectively working Steering Group - Inventory Group - Working Group co-operation has been built up. Members of the mentioned participating units are trained on how to deal with the hazards of obsolete pesticides, how to implement an inventory mission, how to implement the repackaging and how to keep the records of all different project phases and outcomes. With this training- and organizational structure the **local capacity building** was kept in focus allowing to expand the effort on a national scale with the maximum involvement of the local available capacity.

The working group members were selected from unemployed persons, who have the proper educational background to implement the work, but due to the economical difficulties of the country, they did not have a job. With training them on new tasks, giving them new skills and capabilities, the project contributed to the **decrease of unemployment** in the region.

As a result of the project **205 tones of obsolete pesticides were collected**, repacked and safeguarded in proper circumstances. These chemicals are not able any more to cause health damage to the citizens living near the sites/stores.
As the result table shows, the repackaging - with collecting and safeguarding the hazardous obsolete chemicals - had positive effects on the different aspects of the agriculture: quality or safety of the produced crops and livestock. These materials are now safe from entering the food chain or from further contaminating the environment of the Kakheti Region.

All together five priority locations were cleaned from the hazardous substances. Due to the limited financial possibilities in most of the cases only the contaminants could be collected along with a small amount of contaminated soil. These sites are concerned by the local citizens to be safe after the repackaging. The POPs substances being persistent, they are expected to remain in the soil for decades after the implementation of this project.
In the frame of this pilot project the most has been done to eliminate the contaminants from the environment, but to have an outcome that would be expected by European standards, soil change would be necessary. The soil around the former stores and on the sites, where the obsolete pesticides stocks were found, is suspected to contain hazardous chemicals way above allowed limits. The **change of** these **soils is recommended** in case of a nationwide project with bigger available budget.

As mentioned before, the priority locations are being considered by the locals to be safe after the cleanup. In most of the cases the buildings are heavily contaminated. After cleaning up these **former store buildings** all the buildings **should be demolished** and **the rubble should have to be transported to legal hazardous waste dump sites**.

In the present case a former office building was renovated and used as an ICC. With this step a non contaminated building became contaminated because of the storage of the repacked obsolete pesticides. According to the above recommendation - the contaminated buildings should be demolished - an extra volume of hazardous materials were created. In general it can be stated, that in case of a possibility to use an already contaminated building - facilities used to store, sell or mix pesticides or other hazardous chemicals - **it should be avoided to use uncontaminated facilities**.

In the present project there has been two years difference between the Inventory and the Repackaging itself. In some cases completely different circumstances were found than what was expected after the inventory. At one site a store building collapsed, making impossible to collect the obsolete stocks under it. With the collapse of the building the volume of the contaminated materials became a lot bigger, resulting higher costs for the elimination. At another store, the owner disposed of from the obsolete stocks by himself, not waiting for the expert team to do the job, because he wanted to start a poultry farm in the contaminated store building.
These examples show that **the time between the Inventory and the Repackaging should be reduced** as much as possible, in order to be able to collect the most possible volume of contaminants and to avoid extra contaminated volumes because of ‘dilution’ with rubble materials.

As a final conclusion it can be stated, that the repackaging project has effect on rural development. It contributes to local capacity building for the elimination of the obsolete pesticides. The awareness raising helps to make the first steps towards safer agricultural production and safer products, while the cleanup itself contributes to healthier rural circumstances both for humans and animals.

10 Bibliography

1. Montgomery, John H.: Agrochemicals ~ Desk Reference, 2nd ed., New York: CRC Press, 1997, p. 14-16, p. 171-173, p. 207-208, p. 245-247, p. 415-416
2. Tomlin, Clive D. S.: A World Compendium ~ The Pesticide Manual, 14th ed., Alton: British Crop Protection Council, 2006, p. 161-162, p. 282-284, p. 561-563, p. 565-566
3. Prof. Dr. Holubek, Ivan: The National Implementation Plan for Implementation of the Stockholm Convention in the Czech Republic, TOCOEN Report No. 293, Brno, 2006, p. 119, p. 120-121
4. KUC, Wieslaw Stefan: Caution Dangerous Chemicals - Obsolete Pesticides, The European Parliament, Union for Europe of the Nations, 2007, p. 254
5. Betlem, Jan: Obsolete Pesticides in Georgia ~ Inventory of Obsolete Pesticides of the Kakheti Region (Milieukontakt International - Tauw Report), Amsterdam, 2006., p. 36-39
6. Fokke, Boudewijn: Obsolete Pesticides in Kyrgyzstan ~ Inventory of Obsolete Pesticides of the Osh Region (Tauw Report), Deventer, 2008, p. 29
7. Bouwknegt, Matthijs: The Use of Field Test During a Repackaging Campign of Obsolete Pesticides (Tauw Report), Deventer, 2008, p.2-4

Internet

http://en.wikipedia.org/wiki/Aarhus_convention (Aarhus Convention)
http://en.wikipedia.org/wiki/Mirex (Mirex description)
http://www.pops.int/documents/background/hcwc.pdf (Conventions)
http://www.ihpa.info (International HCH and Pesticides Association)
http://africastockpiles.net/about (Africa Stockpile Programme)
http://www.fao.org/docrep/V8966E/V8966e.htm#1 (FAO Pesticide Storage and Stock Control Manual)
http://www.inchem.org/documents/pims/chemical/pim257.htm#3.1%20Origin%20of%20the%20substance (HCH description)
http://www.cec.org/programs_projects/pollutants_health/smoc/presentations/Alaska/12Feb/John-Vijgen_en.pdf (HCH production)
http://www.unu.edu/esd/manage/event/symposium2007slides/shibata.pdf (New POPs)

Appendix

1

Map of Georgia with the project area

Figuur B1.1 Map of Georgia with the project area

Appendix

2

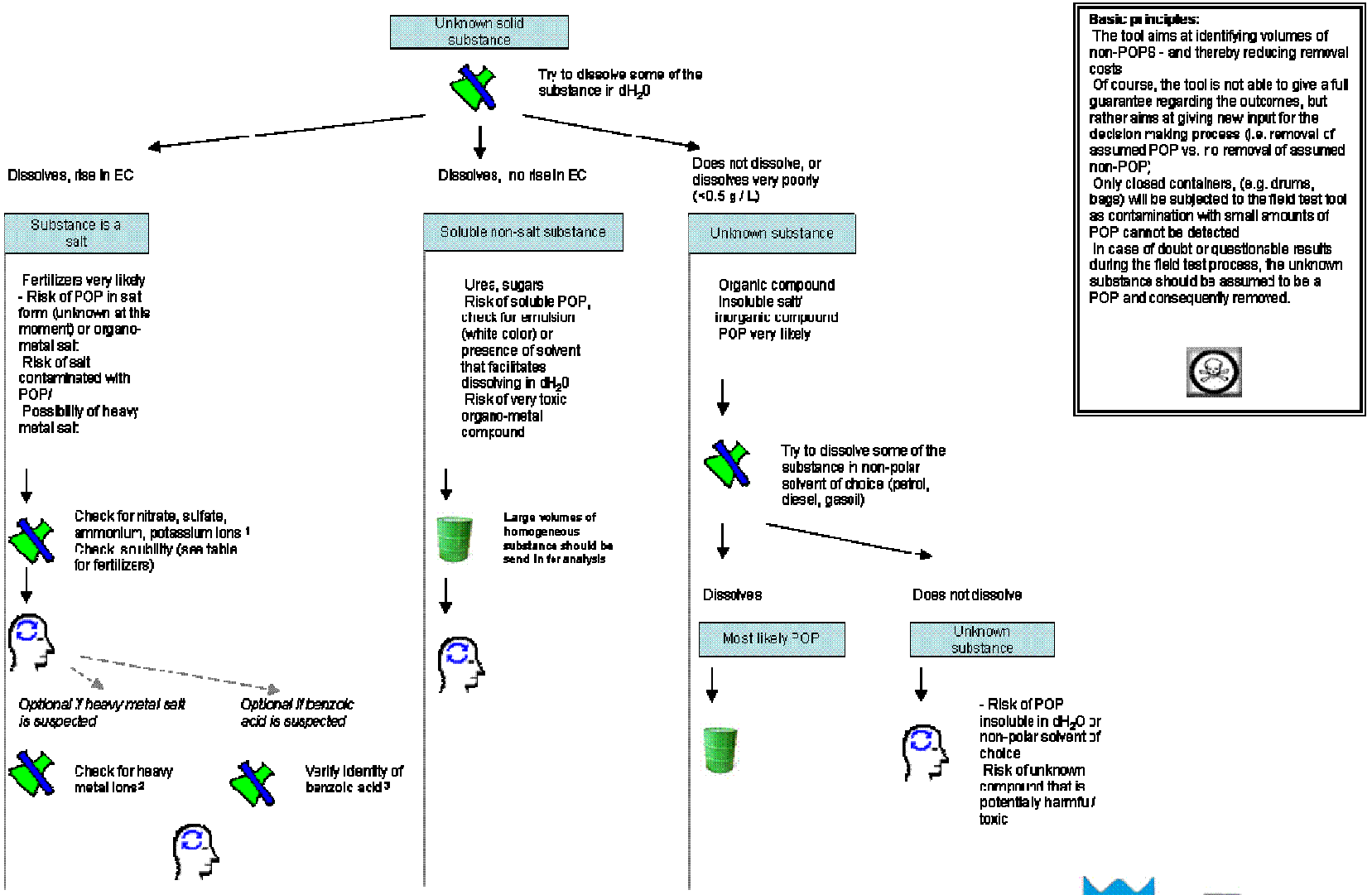
Locations of the sites/stores in Kakheti region

Figuur B2.2 Location of the sites/stores in Kakheti region

Appendix

3

POP field test identification tool



Basic principles:

The tool aims at identifying volumes of non-POPS - and thereby reducing removal costs

Of course, the tool is not able to give a full guarantee regarding the outcomes, but rather aims at giving new input for the decision making process (i.e. removal of assumed POP vs. no removal of assumed non-POP).

Only closed containers, (e.g. drums, bags) will be subjected to the field test tool as contamination with small amounts of POP cannot be detected

In case of doubt or questionable results during the field test process, the unknown substance should be assumed to be a POP and consequently removed.

1 Merckoquant test strips (colorimetric indicator for various concentrations of NH_4^+, NO_3^-, SO_4^{2-}, K^+

2 Follow protocol for identification of heavy metal ions; see Appendix XX. Source: *Nederlandse Pharmacopee*, 6th Edition, 1968

3 Follow protocol regarding identity of Benzoic acid; see Appendix XX Source: *Nederlandse Pharmacopee*, 6th Edition, 1968

Tauw