SESSION 8. PUBLIC AWARENESS RAISING AND PARTICIPATION IN ENVIRONMENTAL SECTOR

PUBLIC AWARENESS RAISING AND PARTICIPATION IN ENVIRONMENTAL SECTOR

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1.CENN Strategy in Public Awareness raising and participation campaign

Since 2001, CENN[1] implements various projects on public awareness raising and public participation in the South Caucasus Region. The main aim of the CENN in this direction is to empower communities, promote public participation in decision making process and increase the level of public impact on social changes.

The strategy of CENN is to strengthen different stakeholder groups through permanent provision of updated information, education, capacity building and collaboration.

2.Framework

2.1.Research and identification of the core problems

While starting implementation of public awareness raising and participationcampaign, it is necessary to know some sociological, economical, political, demographical, ethnical, environmental and other concepts about the nature of communities and the nature of social change in the region where the campaign has to be implemented. The recommended steps for implementation:

- Desk study of the region and its problems
- Rapid assessment through interviewing experts
- Rapid assessment on the site (field work), interviewing local stakeholders

The information gained from the research is used for identification of the core problems of the community, and gives important information about the levels of commitment and willingness to collaborate.

2.2.Identification goals of thepublic awareness raising and participationcampaign

In order to ensure establishment of common expectations for the public's role in the decision making process it is essential to set clear goals of the public awareness campaign.The goals may include: poverty eradication, good governance, changes in social organization, community capacity building, empowering low income and marginalized people, and gender balance.

2.3.Identification of expected outcomes of the campaign

The campaign must clearly identify expected outcomes and indicators as well as sources of verifications. While elaborating the monitoring indicators, one should pay attention to both quantitative and qualitative indicators.

3.Key Stakeholders

3.1.Identification of the main stakeholders

Before developing the public awareness raising and participation campaign, a stakeholder analysis should be carried out to determine key stakeholders' major concerns, perceptions, attitudes and expectations about the problem/field to measure later the effectiveness of the campaign. The purpose of this analysis will be to explore common attitudes and behaviors regarding the problem/field and the sources of information.

3.2.Definition of the target groups

The campaign should be primarily promoted to main target groups such as:

Direct target group:

- General public
- Private sector / industry
- Scientific cycle
- Officials (local and central government)

Indirect target groups who will then assist in promoting it to the public:

- Media and other communication channels
- Non-governmental organizations (NGOs)

Stakeholder analysis to be implemented in the first stages the campaign may identify other than listed target group (or sub-group) needing addressing.

Different activities per target groups (direct and indirect) could be used (Open public, meetings, discussion and hearings regarding the problems and reforms, special internet sites, public events, media campaign and social marketing, etc.).

3.3.Identification of partners

It is necessary to identify partners for promotion of campaign to the public. Partners may include: governmental organizations, NGOs, CBOs, multilateral agencies and private companies keen to be included in and promote implementation of the campaign.

4.Methodology

The following major steps should be stressed when developing the campaign:

- Step 1: Inform: Draw people's attention to the existing problems.
- Step 2: Consult: Launch open public dialog and build confidence to create understanding of the situation, the causes and consequences. Provide feed-back on how public input influence the decisions;
- Step 3: Involve: Engage people and encourage active public participation in activities taking place in the field. Motivate people to do and/or contribute something in the process;
- Step 4: Collaborate: Build public willingness to collaborate actively through public input (suggestions, proposals, comments, etc.) that will be later adequately reflected in the relevant decisions. Motivate people to continue and improve;
- Step 4: Empower: Involve public actively on decision-making on the local level and empower (e.g. through citizen's advisory committees).

However, it should be mentioned that certain activities in campaign may not require going for all five steps.

5.Implementation of Campaign

5.1.Identification of appropriate public awareness and public participation promotion activities per target group

The campaign should stimulate discussions and innovations and not be a rigid instruction of how-to-do this or that. While working on the development of the campaign and discussing different approaches to be used in campaigns following issues should be analyzed:

1. Reach of the campaign: how many persons does the campaign reach? Scale of the campaign
2. The complexity or simplicity of the content: how much "information" is supplied to the public with this approach
3. The extent to which the public is personally involved in activities
4. The amount of influence the "target audience" has on the campaign content

Based on these four criteria three principal approaches in public awareness and public participation promotion campaign could be emphasized. These are: market, educational and social/local approach.

1. **Market approach:** large-reach, simple-content, low level of public participation and low level of audience influence.

   The following activities could be discussed in the framework of the market approach:
   - Live events
   - Public relations
   - Marketing
   - Other policy tools
   - Advocacy
   - Networking
2. **Educational approach:** medium-reach, relatively complex content, and high level of public activity, and low to medium level of audience influence on the content.

   The activities that could be discussed in the framework of the educational approach:
   - Training educators and motivators
   - Public lectures, courses
   - Education in schools

[1]Caucasus Environmental NGO Network

- Demonstration
- Live events
- Children in promotion and action

3. **Social/local approach:** low-reach, medium level of content, high level of active public involvement, and high level of audience influence on the content.

   Social/local approach could encompass the following activities:
   - Children in promotion and action
   - Personal communication
   - Participatory tools
   - Involvement of volunteers
   - Advocacy
   - Networking (community leaders, politicians, private sector)

In the framework of each approach, there are different types of activities that could be undertaken in case the certain kind of approaches is used in PA campaign.

A characteristic of a good PA campaign is an optimal combination of elements from the different approaches. Each of them has its advantages and opportunities that can be a unique contribution to the total mix of campaign strategies.

5.2.Prepare public awareness and participationcampaign work plan towards different target groups

The work plan for the PA campaign with specific activities for the different target groups should be prepared. The work plan should include sequence and schedule of activities, resource allocation, involved HR, expected outcomes and monitoring indicators.

5.3.Run the Campaign

Campaign should be implemented according to the work plan. Some activities (elements of public-education program, media campaign and social marketing, implementation of door-to-door campaigns, life public events, demonstrative projects, advertising of success stories, organization of specific training and workshops, advocacy and networking) might be outsourced to relevant NGOs or consultant.

5.4.Monitor/review results, reactions and feedback

Two aspects of the campaign should be monitored and evaluated: realization of the community mobilization campaign itself; and the effusiveness of the campaign, achieved results.

The campaign must be monitored continuously according to the verifiable indicators identified during the development of the work- and monitoring plans. Monitoring indicators should be quantitative and qualitative and must be developed to monitor both inputs and outputs of the campaign. Follow-up surveys should be conducted annually to measure changes in qualitative indicators.

Activities of thecampaigns should be divided into phases. Each phase should incorporate the range of activities (with indicators) leading to the concrete intermediate outputs. According to these outputs, performance of the campaign implementation should be monitored through continued control. The campaigns must be regularly reviewed against the set objectives and must be open to the feedback and comments of the specialists and the public. The work plan must be flexible and easily adjustable to challenging needs.

6.Time Frame

Time for the campaign should be determined that will be allowed for a campaign, within which several short-term campaigns for behavioural change can be scheduled, to promote program to achieve an acceptable level of awareness taken into consideration the situation in the country / region.

AWARENESS AND PESTICIDES

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Abstract

New technologies and materials are a sign and the reality of our time. Nowadays almost every inhabitant of our planet is their consumer. Modern materials and foodstuffs, technologies and rules of usage demand a competent and careful attitude to reach the desired effect and not to inflict any harm, i.e. they require high consumer culture. And while in developed countries much effort is spent on creating consumer culture, the process of such education in developing countries is usually happening on its own through trial and error of consumers. Such approach has a potentially serious danger for the population of these countries. Unfortunately the majority of foodstuffs are produced nowadays with intensive agricultural technologies, i.e. with active application of chemicals. For the majority of population the decisive factor is the price but not the quality.

To find a solution to the described problem "Green Cross Belarus" is working on an educational program for general population. It works in two directions: increasing the competence of students (an extended course for high school students) and awareness raising among general population. In the frames of the first direction of work was developed a pilot course "Pesticides and me", which was tested in a number of schools of Belarus. There was held a workshop for undergraduates and a number of demonstrational lessons for students, to which context specialists, school teachers as well as university lecturers were invited. The first feedback showed high vivid interest both from the side of students and from the side of teachers. After the workshops the children conducted questionnaire surveys in their localities. The results showed that the overall majority of the population has no idea about pesticides. At the same time people directly connected to agricultural activities and applying pesticides showed only the simple knowledge of the matter.

Having analyzed the initial results in this direction we plan to revise the course and create on its basis appropriate methodological materials for an out-of-class optional course. The main driving force in its application we see in undergraduates and young teachers for whom we plan to hold next summer a joint ecological youth school devoted to pesticide education.

Key words: Pesticides, obsolete pesticides, POP, DDT, public awareness raising, health, risk, safety, danger, education, training, EECCA, Belarus

Introduction

Pesticide usage in agriculture becomes more and more widespread. It is clear that this tendency is connected with further urbanization of the population and as a consequence with increasing demand for cheap food production by the means of intensive agricultural technologies. Nowadays chemical corporations are actively working on new generations of safer pesticides which do not have long-term implications. However, any such chemicals can not be absolutely safe and demand adequate culture of usage.

Public awareness in CIS region

Any technologies, either nuclear or chemical, demand appropriate culture among specialists as well as among general public. Otherwise consequences may have grave implications on local, regional or international scale. As an example to this may serve the Chernobyl catastrophe, the tragedy in Bhopal, tens of thousands of tons of chemical weapons at the bottom of the Baltic Sea or the latest accident in Fukushima.

Therefore actively participating in this process developed countries create a new consumer culture for the direct users working in agriculture as well as for general population who consume a wide range of foodstuffs, produced with new technologies. As experience shows it allows to considerably decrease risks, however does not guarantee full security.

After the collapse of the Soviet Union emerged a range of new countries that have to individually create their own system of technologies and their security. Though new countries have a certain technological heritage from the previous system, they most often do not have the science and technology base as strong as their predecessor's. Moreover the majority of these countries are in a lingering economic crisis which does not allow spending adequate funds on safety assurance. The crisis stimulates interest in cheap technologies and cheap foodstuffs.

Pilot education course for schoolchildren in Belarus

Nowadays there are 6,500 tonnes of obsolete pesticides in burial sites in Belarus. Each year thousands tones of new pesticides are being bought which are being actively used in agriculture.

To increase public awareness of the general public "Green Cross Belarus" developed a pilot course "Pesticides and me" for schoolchildren. The course consists of 7 lessons with senior schoolchildren and is oriented at ecology, chemistry, biology and geography teachers. For it was developed a methodological kit: 7 PowerPoint presentations, a manual with an attachment, tests and questionnaires.

The material is divided into 4 sections:

1. Pesticides – allies and enemies: a historical overview of chemical means usage alongside with the definition of POPs and important normative documents and modern standards for pesticide production and storage.
2. Pesticide classification: a flow chart of the most widespread types of pesticide classifications on the basis of their purpose, dates, action mechanisms, etc.
3. Pesticides in the environment: different ways of pesticide penetration into the environment, migration schemes and pesticide influence on the organic world, alternatives to pesticide usage.
4. The influence of pesticides on human health. In this chapter attention is given to bioaccumulation of pesticides in human body, influence of pesticides on human beings (direct and indirect), study of pesticide substances, major factors of pathologic changes under the influence of minor pesticide doses, preventive measures and reduction of pesticide negative influence on health.

Why have we chosen schoolchildren as our target group? This was done because they are the most open to new information and also try to apply new knowledge. School is the best out of all created systems of knowledge spread. On the other hand this course teaches youth to think and act independently, and that is very important in the modern situation especially in the CIS countries. Schoolchildren also bring their knowledge to the families and try to embed them there usually trying to overcome conservatism of their parents. As the older the person becomes the more conservative he is.

Also the idea of the course is to include students of the major universities into active awareness raising process. New knowledge comes fast and it is necessary to be able to reform yourself and take it to practical application.

Before approbation was held an inception workshop in which participated lecturers from universities, school teachers and a group of senior schoolchildren. During the workshop were held several open lessons and they were reviewed by all participating parties. After that the course went through approbation in 4 schools of Belarus during one school year as part of extracurricular activities. The children spread questionnaires among adult population of their localities. The results showed that unfortunately the knowledge of adults, including specialists, is extremely low in this field. Moreover, concern for the use of pesticide usage among regular people is also low and lies more in the heads rather than in everyday life. With the help of this course we managed to increase awareness in localities where the course was used for approbation. Moreover, extremely important issues of people's motivation to ensure their safety and health protection of their families were raised. It is interesting that the majority of population consider that their health condition depends fully on the sate of national health care system: clinics, hospitals, doctors, medicine, but not a bit on their own behavior, level of knowledge and culture of life, nutrition and life style.

Conclusion

The question of human safety in this case for environment and foodstuffs becomes more and more acute especially for developing countries' population. Those who develop, and those who produce and spread pesticides and other new chemicals need to carry not only moral but as well practical responsibility – through active participation in the consumer culture dissemination.

With this course we attempt to raise awareness in the issue of pesticides and their safe application. We suggest spreading such knowledge through an existing system of school education. An emphasis is given to the link between teachers – students – schoolchildren – families, which can become an important path along which the new culture (first of all the culture of safety) will spread in the society.

A BIOGRAPHY OF IHPA - POPS NEWSLETTER

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The poster takes the reader through the time of the first issue of IHPA-POPs Newsletter issued almost a decade ago. It was the year 2001 in Poznan during the 6th International HCH and Pesticides Forum where the author representing UNIDO presented a paper entitled "Benefits of Regional/subregional networking in developing countries to eliminate /manage POPs". Discussions that ensued the presentation resulted in the starting of IHPA Newsletter called "Bioremediation Newsletter". The first issue dated April 1, 2002 was included in the IHPA website. The main purpose of the Newsletter was to convey information on POPs and related issues, the global concern about ill effects of POPs ti human health and the enviromment, in the form of simple and light reading. When the Stockholm Convention was ratified in 2004 the Newsletter gave greater importance especially to Eastern Europe and the Caucasus Region. It covered all the subsequent IHPA Forums and reached a milestone publishing interviews with the Member of European Parliament (MEP) HE Mr Wieslaw Stefan Kuc, the Minister for Ecology and Natural Resources of the Republic of Moldova, and Mr. John Vijgen, the Director of IHPA. The issue of Malaria was extensively covered due to its importance to developing countries. The Newsletter used simple English as a language of communication not professionally edited King's, Queen's or Oxford English. Under the editorship of the author the 20 issues were successfully published, until it was handed over to Professor. Mahbubar Rahman in 2010. Without the enthusiastic support of Mr. John Vijgen, the Director of IHPA the Newsletter would not have had a successful run for 10 years. The poster will take through some of the topics covered during the last 10 years of its existence.

Key words: Networking, frontiers of technology, DDT scandal, roll-back malaria programme, Globish

Introduction: The 6th IHPA Forum was held in Poznan, Poland, in 2001. The author representing the United Nations Industrial Organization as a consultant presented a paper entitled "Benefits of Regional/subregional networking in developing countries to eliminate /manage POPs". Discussions ensued on the paper and there was a strong feeling of regional networking and the author proposed starting a Newsletter as a beginning of regional networking. This initiated the publication of a Newsletter under the logo of IHPA. The first title of the Newsletter was the "Bioremediation Newsletter" later changed to "POPs Newsletter", and now called "POPs and Obsolete Pesticides Newsletter"

The aim of this newsletter is still the same after 10 years of its existence that is "to disseminate information in a cost-effective way on the developments taking place in bioremediation technology, moving the frontiers of technology for commercial exploitation both in developed and developing countries. Special emphasis will be given to bio-removal of pollutants in soil, water matrices and will cover mainly Persistent Organic Pollutants (POPs) as designated by the Stockholm Convention on POPs, and include other persistent toxic pollutants not covered under the POPs convention. It will also highlight cleaner and environment friendly technologies, which show good promise in this area. The newsletter will not go into technical details of selected scientific publications but only highlight salient features for the benefit of the readers."

Over the decade IHPA Newsletter covered various topics ranging from:

- IHPA taking obsolete pesticide issue to European Parliament (Issue 1; April 2002)
- Contribution from UN Agencies (UNEP, UNIDO, FAO) (Issue 1 and 2; 2002)
- GEF announcement of $250 million for NIP development and 10 hotspots in Poland and soil decontamination using thermal desorption technology (Issue 3; 2003)
- Report from Albania on pesticide contamination (Issue 3; 2003)
- Bioremediation of HCH contaminated soil by TNO/TAUW (Issue 5; 2003)

- First SAICM meeting Nov. 2003 (Issue 6; 2003)
- RECETOX, Brno, Czech Republic , REACH (Issue 6; 2004)
- The story of the DDT scandal that killed millions (article from Times UK, May 7, 2007) (Issue 8; 2006)
- UNIDO signing $20 million for Slovakia project on NC Technology (Issue 9; 2006)
- Moldova starting obsolete pesticides stock disposal project (Issue 9; 2006)
- NIP Tajikistan (Issue 9; 2006)
- Dioxin 2006, Oslo, Norway by Roland Weber (Issue 12; 2006)
- HE Mr. Wieslaw Kuc trying to get obsolete pesticides on the international political agenda (Issue 12; 2006)
- International Conference on Neem, Kunming, China (Issue 12; 2006)
- Stockpile of obsolete pesticides in CEECCA Region (Issue 13; 2007)
- Obsolete pesticides in Caucasus region by Mr. Otar Kiria of Georgia (Issue 13; 2007)
- The December 2007 issue was one of the highlights of the Newsletter that came in two parts. It covered the release of the book on obsolete pesticides and its interview with HE C. Mihailescu, Minister for Ecology and Natural Resources of the Republic of Moldova, and with HE Mr Wieslaw Kuc, MEP, and Mr. John Vijgen, IHPA Director. (issue 14; 2007)
- Issue 15 covered USA position on PFOS/lindane and Germany on PFOS/PFOA and IPEN on short chain chlorinated paraffins, and UK position on bottled water and IHPA taking message to UNIDO Vienna (Issue 15; 2008).
- Issue 16, Dec. 2008 covered obsolete pesticides in Slovenia by Prof. Branco Druzina
- Issue 17, 2009 had an extensive coverage of Malaria by the Editor Dr.B.Sugavanam on the anniversary of WHO Roll- Back Malaria programme and HCH in Brazil by Mr. Joäo Torres
- Issue 18, 2009 covered Dioxin 2009, 25 years of Bhopal accident, legacy of Vietnam war
- Issue 19, 2010 covered POPs project in Central Asia by Dr. M.Bouwknegt and Dr. B.Fokke of TAUW, and SOS from Armenia by John Vijgen.
- **In the Issue No 19, 2010, the Newsletter made announcement of the new Team under Prof. Mahbubar Rahman taking over from the Editor B. Sugavanam**

English Language: The newsletter did not put emphasis neither on Queen's or King's English, nor Oxford English, but on simple English as means of communication. Today spoken English is international: In Singapore it is "Singlish", in India it is "Hinglish" and/or Tanglish". In Spain is it called "Spanglish"? The modern English language is now global used by 4 billion people in some form of a language without grammar and is called "Globish". So authors contributing to the Newsletter should not worry too much about the quality of English. The editors will put it right in simple English. It is of great importance that the New Editorial Team is given all the support to make the Newsletter more and more technical/ informative/ educational and above all fun to read.

Highlight photos from the Newsletter:

HE Mr C. Mihailescu, Minister for Ecology and Natural Resources of the Republic of Moldova, giving interview to the Newsletter (Issue No 14; Dec 2007.)

HE Wieslaw Kuc, Member of European Parliament gave interview to Newsletter after releasing book on Obsolete Pesticides (Issue No 14; Dec 2007)

Issue of water bottle in the UK (Issue No 15; June 2008)

Director of IHPA taking message to UNIDO, Vienna
(Issue No 15; June 2008)

Article on Malaria by Dr. B. Sugavanam
(Issue No 17; June 2009)

POPS ON THE GOOGLE: A COMPARISON BETWEEN BRAZILIAN AND U.S. NEWS

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Abstract

Google News (*Google Notícias* in the Portuguese version) is a Google service that allows the presentation and search for news on the Internet. In this study we evaluate the dissemination of news involving two classes of persistent organic pollutants, by comparing the number of occurrences of News found in Google News tool in Brazil and in the United States. The study was performed using Google News and ScienceDirect database as tools, using two key words in their respective languages: *Pesticidas* and *Dioxinas* for Portuguese and Pesticides and Dioxins, for English search. Searches were conducted using the following addresses http://news.google.com.br/ nwshp?hl=pt-BR&tab=wn (only news in Portuguese and on Brazilian pages) and http://news.google.com/ nwshp?hl=en-US%20&tab=wn (only news in English and on US pages) and, http://www.sciencedirect.com. Furthermore, to evaluate the temporal evolution by the number of publications, the occurrence of news containing those keywords was divided into 10 time intervals (between 1960 and 2010). An evident difference between the number of stories published in Brazil and the United States could be observed with regard to the evaluated compounds. While the Brazilian search returned a total of 2,484 news reports containing the word *Pesticidas* since 1960, we found 54,310 occurrences for Pesticides in the United States for the same period. When it comes to scientific papers published in the ScienceDirect database, it is possible to note that studies with pesticides have been steadily increasing and today a large number of annual studies are still published, despite the fact that most of these compounds were banned decades ago in several countries. It was also possible to notice a large discrepancy between the number of news occurrences published in Brazil and the United States in relation to the keyword Dioxin, reaffirming how much more the subject is discussed in the latter country.

Keywords: Google News, Pesticides, Dioxin, POPs, risk assessment

Introduction

Google runs through more than a million servers in data centers around the world and processes over one billion search requests and twenty pentabytes of data generated by users every day (Czajkowski, 2008; Kennedy, 2008; Kuhn, 2009). Google News (Google Notícias in the Portuguese version) is a Google service that allows the presentation and search for news on the Internet. The main difference of Google News is that the news presented on-screen is not chosen and organized by human editors but rather by an algorithm that takes into account, among other factors, the number of times and in which websites a particular story appears.

The aim of this study was to evaluate the dissemination of news involving two classes of persistent organic pollutants, by comparing the number of occurrences for Brazil and the United States, and the evaluation of data disclosure and risk perception of these two populations.

Material and Methods

The study was performed using Google News as tools. Searches were conducted using the following addresses http://news.google. com.br/ nwshp?hl=pt-BR&tab=wn (only news in Portuguese and on Brazilian pages) and http://news.google.com/nwshp?hl=en-US%20&tab=wn (only news in English and on United States pages), using two keywords in their respective languages: *Pesticidas* and *Dioxinas* and Pesticides and Dioxins. The search was standardized for both languages, in order to return only results related to news containing those keywords. An additional research was done in the http://www.sciencedirect.com database, to compare number of publications on the news and on the scientific community.

Furthermore, to evaluate the temporal evolution by the number of publications, the occurrence of news and scientific articles containing those keywords was divided into 10 time intervals (1960-1969; 1970-1979; 1980-1986; 1987-1992; 1993-1999; 2000-2006; 2007; 2008; 2009 and 2010).

Results

An evident difference between the number of stories published in Brazil and the United States could be observed with regard to the evaluated compounds While the Brazilian search returned a total of 2,484 news reports containing the word *Pesticidas* since 1960, we found 54,310 occurrences for Pesticides in the United States for the same period (Table 1). When it comes to scientific papers published in the ScienceDirect database, it is possible to note that studies with pesticides have been steadily increasing and today a large number of annual studies are still published, despite the fact that most of these compounds were banned decades ago in several countries.

Table 1. Comparison of the number of occurrences found using Google News Brazil, Google News United States and Science Direct for the words *Pesticidas* and Pesticides, for 10 defined time intervals

Year of news publication	Brazil *Pesticidas*	United States Pesticides	Science Direct Pesticides
1960-1969	n.o.	11,300	n.c.
1970-1979	n.o.	3,480	n.c.
1980-1986	n.o.	2,940	n.c.
1987-1992	n.o.	5,210	n.c.
1993-1999	n.o.	7,750	19,156
1999-2006	832	9,980	29,121
2007	264	4,450	6,569
2008	335	3,450	6,837
2009	421	2,980	7,167
2010	632	2,770	7,372

n.o.= not occurrence; n.c.= not calculated

It was also possible to notice a large discrepancy between the number of news occurrences published in Brazil and the United States in relation to the keyword Dioxin, reaffirming how much more the subject is discussed in the latter country. Another important point is that, according to Google, the Brazilian and Portugal versions of Google News search about 1,500 sources. In the U.S. version this number increases to 4,500, which may be responsible for the increased news occurrences found by using the American website. On the Google website, it is possible find a service that provides charts about the timeline of the news (Figures 1 and 2).

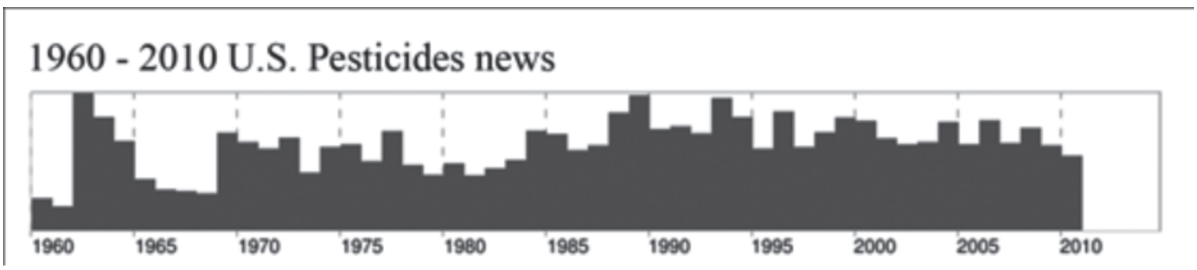

Figure 1. Timeline (1960 - 2010) of news publication containing Pesticides keyword, by Google News (U.S. location). Source: Google®

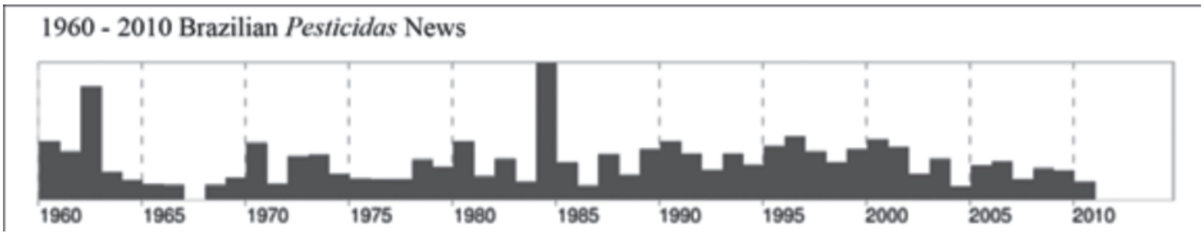

Figure 2. Timeline (1960 - 2010) of news publication containing Pesticidas keyword, by Google News (Brazil location). Source: Google®

As showed above in the U.S. news as in Brazilian news, it can be clearly observed some peaks of news published about pesticides in determined periods of time. The first one was about 1962 when the book *Silent Spring* was published and become a runaway best seller. In her book, the biologist Rachel Carson alerted the public to the side effects of pesticides and *Silent Spring* is probably the most influential environmental book of the 20th century (Farmer, 2005). Another one is about the accident occurred in 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, India. A leak of methyl isocyanate gas and other chemicals from the plant resulted in the exposure of hundreds of thousands of people and it estimated that almost 6,000 people were exposed and killed (Bisarya and Puri, 2005).

In 2001, it could be observed a peak of news again, but this time regarding to the Stockholm Convention on Persistent Organic Pollutants that was adopted on 22 May 2001. The Convention is a living treaty created to remove known and potential persistent organic pollutants from global use and had been ratified by 172 nations. The 2001 Stockholm Convention identified twelve chemicals known as the "deadly dozen" to be removed from worldwide use (Fiedler, 2007).

In 2003 an incident involving soft drinks contamination with pesticides in India was responsible for a new peak in news published about pesticides. A study to assess the levels of pesticides in soft drinks during 2003 on some of the leading brands of soft drinks available in the market as a follow up of media reports of pesticides residue in soft drinks showed that the total pesticides in six leading brands of soft drinks were found exceeding the European (EU) Standards (Mathur et al., 2003). In regards to key-words dioxin and *dioxinas* it could be observed a similar pattern that was viewed to pesticides and *pesticidas*. A markedly numerous of news matches in the U.S. Google News were observed than in the Brazilian Google News website (Table 2).

Table 2. Comparison of the number of occurrences found when using Google News Brazil, Google News United States and ScienceDirect for the words *Dioxinas* and Dioxins, for 10 defined time intervals.

Year of news publication	Brazil *Dioxinas*	United States Dioxins	Science Direct Dioxins
1960-1969	n.o.	n.o.	n.c.
1970-1979	n.o.	1,040	n.c.
1980-1986	n.o.	5,570	n.c.
1987-1992	n.o.	4,020	n.c.
1993-1999	2	5,490	1293
1999-2006	34	5,550	3,156
2007	32	2,210	696
2008	51	2,920	721
2009	32	3,160	689
2010	38	5,850	667

n.o.= not occurrence; n.c.= not calculated

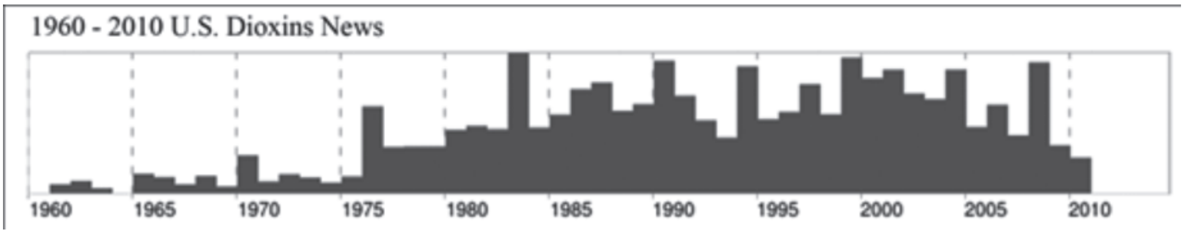

Figure 3. Timeline (1960 - 2010) of news publication containing Dioxins keyword, by Google News (Brazil location). Source: Google®

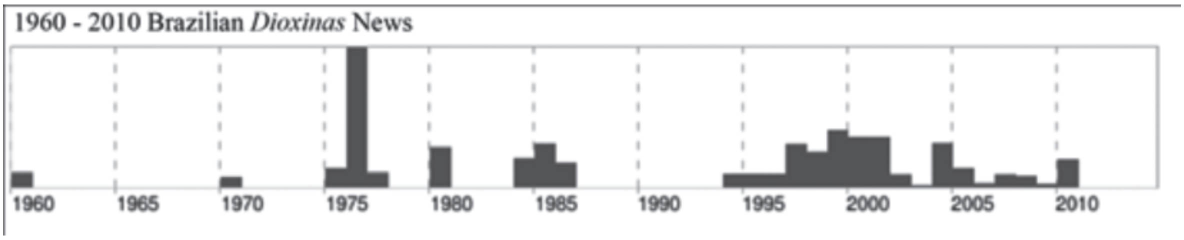

Figure 4. Timeline (1960 - 2010) of news publication containing Dioxina keyword, by Google News (Brazil location). Source: Google®

For dioxins it can be observed some peaks of news starting in 1972 with the Seveso accident where a chain of events in the Icmesa Chemical Company near the town of Seveso in Italy, resulted in the release of dioxin (Cerlesi et al., 1989). The dioxin resulted in the deaths of animals in the area and the hospitalization of many people. In 1983, dioxins were again in the media with Dow Chemical contamination's case. The studies carried out there found that many of the samples, particularly those located directly adjacent to and downwind from the Dow facility exceeded Michigan's residential soil cleanup criteria of 90 ppt. The Dow site levels ranged from 16.5 to 8,840 ppt of dioxin (Dyke and Amendola, 2007).

In September 1994, the USEPA released a final draft of exposure and risk assessment of dioxins and dioxin-like compounds. This reassessment finds the risks greater than previously thought. The Belgian PCB/dioxin crisis" began in January 1999, when 50 kg of PCBs contaminated with 1 gram of dioxins were accidentally added to a stock of recycled fat used for the production of 500 tons of animal feed in Belgium (Covaci et al. 2008). In the 90's in Brazil, the most famous case of dioxin contamination occurred with citrus pulp exported to Germany, for animal feed production. Samples of dairy milk were analyzed and the researches found high levels of dioxin in the feed. After some investigation, they found that the citrus pulp from Brazil was the responsible for the high dioxin concentrations in the final animal feed.

In 2004, the dioxins appear again during the intoxication case of Viktor Yushchenko, a candidate to Ukraine presidency. He had ingested TCDD dioxin and had 1,000 times the usual concentration in his body; during a dinner and until today he is under medical treatment (Schecter et al., 2006). In the most recent news, dioxin were reported in several food products from German farms. Tests conducted in March 2010 showed traces of dioxin contamination in the animal fats produced by the company (dioxin levels twice the maximum permitted amount). The scandal has forced the closure of more than 4,700 farms in Germany and has spread beyond its borders with exports to the Netherlands.

Conclusions

Based on this preliminary assessment it can be conclude that the volume of information in the form of online news available to the Brazilian population is up to 20 times smaller than the number of publications available to the U.S. population, often resulting in problems and harm to Brazilian consumers since, without access to quality information, consumers do not have a basis for decision-making with regard to selecting what types of food they will consume.

Acknowledgements

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TAJIKISTAN: THE POISONS, DESCENDING OF ECOLOGY AND BIODIVERSITY

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In Tajikistan, the population health and the development of economy are connected with the environmental situation and biodiversity preservation.

More than 70% of the population lives in a rural areas and is occupied in agricultural production, therefore, the greatest influence on environment rendered from this sector. Annually, the negative influence of agricultural development on the environment is increasing due to ignorance to crop rotations in economy, irrational use of such traditional types of organic fertilizers, as manure, a collateral part vegetative the rests, composts and ashes in economy. The past practice developed in 1970- 1990s - applying the large quantities of chemical fertilizers and pesticides for cultivation of agricultural crops, has had the big negative influence on the soil condition and leads to deterioration of general environment.

The analysis of present situation in republic shows, that as a result of uncontrollable cattle pasture, cutting down trees reduce an area of dwelling of many biological species, including endangered and disappearing. In addition, the change of the structure of herbage towards prevalence of not grazed types of grass, and the decreased efficiency of a useful biomass to 30% are observed. In 1970-1990s, the use of pesticides in agriculture , including persistent organic pollutants (POP's) in cotton growing areas, exceeded permissible norms 10-15-fold. This resulted in extensive air, soil and ground water pollution. According to the available information, since the establishment in 1973 in fthe Vakhsh burial site more than 7000 tonnes of pesticides were buried in the site, of which about 3000 tonnes comprise the most human carcerogen - DDT (dust). In the Kanibadam burial site the amount of buried pesticides is ~ 4,000 tonnes, of which 1,500 tonnes are DDTs. In the Rasht valley (Tadjikabad area) the buired pesticides make ~5 tonnes of which ~3 tonnes are DDT. It is known that DDT is persistent in the environment. The risk to environment and human health is represented by a large burial site in Tajikistant located in Vakhsh district. It is located in a distance of 17km from the centre of district and occupies 6 hectares area. The site was protected and permanently guarded until designtegration of Former Soviet Union. Afterwards, the site was left without supervision, destroyed and open accessible. It contains 45 burials, each of size 3x20x5m, and almost all pesticides dug out by people for private use against pests of agricultural crops, rodents and carriers of diseases. The pits created as a result of opened burials gather rain water through spring to autumn. Animals grazing at the site (cows, goats, sheep and other animals that belong to local population of nearby villages) drink water from these pits. Since 2009 the Government of Tajikistan in collaboration with international organizations, has implemented a number of projects aimed at mitigation of pollution. In particular, the Government of Tajikistan and the World Bank with financial supportfrom the Government of Canada has finalised the project «Technical research of out-of-date pesticides in Republic Kyrgyzstan, Republic Tajikistan and Republic Uzbekistan». This project has been successfully implemented by consortium of experts of Tauw Group, Environmental Consultants, Milieukontakt International, advisers for environment Witteveen+Bos Environmental Consultants, Green Cross, and International HCH and Pesticides Association. The main objective of the works was preliminary qualitative inventory and risk prioritization of 17 obsolete pesticides stocks in Khatlon oblast, and in Vakhsh range. Within one month 20 local experts have been trained to carry out inventory of pesticides stocks. The recommendations have been provided on mitigation of risks posed by inventorised territories, and on technologies for destruction of pesticides and isolation of the polluted soil. The research revealed that about 40,000 tonnes of pesticides polluted soils (various level of pollution) need to be treated. In the privatised parts of the warehouses, the obsolete pesticides were buried in adjacent territories. The recommendations of the preliminary study were discussed at a meeting of partners with participation of representatives of the government authorities and NGOs in April, 2010. In July-December 2010, various seminars on the subject of obsolete pesticides have been organised in Khatlon oblast such as «Public consultations - hearings on the information and awareness of public about environmental impact and environmental management plan for liquidation of pesticides listed as POPs, mitigation of risks and restoration of the polluted territories in Tajikistan ». The state control centre for implementation of projects related to sustainable development of cotton sector, jointly with the center for implementation of Stockholm

Convention and local NGOs have studied and estimated the social and economic impact of proposed restoration of Vakhsh range .

The elimination and decomposition of persistent pesticides buried in the vast areas of the Tajikistan Republic, the joint efforts of Government, international organizations, local authorities and civil society are required.

STATE OF INTESTINAL BIOCENOSIS OF THE POPULATION LIVING IN THE VICINITY OF OBSOLETE PESTICIDES STOREHOUSES

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Background: While dysbacteriosis induced by improper antibiotic therapy has widely spread for the past years, there is still little data on pesticides induced dysbacteriosis.

Study of this issue contributes to the development of methods of maintenance and correction of intestinal biocenosis of individuals exposed to pesticides.

Objective: To detect alterations of intestinal biocenosis among the humans exposed to the residues of organochlorine pesticides.

Materials and methods: People living in the vicinity of former pesticides storehouses and airstrips were subjected to analysis. Considering that the highest concentration level of organochlorine pesticides (OCPs) accumulated in the body falls on autumn, the present study was performed in this period. A total of 190 people who presented no problems were analyzed and two groups were selected. Group I was comprised of 76 people and Group II (control) was composed of 114 people living in ecologically clean regions.

Study of dysbacteriosis was conducted according to Litvak R.V., Vilshanskaya F.V. "Intestinal dysbacteriosis", M., 1977, and Bondarenko V.M. et al, 2003. To analyze the state of dysbacterosis morning portion of feces (1-2 gr.) were collected and transported to the laboratory for analysis.

Results: In Group I alterations were observed in all groups of the intestinal flora. Decrease in total number of *E. coli* was detected in 36.84%. The number of *E. coli* with low-grade enzymatic properties was observed in 47.36%. Lactosonegative enterobacteria (more than 5%) and an increase of coccal bacteria number were found in 71.05%. Hemolytic staphylococci in total number of all cocci made up 2.63%, Bifidobacteria (below the norm) in 26.31%. lactobacilli were detected in 22.2%, *Candida* - in 10.52%. Microbes of *Proteus genus* were not found.

In Group II presented alterations were observed in the first 4 groups of microbes - 35.08%, 35.08% 31.57% and 26.31%, respectively. The more detailed data are presented in Tables 1 and 2.

Table 1.

Percentage of intestinal microflora alterations in Group I

#	Intestinal microflora	The state of intestinal microflora			
		Normal		Altered	
1	Escherichia coli	-	-	-	-
2	Escherichia coli reduction <300 m/g	48	63,15	28	36,84
3	Escherichia coli with slight enzyme properties >10%	40	52,63	38	47,36
4	Lactose-negative enterobacteria >5%	38	50	38	50
5	Detection of hemolysing Escherichia coli	- -	-	-	-
6	Cocci counts >25%	22	28,94	54	71,05
7	Detection of hemolysing staphylococcus	74	97,36	2	2,63
8	Bifidobacteria < 10^7	56	73,68	20	26,31
9	Detection of *Proteus*	-	-	-	-
10	Detection of *Candida*	68	89,47	8	10,52

Table 2.

The composition of the intestinal microflora in people living in ecologically clean area (Group I)

#	Intestinal microflora	M	max	min	□	m	
1	Total Escherichia coli	258,19	330,00	100,00	72,56	22,94	0,001
2	Escherichia coli with slight enzyme properties (%)	13,68	30,00	5,00	7,89	2,49	
3	Lactose-negative enterobacteria >5%	7,90	25,00	3,00	6,94	2,19	
4	Detection of hemolysing Escherichia coli	0,18	7,00	0,00	2,21	0,70	
5	Total cocci (%)	29,52	40,00	20,00	6,31	2,00	
6	Detection of hemolysing staphylococcus >5%	0,18	7,00	0,00	2,21	0,70	
7	Bifidobacteria < 10^7	5,26	7,00	3,00	1,26	0,40	
8	*Proteus*	0,00	0,00	0,00	0,00	0,00	
9	*Candida*	0,87	3,00	0,00	1,84	0,20	

As shown in Table 2, the rate of bacterial growth averaged $10^{6.46\pm0,20}$ P<0.001 and total counts of Escherichia coli has decreased by 258.19±22.94 m/g, P<0.001, Escherichia coli with slight enzyme properties - 13.68±2.49 P<0.002, total counts of lactose-negative enterobacteria - 7.90±2.19 P<0.005. No microbes of the genera *Proteus* were detected, *Candida averaged* $10^{0.87\pm 0.20}$.

Table 3.

Percentage of intestinal microflora alterations in Group II

#	Intestinal microflora	The state of intestinal microflora			
		Normal		Altered	
		No of patients	%	No of patients	%
1	Total Escherichia coli reduction <300 m/g	74	64,91	40	35,08
2	Escherichia coli with slight enzyme properties >10%	74	64,91	40	35,08
3	Lactose-negative enterobacteria (%)	70	61,40	36	31,57
4	Total cocci (%)	84	73,68	30	26,31
5	Bifidobacteria	114	100	-	-
6	*Proteus*	-	-	-	-
7	*Candida*	-	-	-	---

As shown in Table 2, slight alterations were observed in the first four groups, 35.08%, 35.08% 31.57% and 26.31%, respectively.

The composition of the intestinal microflora in people living in ecologically clean area (Group II)

#	Intestinal microflora	M	max	min	□	m	P<
1	Total Escherichia coli	304,91	400,00	210,00	59,94	18,95	0,001
2	Total Escherichia coli with slight enzyme properties (%)	10,96	16,00	8,00	2,52	0,80	0,001
3	Lactose-negative enterobacteria	5,49	7,00	3,00	1,26	0,40	0,005
4	Total cocci (%)	24,86	30,00	20,00	3,15	1,00	0,001
5	Bifidobacteria	$10^{8,6}$	10^{10}	10^{7}	$10^{0,3}$	$10^{8,4}$	0,001

Thus, the alterations of intestinal biocenosis among the population living in the vicinity of former pesticides storehouses and airstrips are observed in all groups of microbes and this situation requires the development of measures for maintenance and ccorrection of normal biocenosis.

EPIDEMIOLOGY OF ACUTE PESTICIDE INTOXICATION IN AZERBAIJAN

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Pesticide poisoning is one of the major causes of mortality from acute poisoning in many developing countries [1, 2, 3]. Thus, 67.8% of all fatal poisonings are due to intoxication by pesticides [4]. However, in countries with advanced economies, acute pesticide poisoning is much less of a problem for public health system [5, 6].
The use of pesticides is widespread in Azerbaijan, and is often characterised as being uncotrolled. In this study, we aim to clarify the epidemiological situation of pesticide poisonings in Azerbaijan, which still remains largely unexplored.

Materials and Methods

The subjects of this study were 823 patients with acute pesticide poisoning admitted to hospital in the Poison Control Center Ministry of Health of Azerbaijan (Department of Toxicology, CMW) over a twenty-year period (from January 1, 1991 to December 31, 2010).

The data on a code of diagnosis (according to the International Classification of Diseases revision X), toxic substance that caused the disease as well as the age and sex of patients, their place of residence, severity of poisoning, duration of treatment of acute intoxication and its outcome, have been recorded in the standard spread sheet tables. Afterwards, the combined data set were subjected to further processing.

Results and Discussion

Pesticide poisoning of various kinds amounted to 3, 1 ± 1, 05% of the total number of patients (n = 26,223) hospitalized during the study period. However, as can be seen from the slide, there has been a rising trend in the absolute number of hospitalized cases as a result of pesticide poisoning in the last few years.

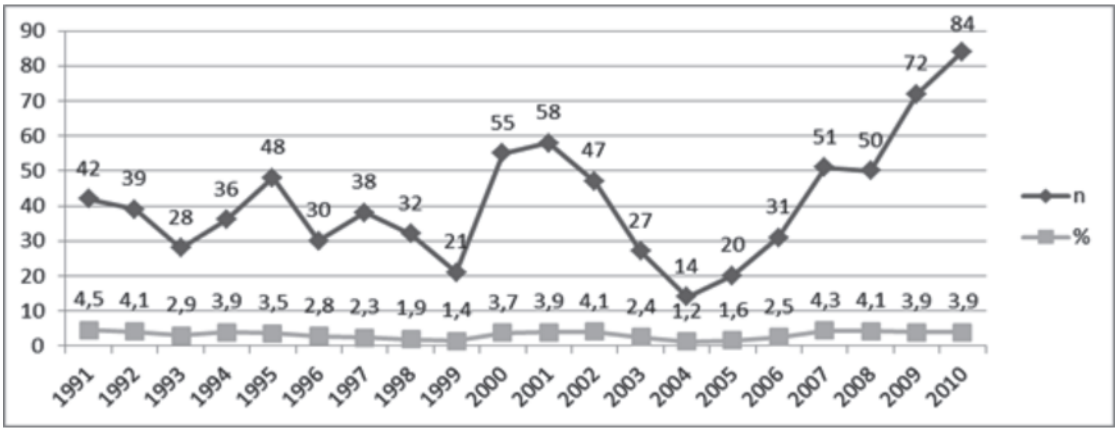

Figure 1. The incidence of hospitalization of patients diagnosed with pesticide poisoning in the years 1991-2010 and its share to the total number of patients persisted.

This situation may be explained by the rapid development of agriculture and animal husbandry in Azerbaijan in recent years, which is directly associated with an increased use of pesticides and, as a consequence, the number of poisoning incidents.

Suicides accounted for 67%, accidental and unintentional pesticide poisoning accounted for 32%, poisoning due to other reasons (professional, criminal, etc.) totalled in less than 1% of the total number of patients with this nosology. In 93% of cases, poisoning happened by the oral route, in 6% of cases by the inhalation, <1% of cases by percutaneous, injection and other routes.

Male / female ratio among patients diagnosed with poisoning accounted for 1.1:1. Importantly, the mean age of patients was equal to 22.7 years.

The number of young patients falling under in the age group of <15 accounted for 187 (22.7%). Herewith, the youngest of the patients had not yet reached the age of 1 upon their admission to the hospital.

The share of residents of the rural regions of the republic as well as of the suburban settlements of Baku City accounted for 86% of the total number of patients hospitalized with pesticide poisonings over the study period.

Despite the fact that all pesticide intoxications are combined into one category (T60) in the International Classification of Diseases X revision (ICD-10), the clinical picture of poisoning varied significantly depending on the substance that caused acute intoxication.

Thus, in case of poisoning by organophosphorus and carbamate compounds (ICD-10 code - T60.0), the toxic effect of which is primarily due to inhibition of cholinesterase activity, in the first place, in the clinical picture of intoxication were distinct signs of cholinergic syndrome, accompanied by muscarinic and nicotinic effects, and pathological effects on the central nervous system.
Among the organophosphorus agents, most frequently reported toxic compounds were found to be BI-58 (dimethoate), dichlorvos, metaphos, trichlorfon, karbofos, neotsidol and some others. Having said that, it should be noted that the poisoning of the WCF, the metabolism of which is held on a "lethal synthesis" (metaphos, karbofos), were heavier and were characterized by a more serious prognosis. Organophosphate poisoning combat action (e.g. sarin, soman, VX, etc.), characterized by irreversible inhibition of cholinesterase activity, were noted during the study period.

Besides organophosphorus compounds, poisoning by the pesticides of synthetic origin, so called parathyroid pesticides, has been detected lately. Those pesticides are the natural analogues to pyrethrins and do not constitute the derivatives to the chrysanthemum acid, as well as more toxic synthetic parathyroids of I and II generations.

While the first group of those constitute the components of the "Raptor", "Fumitoks", "Raid", etc. and are intended for mosquito control indoors, the second group are represented by the highly efficient insecticides and acaricides. Parathyroid pesticide poisoning accounted for a total of 3% of the total number of patients in this cohort and as a rule was relatively benign.

Poisoning by rodenticides (ICD-10 code - T60.4), accounted for 17% of the total number of patients in the cohort of acute intoxication by pesticides. Furthermore, this group of patients could not be considered homogeneous and was represented by cases of acute intoxication by various chemical compounds and active ingredients. These were dominated by the following:

A) Indirect anticoagulants (zookumarins), characterized by toxic effects on blood coagulation;

B) Arsenic compounds characterised by hepato-, nephro- and enterotoxic action;

C) Zinc phosphide and aluminium the toxicity of which is determined by the interaction with hydrochloric acid in the stomach and release of toxic gas phosphine (hydrogen phosphide), which has toxic effects on the lungs, nervous system and metabolism.

Poisoning by organochlorine pesticides (DDT, etc.), insecticides of other chemical groups (boric acid, etc.) as well as other unidentified pesticides, in total accounted for only 2% of the total number of patients in this cohort.

According to the International Classification of severity of acute chemical poisoning, in 64% of hospitalized patients, pesticide poisoning could be characterised as moderate, in 34%- as heavy, and only in 2% of cases -as extremely severe.

Our analysis of the antidote treatment for poisoning by pesticides showed an extremely low level of use of oximes i.e. reactivates of cholinesterase (alloksim, dietiksim, dipiroksim, izonitrozin, pralidoxime, obidoxime, methoxime, and others) for poisoning by organophosphorus pesticides. This could be explained by the lack of delivery of the specific antidotes poisoning WCF to Azerbaijan. Therefore, only pharmacological poisoning antidote atropine was used in the case of intoxications.

To treat the poisoning by rodenticides of zookumarin kind, menadione was used as a special antidote, and in case of poisoning by rodenticides arsenic compounds - unitiol and sodium thiosulfate were applied. In case of arsenic poisoning, another highly effective antidote - dimerkapto-succinic acid (suktsimer, DMSA) was not used in any instance, which could be also explained by the lack of production and export of this drug in Azerbaijan.

In other cases of pesticide poisoning, only symptomatic and infusion therapy were applied. A repeated lavage of the stomach and intestines was used with the aim of decontamination, followed by the introduction of enterosorbents. In cases of heavy pesticide poisoning, some widely used methods were the ekstakorporal (efferent) detoxification - hemodialysis, hemosorbtion, plasmasorption, plasmapheresis and others.

The average duration of inpatient treatment for poisoning with pesticides was 2.6 days.

Mortality rates from pesticide poisoning accounted for 4.7% (47 patients). Thus, the death rates from this type of poisoning ranks the 5th for reasons of mortality from acute intoxication of chemical etiology, and is preceded by the death rates from poisoning with cauterizing agents, drugs, alcohol and drugs.

Among those patients who died were 9 children at the age of < 15. The mortality in children's group accounted for 4.8%, respectively.

Most of the deaths were caused by a number of organophosphorus pesticide poisoning (42 cases) and zootcids based on compounds of arsenic and zinc phosphide (5 cases). No cases of fatal poisoning by pyrethroids, rodenticides of zookumarin kind or organochlorine pesticides have been recorded over the whole period.

Conclusion

A substantial number of admissions to a specialized toxicological hospital in Azerbaijan happen as a result of different types of acute pesticide poisoning. The dominant among the pesticide poisonings are the ones caused by the organophosphate intoxication characterized by the most severe symptoms and serious prognosis. The immediate challenge is to develop standard protocols for diagnosis and treatment of acute poisoning by different types of pesticides, taking into account the need for modern antidote funds, as well as extensive outreach work among the population of agricultural and pastoral areas of the country on prevention of pesticide poisoning.

ADVERSE EFFECTS OF AK-CHABYR AND TASH-BAKA PESTICIDE BURIAL GROUNDS LOCATED IN BAZAR-KORGON AND SUZAK DISTRICTS OF ZHALAL-ABAD REGION (KYRGYZ REPUBLIC) ON THE POPULATION HEALTH AND BIOTA

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Background: Two pesticide burial sites are located on the territory of Suzak and Bazar-Korgon districts of Zhalal-Abad region in the hills of pasture and dry-farming lands where bogharic wheat, barley and oil-bearing crops are cultivated. Ak-Chabyr pesticide burial site is located at a distance of 13 km and Tash-Baka pesticide burial is 3 km from the inhabited localities, embracing areas of 10 and 3 hectares, respectively. The total amount of OCPs in Ak-Chabyr pesticide burial site is 1876.38 tonnes including 1033.4 tonnes of POPs. When it rains, pesticides are washed away by mountain torrents. As a result, pesticides are found in the neighboring settlements, farms and in Bazar-Korgon Lake.

The other pesticide burial ground in Tash-Baka is 3 km from the inhabited settlement.

Besides pesticide burial sites, old pesticide stores are considered to be the sources of the environmental contamination. Out of 183 pesticide stores 135 are completely destroyed.

Water stream (from the one side of the burial site) runs down the wheat field.

Soil is washed away by cloudburst floods from the other side of the burial site and polluted water streams run down the inhabited settlements. Carcasses of different animals are found in the vicinity of the burial site.

Materials and methods:

Concentration of HCH, DDT, Aldrin, Dieldrin in environmental and biological samples were measured by gas-liquid chromatography under the standard operating procedures MU2142-80 and MU 4220-86.

Soil samples were collected from the areas located on the course of cloudburst floods at a distance of 1, 2, 3 km and vegetable gardens. Water samples were taken from Bazar-Korgon Lake. We also examined the wheat cultivated on the territories located in 500, 1000 and 2000 meters from the burial sites. Six breast milk samples taken from the women living in the vicinity of burial sites were subjected to analysis. Milk and meat taken from the cows grazing near the burial sites were also examined. The incidence of breast cancer (BC) in women living in the vicinity of Ak-Chabyr and Tash-Baka burial sites was studied.

Results: An increase in mortality of the cattle grazing in the vicinity of Ak-Chabyr burial site was recorded in 2004. Annual fauna failure is constantly reported. Thirty two humans reportedly suffered meat poisonings in March 2010. All of them consumed fried liver of sheep and calf exposed to high levels of pesticides.

Concentration level of HCH (267.8 mg / kg; 21.14 mg/kg), DDT (767.7 mg/kg; 17.07 mg/kg,), DDD (147.1 mg/kg; 13.4 mg/kg), DDE (60.09mg/kg; 9.4 mg/kg) were detected in soil samples taken from the areas located at a distance of 1 and 3 km from the burial sites, respectively. HCH concentration level in wheat was 2.8 mg/kg, DDT - 2.7, DDD- 1.1 and DDE – 3.09.

Concentration of HCH, DDE (0.03 – 2 mg/l) was found in breast milk of 6 women under examination. The incidence of breast cancer in this area was higher (20.6) as compared to that in ecologically clean areas (4.8) per 100000 female population. The results of study performed showed the presence of HCH and DDE concentrations (0.03 -0.07 mg/l) in cow milk taken from Ak-Chabyr burial site. Concentrations of HCH (2.0 mg / kg) DDT (3.0 mg / kg), DDE (0.5 mg / kg) were also found in meat of dead animals. HCCH in concentrations of 0.05 mg/l, DDT– 0.07 mg/l were detected in water samples from the Bazar-Korgon Lake.

Thus, burial sites located in Suzak and Bazar-Korgon districts pose a serious risk to human health and biota. Appropriate measures for the protection of human health and the environment are urgently needed.

KYRGYZSTAN ACTION TO ADDRESS THE PROBLEM OF OBSOLETE PESTICIDES

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Ministry of Agriculture of Kyrgyzstan

The territory of the Kyrgyz Republic is 199, 5 square km, length from the north to the south – 415 km, from the west to the east – 900 km. The Kyrgyz Republic borders Kazakhstan to the north, PRC – in the south-east, Uzbekistan – in the west and Tajikistan – to the south.

On the administrative-territorial basis the Kyrgyz Republic is divided by 7 oblasts and 40 regions. The capital of the Kyrgyz Republic is Bishkek City.

Kyrgyzstan is a mountainous republic. Just 10% of area fall within a parcel of valleys and plains, and 90% of territory is situated at a height of 1500 and more meters above sea level.

The Kyrgyz Republic has 10,1 million hectares of agricultural lands, among them hayfields and pastures makes up 8,7 million hectares or 86% of all agricultural lands, ploughed field – 1,3 million hectares, including irrigated plowed field – 0,8 million hectares.

Agriculture specializes in the production of dairy and meat products, wool, cereal and feeding crops, cotton, tobacco, as well as vegetable, fruit, ethereal-oil and other crops.

The pesticides, including POP were not produced in the territory of the Kyrgyz Republic and are not produced at present. The pesticides were imported centrally in the line of RPNO “Selhozhimia”.

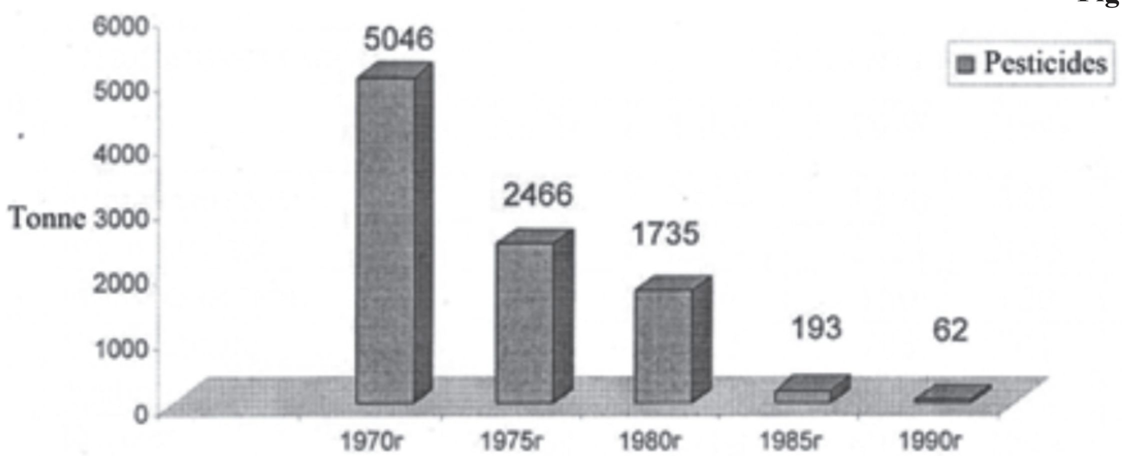
Before 1985 the pesticides of chlorine or organic phosphorus compounds were imported and applied in the Kyrgyz Republic with consumption rate of 10 kg and more, or pesticide load made up 5 kg and more per 1 ha of ploughed field.

The planned system of economy promoted import of new preparation lots, which resulted in accumulation of large quantity of obsolete pesticides, which were buried in 1973 (1313 tonnes) and in 1980 – 375 tonnes.

Chloroorganic compounds (Figure 1) made up the most part of insecticides used in agriculture.

At the peak of their use (in 70-80s) the chemical agents played their positive role in agricultural crop protection from plant pests, diseases and weed vegetation. Therefore, as a result of widespread use of such agents the Kyrgyz Republic took the first place among Soviet Republics on sugar beet crop capacity, and we were in the top four the first group of four among 15 Soviet Republics on productivity of cereal spiked crops, maize and other crops.

Figure 1.



When their negative influence had begun exerting on environment, as well as in other countries the measures were taken to prohibit their use.

At present there are facts of such pesticides import from the neighboring republics.

In entry check points “Torugart” and “Erkeshtam” the cargo, arriving from the People’s Republic of China, are examined selectively, therefore also the banned products arrive to us among other goods. The banned pesticides in customer size package are sold as an insecticide repellent in markets and other shopping streets.

Considering this fact, the Chemization and Plant Protection Department applied officially to the Customs Service of the Kyrgyz Republic, having provided it with a list of banned and obsolete pesticides, in order to tighten control over goods passing through the border. But unfortunately effective control didn’t turn out, and banned weed and pest-killer chemicals continue coming to markets of Kyrgyzstan in small lots.

The further illegal occurrence of POP-pesticides will be possible in the Kyrgyz Republic by means of the plunder from penetrated “burials” as well as the stocks, which are in private ownership of farm enterprises.

Pesticides are stored in warehouses, which don’t meet the safety requirements or are dilapidated. From warehouses available in the Kyrgyz Republic, 72% are adapted (where about 35% of preparations can be stored), anything but all of them meets the sanitary standards.

At that all storehouse facilities are practically adapted for that in high-mountain areas such as Naryn, Issyk-Kul and Talas Oblasts, where flows of master rivers of Kyrgyzstan are formed. Also standard storehouses have large problems related to safe storage of pesticides, whereby there is evidence of container corrosion, pesticide leak flow, contamination of adjoining grounds, surface and ground waters.

Delivery of pesticides to the Kyrgyz Republic by years (tonnes)

#	Kinds of pesticides	Volumes by years					
		1970	1980	1988	1990	2000	2010
1	Insecticides	3419	3434	1100	349	129	91
2	Fungicides	1198	2274	2423	2615	413	55
3	Protectants	247	206	150	120	164	59
4	Herbicides	1461	1715	785	701	129	216
5	Defoliants	738	789	499	428	6	-
	Total:	**7063**	**8418**	**4959**	**4213**	**841**	**421**

Table 1. Pesticides, the application and availability of which was prohibited in the Kyrgyz Republic as of the end of 1989 (tonnes)

#	Description of pesticides	Total	Including	
			In farm enterprises	In agricultural chemistry bases
1	Butifos	12,9	12,9	-
2	Granosan	3,1	2,7	0,2
3	Dichlormethane 80%	14,3	7,3	7,0
4	Kelthane 20%	3,2	2,1	1,1
5	Vinatihuram 80%	4,2	4,2	-
6	Hexathiuram 80%	1,6	1,6	-
7	Aldrin (octalen)	8,6	6,1	2,5
	Total:	**47,9**	**36,9**	**11,0**

Table 2. Remainder of banned pesticides in the Kyrgyz Republic as of the end of 1994 (tonnes)

1	24 DM (ppm)	40,8	33,5	7,3
2	2m-4HP	2,6	2,6	-
3	Prometrin 50%	5,9	3,9	2,0
4	Primextra	7,7	6,4	1,3
5	Citrin	2,6	2,2	0,4
6	Bazudin	9,9	9,3	0,6
7	Dichlormethane 50%	10,9	10,7	0,2
8	Agelon (protrazin)	21,5	16,3	5,2
9	Acetal 55% (acetazin)	4,0	4,0	-
10	Atrazine-rambrode	5,8	5,8	-
11	Nitrafen (nitrochloro)	59,1	46,01	13,1
	Total:	**170,8**	**140,7**	**30,1**

After 1994 the record of remainders of unusable pesticides was not kept, therefore they are not reflected in data as of the beginning of 2000.

These pesticides were accumulated due to their wrong storage, incorrect evaluation of application necessity of such substances, unsatisfactory arrangement of storage and record keeping, ineffective system of sale, distribution and purchase of redundancy by means of humanitarian aid.

Thus, the situation with unusable pesticides is not quite favorable, moreover, they are potential sources of persistent organic pollutants (POP) constituting a high level threat for environment as well as other kinds of chemical weapon.

Kyrgyzstan signed the Stockholm Convention on POP in May 16, 2002 and developed the project to create sustained potential, in order that the Republic might fulfill its obligations within the framework of this Convention, including preparation of National Action Plan.

As is known, the most part of the POP list are pesticides, and all these kinds of preparations are preserved in the territory of the republic and constitute a serious threat for people health and environmental conditions not only at the local level, but also for global environment and wilderness on a largest scale.

It is common knowledge that the threat globalism consists of many local structures, meanings, and Kyrgyzstan with its small territory has negligibly small importance. But here too the scales of environment pollution with obsolete pesticides are large, as if until recently weed and pest-killer chemicals were stored in each farm enterprise (more than 400) than after their dissociation (many small peasant and farm households are formed), a number of such storehouses increased by several times, and thus small Kyrgyzstan became a potential source of contamination not only in its territory, but in the territory of neighboring countries.

In recent years there was not valid information on quantity, quality and storage places of banned pesticides in Kyrgyzstan. The most accurate data would be received just at expeditionary inventory of all warehouses and storehouses, irrespective of forms of ownership, with the participation of competent specialists.

Therefore, in order to exclude completely the hazard of environmental contamination with such preparations, we have developed the Project on subject “Disposal of banned and unusable pesticides in Kyrgyzstan”, jointly with the scientists of Moscow State Science Research Institute of Organic Chemistry & Technology under the auspices of International Science and Technology Center.

In the process of Project, implementation the inventory if all warehouses and storehouses of pesticides were made in the Kyrgyz Republic. More than three dozens of names of pesticides banned and unusable were discovered, which made up in whole more than 800 tonnes.

The inventory results shows, that the assortment of pesticides, banned and unusable in agriculture at various warehouses and storehouses, varies very much. Moreover, pesticides of different classes, preparative forms and various toxicity levels are practically in all storage places.

At present, the FAO jointly with the Ministry of Agriculture (Chemization and Plant Protection Department) implements the Project “Management of banned and obsolete pesticides in the Central Asia and Turkey” under financial support of the Turkish Partnership Program Fund (2007-2009).

Participating countries: Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey.

Goal: Minimizing risks for population health and environment by means of management of banned and obsolete pesticides.

Objectives: Developing the database on obsolete pesticides and associated waste products (namely, inventory conduction).

To determine legal, institutional and technical potential of countries in the pest control and pesticide management.

In June of this year the regional training in inventory was conducted in Bishkek within the framework of which:

The local representatives presented official reports on the situation regarding obsolete and POP-pesticides in their countries.
The country teams were trained in obsolete pesticides inventory conduction.
Inventory plans were prepared in each country.
In autumn, 2011 the schedule of inventory conduction was agreed in Kyrgyzstan. The inventory will be conducted with the direct participation of FAO expert, Katuny Akhalaya (Georgia).

Storage sites of weed and pest-killer chemicals

As is clear from photographs, the preparations are stored in warehouses, which do not meet the safety requirements, or are dilapidated and stand-alone. Moreover, packages are destroyed, which causes their uncontrolled use, rain-wash and contamination of adjoining grounds, surface and ground waters.

OBSOLETE PESTICIDES IN AZERBAIJAN: NEEDS AND OBJECTIVES OF THE PUBLIC AWARENESS AND INVENTORY ACTIVITIES

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Introduction

"Obsolete pesticides"(OPs) refers to pesticide waste comprising specific chemicals which are now banned or unwanted due to environmental and human health concerns (classed as persistent organic pollutants (POPs)) or; unused excessive or expired chemicals (FAO Pesticide Disposal Series #2 1995). Large stocks of obsolete pesticides exist in many different parts of the world and are now the focus of research and mitigation efforts by both international organizations and local governments (Breivik, Alcock et al. 2004).

With the break-up of the Soviet Union - the large regional producer and user of pesticides - the centralized control and supply system of agrochemicals has collapsed, and the emergent New Independent States (NIS) have inherited a problem of large quantities of pesticide waste which accumulated due to supplies in excess within the planned economy system of the Former Soviet Union (FSU). The magnitude of the chemical industry in the FSU and the practice of using persistent bioaccumulative pesticides have been described elsewhere (Fedorov and Yablokov 1999; 2004; Li, Zhulidov et al. 2004; 2006; Aliyeva, Halsall et al. 2012). Open availability of these pesticides in unregulated storage facilities without supervision and adequate safety controls has left a legacy and a risk to both human health and the environment.

Azerbaijan was one of the Republics of the FSU with well-developed agriculture and an efficient pesticide supply system. As in other post-Soviet countries, the large quantities of obsolete pesticides in the extensive network of storage facilities across the country have become a priority environmental issue (Aliyeva, Halsall et al. 2012; Aliyeva, Kurkova et al. 2012).

Since 2009,the International HCH and Pesticides Association (IHPA, www.ihpa.info) acting on behalf of the FAO (which has the mandate on prevention and management of obsolete pesticides, including their disposal) has started the Global Environment Fund programme "Capacity-Building on Obsolete and POP Pesticides" (EECCA project) in cooperation with its partners, including Tauw, Milieukontakt International, Green Cross, and representatives of nine countries of Eastern Europe, Caucasus and Central Asia (EECCA), to address the situation with OPs in these countries. The project comprised of awareness-raising and capacity-building activities and aims to strengthen regional cooperation with the primary goal of mitigating the risk and possible elimination of obsolete pesticides in the target regions (Vijgen and Egenhofer 2009). Many of the obsolete pesticides in post-Soviet countries fall under the category of POPs stipulated in the UNEP Stockholm Convention (www.pops.int).

Azerbaijan took the initiative in joining the project, and organised a workshop on 2-4 December 2008 in the capital of Azerbaijan, Baku, which was attended by both regional and international stakeholders. The Ministry of Agriculture of Azerbaijan has clearly underlined the seriousness of the situation and sent a strong appeal to all parties to take action.

Project Implementation

In July 2011,the UNEP-ECORES NatCom, a non-government organisation based in Baku, Azerbaijan, jointly with the International Resources Complex (IRC) of the University of Languages of Azerbaijan, State Phytosanitary Control Service (SPCS) of the Ministry of Agriculture of Azerbaijan, and Lancaster Environment Centre of Lancaster University, UK, started the project of Awareness Raising and Inventory of OP stocks in Azerbaijan. The project was co-funded by Northwest University of Applied Sciences and Arts, School of Life Sciences within the Tox-Care project in Central Asia (Jutz 2011), and Baku office of the Organisation for Security and Cooperation in Europe (OSCE). The project objectives were organisation of public awareness seminars in the regional centres of Azerbaijan through collaboration with local authorities, development of the network of stakeholders in the rural areas, publication of information material, youth awareness campaigns, and the detailed inventory of obsolete stocks in the country for inclusion to the Pesticide Stock Management System (PSMS) developed by UN FAO.

The project was implemented in accordance with the guidelines of the FAO Pesticide Disposal Series on the management of obsolete pesticides and the preparation of inventories (FAO Pesticide Disposal Series #12 2009; FAO Pesticide Disposal Series #14 2010). The preparation for the inventory of OP stocks in the country can be considered a first sustainable step towards addressing the issue of OPs and reducing the environmental burden and risks associated with these chemicals which is essential for the development of an efficient disposal and mitigation programme. Figure 1 illustrates the structure of the project partners.

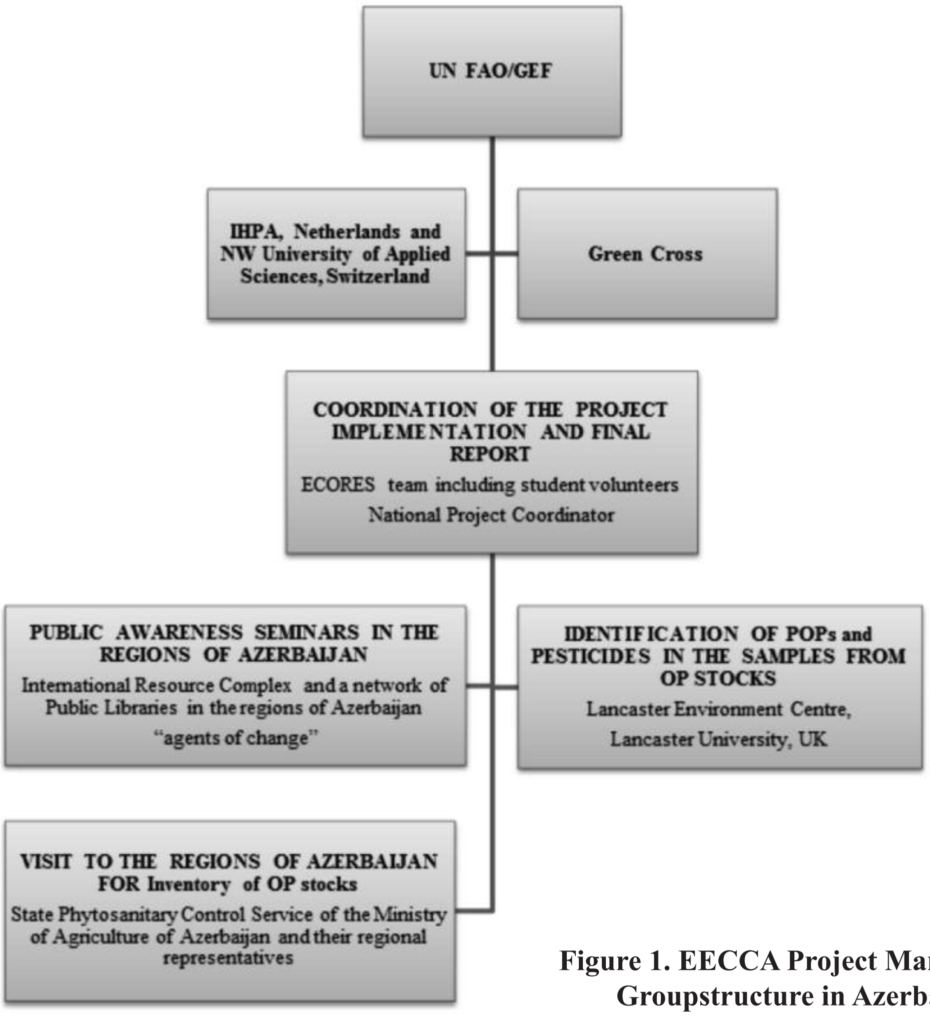

Figure 1. EECCA Project Management Groupstructure in Azerbaijan

The Project Management Group (PMG) developed a working plan according to FAO Environmental Management Toolkit for Obsolete Pesticides - 12, which outlined activity components, and an effective implementation strategy for each component. A meeting of stakeholders to define the scope of the inventory activities and development of the methodology for awareness raising campaigns was held on 2 September 2011 (see Figure 2 and 3).

Figure 2. Meeting of stakeholders on 2nd September 2011

Figure 3. Meeting of stakeholders on 2nd September 2011

Inventory activities

The inventory of OP stocks designed in three stages:

a) Prepration of inventory material, training and establishment of working groups

   Three working groups of experts of State Phytosanitary Control Service (SPCS), including representatives in the regions of Azerbaijan, had been set up to visit OP storage sites and carry out inventory data collection. The experts of the SPCS provided internal training to the experts of working groups on complete PSMS inventory in the FAO format, safety measures and use of Personal Protecting

Equipment (PPE) supplied within the project.

The PSMS material includes inventory forms translted into Azerbaijani language by SPCS, and a database system that is designed to process collected data into evaluation reports, which will be useful for the development of future safeguarding and disposal activities. Therefore, the accuracy of collected inventory data is important for the efficiency of these activities.

b) Implementation of the inventory

During the project implementation, the Government of Azerbaijan established Working Group comprised of several ministries to organize and implement fact-finding mission to OP stocks across the country, build up the inventory, and provide recommendations for further steps to be taken. The expert of SPCS planned the inventory trips to the regions and prepared the programme of visits of working groups to OP sites. The representatives of SPCS in the regions of Azerbaijan helped to liase with owners of private sites to obtain access permission, ensure completion of the PSMS forms and a questionnaire. The findings of the Working Group have been reported to the Government with recommendations on further activities.

c) Data Management

As it was stated earlier, the SPCS has provided internal training to the experts of the working groups on complete PSMS inventory. The SPCS is in charge of inputting collected data to PSMS, while the representative of the State Committee on Land and Cartography is in charge of validating these data. The automated PSMS processing will help to assess the riks related with the status of the sites, and prioritise safeguarding and disposal activities.

Communication strategy and institutional support

The International Resource Complex of Azerbaijan (IRC), a partner of the project, has initiated communication with the regional executive authorities, by sending them official letters of invitation to support organization of awareness raising seminars, and help with invitation of local farmers as well as related institutions.

The awareness raising seminars were planned in Public Libraries of five regional centers of Azerbaijan - Ganja, Kurdamir, Khachmaz, Salyan, Lankaran. These libraries have been developed as “American Centres” within International Resource Complex (IRC) with financial support of the US Embassy in Azerbaijan, and supplied with office equipment and internet facilities for communication and coordination of activities between rural and urban areas of Azerbaijan. The public librarians, i.e. “agents of change” in the regions, are experienced in train-the-trainer awareness raising activities and have previously implemented similar projects.

Public librarians from selected five regional centres have been invited to Baku on 2 September 2011 for the meeting of stakeholders. The meeting was also attended by the regional representatives of the Ministry of Agriculture of Azerbaijan.

The seminars organised afterwards in the regional centres helped to establish two-way communication with farmers and local authorities, where routine problems related to pesticide management have been discussed. The indicator of the positive outcome of the project was the readiness of the local authorities, agricultral institutions and farmers to support further activities related to elimination and disposal of OPs, and clear understanding of the importance of the issue. Information have been provided on handling unwanted stocks of pesticides, dealing with OP stocks, and what they can do to support safeguarding the environment, reducing exposure and disposal activities.

Questionnaires for prioritization of sites and risk assessment

In addition to standard inventory data collection, the UN-FAO questionnaire developed for appraisal of environmental and public health risks associated with each OP stock location as a part of PSMS has been distributed to seminar participants in Azerbaijani language. The questionnaire is aimed to identification and assessment of higher-, moderate- and lower-risk locations. The purpose of the questionnaires is: (i) to collect extensive information about the location and condition of known OP sites; (ii) to identify new sites in a private possession of local population; (iii) to rank the stores according to the level of risk associated with the pesticides contained in each store, their toxicity and packaging conditions, store structure and environmental conditions around the store, and (iv) characterization of the general situation in each store based on calculated risk factors, and prioritization of stores.

This information is required to develop a baseline for planning activities related to safeguarding and disposal of OPs, as well as identification of the reasons of accumulation of pesticides, and development of the strategy to prevent further accumulation of obsolete pesticides, and to reduce the risks associated with extisting pesticides in each site.

Awareness raising material

The Project Management Group (PMG) selected the following publications to be used as awareness raising material, and be translated into Azerbaijani language for dissemination during seminars.

1) UN FAO Series No 7 "Guidelines for the management of small quantities of unwanted and obsolete pesticides" designed for farmers and users of pesticides;
2) IHPA publication "Obsolete Pesticides – ticking time bomb and why we should act now" for the local population and authorities
3) USA EPA "Reference Guide to Non-combustion Technologies for Remediation of Persistent Organic Pollutants in Soil, Second Edition – 2010" EPA 542-R-09-007 (www.clu-in.org/POPs), as a reference document for local authorities for the development of remediation strategies.

The translation and publication of documents (1) and (3) into Azerbaijani language, has been done with support of Baku office of the Organisation for Security and Cooperation in Europe (OSCE).

Collection of samples from OP storages and chemical analysis

The PMG has contracted the Lancaster Environment Centre of Lancaster University for provision of consultancy on detection of concentrations and amounts of organochlorine pesticides (falling under categoryt of POPs) in OP storage sites. The samples were collected by the SPCS of the Ministry of Agriculture and shipped to Lancaster for analysis. The samples were analyzed for the content of organochlorine pesticides. The data analysis estimated the quantities of target compounds in OP stocks. It is important that all stakeholders understand why it is necessary to know what pesticides are being dealt with. The exact information about pesticides contained in the stocks and their quantities is required for the estimation of risks, prioritization of the various sites for control and remediation activities, procurement, further re-packaging, transport and disposal activities.

Selection of target regions

The target regions in the present project were selected based on preliminary research which identified the most polluted areas and areas containing obsolete pesticide stocks (Aliyeva, Halsall et al. 2012; Aliyeva, Kurkova et al. 2012). The extensive review of the past use and production of OCPs in Azerbaijan has been undertaken as a part of a PhD research at Lancaster Environment Centre of Lancaster University. The awareness raising seminars were held in 3 regions out of target 5 due to pending response from the local authorities. Therefore, work with these regions was postponed for inclusion to future projects.

What will happen with inventoried stocks?

The rural population living in the proximity of OP stocks is not aware of the risk of OP contamination and exposure through inhalation, and contact/ingestion of contaminated water, fruits, and vegetable grown near the OP sites, as well as dairy products derived from livestock located in proximity to these sites. Some farmers are still using OP stockpiles to obtain chemicals for use in farming and/or for domestic purposes.

OP contaminated land is used by rural population for grazing livestock or construction of private houses, gardening, and other routine activities.

The common problems at most contaminated sites are:

1. inadequate storage conditions of obsolete pesticides or other agricultural chemicals, that result in their leakage from ruptured or corroded containers and dispersal to the wider environment
2. lack of labels and information on stored chemicals spilled, making it difficult to distinguish OP pesticides from mineral fertilizers
3. inappropriate disposal of unwanted pesticides, such as burial or burning
4. utilization of empty containers of unwanted pesticides for other domestic purposes, such as storage of food for livestock or water
5. obsolete pesticide stocks are located close to agriculture areas due its initial purpose in the past of easy handling and transport to the application area. In Azerbaijan the most developed agricultural areas are located along Kur-Araz lowland, which is regularly affected by flooding of Kur river, hence, the OP storage sites and burials are regularly washed away from the hotspot creating secondary sources of environmental contamination.

In the course of the project, the Ministry of Agriculture has requested the local authorities and municipalities to provide safety of local population by closing access to these sites and setting up safety signs (or, where possible, building fences and setting up security control) until the full-scale disposal and remediation activities launched.

Outcomes and related indicators

1. PSMS set up in the country by SPCS of the Ministry of Agriculture of Azerbaijan
2. Complete inventory of existing OP stocks and contaminated sites, risk prioritization in the inventoried sites (Inventory: complete and correct PSMS data and environmental assessment)
3. Awareness of the local authorities and population about the risk OPs pose to human health and environment (active safeguarding measures by local authorities)
4. Quantification POPs pesticides in the inventoried stocks
5. SPCS of the Ministry of Agriculture has identified priority sites and outlines measures to be taken (Ministry of Agriculture has appealed to the Government of Azerbaijan with request to prioritise the issue of elimintation and disposal of OPs in the identified OP sites. The State Commission has been set up. where jointly with several other Ministries in Azerbaijan, the Ministy of Agriculture are coordinating activities related to repackaging, elimination and disposal of OP stocks after completion of inventory).

Monitoring and Evaluation

At the end of the project, the UNEP-Ecores has organised a workshop hosted by Caspian Centre for Energy and Environment of Azerbaijan Diplomatic Academy, with financial assistance of OSCE office in Baku. The main objective of the workshop was to wrap-up EECCA project, and outline further awareness raising activities in Azerbaijan. During the workshop the stakeholders reviewed and discussed activities and findings of the project, verified whether the expected results have been achievedt, discussed lessons learned and agreed on future projects to be implemented jointly. The workshop was held on 24 October 2012

Conclusions

The farmers and local authorities in both rural and urban areas expressed readiness to join risk reduction measures to reduce/prevent exposure of both humans, livestock and wildlife and the wider environment to open OP stocks.

The project was a successfull exmaple of collaboration of non-goverrnment and government organisation, where NGO can act as a catalyst to facilitate elimination/mitigation activities by the government, and promote awarenbes raising activities among population, government, civil society and academia. The findings of the project serve as a ‘wake up call’ to government institutions to develop a sound Pesticide Management System in Azerbaijan. It is envisaged that this will result in the development and implementation of a legislative framework aimed at management of obsolete pesticides through proper practices of OP disposal and remediation activities. In addition, the legislative framework would promote good agricultural practices, and best practices to protect the wider environment by focusing on the import, registration, quality control, handling, storage, disposal of pesticides, and establishment of regular monitoring activities in Azerbaijan (UN FAO 1989; UN FAO 2003; UN FAO 2010; UN FAO; WHO 2010).

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INTERNATIONAL RESOURCE COMPLEX OF AZERBAIJAN UNIVERSITY OF LANGUAGES. REPORT ON ENVIRONMENT PROGRAM: 'CLEAN-UP' THE WORLD

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Library of Azerbaijan University of Languages, International Resource Complex

The impact of the IRC Environment program has helped the regional libraries to understand thoroughly the purposes and the roles that public libraries play in public awareness efforts, to evaluate and implement new ideas for successful programming and to identify new ways to promote regional libraries as outreach platforms for different programs. One of the strategies of development planning is the environmental direction.

During the first phase of the project, the regional public libraries implemented these main goals according to the strategy of the environment program on public awareness.

1. Increase understanding of the role and purpose of environmental problems in Azerbaijani regions (Gandja, Lenkoran, Xachmas, Kurdemir and Salyan).
2. Demonstrate how the public libraries can work to promote clear understanding on environmental problems such as obsolete pesticides and its risk for human health and environment.
3. Create a collegial environment in which different regional specialists (farmers, local officials on agriculture and environment) can exchange ideas and strategies for effective programming on public ecological awareness.
4. Strengthen regional community awareness of IRC information sources available through book collections and Internet options (useful websites such as Green file - full text database).

How the goals of the program were met:

The IRC staff regularly visit the regional public libraries and use them as outreach platforms for conducting events on ecological issues. Local library staff members generated over 80 percent of their programs themselves. These programs about the ecology included: presentations, exhibits, discussions, round tables, web forums (with the Minister of Ecology and Natural Resources), and web-chats through the network. The library staff made presentations on ecology issues, and each of them reached an additional 1,000 Azerbaijani people: students, specialists, schoolchildren and others.

Library staff members used these opportunities to distribute promotional materials, including bookmarks, translation books on ecology issues (Exxon-Azerbaijan Operating Company's encyclopaedias, BP books on Caspian Sea ecology)

As a result, the total indirect audience for each regional ecology program was at least 3,000 and more per year (a total of about 15.000 plus more for all five regions).

The regional public libraries have become one of the main marketing tools, generating important press about globe ecological programs.

Reaching out to local communities in different regions of Azerbaijan (Gandja, Lenkoran, Xachmas, Salyan and Kurdemir), public libraries are open for everyone.

Under the leadership and direction of the AUL Information Resource Complex, responsible people who are involved in this program (librarians-coordinators) contributed their time, energy, and support in order to make the regional environment program in Azerbaijan a success.

Annual Seminar- October, 2011: This was the first environmental seminar of five Azerbaijani regional central city public libraries. During this seminar, each regional library presented their activity (achievements, challenges and future planning). In addition, librarian -coordinators had a chance to discuss all issues dedicated to the ecological activity as well as to share with each other their personal experience of implementing program strategies on public awareness. They also learned a lot of new tools and rules of using them for future activities (presentations, documents, materials on this issue).

It was a great chance for them to learn from and experience the IRC because this complex serves as a coordinating centre for all five regions. Also, they were taught about using open access electronic resources with the help of special websites through the Azerbaijan Library Information Consortia – a member of International Consortia - eIFL.net. The information in this seminar was covered by local TV channels, as well as spread through innovation tools (Facebook: IRC (Information Resource Complex).

The program's success:

The Environment Program is effective in providing information on environmental problems such as obsolete pesticides and its dangers for human health and environment.

Thanks to the program activity and close relationship with the regional community, the understanding of the main goal has been achieved. The Program distribution material that was delivered to the regions was sufficient.

Future impact of the program and what new plans or projects were conceived:

The Regional Central city public libraries are used as platforms for carrying out various events in Azerbaijani regions.

Future plans of ecology program:

- Workshops / Trainings for coordinators – 5 Azerbaijani regions
- "Photo exhibition" devoted to the environmental issues in regions
- Events dedicated to ecological education, presentations with partner organizations

It should be mentioned that the regional librarians - coordinators fill many roles. They answer hundreds of inquiries from users, and they also act as educational advisors on environmental subjects.

This program has had a great success in Azerbaijani regions, according to feedback, positive facts, changes, news, and etsbalished networks. It has transformed the people's consciousness according to the program's goals.

Cooperation with other organizations and institutions:

The IRC has close relationships with the following organizations: The Ministry of Ecology and Natural Resources, The Ministry of Agriculture, ECORES Analytical Information Agency, Green Baku and other different local organizations and institutions. Thanks to cooperation with these organizations, the IRC has conducted a lot of events on environmental issues: presentations, round - table discussions, seminars, exhibitions, and web –forums among 5 regions and Baku city.

Accomplishments

The main accomplishments of this program were:

- Promoting the free flow of information about ecology
- Creating a network among 6 Azerbaijani ecology corners
- Organizing regular web chats and web forums, Skype connections
- Preparing new strategic development for the environment centres in the future

Program development - 2012/2013

Taking into account that the IRC (Information Resource Complex) should serve as the coordinating and information centre for all regions, IRC staff members will continue to help all with consultations and any informational support they need.

IRC, in partnership with ECORES, is planning to organize forums with the local community of 5 regional "Environment Centres" (established in Public libraries) in the future. These forums will cover environmental problems in the regions of Azerbaijan well as community educational development on environmental issues. This program has to reach different categories of people: teachers, schoolchildren, specialists, students, farmers, state ecology and natural resources department staff, and families.

The IRC, with its partner organizations, will continue to help the regional community to address local problems and needs. Responsible persons will continue to educate more people on the strategy and mission of the IRC environment program.

The pesticide stock management system in Azerbaijan was established in October 2004 and its regulations were confirmed by State Phytosanitary Control Service, which was created by Ministry of Agriculture of Azerbaijan Republic.

ALLOCATION AND USAGE OF PESTICIDES IN THE REPUBLIC OF AZERBAIJAN

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The phytosanitary activities in the Republic of Azerbaijan are coordinated by State Phytosanitary Control Service (SPCS) of the Ministry of Agriculture of the Republic of Azerbaijan established in October 2004. In 2005-2006 the SPCS has developed and adopted the State Pesticide Certification system controlling import and usage of pesticides in the agriculture of the country. In May, 2006 the Parliament of Azerbaijan passed a law on “State Phytosanitary Supervision” of the Republic of Azerbaijan. For regulating the phytosanitary activities in Azerbaijan the Government of Azerbaijan has adopted several laws and guidelines on the condition of storage, transport and application of pesticides. According to the Clause 9 of the Order #10 of the Cabinet of Ministers dated to January 22nd 2007, where the rules on testing, registration and approval of chemical and biological pesticides are prescribed, the Commission comprised of experts of the Ministry of Agriculture, Ministry of Ecology and Natural Resources, Ministry of Health and the Ministry of Emergency Situations is responsible for pesticide control system in Azerbaijan.

The following regulations have been set in place to support activities of the Commission:

1. Regulation on burial and storage of obsolete pesticides
2. Regulation on application of pesticides and the list of highly toxic agrochemicals
3. Regulation on import of pesticides and biological formulations not registered for usage in Azerbaijan
4. Regulations on transportation and storage of chemical substances

According to the Order #14 of the Cabinet of Ministers of the Republic of Azerbaijan dated to 25 January, 2007, the following regulations have also been approved:

1. Regulations on managing the pesticide warehouses and pesticide supply system
2. Regulations on controlling the list of chemical pesticides, biological formulations and agrochemicals, and certification of companies and firms importing agrochemicals

According to these regulations, the state budget allocates particular amounts each year for pest control and pesticide management. The suppliers of pesticides in Azerbaijan are various firms, companies and their local distributors. Pesticides are supplied and stored in warehouses of these companies and firms for distribution to the consumers. The present usage rate of pesticides is ~500-600 tonnes/year.

The inventory of residuals of pesticides in Azerbaijan Republic was outdated since 2006 and it has been updated in a joint project of the SPCS and the UNEP-Ecores NatCom within FAO/GEF project “Capacity building to combat obsolete pestcidies and persistent organic pollutants (POPs) in Eastern Europe, Caucasus and Central Asia (EECCA) countries” in 2011.

The data obtained during implementhe tation of the project were input to the Pesticides Stock Management System developed by FAO. These data have also been used to develop country strategy and action plan for improvement of the environmental situation in Azerbaijan. This includes complete inventory, re-collection/re-packaging and disposal of unwanted and banned substances.

It should be noted that previously the SPCS has refurbished and re-constructed the temporary pesticides burial site (polygon) located in ~50km drive from Baku. The area is permanently secured and safeguarded. In 2008-2010, ~3000 tonnes of solid pesticide residues were re-collected and transported to the temporary polygon from different regions of the country.

In 2010, the SPCS has built additional warehouse for storage of liquid pesticides and 60 hoppers for storage of solid pesticides.

In 2010, the SPCS has repacked ~1180 empty barrels after polydophene and 200 pallets of liquid pesticide and transported them to the polygon for temporary storage until disposal.

In 2009-2010, the experts of SPCS of the Ministry of Agriculture and the Ministry of Ecology and Natural Resources participated in all seminars and workshops held within GEF/FAO project "Capacity Building to Combat obsolete pesticides and POPs in Eastern Europe, Caucasus and Central Asia". The seminars, workshops and trainings on inventory, repackaging, public awareness and the introduction of information into PSMS have created great opportunity to discuss the ways to handle obsolete pesticides and look at the issue from the perspective of international regulations.

The particular attention was given to the repackaging activities. For this purpose, an international expert visited Baku and provided training on spot with report detailing site risk assessment. Within this project, the samples were collected from the existing and newly identified sites for further analytical procedure.

During repeated monitoring, the new pesticides storage sites and contaminated areas have been identified in Siyazan, Samukh, Shemkih, Agstafa, Saatli, Beylagan, Yevlah, Kurdamir, Lankaran and others.

In the course of the projecr, the SPCS facilitated inclusion of the issue of obsolete, banned and unwanted pesticides and related compounds to the "Comprehensie action plan of the Republic of Azerbaijan for the improvement of environmental situation in 2010-2014".

ENVIRONMENTAL GOVERNANCE IN AZERBAIJAN

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Environmental governance can be defined as a whole range of laws, rules, policies, practices and institutions related to the management of the environment in its different forms (conservation, protection, exploitation of natural resources, etc.). Main environmental governance institutions in Azerbaijan are represented by executive branch: Cabinet of Ministers, line ministries, district executive authorities; legislative branch: parliament, municipalities; and judicial branch: courts. Other institutions include business organisations, NGOs, academia, media, universities, etc.

Legislative System of Azerbaijan consists of the following normative-legal acts: Constitution (basis of legislative system), referendum, laws; orders and decrees of Cabinet of Ministers; normative acts of central executive power bodies. Legislative system of Nakhichevan Autonomous Republic should conform to legislative system of the Azerbaijan Republic. Within the limits of their authority local bodies of executive power may accept normative acts not contradicting acts constituting the legislative system. Legal Framework for Environmental Governance in Azerbaijan is based on two main environment related laws: Law on Environmental Protection (1999) and Law on Environmental Safety (1999). The Law on Environmental Protection is a framework law and covers all media (water, soil, air), waste management, protection of fauna, protected areas and ecological expertise. Other important laws are: Water Code (1997), Forestry Code (1998), Land Code (1999), Fishery Law (1998), Wildlife Law (1999), Law on Domestic and Industrial Waste (1998), Law on Access to Information on Environmental Matters (2002, amended in 2010), Law on Hunting (2004), Law on Beekeeping (2009).

The main environment institution, Ministry of Ecology and Natural Resources (MENR) established on 23 May 2001. MENR is responsible for formulating and implementing environmental policy, developing environmental protection measures, screening projects for potential adverse environmental impacts, monitoring implementation of environmental legislation and imposing sanctions, and administering a pollution permit system and for climate change-related functions.

Other key ministries linked to environment are Ministry of Agriculture, Ministry of Economic Development, Ministry of Health , SOCAR , Azersu , Irrigation organizations, etc.

International organizations and agreements: International agreements wherein Azerbaijan is one of the parties constitute an integral part of legislative system of Azerbaijan. UN, UNDP, IAED, UNEP, NATO, OSCE, GEF, OECD, ECO, WB, ADB, WWF and other multy- and bi-lateral organizations. Azerbaijan joined 20 international conventions and signed relevant protocols, including Stockholm and Basel conventions.

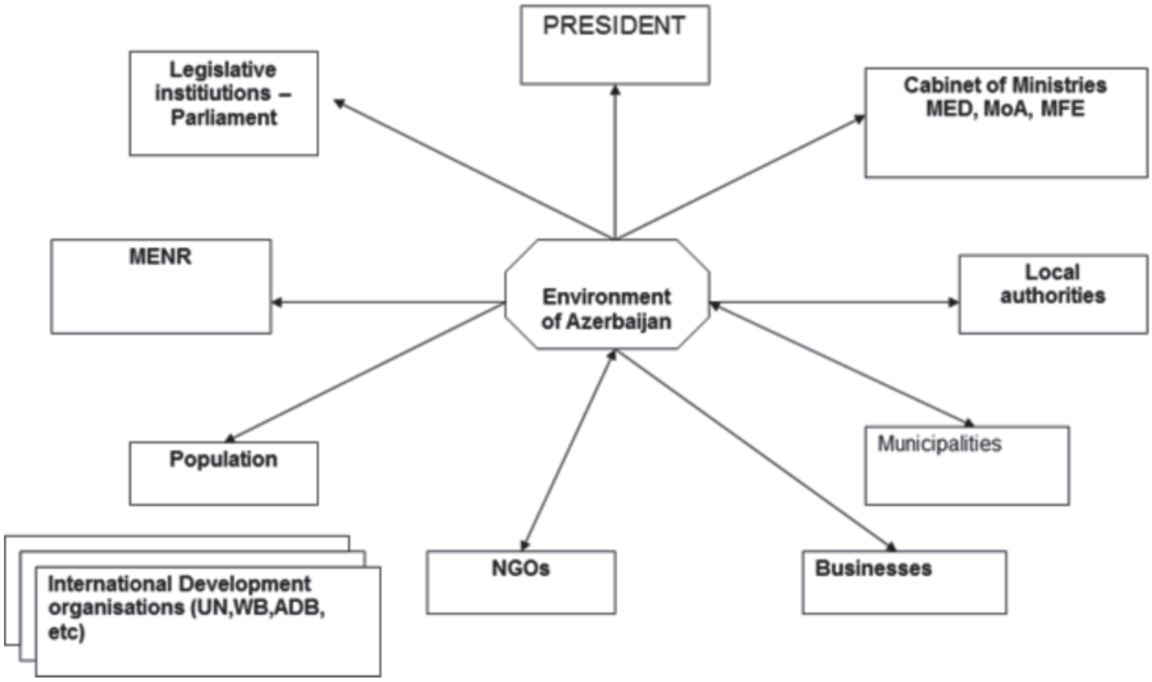
Key Policy Documents on Environment and Sustainable Development: StateProgramme for Poverty Reduction and Sustainable Development (SPPRSD-2008-2015) is aligned with MDGs, one of its nine goals (goal VII) is “improving the environmental situation and ensuring sustainable environmental management”. Additionally, the State Programme defines actions aimed at ensuring reliable water supply and sanitation for everyone, in order to achieve the MDGs. Among other policy documents we can mention National Enviroment Action Plan (NEAP-1, NEAP-2), UN Development Assistance Framework (UNDAF-2009), MDG/PRSP reports, World Bank Country Partnership Strategy (CPS).

Phytosanitary Regulations, Institutions. The Law on Phytosanitary Regulations (adopted in 2006), involving both the Ministry of Agriculture and MENR. The Phytosanitary Control Service was established under the Ministry of Agriculture in 2004, dealing among other things with obsolete pesticides, which still pose a major environmental problem in Azerbaijan.

Challenges in general are linked to Legislative, Implementation/administration, Compliance, Enforcement, Inter-ministerial, inter-institutional (Government-NGOs, NGO-NGO, etc), Financial/budgetary, Donor coordination, Private sector, Municipality etc. Overall, environmental legislation is in place, but needs further development, in particular with regard to implementation of legislative acts, laws, especially at the regional and local levels of governance. Despite the considerable contributions of the first NEAP, Azerbaijan did not complete the adoption of its second NEAP. Environmental policy lacked adequate financing strategies, thus adversely impacting implementation particularly at the local level. Strengthening institutional coordination and cooperation among ministries linked to the environment remains a key challenge. Priority items have not been linked to budgetary sources but rather usually rely on sector-specific funding from a variety of often external sources. There is no integrated state policy planning document that defines spending priorities and rules for selection and arbitration. On the other hand, budgetary requests are not linked to the implementation of existing programs, but rather to the day-to-day functioning of the MENR and cover areas such as equipment and salaries. The draft Additional Action Plan on the Improvement of the Ecological Situation in Azerbaijan for 2010-2014 have been submitted to the Cabinet of Ministers and is pending approval. As Azerbaijan improves its economic performance, integrating environmental concerns into sectoral policies remains a key challenge for the future in order to mitigate negative environmental impacts from high-impact economic sectors, including the oil and gas extracting industries. Pastures belong to local authorities but are rented by farmers who are expected to use them in sustainable ways, although existing control mechanisms are not adequate. As a result, the pasture management situation has been deteriorated dramatically in recent years. Tax collection and supervision of pasture land take place at the local level, where MENR is not represented. There are no explicit provisions on strategic environmental assessment (SEA) in the legislation, but the Law on Environmental Protection defines some strategic environmental decisions where State ecological expertise (SEE) may apply. The current provisions on ecological expertise in the Law on Environmental Protection are too general and needs further elaboration. When it comes to enhancing strategic planning, implementation and enforcement of environmental legislation, a major challenge facing Azerbaijan is to strengthen administrative capacity and vertical coordination between headquarters and the branches of regional and local levels.

Possible Coordination Instruments of environmental institutions. Establishment of the Work Groups (WG) and e-mail networks consisting of representatives of government, donors (UN, WB, KfW, USAID, OSCE, SECO, EU), national NGOs, with leadership of the MENR, bi-monthly or quarterly meetings of the WG on coordination, database of the main documents, reports available to all partners in Azeri and English might be a god start. MENR website might be a depository of documents produced by all related partners, including those by donors. Updated lists of key stakeholders ("Who is who" list in the Environment management in Azerbaijan , "Who is who" list of donors and international experts (who, when, what project developed). A yearly meetings of all stakeholders, including government, donors, private sector, NGOs, even beneficiaries, is another best practice to follow. It is obvious that better established and coordinated governance system may create a very conducive environment for resolving challenges related to pesticides.

Stakeholders in the Environmental Governance in Azerbaijan



SESSION 10. PROBLEMS OF IDENTIFYING UNKNOWN SUBSTANCES IN THE FIELD

FIELD METHODS FOR THE IDENTIFICATION OF UNKNOWN SUBSTANCES

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Consultant Technical Advisor UN FAO

From the experience of many safe guarding operations it is evident that there is a requirement for economic, practical and effective testing methods to identify the multitude of pesticides encountered in the field. This issue is particularly relevant in the for safeguarding projects in the EECA countries where there are many large stock piles of unidentified materials. Identification of unknowns in the field is important for several reasons:

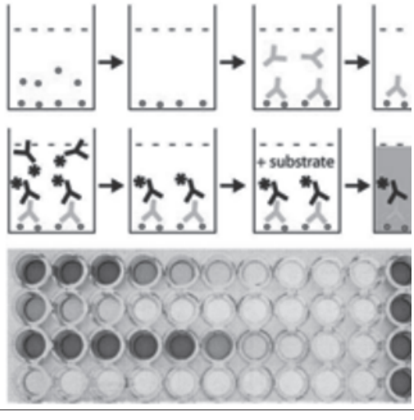
i. To enable inventories to be completed
ii. To minimise hazards occurring during repackaging activities
iii. To allow proper repackaging and labelling to occur according to national and international guidelines and regulations
iv. To facilitate the strategic planning of repackaging, transport and disposal operations

A number of potential identification methods were investigated with respect to the range of materials that can be identified, sensitivity of the method, ease of use, safety of use, time required for analysis, cost, major advantages and major disadvantages.The benefit of a mobile ramanlaser unit was explored, as the method that was highlighted as having the most potential, using the above factors.

It was intended that a number of suppliers and industry representatives would attend the session to be able to describe the effectiveness of a number of potential solutions including mobile gas and liquid chromatography, immunoassay, mobile xray florescence, mobile raman and mobile infrared units. Unfortunately the majority of suppliers contacted declined to attend the event. It is suggested that this was due to the limited number of projects coming on-line, lack of publicity of the obsolete pesticide problem in the West and the suppliers not showing appreciation of an emerging market.

The limited number of suppliers attending the event made the examination of the differing technologies challenging. Further investigation of potential technologies and analysers will be necessary for an effective solution to be determined. It is likely that more than one alternative will be required.

A brief description and illustration of each potential method is found below.

Enzyme Linked Immunosorbent Assay(ELISA) Biological technique for the analysis of groups of chemicals including organochlorines, organophosphates and pyrethroids. Better for economical monitoring in soils rather determining the identity of individual chemicals	

Mobile GC / LC Portable gas chromatograph technology, the item illustrated is 34 kg and has a volume of 43 kg.	
Test strips Many differing type of strips available including strips for chlorates, metals and fertilizers. Easy to use and cheap. Requires direct contact with substance.	
X Ray Florescence Measure the florescence of samples containing metals. Can be used on soils	
Mobile Raman Measures the scatter of a laser beam to identify covalently bonded materials. Safe to use as it does not require direct contact with materials. Potentially able to detect most pesticides encountered in inventory	
Mobile FTIR Fourier Transform Infrared (FTIR) Spectroscopy provides information on molecular vibrations and allows chemical fingerprinting of samples. It is widely used for the analysis of both organic and inorganic materials. This is a non-destructive technique thatrequires only a small amount of sample for analysis.	

A summary of the evaluation of the methods is shown in the table below

	Test strips	ELISA (enzyme linked immuno sorbent assay)	Chromatography (GC-MS, LC-MS)	Mobile XRF	Mobile Raman	Mobile FTIR
Range	Many types available	Specific for one type of material	All organic chemicals depending on column	Usually metals	~ 8000 chemicals	~ 8000 chemicals
Sensitivity	Indicators only	mg/kg however not specific	µg/kg or less	mg /kg	Identification only 10%,min. concentration required	Identification only
Ease of use	Basic	Limited training required	Expertise required	Training required	Basic	Basic
Safety of use	All require some level of training. All require some level of contact with the analyte except the Raman which can penetrate clear packaging (both glass and plastics).					
Time required	5 mins approx.	2 hrs	20 mins – 2 hrs	Instant	2-5 mins	2-5 mins
Cost	$1 – $5 approx, no running costs	$20 per test approx. Equipment required $500 - $10,000	$100s of $1000s for mobile version Running costs inc. laboratory chemist(s)	$10k to $50,000 no running cost	$60,000 no running cost	$60,000 no running cost
Advantage	Ease of use – many types available	Cheap – test soils and waters	Highly specific and accurate	Accurate - no sample prep	Test thro' packaging, v. mobile - no sample prep	v. mobile - no sample prep
Disadvantage	Deductive reasoning required eg qualified chemist	Cross reactivity	High up front cost – sample prep required & other equipment (eg carrier gas or solvent)	Limited to metals	Unable to detect lower concentrations	

COMPOUND TOXICITY PROFILING OF PESTICIDES USING A PANEL OF BIOASSAYS FOR DIOXINE-, ENDOCRINE-, OBESITY- AND OTHER TOXIC EFFECTS

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Pesticide production, use and disposal have contributed significantly to dioxin-, endocrine-, obesogenic- and other toxic effects to environment, wildlife and humans. Pesticides with the highest dioxin levels and release were reported in the past as 2,4,5-trichlorophenoxy acetic acid (2,4,5-T- Vietnam Agent Orange), chloronitrofen (CNP, Japan), chloropyrifos (global) and pentachlorophenol (PCP – involved in several dioxin crisis in Europe) (Holt et al. 2012).

These compounds have been tested by chemical analysis for dioxin-like activity, but not in AhR in vitro reportergene assays like DR CALUX. Other pesticides such as Chlorothaonil, Chlorpyrifos and Prochloraz (Long et al. 2003) showed in the H4IIE in vitro reportergen assays already dioxin-like activities.

However, although there are suggestions for endocrine disruptive and obesogenic potential, not much actual data on their potential activity as endocrine disruptor or obesogenic activity is available, except for ToxCast program from the EPA, USA (US EPA 2007). In addition, pesticides often occur in the environment as complex mixtures and earlier studies did show that e.g., the ER CALUX activities in rainwater could not be explained by chemical analysis of a variety of pesticides (Hamers et al. 2003), showing the necessity to assess such complex mixtures with effect-based bioassays such as a panel of cell-based CALUX technologies.

Therefore in a preliminary study we analysed the toxicity profiles of several pesticides focussing on potential endocrine disrupter- and hormone-like activities in the ERalpha (estrogens)-, PR(progestins)-, AR (androgens)-, RAR(retinoids)-, ERbeta (estrogens)-, GR (glucocorticoids)- and TR (thyroids)- CALUX as well as additional obesity-related activities in the GR- and PPARgamma(antidiabetic compounds such as rosigliazone)- CALUX. Other toxic effects included p53(genotoxicity)- and cytotox(acute toxicity)-CALUX activities. The pesticides used were tri-butyl-tin-acetate, methoxy-chlor, Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, HCH, Mirex E-4, Toxaphene, PCB118/128/ 156, Methylmercury (II)chloride and Endosulfan.

In this presentation we will show compound toxicity profiles (CTPs) and the EC_{50} values, relative toxic potencies (REPs) and relative transactivation activity (RTA) of the pesticides here tested.

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SESSION 11. POLLUTED SOILS

ASSESSMENT OF SOIL MICROBIOLOGY BY BIOREMEDIATION OF POPS CONTAMINATED SOILS

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Abstract

Old chemical storages are one of the principal sources of local soil contamination by pesticides and their metabolites. In recent years the demonstration projects on the bioremediation technologies of POPs polluted soils have been tested *in-situ* in the Republic of Moldova. The POPs degradation and microbiological properties of contaminated soils have been investigated in the application of the phytoremediation experiment and DARAMEND technology. Indices of the microbial biomass, counts of culturable microorganisms (heterotrophic bacteria, actinomycetes and fungi) and dehydrogenase activity were determined by these experiments. The result is that POPs degradation in composts after phytoremediation was significant and coincided with the growth of the microbiological activity. The utilization of DARAMEND in most cases promotes the growth of microorganisms. However POPs microbiological degradation in sites, where DARAMEND was used, showed the similar level in comparison with the background site

Key words: pesticides contaminated soils, DDT, HCH, bioremediation, Daramend, biotechnology, microorganisms

Introduction

Pesticide contamination of soils, water and food is one of the major problems contributing to deterioration in environmental quality. More than 1500 POPs polluted sites were inventoried with the ranking for pollution level in the Republic of Moldova [4]. We determined that soils are mainly contaminated with POPs (DDTs and HCHs isomers, Toxaphene, Chlordane, and Heptachlor) [2]. Five demonstration projects have been implemented with the aim to identify cost-efficient remediation technologies for the decontamination of polluted soils [1,3]. Remediation techniques need to be tailored to fit local characteristics and to be suitable for implementation at more than 1,500 OP sites throughout the country pending the available financial resources. Three controlled stockpiles were constructed to isolate the soil and building rubble in a controlled soil stockpile with impermeable top and bottom liners and covered by protective vegetation in clean topsoil. The importance of this method is that it directly reduces the risks due to its contact with contaminated building materials, since local inhabitants will often recycle these materials despite being informed about the hazards [3].

Another demonstration project is based on in-situ bioremediation by land farming with addition of amendments - DARAMEND® process by ADVENTUS [5]. Sequential cycles of anaerobic (no oxygen, strongly reducing conditions) and aerobic (oxygen present) conditions enhance reductive dechlorination of chlorinated organics. This solid-phase bioremediation technology employs organic and inorganic amendments to stimulate the decomposition of organic contaminants by indigenous soil microorganisms [7]. The testing of the phytoremediation technology for POPs polluted soil was made also in Moldavian conditions [1, 7].

The purpose of this study was to evaluate the impact of DARAMEND technology on the activity of indigenous soil microorganisms by POPs destruction.

Materials and methods

The detailed methodic of both experiments are presented in earlier publication [1,3]. Two experimental sites are located in the central region of the Republic of Moldova in Hincest district (Bujor, Balceana). Soils were contaminated mainly by HCHs, DDTs and heptachlor. 10 cycles of treatment have been applied to the top soil at the demonstration sites. To document the treatment, a sampling and analytical program based on statistical tests using the "Duplicate Method" to quantify contaminant heterogeneity during soil sampling in soil is applied and this method has demonstrated a relatively large degree of soil contaminant heterogeneity within short distances. The DARAMEND granulate is distributed at load of about 0.5% wt/wt for each treatment cycle. The soil is then tilled to mix the granulate to a depth of about 30 cm´s in the soil and the soil is thoroughly irrigated to increase the water content to more than 85% in treatment depth of at least 30 cm.

The anaerobic (reductive) phase: The soil is allowed to rest for at least 5 days during the anaerobic (reductive) phase. Reducing conditions need to be maintained during this period to induce reductive dechlorination of DDT and HCH. This can be achieved by ensuring that the moisture content is high by covering the wet soil with black plastic sheeting. The aerobic (oxidative) phase: The soil is tilled again to provide oxygen and then allowed to rest without any covering or addition of water for at least two days during the aerobic phase.

The composite samples of the experimental plots were collected from 0-30 cm layers thrice during the growing season, after 2, 5 and 10 cycles of biotechnology. All soil samples were sieved to 3 mm and maintained at 4^0C. Microbial biomass was measured by the rehydratation method based on the difference between C extracted with 0,5 M K_2SO_4 from dried soil at 65-70^0C for 24 h and fresh soil samples by K_c coefficient of 0,25. K_2SO_4 – extractable organic C concentrations in the dried and fresh soil samples were simultaneously measured by dichromate oxidation. The quantity of K_2SO_4 – extractable C was determined at 590 nm spectrophotometry. Counts of culturable microorganisms (heterotrophic bacteria, actinomycetes and fungi) were obtained on agar plates. Ammonificators were cultivated in peptone medium, actinomycetes - in amylaceous ammoniacal medium. Fungi were counted using Czapek agar medium. Plates were incubated at 28^0C in darkness. All values for microbiological variables were determined by three repetitions. Organic C was analyzed by the dichromate oxidation method.

Results and Discussion

Results are presented in table 1 and illustrated by fig. 1. All the parameters of microorganism community are growing. An increase of the soil microbial activity is caused by addition of organic substrates and can contribute to the degradation of POPs pollutant in some soils. This effect is a basic concept of DARAMEND biotechnology. This technology activates indigenous soil microorganisms for the acceleration of POPs destruction by co-metabolism. Sequential cycles of anaerobic (no oxygen, strongly reducing conditions) and aerobic (oxygen present) conditions enhance the degradation of chlorinated organics and are generated by mechanical tillage and application of DARAMEND® granulate followed by irrigation to regulate of oxygen availability and moisture content [5]. Degradation of up to 30% - 60% of the organics is expected for each treatment cycle.

Table 1.

Microbial community indices and the organic carbon content in pesticides contaminated soils as a result of the application bioremediation procedure with DARAMEND

Cycle of biotechnology (after)	Plot	Org. C, %	Microbial biomass, µg C g^{-1} soil	Viable counts of microorganisms (CFU*)		
				heterotrophic bacteria, g^{-1} soil •10^{6}	actinomycetes, g^{-1} soil •10^{6}	fungi, g^{-1}soil •10^{3}
2	Control plot	2,22	236,6	4,3	14,4	21,4
	Test plot	1,89	338,7	20,7	24,0	93,2
5	Control plot	2,22	411,2	76,3	43,7	229,0
	Test plot	2,85	534,4	134,9	86,3	299,6
10	Control plot	2,30	391,7	35,1	50,8	45,9
	Test plot	5,19	598,4	282,5	168,8	357,8
Mean value	Control plot	2,25	346,5	38,6	36,3	98,8
	Test plot	3,31	490,5	146,0	93,0	250,2

*CFU – colony forming units; Control plot – no DARAMEND application; Test plot – soil was treated by DARAMEND.

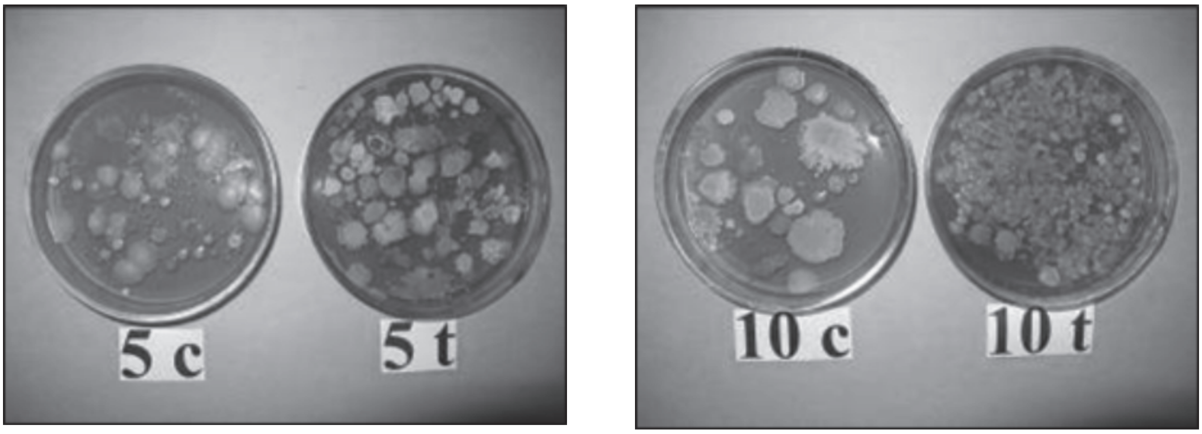

Fig. 1. Heterotrophic bacteria in pesticides contaminated soils in the application of DARAMEND: 5c – control plot, 5t – test plot (5 cycles), 10c – control plot, 5t – test plot (10 cycles)

As mentioned in the previous publication, after 5 cycles of treatment, appreciable reduction of the content of HCHs and DDTs are seen in treatment areas. The control area showed no overall reduction [3]. The mean concentrations after 5 cycles of treatment were still well above the Moldovian soil quality criterion of 0.1 mg/kg, it was proposed that soil treatment in all areas be extended to 10 cycles of treatment. After 10 cycles of treatment, further reduction of the content of DDT is seen in all areas, but the mean concentrations still exceed the Moldovian soil quality criterion of 0.1 mg/kg. However, no significant reduction between the 5 and 10 cycles is seen for Heptachlor and HCH, except for an apparent reduction for HCH in the control area. The results after 10 cycles of treatment demonstrate appreciable reduction of up to 84% for sum of DDT (from 16,3 to 2,6 mg/kg), 42% for sum of HCH (from 16,7 to 9,7 mg/kg) and 76% of Heptachlor (from 6,3 to 1,5 mg/kg) [3].

The growth of different microbiological indexes is observed by mean value for all sampling period. The microbial biomass is raising up to 1,4 times, heterotrophic bacteria – 3,8 times, actinomycetes – 2,6 times, and fungi – 2,5 times in the comparison with control plot. The microbiological indexes exceed regional values in local soils and were growing by the treatment process (from 2 to 10 cycles). Simultaneously we can see an acceleration of organic carbon value on test plot from 1.9 to 3,3 % in connection with DARAMEND application.

We can also indicate a relatively high level of microbiological indexes in polluted soils from investigated site, which demonstrates the presence of the active indigenous soil microorganisms. Thereby we can explain a significant POPs destruction on control plot, without DARAMEND application: 85 % for HCHs and 34% for DDTs [3].

Conclusion

The in-situ bioremediation by land farming could be implemented in Moldova and the results after 10 cycles of treatment demonstrate appreciable POPs reduction. Soil microbiological activity is growing by this bioremediation process which can lead to mentioned destruction process. The soil contamination is still above the Moldovan soil quality criteria for agricultural land, but the risks associated with contaminated soil have been greatly reduced.

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THE CONTENT OF PESTICIDE RESIDUES IN SOILS OF MONITORING POLYGONS FROM THE REPUBLIC OF MOLDOVA

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Abstract

Research on the content of HCHs and DDTs in samples of arable soil in 20 monitoring polygons across Moldova, show concentrations not exceeding the Maximum Permissible Concentration (MPC), that does not represent risk to the environment. Remediation measures should target not only removal of sources, but also include measures aimed to recover and restore affected agrochemical indices of soil, i.e. soil fertility, because soil serve as a "cumulative deposit" and pollutant source.

Key words: monitoring, pesticide, pollution, soils, agriculture

Introduction

Uncontrolled application of fertilizers and pesticides in the agriculture and contaminated lands causes nutritional disorders, impaired and irreversible phenomena, hampers crop production; accumulates the substances above the permissible limits. In most cases, plant pollution with pesticides occurs amid intense negative effects caused by some high emissions. High concentrations of pesticides having carcinogenic, mutagenic, embryotoxic, neurotoxin, immunusupressive effects, and contributing to anemia and liver diseases, negatively impact living organisms by accumulatung in animal tissues.

Material and Method

Analysis of content of pesticide residues in soils was conducted by the Center for Monitoring of Soil Quality of the State Hydrometeorological Service. Thus, 20 soil samples collected from different agricultural zone of the Republic of Moldova were analysed. In the soil samples, organic-chlorinated pesticide residues (alpha-HCH, beta-HCH, gamma-HCH, 4,4-DDE, 4,4 - DDD, 4,4-DDT) were found. The method of determination used was as follows: atomic absorption spectrometry «SOLAAR».

Results and Discussion

Pesticides used in agricultural technologies in the past, some substances with insecticide character, other with herbicide effect, are persistent, and their residues are present in soils and crop production. In previous years, they were totally abandoned and were replaced by organic-chlorine insecticides (based on HCH-hexachlorocyclohexane and DDT-pp´-diclofrenil-trichloroethane), as the organic-phosphorus (methyl-, etilparatione, malathione, mevinphose) due to their high persistence and recovery in soils and crop production. Determination of pesticide residues in soils in the Republic of Moldova has suspended in 1970. However, the high degree of pesticide resistance and high capacity to migrate generated content need to monitoring the DDT and its metabolites in soil and environmental components. Herbicides applied for weed control have cumulative actions in time and sized their amount of residue in the soil, which ultimately determine the lingering effects including phytotoxicity to plants.

Applied in soil, the herbicides enter into interaction with this polydispersity system, participating in a variety of processes resulting in effective action against not only weeds, but also the amount of residue remaining on the plants. These soil-herbicide interaction processes have several actions: fixation by clay minerals and humus absorption from the soil, volatilization of adsorbing substances, leaching of the remaining quantities in the soil solution and obviously, their decomposition by biodegradation, inactivation and activation.

Maximal Permissible Concentration (MPC) for ΣHCH and ΣDDT in soil is 0,1 $mln.^{-1}$. The determined limits of method are: alpha-HCH, beta-HCH, 4,4-DDE, 4,4-DDD – 0.0004 mg/kg; gamma-HCH – 0.0001 mg/kg, 4,4-DDT – 0.0008 mg/kg. Determination results revealed that the pesticide content of ΣHCH and ΣDDT in studied soil samples of monitoring polygons is insignificant and does not exceed the MPC (table).

Table

The content of pesticide residues in soils (Ah 0-20 cm), C, mg/kg

Nr	Alfa-HCH	Beta-HCH	Gamma-HCH	4,4-DDE	4,4-DDD	4,4-DDT
1	0,0002	<0,0004	0,0002	0,0013	<0,0004	<0,0008
2	0,0001	<0,0004	0,0001	0,0054	0,0010	0,0016
3	0,0002	<0,0004	0,0001	0,0031	0,0012	0,0018
4	0,0001	<0,0004	0,0001	0,0084	0,0009	0,0015
5	0,0001	<0,0004	0,0001	0,0086	0,0010	0,0015
6	0,0001	<0,0004	0,0001	0,0032	<0,0004	<0,0008
7	0,0001	0,0008	0,0002	0,0198	0,0133	0,0273
8	<0,0001	<0,0004	<0,0001	0,0028	0,0004	<0,0008
9	0,0001	<0,0004	0,0001	0,0046	0,0008	0,0014
10	<0,0001	<0,0004	<0,0001	0,0019	0,0004	<0,0008
11	0,0001	<0,0004	0,0001	0,0116	0,0008	0,0016
12	0,0001	<0,0004	<0,0001	0,0022	0,0007	0,0013
13	0,0001	<0,0004	<0,0001	0,0029	0,0015	0,0030
14	<0,0001	<0,0004	<0,0001	0,0084	0,0011	0,0023
15	0,0001	<0,0004	0,0001	0,0051	0,0006	<0,0008
16	0,0001	<0,0004	<0,0001	0,0008	<0,0004	<0,0008
17	0,0002	<0,0004	0,0001	0,0162	0,0038	0,0057
18	0,0001	<0,0004	0,0001	0,0132	0,0014	0,0028
19	0,0001	<0,0004	0,0001	0,0302	0,0041	0,0069
20	0,0001	<0,0004	<0,0001	0,0272	0,0044	0,0071

Content amount of DDT ranges from 0.0013 mln.$^{-1}$ to 0.0604 mln.$^{-1}$ (MPC=0.01-0.60 mln.$^{-1}$). The most of the total ΣDDT in soils returns to metabolite DDE. Maximal level of ΣHCH is 0.0012 mln.$^{-1}$ (MPC=0,01 mln.$^{-1}$). In total content of ΣHCH in soils, are predominated isomers as alpha-HCH and gamma-HCH. The content of beta-HCH isomer is less than the detected limit of the device (<0.0004), except for sample nr.7 (typical chernozem post irrigation with wastewater from livestock complex), where the isomer was 0.008 mln.$^{-1}$

Conclusions

From the above, to determine a lower polluting effect as, the preferred use the pesticides with containing the active substance as effectively, but to run out of environment control and treatment (including land) as quickly as possible. The pesticides used to be able to decompose in the soil from one treatment to another, without the accumulation of pollutant, residues. Determination on the same key polygons of pesticides residues in soils showed that their content has reduced and does not exceed the MPC.

OBSOLETE PESTICIDES AND APPLICATION OF COLONIZING PLANT SPECIES FOR REMEDIATION OF CONTAMINATED SOIL IN KAZAKHSTAN

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Abstract

In Kazakhstan, as in the other former USSR countries, the obsolete pesticides represent a serious ecological problem. 2008-2009 and 2011 we surveyed substances stored in 91 former pesticide warehouses in Almaty and Akmola regions of Kazakhstan just to illustrate and clarify the obsolete pesticide problem throughout the country.

Soil sample analysis around the former warehouses showed pesticide contamination included metabolites of DDT (2,4-DDD; 4,4-DDD; 4,4-DDT; 4,4-DDE) and isomers of HCH (α-HCH; β-HCH; γ-HCH), where the concentration of POPs exceed the Kazakhstan MPC (maximum permissible concentration) for soil contaminated by 10 to hundreds of times. This situation is a serious environmental problem resulting in potential ecological and health risks for nearby settlements.

Genetic heterogeneity of populations of wild and weedy species growing on pesticide-contaminated soil provides a source of plant species tolerant to these conditions. These plant species may be useful for phytoremediation applications. Phytoremediation is a promising innovative technology for managing pesticide-contaminated soils.

17 pesticide-tolerant plant species were selected from colonizing plants that grew near the centers of the hot points. Most plants display this model of uptake/translocation profile. However, plants of the genus *Asteraceae*, *Cucurbita, Chenopodiaceae* and *Amaranthaceae* especially the wild species *Xanthium strumarium, Artemisia annua, Cucurbita pepo* L. *pepo*, *Kochia scoparia* and *Amaranthus retroflexus* take up and translocate organochlorine compounds more effectively than other plants.

Key words: obsolete pesticides, phytoremediation, wild plant, DDT, HCH, inventory

Introduction

Kazakhstan signed the Stockholm Convention on Persistent Organic Pollutants (POPs) in 2001 and ratified the treaty in 2007. The National coordinator is the Ministry for Environmental Protection of the Republic Kazakhstan. Ratification of the Stockholm Convention showed that the Republic of Kazakhstan has taken an important step towards integration of cooperation in the field of human health and the environment into the global process.

Decision of the Council of the Global Environment Facility of the country was given a grant of $ 500 000 to support the implementation of the activities of the Stockholm Convention of POPs. In January-May 2001 a preliminary inventory of obsolete and unwanted pesticides (in accordance with the Memorandum of Understanding reached between the Ministry of Natural Resources and Environment of the Republic of Kazakhstan and UNEP Chemicals on January 8, 2001) was carried out and ultimately, a report was released. It contains data on inventory stocks of pesticides (including pesticides among POPs) that are no longer used in Kazakhstan, and the analysis of information collected on the basis of official figures of the Republican Sanitary-Epidemiological Station of the Agency for Health Affairs of the Republic of Kazakhstan. With the support of the Regional Environmental Center for Central Asia the draft NGO "Ecological News Agency" Greenwomen "(Kazakhstan) was produced. During the project it was determined that due to the reduction of land used for agricultural purposes, the banning of already purchased preparations due to high toxicological or environmental hazard, reduce demand for pesticides because of their lack of effectiveness, low stability during storage and high fire risk, breach the integrity of the package; expired preparations in the Republic of the acute problem of accumulation of illicit, not usable and depersonalize obsolete pesticides. Obsolete pesticides are stored in warehouses that do not meet the requirements of storage According to UNEP 2001, as a result of inventory of obsolete pesticides more than one and a half thousand tonnes of banned, obsolete pesticides and their mixtures of unknown composition were detected, more than a thousand tonnes of which require identification, and according to UNEP report, in 2008 their number reached 10000 tonnes. Among the identified pesticide POPs pesticides were not detected. It is expected that POPs pesticides may be present among the unidentified mixtures [1, 2]. This initial inventory of obsolete pesticides described only the condition of pesticide storehouses and quantities and conditions of pesticide containers. There has been insufficient scientific study to estimate the danger to public health and the environment from these sites. People living around the warehouse sites often use the land for pasture, kitchen gardens, and play areas for children, and as a source of construction materials.

Data on the number of warehouses, where pesticides were stored in the Soviet era in Kazakhstan, are contradictory. For example, according to F. Bismildina [3] there are 974 warehouses, including 411 in emergency condition, that accumulated 574 tonnes of pesticides and 54 thousand units of packaging, which are not buried. According to A. Sh Nazhmetdinovoy [4] have not been buried hundreds of tonnes of pesticides, the number of warehouses – 1280, in an emergency state – 236. Consequently, no information of the number of buried is pesticides discrepant in the whole Republic. It is obvious that the same situation is observed in different regions of Kazakhstan. For example, the Department of Environmental Protection finds that the territory of Almaty region to be disposed of more than 87 tonnes of pesticides, and the Ministry of Agriculture believes that in this area shall be disposed of about 126 tonnes of pesticides.

Despite an inventory on the basis of official figures by the Ministry of Environment of the Republic of Kazakhstan, Ministry of Agriculture of the Republic of Kazakhstan, non-governmental organizations and the Republican Sanitary-epidemiological Station Agency for Health Affairs of the Republic of Kazakhstan, unfortunately, no:

- the former warehouses 90% territories are in private possession.
- objective scientific information on the extent of soil contamination with pesticides, the locations of the former warehouses of chemical plant protection products in different geographical zones of Kazakhstan;
- modern laboratory capable of identifying a mixture of obsolete pesticides at the level of international standard;
- reliable data on what classes of pesticides and in what quantities were not buried, not disposed of in various parts of Kazakhstan.
- mass media within Kazakhstan has not given sufficient attention to the problem of chemical contamination of the environment.

Only in the last few years, as a result of increased POPs awareness and necessity of scientific ground for solution of the obsolete pesticide problem, the Ministry for Environmental Protection of the Republic Kazakhstan started to undertake certain steps. In 2010, the government has initiated state program «Zhasil damu» with the support of FAO. Tasks of the program are as follows:

- Realization of the World Bank project on stockpile destruction and, persistent organic pollutant wastes and rehabilitating contaminated territories in Kazakhstan;
- Inventory of POP’s and obsolete pesticides;
- Selection and repacking of obsolete pesticides from the former warehouses and burials.

The Ministry for Environmental Protection of the Republic Kazakhstan wrote a letter to GEF/FAO stating Kazakhstan’s support of the “Program on environmentally sound management of pesticides in the Central Asian countries” in 2012-2014 for implementation of the following tasks:

- The detailed inventory of obsolete pesticides and the legal and institutional needs assessment;

– Building of technical capacity to strengthen the monitoring of pesticides;
– Introduction of proven strategies for the control of obsolete pesticides and pesticide risk reduction.

The political effect of program realization will be expressed in the improvement of Kazakhstans response to requirements of the Stockholm Convention not to produce, not to use and to destroy reserves of chemical substances recognized as especially life-threatening and extending the opportunities for international cooperation in the field of high technologies.

Selection of efficient methods of remediation of pesticide-contaminated soils is an important environmental problem in Kazakhstan. Many different methods can be used for remediation of pesticide polluted soil. Traditional soil remediation technologies require considerable investments. For example, high-temperature incineration of obsolete pesticides in ovens is a very expensive procedure. Within many years, openly stored pesticides contaminated vast areas of soil. Some large-scale and expensive remediation technologies that may be effective for treatment of pesticide-contaminated soil and water are likely to be unacceptable in Kazakhstan due to limited financial resources. In addition, they are not safe for the environment, which necessitates the development of alternative technologies for remediation of contaminated soils.

Phytotechnologies use vegetation to accumulate, degrade, or stabilize environmental contaminants in soil, sediments, surface water, or groundwater. Compared to other clean-up methods, phytotechnologies can be cost effective requiring lower capital costs for installation; however, more time may be needed to achieve environmental management objectives. Phytoremediation consists of various processes describing the mechanisms by which plants could reduce the contamination of the soil [5-8]. Two major processes are involved, depending on whether the pesticide processing takes place outside or within the plant. These processes are rhizodegradation and phytoextraction [9].

Purpose of the work was to develop pesticide contaminated soil remediation technology, using plants and to identify the location and number of former storehouses, quantity of bulk obsolete pesticides, and pesticide contaminated soil in Kazakhstan.

In this study, pesticide analysis was limited to the organochlorine pesticides DDT (p,p'-dichlorodiphenyltrichloroethane) and HCH (hexachlorocyclohexane), along with their associated metabolites and isomers: o,p' DDD (p,p'-dichlorodiphenyl dichloroethane); p,p' DDD; p,p' DDT; p,p' DDE (p,p'-dichlorodiphenyldichloroethylene); α-HCH; β-HCH; and γ-HCH.

Results and Discussion

1.Inventory of Former Obsolete Pesticide Storehouses to Document Obsolete Pesticide Stockpiles

Kazakhstan is a very large country, so we chose two regions to demonstrate a new process that could be applied more widely in the future when sufficient resources become available. In 2008-2009 and 2011 we surveyed substances stored in 91 former pesticide warehouses in Almaty and Akmola areas of Kazakhstan just to demonstrate an example of understanding of the obsolete pesticide problem throughout the country. The observed areas were within 250 km of Almaty (the former capital of Kazakhstan) and within 100 km of Astana (the new capitol). In each district, the Department of Plant Protection of the Ministry of Agriculture was contacted to obtain locations of former pesticide storehouses and permission to access the sites. Local government authorities were contacted to receive further information on locations and permission to survey and sample each site. In this paper, we refer to the former storehouse sites where we have observed pesticide contamination as "hot points". The inventory included description of condition of the storehouse structures, estimation of bulk obsolete pesticide stockpiles and pesticide containers, inspection of storehouses and surrounding areas for pesticide contamination, assessment of vegetation growing at the sites, and public outreach. An inventory worksheet was developed to provide a systematic description of each location.

In Almaty area, several different classes of substances were identified. Much of the bulk chemical substances did not have readable labels and remain unidentified. The following classes of pesticides were observed: triazine herbicides (atrazine, protrazine, propazine, simazine), organophosphate insecticides (metaphos or methyl parathione), organochlorines (nitrophen and illoxan or diclofop-methyl), dinitroanaline herbicides (treflan), carbamate (temik or aldicarb), and a pesticide mixture including compounds labeled as Thiram and Hataonyag. The total amount of identified obsolete pesticides was 352.6 tonnes: forbidden or banned pesticides were 350 kg (saiphos, metaphos), 12 tonnes – hazardous pesticides (propazin, atrazin) and the quantity of unidentified mixtures of obsolete pesticides – 315.0 tonnes or 89.6% of the total obsolete pesticide stockpiles. In Akmola oblast, 100% of the 36,045 kg of obsolete pesticide stockpiles was unidentified chemical mixtures.

According to data of the Ministry for Environmental Protection of the Republic Kazakhstan (2005) report 121 tonnes of obsolete pesticides in territory of Talgar district, 16 tonnes in Enbekzhi-Kazakh district. In addition, in Talgar district we discovered 21 and 17 tonnes of obsolete pesticides in 2010 and 2011, respectively. As noted, 90% of former warehouse territories are in private possession. Some owners cleaned their territory from obsolete pesticides and disposed them to an un-known location. So, screening pesticide polluted sites will provide a base for development of an action plan to prevent or minimize environmental risk of pesticide pollution in Kazakhstan.

2. Level of soil contamination around the former warehouses of pesticides

Our study focused on the analysis of organochlorine pesticides as a marker for field contamination. We took more than 800 soil samples around the former storehouses to determine residual pesticide concentrations. Three replications were taken at each sampling. All soil samples were extracted using the solvent dichloromethane that was boiled and cycled for several hours using a Soxhlet apparatus. Residual concentrations of organochlorine pesticides in soil and plants were determined using standard methods adopted by the United States Environmental Protection Agency for a gas chromatograph (HP6890, Series GC System Hewlett Packard) equipped with an electron capture detector and a capillary column [10].

Analysis showed the presence of organochlorine pesticides as hazardous substances in soil in ~24 former warehouses of pesticides where their concentrations exceeded MPC in ten to hundred times (MPCs in soil is 100 μg/kg). The soil of around 21 former warehouses of the did not discover any contamination, but in soil of 19 warehouses the concentrations of pesticides were < MPC of 100 μg/kg. The basic pollutants were HCH isomers (α- and β- HCH) and DDT metabolites (p,p'- DDE, p,p'-DDD) (Figure 1, Figure 2).

The results showed that the amount of residuals of DDT metabolites and HCH isomers in soil did not depend on presence or absence of obsolete pesticides in storehouses. For example, in Karasajsk district (village 'Belbulak) on territory of former storehouses were about 500 kg of non-identified chemical substances of white color, and concentration p,p'-DDT in soil exceed MPC in 16 times (1670±66 μg/kg), p,p' DDE in 8 times (852±18 μg/kg). In of former storehouses of Talgar district (the village "Kyzyl-Gairar") the pesticides have not been found, though concentration of p,p'-DDT exceeded MPC in 65 times (6584±207 μg/kg), p,p' DDE – in 20 times (2097±54 μg/kg)

In Talgar district (village "Kyzyl-Gairar") level of α-HCH was 1239±136 μg/kg, o,p'-DDD – 398±8 μg/kg, and p,p'-DDD – 1899±42 μg/kg.

In Balkhash, Uigur and Ilijsk district's the insignificant amount of HCH isomers have been revealed. Isomers of HCH are highly toxic and cause mutagen effects.

Control soil samples were taken at ~800 meters from each hot spot (Karasajsk district). Control samples contained some metabolites of DDT and α-HCH. Metabolites of DDT primarily included

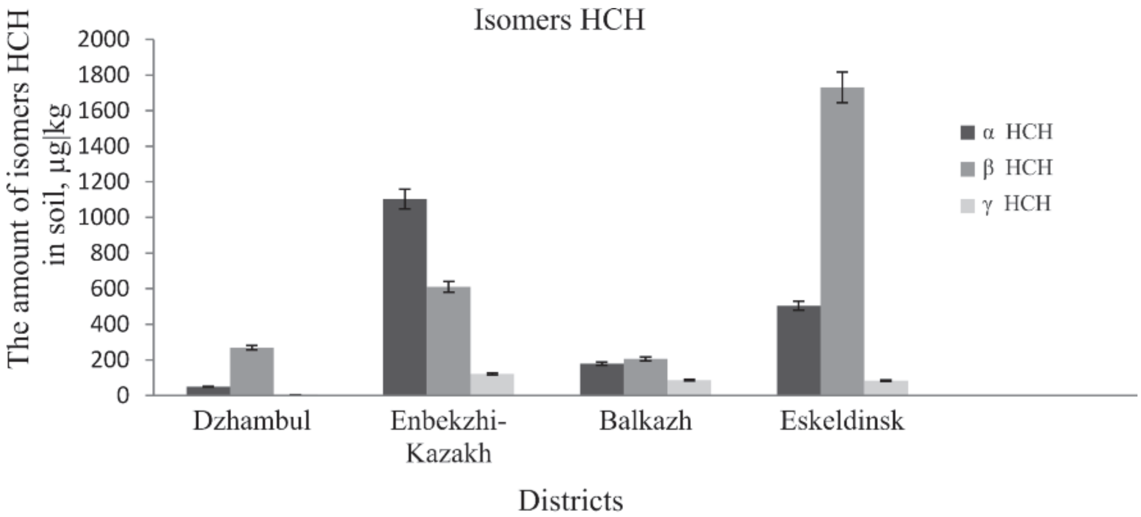

Figure 1. Total soil concentration of isomers HCH from some former pesticides warehouses in Almaty district (depth of soil 0-30 sm).

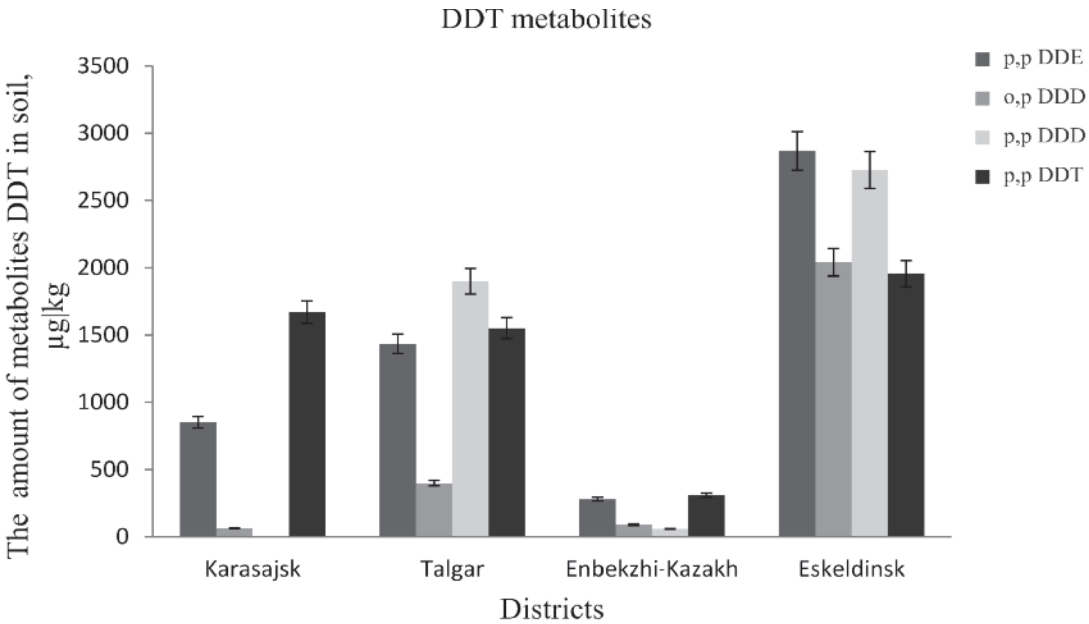

Figure 2. Total soil concentrations of DDT metabolites in some former pesticides warehouses of Almaty district (depth of soil 0-30 sm).

p,p'-DDE and p,p'-DDT, but these did not exceed MPCs.

In Almaty oblast, several lakes are located near former warehouses in Talgar and Dzhambul districts. Lake water was sampled from one lake in each of these areas. Two water samples from a lake located at a distance of 100m from a storehouse in the village of Beskanar in Talgar districts contained an average of 114 µg/L p,p' DDE. Maximum concentration of pesticides observed in soil around the warehouse in these districts was 1660 µg/kg. Chemical exposure to humans could result from contact or consumption of water, or fish from the lake.

These data show the environmental riski of these areas can potentially affect nearby populated areas. It is necessary to take urgent measures on liquidation of all obsolete pesticides and their containers (burial place), and further use bioremediation technologies for restoration of the soils polluted by organochlorine pesticides. So we studied plant community structure in areas surrounding each hot spot to describe botanical diversity, to identify pesticide tolerant plant species that may be useful for phytoremediation, and to understand the mechanisms of detoxification of soil by plants.

3. Study of the Effect of Fertilization on Phytoremediation Potential in the Greenhouse and Field

The natural establishment of plant colonies at polluted sites is a result of formation of distinct vegetative communities. Plant genotypes growing in such conditions may have some level of stability or tolerance to the pollutants. The identification of this plant populations provided potential genetic resource for phytoremediation technologies and determination of the physiological and biochemical basis for the ability to grow in the presence of the pollutants. Can plant species that naturally colonize the abandoned storehouse sites play a role in restoration and recovery of these sites?

Selection of plant species is a critical decision for successful application of phytotechnologies. So we documented plant community structures at the hot points and identified plant species that grow in pesticide-contaminated soil near the center of the sites. The type of vegetation was characterized as early succession plant species dominated by annuals and biannuals. Many of the species would typically be considered as weeds. Evaluated selected pesticide-tolerant plant species to document the growth characteristics in pesticide-contaminated soil compared to clean soil. Described interaction of pesticides and selected plant species to identify species that might accumulate pesticides in plant tissue and translocate them to aboveground plant tissue. We have shown that plants have a direct effect on the soil concentrations of organochloride pesticides, hydrophobicity of pesticides and biomass plants [11].

It is known, that low phytoextraction percentage is partly connected with slow growth of plants and limited biomass production. Several experiments were conducted using mineral fertilizers to increase plant biomass and monitor its effect on phytoextraction potential. Experiments were conducted under greenhouse conditions and under field conditions at a former pesticide warehouse site. Objects were pesticide-tolerant species *Artemisia annua*, *Amaranthus retroflexus*, *Kochia scoparia*, *Xanthium strumarium*, and the known DDT-accumulating species, *Curcurbita pepo* ssp. *pepo* [12]. Additions of fertilizer appeared to increase the plant biomass production and increased the amount of pesticide accumulated in plant tissue.

In greenhouse study the results demonstrated that added fertilizer (500 mg of ammonium phosphate and 250 mg of potash chloride added to each 3 kg soil plot) extended the plant vegetative period and resulted in increased biomass production. Pesticide concentrations in soil decreased in all treatments included fertilized and unfertilized controls without plants. Mean initial concentration of pesticides in the soil was 145 μg/kg for all pots. Most pots showed a reduction in pesticide concentrations. Soil with no plants and no fertilizer showed a final pesticide concentration of 68 μg/kg compared to an initial concentration of 147 μg/kg for a reduction of 27%. Soil with no plants and added fertilized had an initial concentration of 155 μg/kg before the experiment and 112 μg/kg at the end of the study for a reduction of 37%.

We showed that metabolites of DDT and isomers of HCH was absorbed by the plants, but with very small translocation into the plant. Plant uptake of pesticides accounted for a small proportion of the overall reduction in soil pesticide concentrations, although added fertilized increased plant biomass and increased the amount of pesticide taken up by plants.

Known that metabolites DDT and isomers HCH are strongly lipophilic, with log Kow values for DDT metabolites between 5.5 and 6.9, HCH isomers– 3,9-4,1. They thus strongly adsorb on soil particles. The lipophilicity of these compounds also limits their translocation in plants. In plants, these compounds tend to be adsorbed on root systems and are very weakly taken up. Example, in common reed (*Phragmites australis*), the ratio between the shoot concentration and the root concentration was lower than 0.75 for DDT. Their accumulation in shoots depended also on the isomer organochloride pesticides [13]. Among the five plant species included in the study, *Artemisia annua* and *Xanthium strumarium* showed the highest pesticide accumulation ability including all plant biomass. *Cucurbita pepo ssp. pepo* and *Kochia scoparia* showed the highest translocation factors for accumulating pesticides in aboveground plant tissue. Tranclocation factor (the ratio between the shoot concentration and the root concentration pesticides) for *Cucurbita pepo ssp. pepo* –0,4, and *Kochia scoparia* – 0,5. The residual concentration of pesticides in *Artemisia annua* tissues have been exceeds the MPC to 21 times, *Xanthium strumarium* – 25 times (MPCs in plant is 20 mg/kg).

Application of fertilizers resulted in increased plant biomass and increased percentage phytoextraction of pesticides. *Xanthium strumarium* phytoextraction percentage increased from 0.3 to 0.6%, Artemisia *annua* – from 0.5 to 0.7%, and *Cucurbita pepo ssp. pepo* – from 0.4 to 0.7%. *Kochia scoparia* and *Amaranthus retroflexus* had low biomass production in this study and did not increase phytoextraction with added fertilizer. In rhizosphere at *Artemisia annua, Kochia scoparia, Amaranthus retroflexus* and *Xanthium strumarium* have been decreased the concentration of pesticides on 11-24 % in comparison with experience without plants and without fertilizers.

In field study experiments conducted on territory the former warehouses (Karasajsk and Talgar districts). Soil in Talgar and Karasajsk districs are foothill light-chestnut calcareous soils. Object was species *Xanthium sturmarium* because it is one of the dominant species occurring at the former storehouse sites with high biomass production, a short vegetative period, and demonstrated ability to accumulated metabolites of DDT and isomers of HCH. It is also poisonous and not consumed by livestock.

We studied the effect of added fertilizer on phytoextraction by *Xanthium sturmarium*, and changes in soil pesticide concentration after one growing season (Table 1). One plot included plant with added fertilizer (20 g ammonium phosphate and 20 g potash chloride) and the other plot included plant with no added fertilizer.

Plants accumulated significant concentrations of pesticide into plant tissue compared to the initial concentrations in soil; however, the mass of pesticide taken up into plant tissue represents a very small fraction of the total pesticide mass in the soil. Therefore, the reduction of pesticide concentrations in soil was not due to plant uptake of pesticides. Other processes are mostly responsible for changes in pesticide concentrations in the soil. Additions of fertilizer appeared to increase plant biomass production and increase the amount of pesticide accumulated in plant tissue. The decline observed in soil pesticide concentrations suggests practically useful soil remediation processes may be functioning; however, mechanisms other than phytoextraction are apparently responsible for this change. Prior bioremediation and phytoremediation studies with DDT and HCH have reported that transformations take place in soils under favorable conditions [14-17].

Conclusion

We have found 91 former pesticide warehouses in Almaty and Akmola rayons of Kazakhstan to demonstrate an inventory process needed to understand the obsolete pesticide problem throughout the country. In Almaty rayon, a total of 352.6 tonnes and Akmola rayon – 36 tonnes of obsolete pesticides. Research showed the presence of POP's (metabolites of DDT and isomers of HCH) as hazardous substances in soil around of 24 former storehouses of pesticides where their concentration exceed MPC (maximum concentration limit) in tens - hundreds times.

Table 1. Pesticide concentrations and mass in soil and *Xanthium strumarium* plants from two test plots at hot points; one test plot had no added fertilizer and one test plot was fertilized with ammonium phosphate and potash chloride.

Experiments	Soil or plant mass, Kg	Pesticide concentration μg/kg	Pesticide mass μg
Karasajsk district			
Contaminated soil without fertilizer			
Soil before experiment	402	489	196.6
Aboveground plant biomass	1.3	60	78
Root biomass	0.1	182	18
Soil after experiment	402	227	91.3
Contaminated soil with fertilizer			
Soil before experiment	402	420	168.8
Aboveground plant biomass	3.3	101	334
Root biomass	0.3	474	142
Soil after experiment	402	113	45.4
Talgar district			
Contaminated soil without fertilizer			
Soil before experiment	200	7291	1,458.2
Aboveground plant biomass	0.140	1221	170
Root biomass	0.016	2410	38
Soil after experiment	200	4915	983.0
Contaminated soil with fertilizer			
Soil before experiment	200	7291	1,458.2
Aboveground plant biomass	0.224	1067	239
Root biomass	0.015	2988	44
Soil after experiment	200	3551	710.2

These data demonstrate the potential ecological danger and health risk posed by the former pesticide storehouses, especially those located near populated areas. Resolution of this risk will require elimination of obsolete pesticide stockpiles and pesticide containers, including locations where pesticides have been buried. Further priorities include remediation of soil polluted by organochlorine pesticides. Screening pesticide -polluted sites will provide a basis for the development of an action plan to prevent or minimize ecological risks from pesticide pollution in Kazakhstan. Results of inventories and inspection of former pesticide storehouses provide an additional source of data for official inventory of obsolete pesticide stocks, and for development and conduct of public and state programs and projects on preservation of the environment and maintenance of ecological safety.

It is investigated that wild species may be used for phytoremediation of organochloride pesticide-polluted soil. The tolerant plants have the high ability to accumulate pesticides in tissue and to translocate pesticides from root to above-ground. Use of mineral fertilizers resulted in stimulation of growth and biomass accumulation that increased phytoextraction of pesticides.

Acknowledgments

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THE BIOREMEDIATION OF SALINE SOILS, POLLUTED BY ORGANOCHLORINE PESTICIDES

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One of the global environmental problems is a problem of use, accumulation and utilization of organochlorine pesticides. Being the low-polarity organic compounds, the organochlorine pesticides possess cumulative toxic effect - are accumulated in fatty tissues, and with drop of fat get into breast milk [1]. The ability of the atom of chlorine to nucleophilic exchange reaction explains their high biological activity [2]. HCH or its isomer lindane which was used as a protectant of seeds has a high level of persistence – safety in soil [3]. Abreast of other persistent anthropogenic organochlorine pollutants it necessary to mark polychlorinated biphenyl (PCB), which are widely used in electrotechnical, chemical and textile industry [4]. A number of isomers of polychlorinated biphenyls (for instance, tetrachlorbephenil) possess dioxin characteristics [5]. The pesticides are absorbed by living organism and, migrated on food chain enlarging in over and over again their own concentrations, render the bad influence on natural ecosystems, alive organisms and person [6].

The degree of negative effects from using the pesticides defined to a large extent that, insofar quickly and effectively occurs their detoxification in nature. The detoxification of pesticides in soil can occur in many different ways. There is an account of purely chemical destruction of pesticides, about catalytic action of metals in the process of the decomposition (Fe, Mn, Co, C) and some minerals; about photooxidation of pesticides. The processes of washout, volatilization, detoxification play an important role in participation of the plants and animals [7-8]. Microorganisms are responsible for conversion of pesticides in biosphere to a considerable extent. Their contribution to mineralization of the compounds of pesticides is valued by miscellaneous author in 10-70% [9-11].

The methods of bioremediation, the cheapest and not inflicting additional damage to environment, must be attracted for remediation of huge territories polluted by persistent organochlorine pesticides. One of the factors, reducing efficiency of degradation, is a comparatively low number of microorganisms-destructors in soil. In connection with than from 1992 some research work on destruction of some organochlorine pesticides started to be carried out in the Institute of Geneticists and Experimental Biology of Plants AN RUZ under the supervision of Kh. Yadgarov. The local active strains of soil bacteria, capable to degrade HCCH, DDT and PCB, as well as their combination were isolated and studied by a group of scientists (Kh.T. Yadgarov, G.I. Djumaniyazova, A.A. Kim, et al.). Biopreparation was created on the basis of the execution studies from 5 active strains capable to degrade PCB in soil. The remaining amount of PCB formed 23% (from contributed 100%) [12-13].

A major concern is the purification of saline soils from residual organochlorine pesticides as a consequence of fading in them microbiological processes and as effect, a slower and longer natural autopurification of saline soils from pesticides. In connection with foregoing, the main **purpose** of our research is to create biotechnologies of the bioremediation of saline soils, polluted by organochlorine pesticides. In laboratory of soil microbiology of Institute of microbiology of the ASRUz under direction of G.I. Djumaniyazova, starting from 2005 several studies on the influence of organochlorine pesticides (HCH, DDT and PCB) on microflora of saline soil were conducted. As the results research, it was established that pesticides render some negative influence on useful microbial community of saline soils – quantity of ammonificators, oligonitrophiles. The more sensitive to pesticides were ammonificators, oligonitrophiles, and more stable – micromycetes and actinomycetes [14-18].

The quantity of all studied groups of microorganisms decreased sharply by 2 levels (ammonificators, oligonitrophiles), and by 1 level (micromycetes and actinomycetes) during the first month of experiment in contrast with initial soil and stand on that level during the experiment. We did not reveal the colonies of Azotobacter chroococcum and Azotobacter vinelandi, that authenticate about negative influence of pesticides on free-living nitrogen-fixing bacteria.

Then, the research on search, isolation and studying of bacteria-destructors from rhizosphere of cotton plant on saline and polluted by organochlorine pesticides soils of Hungry steppe (Sirdarya region) was conducted by Kh.S. Narbaeva and G.I. Djumaniyazova. It could isolate 4 active salt-stable (to10-15% of NaCl) strains of bacteria-destructors genus of Bacillus.

The ability of salt-stable monoculture and their association to decompose HCCH and PCB in model condition in the soil by gas-liquid chromatography and radioisotopic methods was investigated. The two independent methods show the ability of rhizobacteria of g. Bacillus to decompose organochlorine pesticides, The experiments were conducted on synthetically salted (4% of NaCl) and polluted (100mkg/50g of soil) soils. After a month of incubation of introduced bacteria, the content of HCCH essentially reduced from 2041,5612 ng/g soils to 14 ng/g soils, that formed less tha 1% from introduced HCCH.

The research of PCB-destructive ability of strains by radioisotopic methods in dynamics after 2 and 4 months of incubation was tested that in samples with introducing strains watched reducing of radioactivity counting within 11.5% - 32.5% after 2 months, and after 4 months of incubation – 24.27% - 55.5% (Table 1).

Table 1.

The dynamics of the count of radioactivity in soil during 4 months of incubations of samples, introduced by salt-stable strains of rizobacteria

Samples	The count of radioactivity in soil's samples			
	2 month of incubations - count 100 mkl imp/10 sek	2 month of incubations - % from incorporated to radioactivity	4 month of incubations - count 100 mkl imp/10 sek	4 month of incubations - % from incorporated to radioactivity
control - soil +4% NaCl	20.500	100%	20.500	100%
[illegible]	18.161	88,59%	11.796	57.54%
soil +4% NaCl + strain № 83	13.848	67,55%	9.116	44.47%
soil +4% NaCl + strain № 113	16.718	81.55%	15.524	75.73%
soil +4% NaCl + strain № 118	14.506	70,76%	13.824	67.43%
soil +4% NaCl + association of 4 strains (№№ 80 +83 + 113+118)	15.572	75.96%	12.152	59.28%
control – soil without NaCl	20.500	100%	20.500	100%

The revealed dates make it possible to conclude that 4 monoculture of rhizobacteria of the cotton plant with respect to HCCH and PCB possesses a highly destructive ability.

We have installed good survival rate introduced bacteria of the g. Bacillus (up to10^8-10^9 CFU/g soil) on artificially infected by pesticides (HCCH, PCB and HCCH + PCB) soil in dynamics during 12 months. Because the cotton plant is one of the main cultures, cultivated in Uzbekistan, and in some other countries in the world community, we created the microbial biopreparation of the complex action on the basis of the association from 4 strains of rhizobacteria of cotton plant of g.Bacillus. The experiments with cotton plant were conducted in field condition on saline soil. The biopreparation used for inoculation of cotton plant seeds. As a result of during the vegetation of the cotton plant we observed the good development inoculated plants unlike checking. The harvest of the pat increased on 5-7 c/ha in contrast with checking, which also perfected the quality of fiber.

Thereby, on the basis of conducted research it might be possible to do conclude that the use of biopreparation promotes the bioremediation, to account of active strains-destructors of pesticides, and biorecovering, about than witnesses increasing of the fertility of saline soils to account for an increase in the number of useful microflora of soil, reduction pH of soil solution, increase in the contents of humus, rolling, digestible by plants of the forms of biogenic elements, as well as reductions of the contents of the toxic salts and in total increasing the productivity of the cotton plant.

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POLLUTION SPECTRUM AT OLD PESTICIDE STORAGES IN MOLDOVA

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Abstract

The inventory of old pesticide storages in Moldova executed by the Ministry of Environment and World Bank showed a large quantity of polluted sites (1589) remains after the repacking and evacuation project. Near 16 % of old storages have POPs pollution level at more than 50,0 mg/kg in soil. The aim of this study was an assessment of the pollution spectrum in hotspot soil samples at old pesticide storages. This objective was realized by the determination of different types of pollutants by using Gas Chromatography method. The pollution spectrum is a complex method which consists of five POPs groups (DDTs, HCHs, Toxaphene, Chlordane, and Heptachlor), Trifluraline, Triazines, PAHs, Metolachlor and others. Several sites with relatively low POPs pollution have a high concentration of other toxic organic substances (Triazines, PAHs), which are included in Water Framework Directive for the monitoring. The spatial distribution of extra high polluted sites is characterized by GIS methodology and can be assessed operatively for the decision making. Several risk indexes were calculated for all territory of Moldova for different POPs pollution clusters: 0.10 – 1.0 mg/kg; 1.0 – 10.0 mg/kg; 10.0 – 50.0 mg/kg; and > 50.0 mg/kg. The similar distribution is characterized for other toxic pollutants. The conclusion is the pollution spectrum of hotspots sites is complex and should be considered by the planed remediation action and decision making.

Key words:
Soil Pollution, POPs, PAHs, old pesticides, GIS, Gas Chromatography

Introduction

The inventory of old pesticide storages in Moldova executed by the Ministry of Environment and World Bank showed a large quantity of polluted sites (near 1500) remains after the repacking and evacuation project [1,2]. This work was made first of all for Persistent Organic Pollutants (POPs). More that 15 % sites were determined as extra high polluted territory with the POPs concentration in soil more 50,0 mg/kg. They include some of the world's most harmful chemicals including highly toxic pesticides such as HCH, DDT; industrial chemicals such as PCBs. The management of domestic and hazardous wastes is considered as one of the most urgent environmental problems in Moldova. Old pesticide storages are in different conditions and can be classified as important pollution sources for the environment. Other toxic substances were detected also in soils which are in list of monitoring substances of Water Framework Directive: PAHs, trifluralin, triazines and others. They are synthetic chemical substances with high toxic characteristics to wildlife and humans. However the information about the actual status and complete pollution spectrum is not sufficient at present. This investigation is also important for the assessment of which remediation technologies can be used for the future soil detoxication.

The aim of the study was to asses the pollution spectrum in soil at obsolete pesticide storages. This objective was realized by the determination of different types of pollutant in Gas Chromatographs equipped with ECD and mass selective detectors.

Analytical procedure

Sampling

Samples were collected according to the Standard Guide for Composite Sampling and Field Sub-sampling for Environmental Waste Management Activities, and EPA's Guidance for Choosing a Sampling Design for Environmental Data Collection, EPA QA/G-5S (USEPA 2000c), and other standardized procedures [3-8].

Extraction and clean up.

The extraction and analytical procedures were made by appropriate normative documents [9-13]. Prior to the extraction, the soil samples (1 g) were spiked with 1 ml of the solution of two internal standards (PCB29 and DCB) with the appropriate concentration. Extraction was carried out by the Microwave Extraction System in the mixture of hexane-acetone (proportion 1:2, 20 ml) three times. After cooling down, the extracts were collected in the glass condenser and concentrated in n-hexane to a volume of 1 ml. The extracts were cleaned up on adsorption chromatography columns filled up with 1 g of activated silica gel (activated at a temperature of 135^0 C for 16 hours. The column was conditioned with 5 ml of hexane. Interested substances (PAHs and POPs) were eluted from column with 5 ml of n-hexane, followed by 5 ml of n-hexane/dichloromethane mixture (1:1). Final elutes were evaporated in argon flow to 1 ml. Sulfur interference was removed by Cupper powder activated in nitric acid.

Analytical determination

All reagents (solvents, standard solutions, anhydrous sodium sulfate, and pure gases) were of the pesticide grade purchased from Supelco-Aldrich. Agilent 6890 gas chromatograph equipped with 63Ni µECD detector, split–splitless injector, and capillary column HP5 were used for the pesticide analysis. PAHs and trizines analysis were performed on Agilent 6890 gas chromatograph equipped with Agilent 5973 Mass Detector (CG/MS 6890/5973) based on the selected ion monitoring system (SIM) of molecular ion peaks and associated characteristic fragment ion peaks. Method conditions are presented in tables 1 and 2. Other toxic substances were identified by SCAN mode in CG/MS 6890/5973 system.

Table 1. Experimental Conditions for pesticide determination in GC 6890

System elements	Method parameters
Injection ports	Split/splitless inlet; injection – Split 5:1, 2 µl, inlet temperature of 300°C
Column	HP-5: 30 m Length, 320 µm I.D., 0,25 µm Film, max 325^0 C
Carrier gas	He, 1,4 ml min^{-1} or Average Velocity 30 cm/sec, Constant Flow
Oven	First ramp: 100°C (hold 1 min) to 200°C at 20°C min^{-1} hold 2 min; Second ramp: 200°C to 280°C at 10°C/min, hold time 2 min.
Detector	63Ni µECD, 320^0 C, N2 makeup gas, 60 ml min^{-1}
Data collection	ChemStation

Table 2. Experimental Conditions for PAHs and triazines determination in CG/MS 6890/5973

System elements	Method parameters
Injection	Autosampler Agilent 7683 B
Injection ports	Split/splitless inlet; injection – Splitless (keeping the split closed for 1.0 min), 1 µl, inlet temperature of 300°C
Column	HP-5MS: 30 m Length, 320 µm I.D., 0,25 µm Film, max 325^0 C.
Carrier gas	He, 1,5 ml min^{-1} or Average Velocity 46 cm/sec, Constant Flow
Oven	First ramp: 120°C (hold 1 min) to 200°C at 20°C min^{-1}; Second ramp: 220°C (hold 1 min) to 290°C at 5°C/min, hold time 2 min.
Detector	Mass detector, EI 70 eV, quadropole 150^0 C, SIM
Data collection	ChemStation

The following instrument calibration parameters were calculated: the sensitivity (I-SE) as the slope of calibration curve at P-value < 0,05, linearity (I-LI) as a correlation coefficient for the calibration regression line, and the instrument detection limit (IDL) corresponding to 3SD (standard deviation) of five replication of the lowest standard solution.

Results

Five POPs compound groups namely ∑ DDT, ∑ HCH, Chlordane, Heptachlor and Toxaphene have been found in soil samples taken at investigated sites, in concentrations exceeding the national standard for organochlorinated substances in soil (0.1 mg/kg). Six DDTs isomers, three HCHs isomers, and Toxaphene as a mixture of approximately 200 organic compounds were analyzed in soil and waste samples. The pollution of POPs sites with DDT (88%) and – to lesser extent – with HCH (75%) can be defined as widespread. The share of sites contaminated with Chlordane (31%) and Heptachlor (23%) is also significant. The smaller number of sites are polluted by Toxaphene mixture (10%), but this pollution is usually characterized by the high level. Aldrine, Dieldrine, Endrine, HCB and Mirex were not detected in the investigated samples. The acquired data showed a severe level of soil contamination with DDTs and HCHs at some sites, in hundreds and even thousands of mg/kg.

The part of site is polluted by several groups of compounds. The toxicology impact on these sites is higher in the case of synergism of different toxicants. The distribution of high polluted sites (more 50,0 mg/kg) by POPs compounds are following: 144 sites are polluted by one substance; 48 sites – by two substances; 9 sites – by three substances, and 3 sites – by four POPs. Actually there are 252 POPs polluted sites with the concentration more that 50.0 mg/kg (15,9 % of total 1589 sites). The interpretation of this large set of analytical results and wide interval of concentration may become easier by showing their distribution (assuming distribution is lognormal) in a few clusters: 0.10 – 1.0 mg/kg; 1.0 – 10.0 mg/kg; 10.0 – 50.0 mg/kg; and > 50.0 mg/kg. The distribution of five investigated groups by pollution clusters gives a better understanding of the extent and severity of contamination (Fig. 1 and 2).

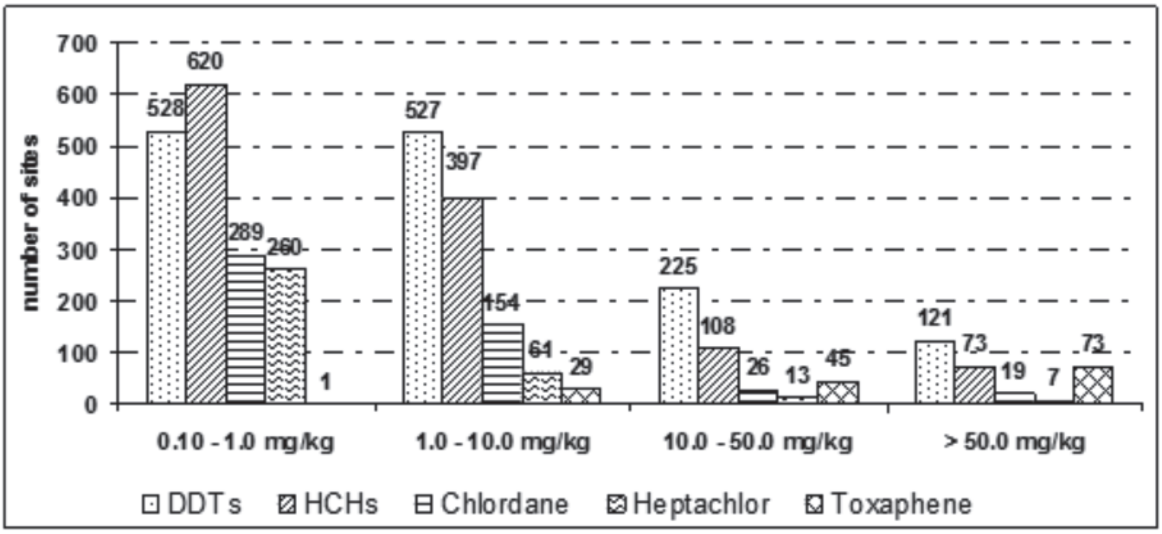

Figure 1. Distribution of polluted sites by POPs pollution clusters

Sites with high POPs concentration (more 50,0 mg/kg) have a additional complex pollution by Trifluraline (85%) Triazines (64%) and PAHs (33%), which were not taken into consideration by World Bank inventory project. Some sites with relative low POPs pollution have high concentration of other toxic organic substances. Near 10% of investigated site have high pollution (more 50,0 mg/kg) by other toxic substances which should to be monitored: OVEX, Metalochlor, Tetradifon, Phosalone, Phthalates, etc. The spatial distribution of old deposits ranges with the different pollution level in soil is presented in Figure 3. This map is illustrated total POPs concentration in complex soil samples. The density of high polluted sites is higher for the regions with more intensive fruit production. 18 raions have more that 15% of extra high pollution sites. The polluted soil with concentration more 50,0 mg/kg can be classify as hazardous waste. This fact means these sites should be protected first from the population access and recommended for the remediation to minimize direct contact with animals and people. The sampling of these sites confirmed a relatively big volume of toxic waste residuals on old pesticide storages.

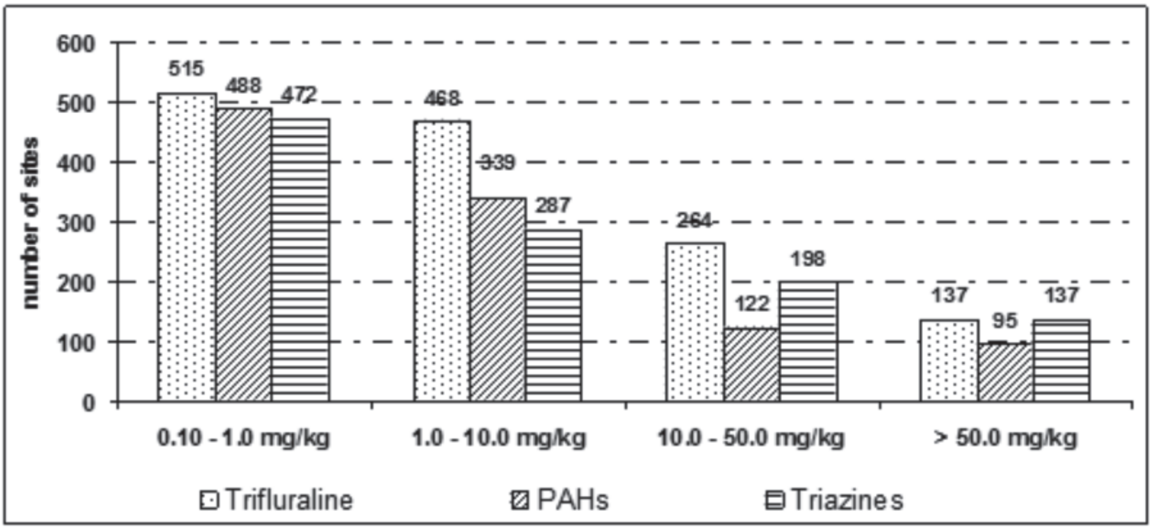

Figure 2. The distribution of polluted sites by clusters of other toxic substances

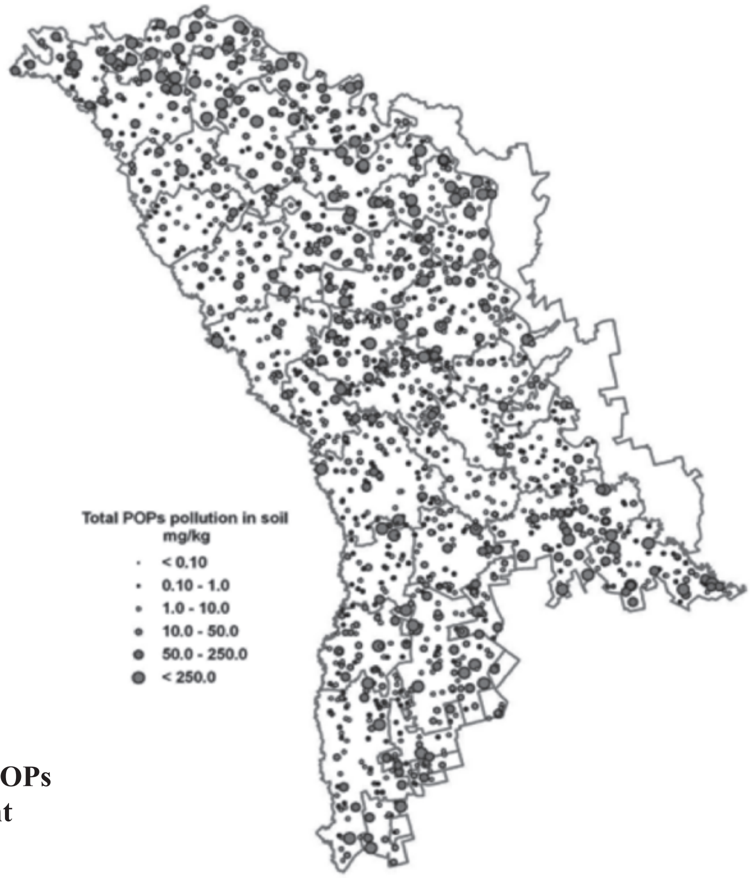

Figure 3. Spatial distribution of POPs contaminated sites by the different pollution level

Conclusion

- the pollution spectrum of POPs consists of five groups: DDTs isomers, HCHs isomers, Toxaphene mixture, Chlordane and Heptachlor. The principal groups among these substances are DDTs and HCHs isomers;
- the pollution spectrum is characterized also by other toxic substances as triazines, trifluraline, PAHs and others, which are included in normative documents for the monitoring of water quality (Water Framework Directive of EU, etc);
- the database of POPs polluted sites, created by the inventory project in Moldova, needs in the development for other pollutants and

classification for risk level for environment.

- the character of pollution spectrum demonstrates a complex character of future remediation and other action by the elimination of negative impact from polluted sites to environmental and public health.

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STUDY OF PLANT-MICROBE SYSTEMS IN A PROCESS OF PHYTO-BIOREMEDIATION OF OIL POLLUTED SOILS

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Technological processes of oil production and manufacture of oil products, their transportation and storage are inevitably connected with certain losses, that in turn results in occurrence of environmentally dangerous situations. At present technogenic environmental pollution has global character. This problem is very important for Azerbaijan where the oil production makes the basic part of its economy. A problem of pollution and degradation of soils is most acute on Absheron Peninsula where oil is extracted over a century and through which territory oil pipelines pass.

Every year pollution by oil and oil products results in a significant loss of great volume of the productive soils, decreasing their biological activity, arising or strengthening erosive processes. In addition there is joint negative impact of oil products and polluting substances (readily soluble salts, heavy metals, and other xenobiotics) [1]. Traditional technologies of detoxication and re-cultivation of oil polluted soils are not always effective and consequently restoration of soils isn't possible.

At present for clearing up soils from various pollutants there is widely used phytobioremediation - an effective and economic biotechnology based on use of plants and microorganisms associated with them (decomposers). Owing to the mutually advantageous coexistence plant-microbe associations (symbioses) have the big advantages at surviving in adverse environmental conditions [2,3].

Accelerating processes of degradation of pollution in soil are becoming possible not only by sowing specially selected plants, but also creating conditions for their intensive growth and increase of metabolic activity.

It is known that microbe communities of plants' root zone take a special place in natural fertility management system. For correlation of composition and function of such communities microbe preparations are applied.

The purpose of the given work was studying action of some plant-microbe systems for working out scientifically based technology of phytobioremediation of oil polluted soils of Absheron Peninsula in the future.

The research objects were the oil polluted soil samples selected from radical sphere (rhizosphere) of plants, typical for territory of Surakhany oil-field area. As the control soil samples from territory of the named area were used.

In samples there were conducted a number of physical and chemical (moisture content, pH, oil content) and microbiological analyses.

The content of oil products in soils was defined by a weight method after extraction of hydrocarbons from a soil sample with hot hexane in Soxhlet device.

Separation of oil allocated from the polluted soils was realized by use of liquid absorption chromatography on a column with a double sorbent (below – aluminium oxide, upwardly-silica gel 40/100 microns).

As an eluent hexane, benzene, ethanol - benzene (1:10) (tab.1.) were consistently investigated.

As can be seen from research results indicated in tab1 in comparison with crude oil extracts of oil pollution do not contain easy fractions and are characterized by higher density. Obviously, under influence of climatic - ecological factors there is observed change of fractional composition of oil.

Special methods and nutrient mediums were applied to isolate and count groups of microorganisms. They differ depending on biochemical features of the isolated microorganisms.

Table 1.

The characteristics of oil products

Samples ##	Content, %	.	Moisture content	Density, 20 °C, gr/sm^3	Component composition, mass %		
					hexane	benzene	ethanol-benzene
1	5	7,75	2,08	0,8922	39 n_D^{20} 1,4815	17,5 n_D^{20} 1,5325	16 -
2	8,3	7,8	1,4	1,0695	40 n_D^{20} 1,4928	20 n_D^{20} 1,5135	17 n_D^{20} 1,5295
Oil (native)				0,8488	46 n_D^{20} 1,4770	21 n_D^{20} 1,5169	12

For quantitative estimation of microorganisms there were used a method of sowing on firm nutrient mediums and a method of limiting cultivations on liquid nutrient mediums.

To determine quantity of bacteria in 1 gr of dry soil there were used the following nutrient mediums: for bacteria - meat infusion agar (MIA), fungi - a firm nutrient medium - wort-agar (WA), actinomycetes - starch-and-ammonia agar, and sporous – mix of MIA + WA (1: 1).

Microorganisms were cultivated in a thermostat at temperature of 30-32^{0}C. The quantitative determination of bacteria was conducted on 3-4th day, fungi -5th day, sporous 4-5th day, actinomycetes - 7-10th day.

The obtained results are shown in tab.2, whence it is possible to conclude that in investigated soils the quantity of bacteria considerably exceeds the quantity of fungi and yeast culures. The quantity of hydrocarbonoxidizing microorganisms in the oil polluted soil samples exceeds considerably the quantity of those in the control. It indicates presence of considerable quantity of organic food in the medium.

Besides determination of total microorganisms on nutrient mediums the task of the research was studying narrower groups of microorganisms, so-called physiological groups. These microorganisms are connected with a certain stage of transformation of organic and inorganic substances. For example, certain groups of microorganisms are connected with separate stages of transformation of nitrogen: nitrogen fixers, nitrifiers, amine fixers, denitrifiers. Studying cellulose-fermenting microorganisms able to utilize phosphorus compounds which are difficult of access for plants, and also participating in certain stages of transformation of sulphur and iron is of greate importance. Presence of a considerable quantity of the microorganisms participating in processes of nitrogen fixation, nitrification, cellulose destructions testifies to fertility of soils.

With the use of elective (selective) mediums there have been allocated and quantitatively characterized aerobic, anaerobic, nitrogen fixing and cellulose-fermenting and also nitrifying, denitrifying, sporous bacteria and actinomycetes. For obtaining accumulative cultures mediums composition of which satisfied to requirements of any group of microorganisms (elective or selective mediums) were applied.

The quantitative estimation of anaerobic nitrogen fixing bacteria was carried out using a liquid Vinogradsky's medium. Inoculum was brought into the bottom of sterilized test tubes with a nutrient medium. Results of calculations are shown in tab.2. As a nutrient medium for aerobic nitrogen fixing microorganisms Ashby medium was used. Results were registered after incubation of cultures at temperature of 28-30^{0}C within 12-14 days. In test tubes with developing cultures on the surface of a nutrient medium there is formed the thin film. As can be seen from calculations the number of aerobic nitrogen fixing bacteria in the polluted soil is less than in the control.

Depending on the nature of soil and its water mode processes of destruction of cellulose occur either

Table 2.

The quantitative estimation of microorganisms in soils

Groups of microorganisms	Soil samples				
	# 1		# 2		Pure soil
	Radical zone	Oil polluted soil	Radical zone	Oil polluted soil	
Bacteria	$29 \cdot 10^6$	$7 \cdot 10^6$	$56 \cdot 10^6$	$9 \cdot 10^6$	$11 \cdot 10^6$
Fungi	$11 \cdot 10^4$	$6 \cdot 10^4$	$13 \cdot 10^4$	$5 \cdot 10^4$	$2 \cdot 10^3$
Actinomycetes	$55 \cdot 10^5$	$7 \cdot 10^5$	$39 \cdot 10^5$	$5 \cdot 10^5$	$40 \cdot 10^5$
Sporous	$9 \cdot 10^3$	$5 \cdot 10^3$	$20 \cdot 10^3$	$3 \cdot 10^3$	$2 \cdot 10^3$
Yeast cultures	$9 \cdot 10^3$	$3 \cdot 10^3$	$6 \cdot 10^3$	$2 \cdot 10^3$	$2 \cdot 10^3$
Hydrocarbonoxdizing	$75 \cdot 10^4$	$8 \cdot 10^4$	$81 \cdot 10^4$	$12 \cdot 10^4$	$9 \cdot 10^3$
Aerobic nitrogen fixers	$14 \cdot 10^2$	$3 \cdot 10^2$	$17 \cdot 10^2$	$10 \cdot 10^2$	$23 \cdot 10^2$
Anaerobic nitrogen fixers	$459 \cdot 10^2$	$12 \cdot 10^2$	$31 \cdot 10^2$	$9 \cdot 10^2$	$8 \cdot 10^2$
Aerobic cellulose-fermenting	$18 \cdot 10^2$	10^2	$43 \cdot 10^2$	10^2	$19 \cdot 10^2$
Anaerobic cellulose-fermenting	$17 \cdot 10^2$	$5 \cdot 10^2$	$2 \cdot 10^2$	$19 \cdot 10^2$	$9 \cdot 10^2$
Nitrifiers	$10 \cdot 10^2$	$5 \cdot 10^2$	$17 \cdot 10^2$	$2 \cdot 10^2$	$4 \cdot 10^2$
Denitrifiers	$804 \cdot 10^2$	$18 \cdot 10^2$	$19 \cdot 10^2$	$23 \cdot 10^2$	$4 \cdot 10^2$

in aerobic, or anaerobic conditions. Accumulative cultures of anaerobic cellulose-fermenting bacteria are obtained through growing up them on various mediums with adding cellulose to them. Composition of a nutrient medium for anaerobic cellulose-fermenting bacteria (gr/l):

$(NH_4)_2SO_4$ - 10; K_2HPO_4 - 2; $MgSO_4 \cdot 7H_2O$ - 0,4; NaCl - traces; $CaCO_3$ - 20; a filtering paper.

For isolation of cellulose-fermenting aerobic bacteria Hutchinson medium of the following composition (g/l) was used:

K_2HPO_4 - 1; $CaCl_2$ - 0,1; $MgSO_4 \cdot 7H_2O$ - 0,3; NaCl - 0,1; $CaCO_3$ - 3, starch - 10; agar-agar 20.

The quantitative estimation of sporous forms of microorganisms was made on mixed medium: MIA + WA (1: 1).

As can be seen from Table 2 the quantity of microorganisms in rhizosphere is higher than in the rest of soil mass. Obviously it is connected with the fact that in allocated roots there are the organic compounds possessing considerable physiological activity - vitamins, growth substances, hormones etc., playing a big role in mutual relations of the higher plants with microorganisms.

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AGRUNIVER HOLDING LTD – PARTNER IN REMEDIATION AND RESEARCH –DEVELOPMENT: FROM HYDROCARBONS TO PESTICIDES

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AbstracT

Agruniver Holding (AGH) is one of the leading environmental engineering, consultant and research development companies in Hungary. AGH has vast experience in various fields of environmental activities, especially in the field of site investigation, remediation and monitoring of hydrocarbons contaminated sites. Since 2008 our company is actively working in POPs pesticides projects in Eastern Europe and Central Asia carrying out inventory, repackaging and PSMS training activities. During the years of working with hydrocarbons contaminated sites, thanks to tireless joint research with Szent Istvan University, our company developed a collection of microbial strains capable of degrading contaminations of hydrocarbon origin in soil and groundwater. Seeing the scale of pesticides contamination in soil and groundwater in the EECCA region our research focus turned towards the biodegradation possibilities of pesticides contamination. The goal is to isolate microbial strains from contaminated samples capable of degrading pesticides in the environment in a safe and effective manner.

Key words: POPs pesticides, hydrocarbons, DDT, Atrazine, bioremediation, soil contamination, microbial degradation

Introduction

Petroleum products contain numerous carcinogenic, teratogenic or mutagenic compounds that can be harmful to human health and the environment. The worldwide usage of hydrocarbon -based products increases the importance of clean-up technologies for the elimination of these pollutants from the environment. The use of biodegradation processes can be an environment -friendly and cost -effective alternative to remediate contaminations caused by hydrocarbons or hydrocarbon-based chemicals. The Environmental Protection Agency of the United States (US EPA) promotes the application of biological methods in all possible cases instead of other (thermal, physical-chemical) methods (U.S. EPA 1994 and 1995). Out of the 21 (that will be 22 from April 2012 with the addition of Endosulfan after the Fifth Meeting of the Conference of the Parties to the Stockholm Convention) POP compounds listed presently by the Stockholm convention 14 (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, chlordecone, alpha hexachlorocyclohexane, beta hexachlorocyclohexane, lindane, pentachlorobenzene) are pesticides. All of these POPs pesticides are of hydrocarbon origin leaving a fair good chance that microorganisms, which are effectively degrading hydrocarbon contamination could eliminate (organochlorine) pesticide contaminants, too.

Discussion

After years of working with and studying hydrocarbons contaminated sites AGH - in joint research with Szent Istvan University - has developed a collection of microbial strains capable of degrading contaminations of hydrocarbon origin in soil and groundwater. During the research period 129 hydrocarbons degrading microbes were isolated from contaminated soil and groundwater samples. 65 strains proliferated on such selective substrates that indicated that the strains are most like pathogenic, because of what those strains were excluded from further studies. Among the remaining strains 51 showed degrading capacity over 30% and 26 were identified and proven as non-pathogenic for humans. Out of the 26 strains 11 showed significant degrading capacity, at over 50%. The individual degradation spectra of these strains were determined in order to allow tailormade application for different contamination profiles. Further studies showed that the highest degradation potential occurs in case of mixed application of the strains that belong to four different genera (Szoboszlay et al., 2004). The microbes constituting the newly developed inoculum product fall under patent protection (Atzél, 2008). A semi-industrial experimental fermentation laboratory was established (with automated fermentors of 5L, 50L and 500L volumes) which allows the production of inocula from microbiological products even in commercial volumes. The product is called SAFEREMED-AH, is permitted by all relevant authorities and national institutions in Hungary for environmental biodegradation application. Because high heavy metal concentrations are toxic and able to decrease the growth of aerobic bacteria the toxic metal (copper, nickel, lead, chrome, zinc) tolerance of the constituting strains was determined as well later on (Szabó et al, 2009).

Since the permits were obtained in 2008, SAFEREMED-AH was applied in over 50 contaminated sites with high efficiency and it remains one of the leading biodegrading products in Hungary for the treatment of hydrocarbons contaminated sites.

For pesticides studies a similar approach was set up for Atrazine and DDT. For DDT degradation research contaminated soil samples were collected from the close vicinity or from the store floor of former pesticide storages in Kyrgyzstan and Ukraine. 13 bacteria were isolated from the DDT contaminated soil samples as axenic cultures. 11 out of the 13 strains could be identified on a species level; these species belong to the *Bacillus, Pseudomonas* and *Gordonia* genera. According to the results of the GC analyses only the strain *Gordonia amicalis* was able to significantly decrease the DDT concentration of the substrate during the five-day experiment: notable, more than 90% degrading activity was detected, the original 1ppm DDT concentration decreased to 0.057 ppm (Raska et al. 2009). Although the aromatic degrading ability of the *Gordonia* species is well documented (Kim et al. 2000, Nishioka et al. 2006), no data are published so far about their DDT degrading capability.

According to international literature the most effective DDT degradation results can be achieved with mixed cultures therefore the research continues in search of further degrading strains that could build up a mixed culture.

Atrazine is one of the most widely used herbicides of the world. It was banned in the European Union in 2004 but remains in use in other parts of the world. It has significant biological effect on reptiles: teratogenic and has endocrine disrupting effects (Mizota et al. 2006). For Atrazine degradation research a collection of 219 strains was screened constituting of aromatic compounds degrading microorganisms. The laboratory tests showed that three strains (*Rhodococcus sp., Pseudoxanthomonas sp. and Sphingopyxis sp.*) could degrade Atrazine with a capacity over 60%. Further research takes place with these strains in order to develop an immobilized structure for biofilter application.

Conclusions

The DDT and Atrazine degradation research of AGH and St István University has promising results. For both pesticides effectively degrading strains were isolated and identified on a species level. In order to increase efficiency and environmental applicability several more research phases are needed and more microbes have to be identified, but there is good chance that pilot test results can be shared by the time of the 12th HCH Forum.

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SESSION 12. PROGRESS IN THE FAO-GEF REGIONAL PROJECT ON "CAPACITY BUILDING ON OBSOLETE AND POPS PESTICIDES IN NINE EASTERN EUROPE, CAUCASUS AND CENTRAL ASIA (EECCA) COUNTRIES"

STRENGTHENING CAPACITIES TO TACKLE OBSOLETE PESTICIDES IN THE EECCA REGION PLANNED EU-FUNDED ASSISTANCE PROJECT

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European Neighbourhood Policy Sector Co-ordination (Environment)

1. Background

Obsolete pesticides (OPs) are a significant environmental and health concern in the EECCA region, either deregistered locally or banned internationally or unusable because of long-term storage leading to degradation. It is estimated that around half of the world's quantities of obsolete pesticides can be found in the EECCA region.

While efforts to date have contributed to raise awareness and started to address part of the issue, the bulk of the problem remains unsolved. As of 2012, a new EU-funded project is planned to help strengthening capacities to tackle obsolete pesticides in the 12 partner countries in the EECCA region, promoting exchange of experience and expertise as well as opportunities for synergies and cross-regional co-operation. The project budget is expected to be EUR 7 million (including EUR 1 million co-financing from the FAO) for a time period of 4 years.

While the planned project will not cover destruction activities due to the costs involved and the available budget, it will offer the possibility to complete/create inventories, identify priority sites, carry out risk assessments, capacity building, action plans, improve the legislative framework, promote integrated pesticides management and prevention/reduction of pesticides' use as well as awareness-raising. It is also planned that two pilot projects will be implemented on safeguarding/safe storage.

The project will be implemented by the FAO, which has developed a methodology for addressing stockpiles of obsolete pesticides that can also be used as a tool to tackle unused hazardous chemicals more generally. The project will build on activities of the FAO on pesticides management in nine EECCA countries.

The proposed project will, through the exchange of information and donor coordination, make available the existing methodology for obsolete pesticides in order to promote further action to eliminate other hazardous chemicals.

2. Objectives

The project aims to contribute towards better protection of environment and public health in the EECCA region, through reducing the risk posed by hazardous waste in the region, placing specific emphasis on pesticides as a model group of hazardous chemicals.

Specific objectives:

1. To strengthen knowledge about the extent of the problem by completing/creating inventories of pesticide stockpiles and contaminated sites, serving also as a model for other hazardous chemicals. Depending on the size of the country the inventory may be carried out at national or regional level.
2. To strengthen national and local in-country capacity and expertise to carry out risk assessments and establish priority based action plans to address polluted sites, safe storage and destruction as well as identifying needs for capacity building and financing.
3. To carry out pilot activities intended to build capacity and demonstrate ways of working relevant to Partner Countries' state of advancement in dealing with obsolete pesticides and pesticides management, such as safeguarding and safe storage at priority sites, communication strategies, promotion of

integrated pesticides management (IPM) approaches in crops using high levels of pesticides, community monitoring of pesticide related incidences, remediation of contaminated sites, strengthening of pesticide registration systems, construction or refurbishment of pesticide storage facilities, etc.

4. To improve the legislative framework in line with EU policy approaches and relevant multilateral environment agreements.
5. To prevent the recurrence of obsolete pesticides by strengthening effective life cycle management for pesticides and promoting strategies to reduce pesticide use.
6. To improve awareness among decision makers and the public of the risks associated with obsolete pesticides and hazardous chemicals and the need to take action, including the costs in both human and economic terms of non-action.
7. To enhance cross-regional exchange of expertise and experience.
6. To improve donor coordination through a dedicated donor platform.

3. Stakeholders

The main stakeholders will be national authorities (such as Ministries of Environment, Ministries of Agriculture, Ministries of Health, Ministries of Industry, Ministries of Emergencies) in Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. A project description has been transmitted to partner countries for comments.

Selected regional and local administrations and agencies involved in the implementation of pesticides and hazardous chemicals management will be involved as well as NGOs concerned with environmental, health and agricultural matters and the private sector in the form of pesticide producers and vendors, the food industry as buyers of agricultural produce and the hazardous waste industry as potential advisors and investors.

The involvement of civil society with specific attention to the NGOs plays a vital role in awareness raising activities. The Regional Environment Centres (RECs), represented in most of the countries, provide networks for the public.

Intergovernmental organizations active in relevant areas will also be involved. These include UNEP, UNIDO, UNDP, the World Bank, the Secretariats of the Rotterdam, Basel and Stockholm Conventions and others as relevant.

AWARENESS RAISING ACTIVITIES ON OBSOLETE PESTICIDES AND POPs PESTICIDES IN ROMANIA

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Romania ratified the Stockholm Convention in 2004 by Law no 261 and the first step undertaken after the ratification was the development of National Implementation Plan (NIP) for Stockholm Convention. The NIP was adopted by the Minister in April 2006 and sent to the Stockholm Convention Secretariat. After the NIP development the real work started and great efforts was made for an effective implementation of its action plans.

One of the main issues which were not well-explored and dealt within the NIP was the OPs and POPs pesticides contaminated sites. After the inclusion into the Convention of HCH, including Lindane at the 4th meeting of the Conference of Parties (COP-4), in May 2009, the OPs and POPs contaminated sites issue became one of the global key-issues and one of the biggest problems of Romania.

In this context Romania had to face the lower awareness level of local authorities (mayors, city councils) about hazards by contaminated sites and their responsibilities and their opportunities in dealing with this problem.

The Regional Project "Capacity Building on obsolete pesticides in the EECCA Region" enabled Romania to undertake first steps towards proper awareness raising on OPs and POPs pesticides contaminated sites, especially for those contaminated with HCH, including Lindane, by holding an one-day workshop at the environmental protection authorities decision-making level. During the workshop was presented the current situation of OPs and POPs pesticides contaminated sites in Romania and further actions were proposed in order to increase the country capacities to deal with this challenging problem.

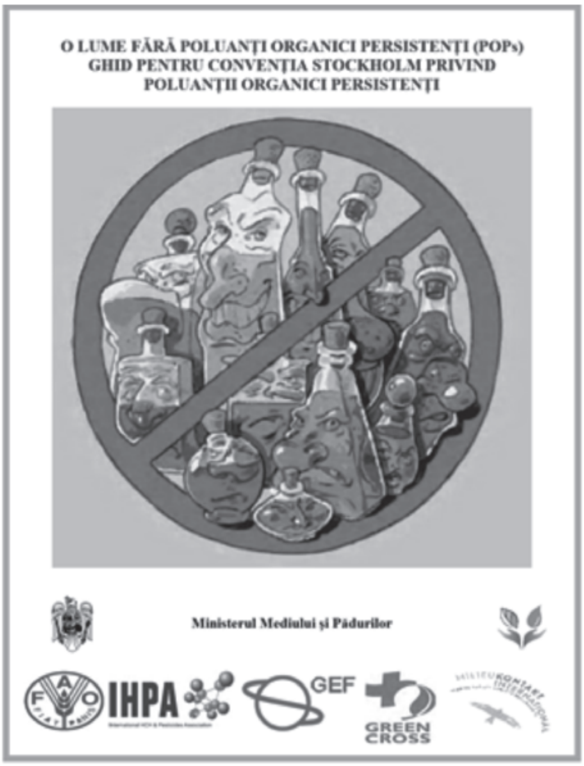
In the frames of the *micro-support project for awareness raising* granted by the Regional Project "Capacity Building on obsolete pesticides in the EECCA Region", the Ministry of Environment and Forests started to prepare an awareness raising campaign on OPs and POPs pesticides contaminated sites in order to increase the number of applications for funding to the EU Commission for contaminated sites remediation as an action towards the implementation of Article 6 paragraph (1) letter e) of the Convention.

The campaign will comprise of awareness raising materials on the proposed theme as well as a series of 8 workshops for a target of at least 30 % of the administrative and environment protection local authorities and it is estimated to be done by the end of October 2011.

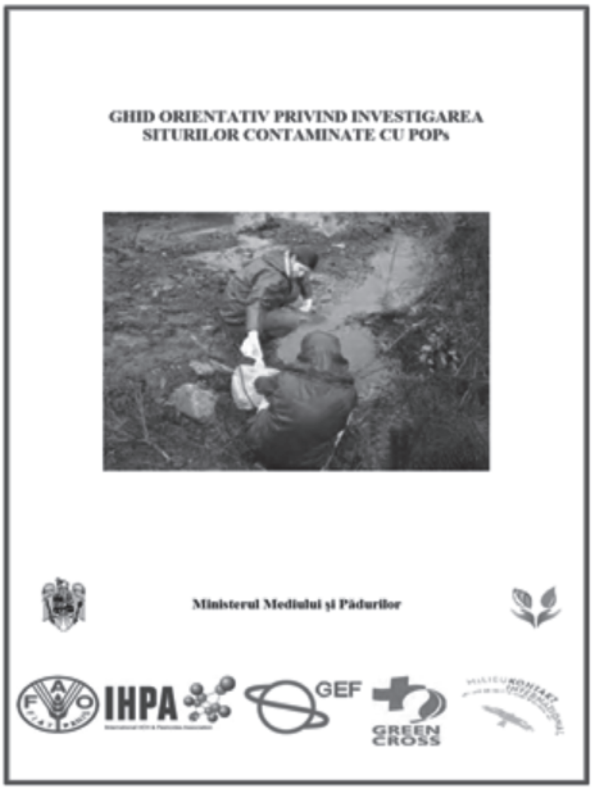
In this context, the experts from the Ministry of Environment and Forests together with the experts from the National Environmental Protection Agency have prepared several awareness raising materials which will enable the information dissemination towards stakeholders.

These materials include a poster and a leaflet on POPs and OPs contaminated sites issue and several guidelines, namely:

- a general guideline on persistent organic pollutants (POPs) and obsolete pesticides (OPs). This guideline is designed in simple language in order to address both the authorities (local and environment) and public, and presents general information about POPs and OPs, their harmful effects on human health and environment, the main provisions of the Stockholm Convention in dealing with it, as well as the national, European and international legislative framework on POPs and OPs.
- a general guideline on the investigation of POPs contaminated sites. This guideline is mainly addressed to the environmental authorities and gives a good overview on the site investigation process as well as the sampling procedure in order to determine if a site is contaminated or not. This guideline



is very useful to the environment authorities because, based on these investigations, may prioritize the contaminated sites requiring urgent action for remediation, due to the great danger impose to human health and environment.



- a general guideline on financial sources for the remediation of POPs and OPs contaminated sites. This guideline identifies all possible financial sources which could be accessed by various stakeholders (in principal local authorities and private owners of the contaminated sites) in order to deal with POPs and OPs contamination. Moreover the guideline makes reference to the respective financial programmes web-pages where could be accessed all relevant documents required for obtaining the financial support.

Starting with **15 of September 2011** the information included in these materials will be disseminated through 8 workshops held in each of the regions in Romania, as are presented in the map bellow.
The experts of the Ministry of Environment and Forests and those of the National Environmental Protection Agency will prepare the agenda of the workshops as well as the calendar of holding the 8 workshops.

The workshops will be hosted by each of the 8 Regional Environment Protection Agencies (REPA Bucuresti, REPA Bacau, REPA Cluj-Napoca, REPA Galati, REPA Sibiu, REPA Pitesti, REPA Timisoara, REPA Craiova).

The experts from REPAs will be responsible for inviting all the relevant stakeholders in their area of competence (local authorities, economic agents, interested public etc.) to the workshops. The average number of workshop participants per region will be 30.

The aim of the awareness raising campaign is to join the team of experts responsible for the National Implementation Plan review. This awareness raising campaign is beneficial to the process of review due to the fact that offers possibility to gather new information as well as to validate the existing one related to the POPs and OPs contaminated sites.

The awareness raising campaign will provide the local authorities with both administrative and environmental appropriate information on the risks on human health and environment of OPs and POPs contaminated sites. Furthermore, will provide available methods to deal with this global issue as well as guidance on how to get funding to solve it, **aiming for a "OPs and POPs free future".** It is expected that this win-win situation will confer the sustainability in solving the obsolete and POPs pesticides contaminated sites.

The impact of this awareness raising campaign will be quantified by the number of funding applications approved as well as by the total amount of funds attracted by the relevant stakeholders from various donors used in dealing with the POPs and OPs contaminated sites issue in Romania.

OBSOLETE PESTICIDES MANAGEMENT PUBLIC AWARENESS ACTIVITIES IN MACEDONIA

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Abstract

The Republic of Macedonia ratified the Stockholm Convention in 2004 and adopted the NIP in 2005. NIP development meant more aggressive action for phasing-out POPs in the country.

The limited national budget and insufficient institutional capacities were the main reasons for postponed action on OPs management in Macedonia. The only real opportunity to strengthen national structures in this field was participation in the project Capacity Building on Obsolete and POPs Pesticides in EECCA countries.

As a part of the project the Ministry of Environment and Physical Planning has started the actions on OPs inventory in 10 companies in Central and South parts of the country. During the inventory process public awareness activities will be conducted. Although, most of the companies are situated in the vicinity of Skopje, the capital of Macedonia, the public awareness will also be performed in two different regions in the country that apply different pesticides. The Kavadarci location was chosen as a pilot location for starting the inventory and the awareness raising activities at the same time. In the course of the awareness raising project, (in accordance with the preliminary list of companies possessing OPs), several other companies have been selected, such as: RADOMAK, Skopje, AGROHEMIJA KOMERC, Skopje, HROMOS PESTICIDI DOO, Skopje, AGROPIN, Kavadarci, HERBOS, Skopje, MAGAN MAK, Skopje, AGROJUNIKOM, Skopje, HERBA HEM, Skopje, OHIS AD Skopje, ANGRO PROMET, Kavadarci.

The overall public awareness campaign will consist of several activities:

1. Preparation of public awareness materials:
   - Leaflet with general information on OPs and PPE
   - Handbook on OPs Handling and Management
2. Organization of two raising awareness workshops for the stakeholders from the selected regions
3. Organization of two meetings with local authorities in the selected regions
4. Dissemination of the public awareness materials to the target groups representatives.

The main topics that will indicate the public awareness success are: number of companies and farmers informed about the proper management with OPs, number of regions invited and informed about sound management of pesticides and OPs, quantity (tonnes) of OPs properly stored in the storage premises and number reduced quantities of new OPs.

As the most important outcome of the activities undertaken in the frame of the awareness raising project is the opportunity to get companies possessing pesticides stocks to apply methods and practices in line with the principles of sound obsolete pesticides management. If this is achieved, it will contribute to the long-term sustainability for sound obsolete and POPs pesticides management in the country and for certain aspects of the good agricultural practice.

Key words: public awareness, obsolete pesticides, persistent organic pollutants, inventory, farmers, companies

Introduction

"Stockpiles of the former use of pesticides have not been assessed in detail. Additional analyses for the evaluation of the present situation are to be made" (NIP 2005)

The Republic of Macedonia signed the Stockholm Convention on May 22, 2001 and ratified it on March 19, 2004. In order to give directions and facilitate the Stockholm Convention, the implementation of the National Implementation Plan (NIP) for POPs Reduction and Elimination was developed and adopted in 2005. The NIP gives some preliminary data and information on obsolete POPs pesticides which are not enough to create a picture about the obsolete POPs stocks situation in the country.

A base was established after the NIP development, and the project Capacity Building on Obsolete and POPs Pesticides in Eastern European Caucuses and Central Asian (EECCA) countries was just on time to accelerate the action on creation a national system for obsolete and POPs stockpiles management.

The Regional project on Capacity Building on Obsolete and POPs Pesticides is mainly dedicated to the reduction of pesticide releases into the environment and elimination of human health and environmental threat they pose in EECCA countries. The project should facilitate viable and environmentally sound measures for the identification, handling and disposal of pesticides stockpiles and wastes, and incorporation of strategies for prevention and management of obsolete pesticides into national policies with a strong emphasis of regional and sub-regional approaches.

One of the expected project results is greater awareness concerning pesticides and POPs wastes within participating countries.

Therefore the aim of the Micro-support for Inventory and Awareness Raising is to facilitate and accelerate national activities for raising awareness in the obsolete and POPs pesticides area.

As mentioned earlier, there is no clear picture on existing obsolete stocks in Macedonia and the responsible institutions intensively works on establishing a database on identified locations with obsolete pesticides. There is a general opinion among the professionals, that there are not so many locations burdened with high quantities of obsolete pesticides. However the location of the quantities should be identified, like it should be investigated if they storage are proper performed and how the quantities affect the surrounding.

According to the previous experience in the country, the level of knowledge and awareness among traders and users of pesticides, on proper handling and storage of pesticides is very low. So, the need for undertaking actions on awareness raising campaigns on OPs and POPs handling and overall management is a strongly necessary in the country.

Therefore, several targets were highlighted in the project. By the end of the project:

- The number of educated representatives of the stakeholders (industry, traders) was to be increased.
- At least 1 - 2 persons per company/ stakeholder should have knowledge of proper management of obsolete pesticides and prevention of generation of new obsolete pesticides quantities in the regions of Skopje and Kavadarci.
- At least 5 companies in the regions of Skopje and Kavadarci placing pesticides on the market should be introduced to the standards for proper temporary storage of obsolete pesticides/personal protective equipment, obsolete/waste pesticides inventory.
- At least 20 tonnes of obsolete pesticides should be properly stored at its own facility until the final disposal solution is chosen
- Newly generated obsolete pesticides in the Skopje and Kavadarci region is to be reduced by 50%.

PREPARATORY ACTIVITIES FOR PUBLIC AWARENESS CAMPAIGN

Leaflet on Personal Protection

The Leaflet gives some general information about the obsolete pesticides stocks, pesticides groups:

- Pesticides application (agricultural branches, individuals)
- Reasons for generation of obsolete pesticides
- Reasons for pesticides getting hazard for human health and environment.

Actually, it is divided in two parts: obsolete pesticides and their harmful impacts (first part) and obsolete pesticides sound handling and management (second part).

The first part of the leaflet informs about the symptoms of acute and chronic poisoning caused by the hazardous obsolete pesticides. The language in the leaflet is adjusted to all target groups: professionals that have direct contact with obsolete pesticides and public that could be contaminated/poisoned through food and due to the chronic exposure on hazard stocks impacts. For instance, the acute symptoms are clearly explained to everyone that has contact with obsolete pesticides to recognize first symptoms and undertake immediate and adequate action. The environmental damages that results from inadequate obsolete pesticides handling and management are also listed in the leaflet.

The second part gives concrete (short) advices on inventory, repackaging, storage and transport of obsolete pesticides. It pays special attention on the strict recommendations to be applied during the inventory (to prohibit access of unauthorized persons to the storage of the obsolete pesticides, to use adequate protective equipment, etc). The personal protective equipment is given as a main point of the leaflet. The detailed list of the personal protective equipment is given in order to remind the professional (on the first place) not to forget to protect themselves while handling obsolete pesticides.

Handbook on Obsolete and POPs Pesticides Management

The Handbook on Obsolete and POPs Pesticides Management covers most of the aspects important for the sound pesticides stocks handling and management and is generally useful for two target groups: institutions managing obsolete pesticides and professionals having direct contact with the obsolete pesticides. It consists of six thematic chapters:

1. *International treaties and national legislation in the area of pesticides management*

The chapter outlines most of the international treaties that contain provisions linked with obsolete and POPs pesticides. The conventions that are directly dedicated to this issue are well explained in order to emphasize the necessity for national action for their provisions implementation. Furthermore, the Handbook gives an overview of the national legislation in the field of pesticides and waste management as well as table with the institutions that are involved in the process of obsolete and POPs pesticides management.

2. *General information and potential POPs hazards*

This chapter gives information on general POPs characteristics, brief POPs background and explains POPs application. At the same time the chapter also offers detailed information about the POPs impacts on humans and environment to the stakeholders. The chapter ends with the question: "Do the POPs cause cancer?"

3.Identification and monitoring

This chapter is the most important part of the Handbook. It gives systematic and detailed information, descriptions and recommendations for the sound identification, inventory and monitoring of the obsolete and POPs pesticides. It starts with the specific country information to be introduced in the inventory and continues with the FAO Pesticides Stocks Management System (PSMS). Due to the fact that the project "Capacity Building on Obsolete and POPs Pesticides in EECCA countries" has given opportunity to the Macedonian institutions familiar with obsolete pesticides management to work on PSMS for the first time, the detailed explanation for all PSMS steps is a major part of the Handbook: inventory preparation, soil samples, procedure for laboratory analysis, data basis (PSMS), PSMS functioning, data on storage/location, risk analysis, data on pesticides, PSMS feedback.

With special attention an issue of obsolete pesticides labeling is approached. This issue also touches the packing, storage and final waste pesticides elimination.

The chapter gives instructions to be used in process on contaminated site monitoring including sites inventory, risk assessment, analysis in order to assess the contamination extend. The chapter ends with the scheme for procedures for contaminated sites monitoring.

4cPOPs = 4.POPs Management

The POPs Unit in Macedonia has significant experience in field of POPs management, especially handling and management of the equipment and sites contaminated with POPs. In order to transmit the experience to the other stakeholders and to apply in the cases of other obsolete pesticides and locations contaminated with obsolete pesticides, a chapter on POPs management was provided within the Handbook. It covers all necessary stages for the POPs management and covering all stages of their life-cycle. The additional reason for including a special POPs chapter within the Handbook is the fact that there is still no evidence of obsolete pesticides stocks presence in the country (historical and contemporary), expect HCH-waste hot spot in Skopje. It is therefore foreseen that it will be useful for the stakeholders in their activities on POPs stocks identification and management.

5.Obsolete Pesticides Management

Obsolete pesticides management was developed with special attention to help farmers and other stakeholder that are exposed to the pesticides adverse effects to protect themselves and other population that could be impacted by the pesticides and environment. Despite the general review of the key elements in the obsolete pesticides handling, it covers advices how to meet the recommendations of the best practices for transport, reloading and repacking of the obsolete pesticides. The chapter gives detailed information about pathways for exposure to the obsolete pesticides adverse effects. In addition to the disposure items the personal protective equipment is listed and explained.

6.Emergency situations and cleaning

In order the Handbook to cover all relevant aspects linked with the obsolete and POPs pesticides handling and management, a chapter on emergency situations and cleaning was added. It covers incidents that may occur due to the impropriate obsolete and POPs pesticides management. The accidents/explosions involving obsolete and POPs pesticides are followed by the recommendation on how to proceed in case of such an event.

COMMUNICATION WITH STAKEHOLDERS

Workshop on Obsolete and POPs Pesticides Inventory

In accordance with the micro-project time frame on 4th July 2011 a Workshop on Obsolete and POPs Pesticides Inventory was organized. Representatives from 15 companies engaged in the process of pesticides trade and application were invited to participate in the workshop. Some of them were already introduced with the project objectives and activities during the visits made in the frameworks of the inventory micro-project.

The workshop agenda was divided in two parts:

- *Introductory issues*

Project on Capacity Building on Obsolete and POPs Pesticides in EECCA countries – activities in the Republic of Macedonia

The overall project activities, results to be achieved through its implementation, were explained to the participants. Special accent was put on the previous activities realized in Macedonia in the frame of the project (inventory workshop and pilot project). It was interesting that some of the participants (for instance representatives from OHIS, Skopje) had opportunity to be direct actors in the previous project activities and they shared their experiences with other stakeholders present.

The presentations on national legislation in the field of pesticides and waste management were given in two parts: national legislation in the field of pesticides management, presented by the representative from the Phytosanitary Administration and national legislation for waste management (presented by the representative from the Department for Waste Management under the Ministry of Environment and Physical Planning). It was a good opportunity for the participants to be introduced to the national legislation that covers all stages in the pesticides life-cycle. Also, the colleague from the Department for Waste Management shared his experiences gained during the training of obsolete pesticides repacking (Belarus) with the participants.

Due to the fact that the main reason for treatment of the obsolete and POPs pesticides stocks is their impacts on the human health and environment, a presentation that gives details about the hazardous characteristics of the obsolete and POPs pesticides, UN hazard classification, exposure pathways, specific risks to the human health and environment was given. The presentation was supported by information on the previous experieces in the field of POPs management in Macedonia.

- *Obsolete and POPs stocks management*

Starting from May 2011 the inspectors from the State Environnmental Inspection have undertaken activities for obsolete pesticides inventory. The results and experience that they gained during the inventory process were presented in the first part of the stricktly dedicated part of the workshop. Also, they stressed that throughout the overall inventory activities the FAO PSMS forms were used for evidence of the stocks quantities.

Some general data on the procedure for obsolete pesticides inventory were given in order to facilitate the acceptance of the detailed information that were completely new for some of the companies. The presentation was simple summaries of most of the action to be undertaken for the sound obsolete pesticides inventory.

At the same time a detailed presentation on personal protective equipment (PPE) was explained to the participants, including all sorts of reccomendations in sense of available types of personal protective equipment, application of the equipment, management of the waste equipment and PPE selection in accordance to the level of protection.

One of the most important issues that was approached with the special attention was FAO Pesticides Stocks Management System. The presentation gave detailed description of the system and data, information, photos, etc that are necessary to be collected in order to fill all the records requested in the system.

At the end of the workshop the environmental inspector presented the current data on the obsolete and POPs pesticides inventory process in Macedonia.

Permanent communication with the stakeholders

The working group consisted of representatives of the Ministry of Environment and Physical Planning and the Ministry of Agriculture, Forestry and Water Economy together with consultants, who has permanent contact with the stakeholders, especially those that are directly covered by the inventory activities. The leaflets that were prepared at the early stage of the public awareness micro project have been dissminated among the stakeholders in order to give them initial precausions and recommendations on how to protect themselves while handling obsolete and POPs pesticides. Each held company visit or separate meeting with stakeholdes, has been used to explain their obligations to the legislation or to inform about reccomendations given by the international experts, which should be applied in the everyday practice for sound obsolete and POPs pesticides management. Also, the FAO PSMS forms are recognized as good approaches that facilitate the obsolete pesticides evidence. It is worth mentioned that the stakeholders expresses interest to adjust their work to the newly introduced procedures and to participate actively in the overall national action on obsolete pesticides generation prevention and control and management in the sound manner.

INSTEAD OF CONCLUSIONS FUTURE ACTIVITIES FOR PUBLIC AWARENESS IN MACEDONIA

Workshop on Obsolete and POPs Pesticides Inventory

The second workshop on obsolete and POPs pesticides inventory will be organized in the period September – October 2011 for the companies in the Kavadarci region, where significant amount of pesticides was identified. Despite the representatives from the directly involved company in Kavadarci, the representatives from other companies and farmers in the region are going to be invited to participate in the workshop too. The workshop themes will be similar to the topics covered by the Skopje event. The themes are mainly dedicated to the characteristics of harmful pesticides, obligations of the authorities and concerned stakeholders regarding the national and international legislation on POPs and other dangerous chemicals, health aspects of obsolete pesticides, PPE - proper use and occasion, when they should be used.

In the period between the two workshops the members of the working group on obsolete and POPs pesticides inventory and public awareness will use each opportunity to inform stakeholders of proper handling and management of obsolete and POPs pesticides. It gives the opportunity to establish permanent improvement of the communication among responsible institutions and directly involved stakeholders (trading companies, farmers, etc.). Further it gives the opportunity to cooperation among all mentioned stakeholders towards long-term sustainability for sound obsolete and POPs pesticides management in the country and certain aspects of good agricultural practices.

The previous experience showed that it is crucial to extend the list of stakeholders to take part in the national public awareness campaign on obsolete and POPs pesticides management. The important actors are local self-government representatives. They should be involved in the future trainings and made prepared to share the information on the local level, especially among the farmers in the rural areas.

Another target group that should be considered is students from the secondary vocational schools. The first step should be training of the trainers (professors) and inclusion of the pesticides management in the secondary vocational schools curriculum. It will contribute to sharing information and data linked with the sound obsolete and POPs pesticides in the early stage of education of the future agricultural professionals.

As a final conclusion, it could be stated that the project Capacity Building on Obsolete and POPs Pesticides in EECCA countries was an excellent starting point to create awareness among most of the stakeholders about the need for raising awareness in the sense of obsolete and POPs pesticides management that should be developed in the permanent national campaign for prevention and management of the hazardous obsolete pesticides stocks.

INVENTORY ACTIVITIES ON OBSOLETE PESTICIDES IN THE REPUBLIC OF MACEDONIA

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Abstract

Macedonia was actively involved in the POPs Elimination and reduction activities since its first POPs Enabling Project (2002), through the development of the NIP and Post NIP activities. The POPs Unit is strongly committed to full implementation of the action plans dedicated to POPs pesticides and the remaining obsolete stocks.

The Regional Project "Capacity Building on obsolete pesticides in the EECCA Region" was an additional opportunity for the POPs Unit to undertake additional steps towards proper and sound management of obsolete pesticides in the country.

As a part of the Regional project the Inventory Training Workshop and Pilot Inventory Project was organized in Macedonia, where the countries from the Region were invited to be trained for the inventory works.

In the frames of the Micro support project for inventory works, the POPs Unit started with the pilot inventory focusing on the initial locations of obsolete pesticides that are previously reported.

According to the preliminary data provided by the Phytosanitary administration, on the stocks of obsolete pesticides, the POPs Unit together with the Macedonian responsible institutions have identified 10 locations where the obsolete pesticides were stored.

In general all the locations are possessed by the private companies dealing/trading with pesticides. The initial visits were organized to define the real situation and to determine the conditions under which the pesticides are stored.

A special PPE was provided for all involved persons present at the onsite visits to avoid any exposure to the harmful effects of the OPs.

In the course of the Micro support project, the POPs Unit prepared a Handbook/Manual for proper management and safe handling with OPs. It is dedicated to the professionals that are handling OPs.

Inventory forms provided by FAO were used for introducing the newly obtained data at the onsite visits. It was also planned according to the FAO instructions to use the access to the global PSMS to include all relevant inventory data and at the same time Macedonia to become part of the global system for data management OPs.

Key words: obsolete pesticides, persistent organic pollutants, inventory, companies, PSMS, temporary storage

Introduction

Since 2002, when the Republic of Macedonia signed the Stockholm Convention, Macedonia has been very active in the implementation of different projects dedicated to POPs elimination and reduction.

According to the first document that was developed in the frames of the Enabling activities project, the National Implementation Plan on POPs, there was no official statistical data about the obsolete pesticides in Macedonia. The only available data was obtained from the customs administration containing precise data of imported/ exported quantities of pesticides.

It was concluded that POPs pesticides were present in the daily practice were seldom, and most of them were banned in early '80s. Only DDT was the most common POPs pesticide used in the country, mainly for malaria disease control.

Historical problem of OHIS- HCH (α, β, δ) technical mixture waste

The problem that exists in the country for a longer period (since 1970's-up to now) is the extremely big quantity of HCH waste (α, β, δ-app38.000tones) stored in the OHIS factory. Although it was not initially listed among the POPs chemicals, it was considered as very important to be mentioned in the NIP on POPs. After many efforts of the Ministry of Environment and its POPs Unit to provide financial support nationally and internationally, a conceptual design was prepared to compare several feasibility studies that were developed in the past. According to this conceptual design a project proposal for the pilot clean-up activities in OHIS was prepared and submitted to GEF. Hopefully it will start, as soon as the funds become available. All the activities for finding proper solution were coordinated by the POPs Unit under the Ministry of Environment and Physical Planning.

Initial activities for obsolete pesticides in the country

In the period 2004-2010, according to the NIP action plans, the POPs Unit worked on collecting more information on obsolete stocks of pesticides.

In this period the Republic of Macedonia became a partner country in the Regional Project "Capacity Building on obsolete and POPs pesticides in the EECCA Region". It was very important and a significant support for the POPs Unit to undertake additional steps towards proper and sound management of obsolete pesticides in the country. The primary objective of the project on Capacity Building on Obsolete and POPs Pesticides in EECCA countries is the reduction of pesticide releases into the environment and elimination of human health and environmental threat they pose in EECCA countries. In the frames of this Regional project, representatives from the involved institutions were trained on different issues, such as raising awareness, inventory, identification, repackaging, PSMS (Pesticides Stocks Management System).

Preparatory Activities under the Micro support project for inventory works

In addition, in the course of the mentioned Regional project, Macedonia received Micro financial support for inventory works and parallel with it, additional support for awareness raising on obsolete pesticides. Both micro projects were financed by GEF/FAO through Green Cross Switzerland as an executing agency. The preparatory activities for the inventory works started in December 2010. Thanks to the collaboration with the Phitosanitary Administration under the Ministry of Agriculture, Forestry and Water Economy and the State inspectorate under the Ministry of Environment, the POPs Unit prepared a preliminary list of registered obsolete stocks of pesticides.

Having in mind that these data were collected in 2006, the POPs Unit under the Ministry of Environment and Physical Planning has started the actions on OPs inventory to inspect the current situation on site in the above mentioned companies (10) in Central and Southern parts of the country. The State Environmental Inspectorate following the preliminary data on OPs (Annex 1) undertook the obligation to visit all the listed companies to collect basic information. Although, most of the companies are situated in the vicinity of Skopje, the inventory works were planned to take place in two different regions in the country that apply different pesticides.

There was an evidence provided by the State Environmental Inspectorate and Agricultural Inspectorate that approx. 20'000 l OPs herbicide are stored in the premises of the company Angro Promet in Kavadarci. The Kavadarci location was chosen as a pilot location for starting the inventory and the awareness raising activities at the same time.

Pilot Inventory activities in Macedonia

In the frames of the Micro support project for inventory works, the POPs Unit started with the pilot inventory focusing on the initial locations of obsolete pesticides that are previously reported.

The Pilot Inventory was planned to be implemented within a period of three months Mid June, 2011- Mid September, 2011. However, few months before this date the preparatory activities started and contributed to more comprehensive and complete inventory works.

All the companies listed in the preliminary data (10 companies), were separately visited. All safety measures for protection of the inspectors were undertaken. A special PPE was provided for all involved persons present at the onsite visits to avoid any exposure to the harmful effects of the OPs.

Figures 1&2. On site visits

In May 2011, the inspectorate visited the site at Angropromet and found out that since 2006 many barrels were damaged and leached and also lot of them were stolen as the location was not properly fenced and protected from unauthorized access. So the quantity is reduced, app.60 barrels in total.

Figures 3&4.-Angropromet, Kavadarci

Figures 5, 6. - Improper storage of herbicides in Angropromet, Kavadarci




Figures 7, 8, 9, 10. OHIS site- 220 drums of unknown pesticides, empty containers

In addition, several on site visits of the other companies that were included in this pilot inventory, showed some new findings, as follows:

The company Hromos pesticidi does not possess obsolete pesticides, but expressed their deep concern regarding the waste from pesticides packaging. App. 22m ^{3} are stored in the separate storage in Hromos pesticide's warehouse. This is an issue that the country should pay much more attention on in the future, as there are still no appropriate facilities for temporary storage and treatment of the empty containers.


Figures11&12.Hromos pesticidi- burden of empty containers of pesticides, Skopje


Figures 13&14. –Radomak, Skopje-outdated and properly stored

In the frames of this pilot inventory, several other city regions (Bitola, Gevgelija, Kumanovo, Ohrid and Strumica) were visited to confirm if there were some other quantities that were not previously evidenced in the preliminary data.

According to these visits, only in Strumica were found some quantities of obsolete pesticides (438 liters and 1580 kg).

All data collected in the period of the project duration will be summarized and introduced in the PSMS. The PSMS set-up is available for the country, and there are nominated and trained persons, who will be responsible for introducing data.

In the course of the Micro support project, the POPs Unit prepared a Handbook/Manual for proper management and safe handling with OPs. It is dedicated to the professionals that are handling the OPs.

Figure 11. Handbook/Manual for proper management and safe handling with OPs

What will happen with inventorised stocks?

The inventoried stocks of obsolete pesticides will be collected, temporary stored and disposed in an environmentally sound manner.

According to the EECCA Project plan, the obsolete pesticides management plan will be developed as well as disposal plan. The document will contain a special action plan which will contain all activities linked with the OPs management. In that context the activities for OPs disposal will be described.

Conclusion

The Micro support project on Inventory of Obsolete Pesticides is an excellent occasion to bring the new approach in keeping data and evidence on OPs.

It also increases the responsibility among the directly involved institutions, trading companies and decision makers and their willingness to contribute towards proper management with obsolete pesticides, reduction of the newly generated obsolete stocks of pesticides, etc.

These activities on proper inventory will allow the country to strengthen capacities and undertake further measures for environmentally sound collection, storage and disposal of obsolete pesticides as well as minimizing new stocks of obsolete pesticides.

Annex1 Preliminary data on OPs in Macedonia (2006)

Commercial pesticide name	Company	Location	Quantity (l or kg)	
			Liquid (l)	Solid (kg)
PROHELAT-T	Herbos	Skopje	9209	
ATRANEX	Magan Mak	Skopje	1882	
MITIGAN	Magan Mak	Skopje	701	
BAYLOZED	AGROJUNIKOM	Skopje		182,3
FENITROZED	AGROJUNIKOM	Skopje	326	
ELISA	AGROJUNIKOM	Skopje	66	
GALOLIN KOMBI	AGROJUNIKOM	Skopje	1104	
FORMULA	AGROJUNIKOM	Skopje	496	
TRIKEPIN	AGROJUNIKOM	Skopje	424	
ETIOL	AGROHEMIJA KOMERC	Skopje	2042	
GALATION G-5	AGROHEMIJA KOMERC	Skopje		35857
TETETON	HERBA HEM	Skopje		25059
BEVEMIL	HERBA HEM	Skopje		10354
BEVETICID	HERBA HEM	Skopje	35	
BEVEMILEKS	HERBA HEM	Skopje	187,9	
BEVERINOL	HERBA HEM	Skopje	394,2	
DAST OIL NEW	HERBA HEM	Skopje	4648,2	560
MEFENACET	AGROHEMIJA	Skopje		
OHISTION	OHIS AD	Skopje		8000
OHIS BAYCID	OHIS AD	Skopje	1200	
ZINEB S-65	OHIS AD	Skopje		260
BENOMIL	OHIS AD	Skopje		2720
ZINEB	OHIS AD	Skopje		2690
SAPROL	OHIS AD	Skopje	2640	
RIDOSAN	OHIS AD	Skopje		8220
ASODIN	OHIS AD	Skopje		3810
AGROCID	OHIS AD	Skopje		1380
AGROCID OLEO	OHIS AD	Skopje	12140	
AGROLUX	OHIS AD	Skopje	1680	
METOAT	OHIS AD	Skopje	6220	
TERBUFOS	OHIS AD	Skopje		11200
FASTACID	OHIS AD	Skopje	1040	
FLURALIN	OHIS AD	Skopje	6435	
PROMETRIN	OHIS AD	Skopje		11360
FENITROTION(active material stocks)	OHIS AD	Skopje		230
MALATION (active material stocks)	OHIS AD	Skopje		100
FENTION (active material stocks)	OHIS AD	Skopje		10174
TREFLAN EC	Radomak	Skopje	550	
STAM F 34	AGROPIN	Skopje	6405	
FACIRON FORTE	ALGINA	Skopje		639,5
FACIRON	ALGINA	Skopje	357,2	
KOFUMIN	ALGINA	Skopje	1586	
		TOTAL	**61768.5**	**132795.8**
Dicrophos ($C_8H_{16}NO_5P$)	ANGROPROMET	Kavadarci		
Mecarbam ($C_{10}H_{20}NO_5PS_2$),	ANGROPROMET	Kavadarci		
Tri-allate ($C_{10}H_{17}Cl_2NOS$	ANGROPROMET	Kavadarci		
		TOTAL	**≈20.000lit**	

Annex 2. Current findings in the frames of the pilot inventory

	Type	Pack Unit	Qty	Liters	Kg
Radomak					
Radazin A5	Herbicide	5Liters	58	290	
Zlatica Ofunak	Insecticide	1kg	70		70
Anvil A-100		100gr	105		1050
Imidan C50 A-1200	Insecticide	1200gr	4		4.8
Karatan A-900	Fungicide	gr	19		17.1
Venturin A -1		litres	16	16	
Falcon- Kuklis, Strumica					
MAGNESIUM HELAT	fertilizer	1 liter	3	3	
FEROHELAT	fertilizer	200grams	2		0.4
FERTLISER	liquid fertilizer	1liter	2	2	
SLAVOL	liquid fertilizer	250ml	2	0.5	
MERLIN	Herbicide	100grams	4		0.4
GLIFPIN	Herbicide	100grams	1		0.1
TOUCHDOWN	Herbicide	0,3grams	3		0.0009
FUZALEJ	Herbicide	0,1	1		0.0001
BAYCOR	Fungicide	100grams	19		1.9
PASTA KAFARO	Fungicide	1liter	4	4	
LITAN M45	Fungicide	500grams	6		3
KOCPIN	Fungicide	500grams	4		2
POLIRAM	Fungicide	4kg	1		4
CUPRABLAU	Fungicide	0,035gr	13		0.00045
CIBAK	Fungicide	1kg	1		1
BLAVIT	Fungicide	1kg	1		1
KAPTAN	Fungicide	1kg	1		1
CIMOFOR	Fungicide	0,3grams	9		0.027
BAYLETON	Fungicide	0,1grams	2		0.0002
VINER	Fungicide	0,3grams	2		0.0006
OLIMP	Fungicide	0,1grams	1		0.0001
TUBERIT	Fungicide	0,1grams	3		0.0003
DITAN	Fungicide	0,1grams	11		0.0011
KOSAN	Fungicide	1kg	1		1
ANTRAKOL	Fungicide	0,1grams	1		0.0001
TILT	Fungicide	litre	2	2	
HROMOREL	insecticide	litre	1	1	
ABEMEKTIN	insecticide	0,1	3		0.0003
CONFIDOR	insecticide	0,01	3		0.00003
Agrohemija comerce					
Bordovska corba VP	Fungicide	a-1kg	286		286
Bakar oksihlorid	Fungicide	a-1kg	52		52
Bakarna krec		a-1kg	10		10
Kaptan		a-1lit	298	298	

Kaptan		a-0.25lit	427	106.75	
Kosan	Fungicide	a-1kg	154		154
Mankogal C	Fungicide	a-0.2kg	50		10
Mankogal 80	Fungicide	a-0.25kg	686		171.5
Mankogal C	Fungicide	a-1kg	8		8
Galition	Insecticide	a-1kg	54		544
Etiol parf.prav	Insecticide	a-0.2kg	24		4.8
Vetiol prav	Insecticide	a-0.2kg	1368		273.6
Vetiol liquid	Insecticide	a-0.1kg	15		1.5
Cineb	Fungicide	a-1kg	20		20
Cineb	Fungicide	a-0.5kg	18		9
Ciram	Fungicide	a-0.25kg	40		10
Phosphamid		a-0.2lit	88	17.6	
Galmin		a-0.3lit	13	3.9	
Hromos pesticidi					
Liquids rinsing solutions and conc.solutions				3000	
Liquid sludge				300	
Solid waste containing hazardous substances					$10m^3$
Obsolete pesticides packagings					$10\ m^3$
Contaminated Absorbents, filters, wiping material, protective equipment					$0.15\ m^3$
Paper and cardborad					$2\ m^3$
Angropromet,Kavadarci					
Dicrophos ($C_8H_{16}NO_5P$)	Herbicide				
Mecarbam ($C_{10}H_{20}NO_5PS_2$),	Herbicide				
Tri-allate ($C_{10}H_{17}Cl_2NOS$	Herbicide				
Total		100litres	60	6,000	
OHIS doo Skopje					
OHISTION					8,000
OHIS BAYCID				1,200	
ZINEB S-65					260
BENOMIL					2,720
ZINEB					2,690
SAPROL				2,640	
RIDOSAN					8,220
ASODIN					3,810
AGROCID					1,380
AGROCID OLEO				12,140	
AGROLUX				1,680	
METOAT				6,220	
TERBUFOS					11,200
FASTACID				1,040	
FLURALIN				6,435	

PROMETRIN					11,360
FENITROTION(active material stocks)					230
MALATION (active material stocks)					100
FENTION (active material stocks)					10,174
TOTAL				**41,399.75 Liters**	**62,856.13kg +22.15**m^3 waste

OBSOLETE PESTICIDES INVENTORY AND PUBLIC AWARENESS RISING ACTIVITIES IN SOME REGIONS OF GEORGIA

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Abstract

Problem statement/background information

Pollution of the environment by wastes and chemicals is one of the serious environmental issues in Georgia. POPs pesticides started accumulating in Georgia during early 1970s due to the oversupply of pesticides as a result of the former planned economy system. The obsolete pesticide collection during 70s and 80s was not extended to minor warehouses. The obsolete agrochemicals, especially pesticides, left on country's territory after the breakdown of the USSR in big amounts: around 2700 tonnes of hazardous chemicals are located in the damaged waste-burial pit at Iagluja hill. Part of obsolete pesticides was left on territories of former storehouses of kolkhozes and sovkhozes all over Georgia. The pesticides are mixed together, and possible labels are not usually illegible. Georgia with its own resources and donor (Dutch) assistance was able to start collection of non-soil mixed pesticides at purposefully built storage; Obsolete pesticide stockpiles were sampled and analyzed during the POPs Enabling Activity project. Part of the reported obsolete pesticides (about 230 tones) has been collected, packed and temporarily stored at Iagluja waste-burial pit together with up to 600 tones of the pesticide contaminated soil. Currently dumpsite is in a very bad condition: the territory has no fencing, drainage ditches are not operational and grazing animals have free access to the territory and pesticide stockpiles. In 2003-2007, Government of Georgia with assistance of GEF/UNDP developed a draft National Implementation Plan for the implementation of POPs Stockholm convention, which was adopted in 2011 by the Order of the Government of Georgia (N 907; 21.04.2011). One of the top priorities of NIP is reduction of releases of POPs pesticides. The Inventory of POPs-pesticides is defined as the first activity of the action Plan under this target. Moreover this issue is in line with draft NEAP 2 document (Target 2: Reducing environmental pollution from accumulated wastes). In 2009 the Ministry of Agriculture conducted preliminary survey of obsolete pesticides in the regions. The questioners were developed according to FAO requirements. Based on the results of preliminary survey identified 18 sites in 4 regions of Georgia were obsolete pesticides, obsolete agrochemicals and unknown mix of substances were find out in the territories of former storehouses of kolkhozes and sovkhozes. As to the legislation framework POPs control is an integral part of regulating hazardous chemicals, pesticides and agrochemicals. In spite of some government and donor funding available for safe disposal of POPs pesticides there is still lack of needed funding for these purposes.The overall objective is safety disposal of containment of accumulated obsolete pesticides in some regions of Georgia. This will result in the improvement of environmental conditions in the regions of Georgia and elimination of negative impact on human health.

Expected Results

The following results are expected to be achieved:

- Detail inventory of volumes and distribution of obsolete pesticides in 18 sites of 4 regions of Georgia.
- Collection, packaging and storing of reported POPs according to the international standards.
- Improvement of the environmental and living conditions of population in the regions of Georgia (obsolete pesticides surrounding territories).

The principal stakeholders in inventory process are the Ministry of Environment Protection

(MoE), Ministry of Agriculture (MoA) and Local municipalities.

MoE and MoA will be coordinating and implementing/executing institutions.

Local municipalities in whose territories obsolete pesticides stockpiles are located are principal project partners as they will be directly involved in the project implementation.

Public awareness campaign is planed to be conducted by joint group of relevant professionals before starting the inventory activities in identified regions. During the project all local governors, central government officials, media and civil sector was informed about proposed inventory process and the danger residing throughout country. Top reaching awareness rising campaign will covered by TV news, Newspaper front pages and overall mass communication channels. A photo art exhibition “POPs the Real Danger” will be organised.

Conclusion: Realization of inventory of absolute POPs activity and appropriate public awareness rasing activities will support minimization of negative environmental and health impacts of obsolete pesticide stockpiles in some regions of Georgia. Moreover this will develop strong theoretical and practical background for inventory of volumes and distribution of obsolete pesticides. It will support to gain experience in collection, packaging and storing of reported POPs and OPs according to the international standards. Clearly defined goal and public awareness raising strategy, strong desire to deliver the exact information, wide and tough contacts on all levels of society will be established.

PSMS – BELARUSIAN EXPERIENCE

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Abstract

In frames of the GEF/FAO EECCA project a Pilot Project on obsolete pesticides repackaging was held in Belarus.One of the major stages of this project was the inventory of OPs, systematization and assessment of the data. For data systematization and assessment received in the course of inventory in Belarus there was used an application, PSMS, that was developed by the Food and Agriculture Organization of the United Nations (FAO) to be used by countries to record and monitor their inventories of pesticides and their usage.

Practical training on PSMS usage was held in the frames of the GEF/FAO EECCA project. Belarus, as well as other participating countries, was granted access to the PSMS data base. The training was held with the usage of real inventory data, which simplified greatly further work with this information.

Entering the data into PSMS allowed to clearly and promptly identify gaps in the inventory and rapidly solve the identified problems.

The work on entering inventory data into PSMS has not finished yet. Experience gained during the EECCA Pilot Project on obsolete pesticides repackaging in the Vitebsk oblast of Belarus will be the basis for the future activities on the OPs environmental impact reduction. Creation of a full, easy to use OPs database on the basis of the PSMS application will allow objective assessment of the situation in Belarus, identify the most burning, highest priority tasks.

It is important to remember that today we are solving the problems which might not have existed if there had been competent pesticides stock management in the past. Using today the PSMS application in the pesticide accounting used in agriculture will allow optimizing pesticides stock management.

Our future and the future of our children is decided upon today. We should remember this and put all the effort for our ancestors not to solve the same questions with which we are dealing today.

Key words: Pesticides Stock Management System (PSMS), inventory, repackaging, obsolete pesticides, inventory forms, EECCA project

Contents:

Introduction

In frames of the GEF/FAO project "Capacity building on obsolete and POPs-pesticides in Eastern European, Caucasus and Central Asian countries" there was held a Pilot Project on obsolete pesticides repackaging in Belarus. One of the major stages of this project was the inventory of OPs, systematization and assessment of the data using the application PSMS, that was developed by the Food and Agriculture Organization of the United Nations (FAO) to be used by countries to record and monitor the results of pesticides inventories and their usage.

Inventory of the storages with obsolete pesticides

When planning the activities on inventory and repackaging of obsolete pesticides the data received during the previous national inventory was taken as the basis. The work was a bit easier as all the obsolete pesticides were traced, sites of their storage, quantities and responsible for their storage people were known. However, the data of the national inventory was insufficient for the planning of the repackaging activities. In October 2010 by specialists of the State inspections of seed production together with an expert from the EECCA project there was held an inventory of obsolete pesticides stocks in Vitebsk oblast. Though after the inventory there was sufficient information on location and construction of the storages, quantity of pesticides and their physical state (liquid, solid or paste) the question on pesticide identification remained unsolved, as the majority of materials to be repackaged were not in their original packaging. Most of the preserved containers were in bad state and had only partial information on them.

Considering a very big part of unidentified pesticides samples were taken at each of the storages. Firsthand pesticides were sorted by their appearance (similar packaging, form and colour). Then they were marked and from the general homogeneous amount was taken an averaged sample. Further on the samples were identified in the control-toxicology laboratory of the Main state inspectorate for seed production, quarantine and plant protection. For identification of active ingredients of the pesticides there was used a method of mass chromatography with mass detection. Additionally to supplement the missing on the labels information was used a reference book “Chemical materials for plant protection” published in 1979 by the USSR State committee on production and technical support to agriculture.

Training on PSMS

After the works on inventory were finished it was planned to hold a training on PSMS. Specialists working on the inventory took up the roles of consultants and validators as they could assess the correctness of the information entered by the participants into PSMS. Usage in the practical part of the training of real inventory forms and inventory data was really useful. Participants could work with the forms that were filled in during real inventory activities, so they could see all the difficulties that they might come across when entering the data into PSMS.

One of the difficulties working with the forms was safety provision. Though all the rules of personal protection were observed and contact of the filled in forms with obsolete pesticides was limited to the maximum, some of the forms still had the specific pesticide smell, which pointed to pesticide contamination of the forms. To reduce the impact of obsolete pesticides on people the forms were put into separate files and before that the work with them was carried out only in protective equipment.

Simple and comprehensible interface of the PSMS application helped in its quick mastering. The fact that during the inventory were used the forms from the PSMS data based simplified data entry and minimized possibility for a mistake.

Each country-participant of the training was granted access to PSMS. From Belarus participated two representatives: one from the Ministry of Agriculture and Food and the other from the Ministry of Natural Resources and Environmental Protection, and they both received their own access codes. Joint participation of the representatives from the two Ministries in the EECCA workshop allowed already on the stage of theoretical training to discuss many issues of further collaboration, organize joint meetings on the organization of the pilot project on repackaging and make mutual decisions on financing of future activities.

Data entry into PSMS

After the training Belarusian specialists needed to enter the inventory data into PSMS. The works on data entry were carried out in close collaboration of Belarusian specialists with experts of the EECCA project. After all the data was entered into the system it was possible to fully appreciate the program. The necessity to enter into the program photos of the storages, immediate environment, obsolete pesticide position inside the storage allowed to visually assess the situation on site and later on during monitoring of the sites note the changes. The interface of the program provides placement of scanned inventory forms copies which is also very convenient.

Each storage had its inventory form and the work with paper forms was minimized. They were used only to capture information and to make scanned copies after which were placed for storage. Into the system was also put information on pesticide placement in the storage, pesticide names, results on identification and a lot of other information necessary for planning of the obsolete pesticides repackaging. Simplicity and similarity of the PSMS interface to the inventory forms allowed quick training of the personnel on work in the system.

Resources of the program allowed assessing the most problematic storages with obsolete pesticides, determine the risk factors of influence on the environment and public health. It also helped with estimating the necessary amount of materials for repackaging and planning the activities on preparing the working areas for repackaging. Some obsolete pesticides storages were located in hard to reach areas and repackaging presumed preparatory works on organizing secure road access.

Experience gained during the work with inventory data of the Vitebsk oblast obsolete pesticides will be used in planning repackaging activities in Minsk and Grodno oblasts of Belarus.

Possibilities of PSMS application

When entering the obsolete pesticides inventory data and further work with databases in PSMS Belarusian specialists noted simplicity of the system and its effectiveness in systemizing the data. Belarus adheres to a very strict approach when dealing with ecological problems and creating of a safe environment for human health and life is one of the country's priorities.

However, when solving the problems with obsolete pesticides that were accumulated during the Soviet era, it is important not to forget that pesticides are applied in agriculture nowadays as well. Shortcomings in pesticide registration and monitoring lead to creation of new obsolete pesticides stockpiles in the future. Reasons for their accumulation can be different. Especially relevant they are for fungicide and insecticide preparations, the usage of which is directly connected to the phytosanitary situation in the oblast of their application. Belarus seeks to modernize pesticide control and registration system. Integrational policy of the country seeks to introduce other countries' experience.

PSMS is of great interest for usage in the agricultural and plant protection chemicals (pesticides) production fields. Participation of the Republic of Belarus in the EECCA project allowed the country to globally assess the problem of pesticides and to start making decisions contributing to their risk reduction for the next generations.

EXPERIENCE ON PILOT PROJECT ON REPACKAGING OF OBSOLETE PESTICIDES IN BELARUS

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Abstract

In the framework of the international GEF-FAO Project *Capacity Building on Obsolete and POPs Pesticides in EECCA Countries,* a training workshop was held as part of a pilot project for the repackaging of obsolete pesticides in Belarus. The main aim of this event was to teach specialists from the Ministries of Environmental Protection, Agriculture and Emergencies of seven attending Eastern European, Central Asian and Caucasus countries (Armenia, Azerbaijan, Belarus, Georgia, Macedonia, Romania and Russia) the methods of safe pesticides repackaging according to internationally recommended standards. During the 20-day training workshop, 16 participants were introduced into the theoretical basis of the repackaging methodology according to UN FAO guidelines as well as conducting a practical training course within which 25 tonnes of obsolete pesticides were repackaged under the supervision of international experts. In June-August of 2011, it is planned to complete repackaging of the 120 tonnes of obsolete pesticides remaining in the stores of the Belarus Ministry of Agriculture. The work will be carried out under the direct supervision of 4 Belarusian participants trained during the pilot project. We would like to share some of the lessons learned during this p tonnes project.

The most important primary requirement is to conduct a competent and detailed inventory, without which it is impossible to start repackaging. Without proper inventory, it is difficult to order appropriate repackaging materials and the health and safety of repackaging teams is potentially put at risk if materials are not identified correctly.

The following steps are considered vital in the actual repackaging process:

- Preparatory stage: Inventory, Planning and coordination with the responsible Ministry and at regional and local levels, providing necessary materials and equipment (purchase, custom clearance and delivery to particular sites).
- Involvement of highly motivated professional staff for training and practical field work.
- Implementation of pilot repackaging (planning, management, coordination and collaboration).
- Detailed analysis and reflex with participants, recommendations for further repackaging.
- Lessons learned.

Key words: Pesticides, obsolete pesticides, POP, DDT, repackaging, training, UN standards, pilot project, FAO, EECCA, Belarus, risk, safety, storing, disposal

Introduction

The EECCA project is aimed at "Capacity building on obsolete and POPs-pesticides in Eastern European, Caucasus and Central Asian countries". The Project is being held since 2009 in collaboration with GEF, FAO, Green Cross, International HCH & Pesticides Association and Milieukontakt International. The final goal of the Project is to achieve a greater awareness of the danger of obsolete pesticides and to increase capacity to manage, dispose of and prevent obsolete pesticides and POPs stockpiles. In addition, the Project facilitates information exchange and cooperation between participating countries, as well as stimulates a systematic involvement of a wide range of stakeholders.

Information on the Pilot Project

One of the main objectives of the Project is conducting Pilot Projects in EECCA countries, in the course of which participants from these countries are trained theoretically and then have an opportunity to put their knowledge into practice in accordance with up-to-date international standards. In May-June 2011 in the framework of the EECCA project a training course was held as part of a pilot scheme regarding the repackaging of obsolete pesticides in Belarus. The major aim of the event was to train specialists from the Ministries of Agriculture and Emergencies of the seven participating countries in the methods of safe pesticide repackaging. 14 representatives from Armenia, Azerbaijan, Belarus, Georgia, Macedonia, Romania and Russia took part in the project.

The Pilot Project (PP) consisted of the following stages:

1. Preparatory stage: inventory, planning, coordination, equipment and material procurement;
2. Training of the international team on the methods of safe repackaging of obsolete pesticides according to FAO UN guidelines;
3. Repackaging of 25tonnes of obsolete pesticides kept in stores belonging to the "Belagroservice" association of the Ministry of Agriculture of the Republic of Belarus;
4. Field work review, analysis of the situations encountered, distribution of training materials among the participants, recommendations on further repackaging;
5. Further implementation and finalizing of the repackaging by the local staff under the guidance of trained specialists;
6. Lessons learned.

In this article we will give special attention to the organizational issues of the PP.

Project Preparation and Inventory

A long period of preparatory work preceded the implementation of the PP. In autumn 2010 two Ministries, the Ministry of Agriculture and the Ministry of Environmental Protection of the Republic of Belarus, addressed local administrations of three regions with an inquiry to allocate funds from regional budgets for 2011 on repackaging of obsolete pesticides. Regional administrations put these works into their plans and budgets for 2011. Further on the Ministry of Agriculture presented to the EECCA project a revised list of all the obsolete pesticides in stock in Belarusian storages. An analysis of the list was carried out and a number of potentially convenient for the training storages was chosen. In October 2010 Mr. Russell Cobban, an expert appointed by FAO, together with representatives of the Ministry and local administration visited the proposed for repackaging sites. Some samples were gathered, conditions of the stores were assessed and requirements for the work were determined. As a result a list of necessary equipment and materials was compiled, a tender was announced and procurement was completed in the United Kingdom and Russia. There were transportation and customs issues with the materials from the United Kingdom. These problems delayed the implementation of the PP. An important lesson from this process is that the timely import of all necessary materials, is directly related to the customs regulations of the repackaging country and presence of all import certificates, is an important issue. To supply materials and equipment necessary for the repackaging it was important to create a detailed list of containers and other necessary materials, and a plan of their transportation directly to the sites.

On the basis of a detailed request from the EECCA project Ministry of Agriculture assigned responsible organizations and people as well as coordinated the works with local authorities. The Ministry organized a meeting of all the stakeholder representatives twice. During the meetings all the coordination and organizational issues were decided upon. Republican inspection on quarantine and plant protection was assigned as responsible for all the general issues, and Republican association "Belagroservice" was assigned as responsible for receiving the imported materials. Both the organisations have regional departments throughout Belarus. Local administrations assigned the implementation of the works to the regional Ministry of Emergencies departments. In each region a manager was appointed who coordinated the work with pesticide owners and local authorities. "Belagroservice" received all the materials and equipment, conducted customs clearance and according to the provided list distributed all the materials among the sites.

Theoretical Training

Before the pilot repackaging took place theoretical training was given in repackaging techniques. 16 specialists from the Ministries of Emergency and Agriculture from 7 countries took part. To appoint their country participants country coordinators received letters with criteria for participation. Despite the letter the group turned out to be rather heterogeneous. Motivation of some of the participants was very low which evident in their refusal to take part in elements of the practical repackaging.

Theoretical training was held for 6 days and it included:

1. Introduction to Sites
2. PSMS Inventory Outputs
3. Classification of Materials
4. Packaging Equipment
5. Personnel Protective Equipment
6. Site Zoning and Site-setup (with exercises)
7. Site Briefings
8. Zone Specific Standard Operating Procedures (SOP)
9. Preparation of Zone Specific
10. Spill clean-up /Fire & explosion /Gas monitoring
11. Task Based Risk Assessment
12. Activity Specific SOPs
13. General Instructions for Repackaging of Solids
14. First Aid Training

The training was held by Mr. Russell Cobban who was well acquainted with the situation at the repackaging sites. The language of the training was English and there was provided Russian translation. Participants were split into several smaller groups of 4-5 people taking into account their languages and cultures, as well as professional experience in the field. All the attendees resided in the same building, which had facilities both for teaching and accommodation. Consequently the participants had an opportunity to work as individuals and in groups following the classroom teaching; this helped to generate a deeper understanding and adoption of material. Overall the group finished the training successfully and every participant received a certificate upon completion of the theory training.

Pilot Repackaging

14 participants took part in the pilot repackaging. The group was led by the same expert who conducted theoretical training – Mr. Russell Cobban. He was assisted by the expert on POPs from Georgia – Ms. Khatuna Akhalaia. The repackaging was held within 7 days at 4 stores in the Vitebsk region: Tolochin (where there were liquid pesticides), Poviatie, Papshuli and Pastavi. In the course of the project 25tonnes of OPs were repackaged. The sequence of sites for repackaging was set taking into account transportation issues and readiness of the sites. One of the major concerns of the team leader was the question of safety and it was given special attention every day.

Thoughout the training most of the participants performed well however this situation changed during the practical element of repackaging pilot. Representatives of several countries did not fully participate in the practical training but remained mere observers. Some of the reasons were: fear of pesticides, a habit to manage others and not be involved with practical work, maladjustment to difficult working, living and transportation conditions, poor motivation and lack of interest. These traits were especially visible in representatives from the Caucasus region. There was obviously a pattern according to which people were chosen for participation, but it was not following the criteria sent to the country coordinators. Participants from Belarus, Russia, Romania and Macedonia demonstrated very good performance.

Implementation of works demanded great flexibility as it was hard to estimate the exact time that should be spent on each task at each site. For example, there was a delay in Tolochin before a forklift truck could be found. The stores at Poviatie and Papshuli were repackaged ahead of schedule. Repackaging works at Liozno were cancelled due to significant health and safety concerns raised by the course leader (as there was a risk of rusty cylinders' collapse).

Communications with local authorities and personnel proceeded mostly without mishap. People assigned by local authorities, e.g. heads of regional ecology departments or regional seed and plant protection inspections, were responsible for accommodation and meals. This facilitated timely solutions to unforeseen technical issues and aided with flexible transportation requirements of the group. Living conditions were mostly rather modest as regional infrastructure of the Republic does not have comfortable hotels. On several occasions the group had to organize the meals themselves in the form of dry lunch. On some locations gnats were especially aggressive. All in all living conditions were field-type. It was handy that a bus with the driver was at the full disposal of the group. This helped in solving many technical questions and greatly increased requirement for flexibility in transport and mobility of the group. Equipment and materials were transported by the ministerial transport.

It was hard to estimate the exact requirements of each site in terms of repackaging equipment and containers; after the first repackaging event at Tolochin containers were requested to be redistributed. As the Belarusian law system concerning the distribution of humanitarian aid is very complex and the materials were imported as such, redistribution of materials and equipment proved to be a difficult challenge.

Analysis and Recommendations

After returning to the Centre from where the training began there was a two-day evaluation period. Participants made a detailed analysis of all the situations encountered, dangers, applied solutions and their alternatives. All the training materials, guidelines, copies of forms, etc. were collated on a CD, a copy of which was given to each of the participants. The list of the trained specialists was sent to Ministries and other stakeholders, both domestic and international. Russell Cobban developed recommendations for further repackaging in Belarus which were forwarded to organizers of future repackaging activities.

Final Repackaging

Further repackaging works in the Vitebsk region was conducted by the employees of the Ministry of Emergencies. The work was managed by the specialists trained during the Pilot Project. In July-August the remaining 80 tonnes (approximate) of obsolete pesticides were repackaged. Unfortunately the inventory that preceded these repackaging works was not complete and some of the barrels had to be stored without the necessary labels and identification. Sampling and special labelling of these containers was not done, though it could simplify such works in the future.

Lessons Learned

<u>With success:</u>

1. Close cooperation with the Ministry of Agriculture of Belarus allowed planning and implementation without any major delays or costs. Official appointment of responsible organizations and people in the Ministry and locally helped in smooth implementation of the field phase of the repackaging training. The question of safety was solved by the appointment of regional Ministry of Emergencies departments responsible for the repackaging.
2. Engaging UNDP helped in avoiding some of the customs problems. This office gave effective advice on the importation of materials helped with making several payments, which might have been missed without their experience.
3. By liaising early in 2010 with the Belarusian local authorities allowed these organizations to include the project in their budgets and plans for 2011. This activity was well rewarded as substantial figures were subsequently allocated to the repackaging work. These funds together with the EECCA project contribution allowed repackaging of the remaining in the country 120 tonnes of obsolete pesticides.
4. The decision to form groups during the training according to the linguistic-cultural and professional criteria proved an important factor in uniting participants. All

the training materials provided were bilingual which also proved to be very convenient. Power Point presentations were also provided in both in English and Russian, with the text in two languages present on each slide (the division was graphically visible by colour and font size).

5. A list of trained specialists was compiled and made available for Ministries and international organizations working in the region. This was to ensure future involvement of the newly trained specialists in other obsolete pesticides projects.
6. During the training a working room with computers and Internet access was available for the participants where they were able to work at their convenience after the end of the days training, consult with each other or work individually. This was a great asset to the training.

With problems:

1. The first major conclusion was the necessity of a detailed inventory before the repackaging works take place; even taking into consideration the costs and difficulties associated with it. An incomplete inventory led to the suspended problem of pesticide identification. It is not ideal that following repackaging a number of drums of the recently repackaged material will have to be opened for sampling and identification at a later date prior to disposal in the future.
2. Customs lessons learned: first of all, not to order from abroad those materials which can be bought directly on the local market. As far as possible substitute imported materials with those available locally. The list of imported materials should be shortened as much as possible to allow considerable decrease in overhead costs. This will save time and funds on customs clearance. No medical supplies should be ordered from abroad, e.g. first aid kits, as they need a license from the Ministry of Health, which takes a lot of time and a significant number of different importation certificates. Double the estimated time should be reserved for all the customs formalities. At the same time transportation by land is preferable as it allows delivery of goods directly to the sites.
3. Recommendations on further repackaging should be given directly after the end of the pilot stage of the project, as only then they can be effectively implemented.
4. Selection of staff for the pilot repackaging requires a very considered approach to avoid choosing random people that not only leads to unnecessary expenditure but also interferes with the group's capacity to work effectively as a team. All the participants should be aware that this type of work requires personnel that are not concerned with working in a professional capacity with pesticides have the ability to work hard physically and work under uncomfortable living conditions in the field. Personnel selected should be motivated to provide mutual help and to work in a team Environment. Prospective participants should be well informed both about working with pesticides and the necessity to work under field conditions prior to the project starting. Moreover personnel selected should be those people that will manage or participate in the repackaging activities in their countries and therefore have a vested interested to perform well at a training event of this nature. It is also important to take into consideration the cultural characteristics of all the prospective participants. National counterparts should approach the choice of candidates with all the responsibility, as these people should not only be specialists in this field but also be highly motivated, active and not afraid of the field work difficulties.
5. The final aim – pesticide disposal – was left out of sight as both the Ministries of Environmental Protection and Agriculture and not ready to make long term plans.

BELARUS – A STEP TOWARDS THE COUNTRY WITHOUT OBSOLETE PESTICIDES

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Abstract

The problem of obsolete pesticides is one of the most pressing issues of our time. It is especially acute in the countries of the former Soviet Union. Tones of pesticides are kept in places accessible to general public and cattle, close to settlements and water resources. Many of the obsolete pesticides storages have decayed and pesticides are exposed to the environment. In Belarus all obsolete pesticides sites are identified and included into the national inventory, but this step is not the solution to the problem. Over time, the danger from non-repackaged obsolete pesticides drastically increases.

The first step to solving the problem is the repackaging of OPs. Participation of Belarus in the GEF/FAO EECCA project helped to increase the professional level of specialists, to carry on the work on limiting the OPs impact on the environment. Repackaging of obsolete pesticides in Vitebsk oblast highlighted a range of technical problems. It was planned to repackage solid, liquid, paste pesticides as well as mixtures of chemicals. However, the majority of them could not be visually identified. Some of the storages were difficult to access or had unusual design.

Participation of experienced specialists in the repackaging allowed to make simple and effective decisions. The importance of a preliminary qualitative and quantitative inventory of repackaging sites.was determined. It is important to note that the most problematic questions concerning pesticide inventory and repackaging were touched upon. Practical solutions to problems that seemed to be insoluble were developed. A range of organizations capable of providing necessary services we also defined. Joint work of several institutions helped to establish closer professional relations and work out an effective scheme of cooperation.

Key words: Obsolete pesticides, inventory, repackaging, EECCA project, environment

Contents:

Introduction

Solution of the problem of obsolete and POPs pesticides in the Republic of Belarus is one of the major conditions for realization of the constitutional right of the population for health protection and favorable environmental conditions. In accordance with the Presidential decree from December 26, 2003 № 594 "On ratification of the Stockholm convention on persistent organic pollutants by the Republic of Belarus" the country agreed for the bindingness of the Convention's provisions. Therefore the work on minimizing and preventing of the harmful influence of obsolete and POPs pesticides on human health and environment is the priority.

One of the lines of activities in this direction is the development of the analytical, technical and personnel potential in the sphere of obsolete pesticides and persistent organic pollutants management. Ministry of Agriculture and Food of the Republic of Belarus is interested in implementing the activities of such kind as increasing analytical, technical and personnel potential will help in really successful works on reduction of the pollution sources.

Participation of NGOs of the Republic of Belarus and international partners and donors in the works on minimizing the harmful impact of the obsolete pesticides and POPs on the environment plays a very important role. The GEF/FAO project “Capacity building on obsolete and POPs-pesticides in Eastern European, Caucasus and Central Asian countries” contributed greatly to prevention the harmful effects of obsolete pesticides.

Undoubtedly, joint work of the Government, local executive and administrative bodies, non-governmental organizations, international partners and donors allows making the environment cleaner, therefore providing a more qualitative level of living for next generations.

Participation of Belarus in the GEF/FAO EECCA project

Participation of Belarus in the GEF/FAO project “Capacity building on obsolete and POPs-pesticides in Eastern European, Caucasus and Central Asian countries” (EECCA) was the starting point for the solution of the problem with obsolete pesticides kept on the storages of agricultural organizations.

Participation of the representatives from both the Ministry of Agriculture and Food and the Ministry of Natural Resources and Environmental Protection in the project allowed to coordinate all the activities at an early stage of implementation and further on having fruitful joint work.

Participants from Belarus of the workshops within the EECCA project went through the trainings on planning and carrying out an obsolete pesticides inventory, on carrying out a full awareness raising program for general public and other stakeholders, on the FAO Pesticides Stock Management System (PSMS) usage. They also gained skills on obsolete pesticides repackaging.

The Ministry of Agriculture and Food, The Ministry of Natural Resources and Environmental Protection, Government Institution «Main State Inspectorate for Seed Production, Quarantine and Plant Protection» supported in all possible ways the implementation of the EECCA project. For practical activities within the trainings Belarus provided an opportunity for the participants to visit obsolete pesticides storages in Minsk oblast, there was provided data on obsolete pesticides inventory in Vitebsk oblast. Engaging into the training of real storages and data was an important experience for all the trainings’ participants.

The major assistance from the EECCA project to Belarus was holding a Pilot Project on obsolete pesticides repackaging in the storages of agricultural organisations that was held in May-June 2011, and that allowed to reduce the risks of obsolete pesticides impact on the environment of Belarus.

Problem of obsolete pesticides in Belarus

Republic of Belarus as well as other former Soviet Republics received a legacy of pesticides that were beforehand widely used in agriculture and now are obsolete and pose a threat to the environment and public health. Each year the risk of such impact from the obsolete pesticides increases.

On 56 storages in Vitebsk, Grodno and Minsk oblasts according to preliminary data of the national inventory was kept about 140t obsolete pesticides, the majority of which were mixtures impossible to be visually identified. Decay of the storages and leakages of the pesticide containers under the influence of natural factors required immediate intervention. Solution of the problem depended mostly on international donor help as the problem could not be solved only on the allocated national budget. Government and local executive and administrative bodies were ready to provide necessary co-funding and in-kind contribution for realization of the needed activities. For quicker solution of the problem the Ministry of Agriculture and Food of Belarus addressed the EECCA project with a request for technical and financial assistance. The request was satisfied and it was decided by the Project Steering Committee to hold a Pilot Project on obsolete pesticides repackaging in Belarus.

Repackaging of obsolete pesticides stored in the agricultural organizations’ storages

Vitebsk oblast was chosen for the Pilot Project as according to the national inventory data on its territory was stored more than 95t of obsolete pesticides. A considerable amount of pesticides was stored in Liozno (28t), Pastavy (21t), Tolochin (12,4t) and Verhnedvinsk (10t) regions. Though all the pesticides were traced and there was available information on their amounts the data was not enough for planning repackaging activities. In October 2010 the expert from the EECCA project, Mr. Russell Cobban, together with the employees of the State inspections on seed production, quarantine and plant protection implemented inventory using the forms developed by FAO. Samples of unknown mixtures of materials taken during the inventory were later on identified in the control-toxicology laboratory of the State inspectorate for seed production, quarantine and plant protection. Having the inventory according to the FAO forms allowed registering the necessary data for planning the obsolete pesticides repackaging activities. When the inventory was implemented all the acquired data was entered into PSMS. PSMS in its turn helped in prioritizing the storages for repackaging works, and identify the needs in terms of materials and equipment.

To provide ecological safety of the environment and to prevent any adverse impact of obsolete pesticides on public health it was necessary to have a safe and qualified repackaging of obsolete pesticides into new containers. The EECCA project provided Belarus with humanitarian aid to conduct the inventory of obsolete pesticides in the form of packaging materials, containers (1422 barrels), personal protective equipment and other materials and equipment necessary for repackaging. Experts from the EECCA project also provided technical guidance on repackaging. To participate in the Pilot Project specialists from Vitebsk oblast Department of the Ministry of Emergencies and Vitebsk oblast Inspection on seed production, quarantine and plant protection were assigned. Technical assistance was entrusted to the public corporation “Vitebsk Oblagroservice”.

From the Belarusian side financing of the activities on obsolete pesticides repackaging was done through the funds allocated by the Vitebsk Oblast Committee on Natural Resources and Environmental Protection and Special State Budgetary Fund for Conservation. About 250mln Belarusian rubles were allocated for repackaging activities, which equals about 65 000 USD.

In frames of the training under the guidance of the EECCA project expert was carried out the repackaging of liquid obsolete pesticides in Tolochin region, mixtures of pesticides in Miory and Pastavy regions. Total amount of obsolete pesticides repackaged during the practical part of the training was about 25 tonnes.

Further inventory, identification and repackaging was carried out by the experts of the Vitebsk oblast Department of the Ministry of Emergencies and oblast Inspection on seed production, quarantine and plant protection. There were repackaged pesticides from the storages of Verhnedvinsk, Vitebsk, Gorodok, Dubrovna, Liozno, Orsha, Rossony, Seeno, Sharkovshina and Shumilino regions. Total amount of the repackaged pesticides was 80.5 tonnes. Repackaged into new barrels and bulk containers pesticides were transported to central storages of regional agricultural services were they are controlled on a daily basis. It is planned to carry out the full repackaging in the third quarter of 2011.

Obsolete pesticides repackaging in Grodno and Minsk regions is planned to be carried out in 2012 with the funds of local budgets.

The role of the EECCA project in the improvement of the environmental situation in Belarus

Collaboration of the Republic of Belarus with the EECCA project allowed to solve the problem of obsolete pesticides kept in storages of agricultural organizations in a very short period of time. Acquired knowledge, experience, technical and material help became an invaluable contribution to the fight with obsolete and POPs pesticides in Belarus. Joint work of representatives from different countries in the EECCA project activities proved that the problem of pesticide legacy has no boundaries, just like our ambitions to reach the goal of cleaner environment.

PERSISTENT ORGANIC POLLUTANTS STOCKPILES MANAGEMENT AND DESTRUCTION IN MOLDOVA

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Abstract

Ten years after signing of the Stockholm Conventionon POPs the Republic of Moldova has registered tangible progresses in sustainable management and disposal of persistent organic pollutants stockpiles, these being due tobothits own efforts and means,and substantial support from the international community.

Over3,350 tonnes of obsolete pesticides were collected, repacked and stored in a safe manner.About1,300tonnes from these stocks were removed and incinerated abroad. The entire stock of18,660 electrical capacitors with PCBs was removed from the electrical transformer stations. The inventory and mapping of POPs contaminated areas and PCB-contaminated dielectric oil in the energy sector formed up the main achievements at the national level.Databases containing this information will serve the authorities to develop and implement the remediation of these sites.The national legal and regulatory framework in the management ofPOPs and other hazardous chemicals and wastes was revised and improved in line with EU legislation and relevant international agreements. A large national campaign of information, awareness and education on POPs has been carried out at various levels.

The most stringent issues remaining on the agenda, and to be addressed in the next 3-5 years, include the elimination of 2,000 tonnes of pesticides, remediation of about 200 of the most dangerous sites contaminated with POP pesticides, development and implementation of plans on sound management and disposal of PCB contaminated equipment, and implementation of new legal and regulatory framework on POPs.

Key words: persistent organic pollutants (POPs), obsolete pesticides (OPs), polychlorinated biphenyls(PCB), POPs management, Stockholm Convention on POPs

Introduction

The Republic of Moldova is a small, landlocked and densely populated country located in the South-Eastern part of Europe. The country has an area of 33.8 km^2 and population of 4.3 million people. Out of the total population, 54% are rural inhabitants, most of them involved in agricultural activities. The prevalence of rural population has important social, economic, political and environmental consequences.

Moldova remains one of the poorest countries in Europe despite recent progress from its small economic base. Despite good economic growth over the last years poverty continues to be a serious problem: more than one fifth of the population has consumption level below the internationally comparable absolute poverty line, and approximately one third falls into the category of chronically poor.

Moldova has long-lasting traditions in agricultural production and used high amounts of pesticides in the past. It is estimated that between the 1950s and 1990s about 560,000 tonnes of pesticides were used in Moldovan agriculture including 22,000 tonnes of organochlorine pesticides. In the absence of an adequate pesticides management strategy, including the prevention of new stockpiles accumulation, over the years, significant amounts of now banned and useless pesticides, approximately 3,000 tonnes, have been accumulated in storage facilities all over the country. The number of those facilities in 1990 was about 1,000.Representative sampling analysis indicates that the average share of POP pesticides in the total stock of obsolete pesticides is about 20-30%. The stockpiles of POP obsolete pesticides pose a continuous threat to the environment and public health. Studies have shown conclusively that these materials have contaminated the sites as well as the surrounding areas, including nearby surface waters.

Besides obsolete pesticides, Moldova has accumulated large amounts of polychlorinated biphenyls (PCBs). Most of the PCBs were used as dielectric oils in power installations e.g. capacitors and transformers. Approximately 19,000 PCB-containing capacitors with a total weight of more than 900 tonnes were located in 13 electrical substations throughout the country. About 30,000 units of electrical equipment being in use contain more than 23,000 tonnes of potentially PCB contaminated dielectric oils. The main pathways of environmental pollution are PCB-containing oil spills and leaks from this equipment, especially capacitors.

The Moldovan Government initiated solving of POPs issues in 2002 based on its own financial and human resources by approving a special decision on additional measures for centralized storage and neutralization of obsolete pesticides. Also, on May 23, 2001 the Republic of Moldova signed the Stockholm Convention on Persistent Organic Pollutants and ratified it on February 19, 2004.The National Implementation Plan (NIP)has been approved by the Government Decision on October 20, 2004. The NIP identified the POPs chemicals of concern in Moldova as being stockpiles of OPs and PCBs contained in electrical equipment.

Addressing the issues

Institutional framework and relationship

The Ministry of Ecology and Natural Resources (at present – the Ministry of Environment) was the central national environmental authority designated as the Stockholm Convention competent authority and as such is responsible for coordinating the POPs related activities of all the government bodies involved in chemicals management issues: the Ministry of Agriculture and Food Industry (MAFI), the Ministry of Economy, the Ministry of Defense (MoD), the Ministry of Health, the Civil Protection and Emergency Situations Service (CPESS), the Customs Service and other central public authorities. The local authorities bear responsibilities for environmental protection and management in the limits of their territory. A National Coordination Committee (NCC) for the implementation of the Stockholm Convention, bringing together senior officials from the key ministries and led by the Ministry of Environment (MoE), has been established in July 2002 to provide overall guidance and coordination for NIP development and implementation. An inter-ministerial Group for the repackaging, collection and centralized storage of obsolete pesticides,led by the MAFI,acts from November 2002.

Financial and human resources and technical assistance

The Moldovan Government approved by the special decision, in November 2002, the Plan on additional measures for centralized storage and further neutralization of obsolete pesticides. This decision provides that each district authorities will select a warehouse for storing of obsolete pesticides from the administrated territory and jointly with the MoD and CPESS will conduct the works of their repackaging, transportation and storage until elimination. The expenditures for the planned measures were covered by the National Environmental Fund (NEF) and the state budget.

Also, after signing the Stockholm Convention Moldova has benefited from the international support in its efforts to solve POPs issues. In 2002 the Moldovan Government has received a $410,000 GEF/WB grant for enabling activities regarding the implementation of the Convention. Under this grant the National Implementation Plan has been prepared and approved. Another $330,000 WB/GEF grant has been received in 2004 for preparation of full size project on implementation of the NIP. Thus the ***Persistent Organic Pollutants Stockpiles Management and Destruction Project*** acted based on the GEF grant of $6.35 million and a counterpart contribution of $3.72 million from the state budget and National Ecological Fund, including $1.6 million allocated for disposal of obsolete pesticides and has been implemented by the Ministry of Environment in the period 2006-2010.Within this project the main objectives of the NIP have been achieved. Its results were substantially and successfully complemented by those achieved under other similar project implemented in this period, such as NATO/OSCE Project for the Destruction of Pesticides and Dangerous Chemicals *(MoD)*, Regional Project „Elimination of Acute Risks of Obsolete Pesticides in Moldova, Georgia and Kyrgyzstan*"* *(Milieukontakt International)*, GEF/CIDA Project "Remediation of POP pesticide polluted areas and inventory of PCB contaminated oil in power equipment" *(MoE)*, UNEP Project "Moldova-UNEP Partnership on capacity building for improving the environmentally sound management of chemicals in the Republic of Moldova and the implementation of SAICM" *(MoE)*, GEF Regional Project "Capacity Building on Obsolete and POPs Pesticides in Eastern European, Caucasus and Central Asian (EECCA) Countries" *(FAO, IHPA)*; CZDA Project „Remediation of environmental burdens caused by pesticides in Moldova" *(CZDA)*. The amount of funds used until now for implementation of the Stockholm Convention in Moldova is about $15 million.

Objectives, activities and results

The main *objectives*of the implemented projects were to protect the environment and human health by safely managing and disposing of POPs contaminated pesticides and PCBs stockpiles, establishing a sustainable POPs stockpiles management and strengthening of the regulatory and institutional arrangements for long term control of POPs and other toxic substances in line with the requirements of the Stockholm Convention and other related conventions and protocols ratified by Moldova.

The measures taken and activities carried out to achieve these objectives included:

- management and destruction of POPs stockpiles;
- strengthening the regulatory framework and capacity building for POPs management;
- institutional strengthening for POPs management, monitoring and reporting;
- identification of POPs residuals and mapping of polluted areas, and inventory of PCBs;
- remediation of POP pesticides polluted areas;
- POPs awareness and educational activities.

The major results achieved in these activities are the following:

- About 3,350 tonnes of POPs containing and contaminated obsolete pesticides from 390 sites have been repacked and stored in 35 guarded central district warehouses;
- 1,292 tonnes of OPsfrom 11 central storages have been transported out of the country and destructed;
- 18,660 electrical capacitors containing PCBs have been dismantled/excavated, packed, transported, and destructed (totally 934 tonnes, including highly polluted soil);
- New or revised national policies, regulations and guidelines have been developed. The National Programme on Sound Chemicals Management and Regulation on Polychlorinated Biphenyls have been developed and approved; Handbook on environmental sound PCB management in electrical equipment, Handbook on inventory and mapping of POPs contaminated sites, and Handbook on remediation of POPs contaminated sites have been published. Over 12 packages of draft legal and regulatory documents, including Law on Environment Protection, Law on Chemicals and Law on Waste, have been completed and are in the procedure for coordination and approval;
- The National Concept of the Information Management and Reporting System on POPs has been developed;
- Two modern laboratories have been equipped with high resolution equipment which is used for monitoring and identification of POPs in environment components;
- The environmental, plant protection and energetic inspectors have been trained in enforcement and compliance with the POPs convention requirements based on the new legal documents on POPs management;
- The Inventory Registration System with about 30,000 units of electrical equipment and National database for PCB containing oils with concentration over 50 ppm has been put in place;
- The National Inventory and Mapping of POPs polluted sites has been done. The database containing 1,600 sites is available on website: http://pops.mediu.gov.md/;
- POP pilot remediation works at six sites

with an approximate area of 4 ha have been carried out;

- The public awareness and information campaign has been conducted trough local, regional and national seminars and conferences, radio and TV programs, documentary movies and spots, articles in the local and national newspapers, printing and dissemination of thematic posters, calendars, leaflets, project website www.moldovapops.md etc. The special surveys showed a significantincrease of public awareness in the field of POPs;
- The results obtained have been presented within more than 50 local, national and international workshops and conferences, including the last five International HCH and Pesticides Forums.

Lessons learned

Key approaches and decisions that facilitated implementation

The approaches and decisions that led to successful achievement of the established objectives consisted in the fact that all initiated projects and measures carried out had continuity in time and complemented each other, all parties have respected their commitments and activities have been completed within the time limits set.

Equally important was the awareness and perception of the problem at national and local level, and constructive cooperation of project management team with local partners and in particular with government institutions in the territory andcivil society.Involvement of local stakeholders in the project implementation is considered as a good experience achieved, stating that all partners had been consulted and involved in taking crucial decisions which culminated in an important success.

Also, the establishment at an early stage of a good cooperation with the World Bank and World Bank Office in Moldova was important. Due to this fact, transparency and better planning of project activities in terms of finance and procurement can be pointed out. The WB procurement and financial procedures have played a crucial role in the safety and successful implementation of the project. Later on it was possible to involve other international donors in solving of POPs issues in Moldova, like Canadian POPs Trust Fund, UNEP and others.

From a practical implementation point of view, one of the important decisions was the establishment and maintenance of the Project Management Team that, once established in 2004 by the MoE’s decision, continues to work in the original composition at this moment.This unit was responsible for fiduciary activities of POPs projects and has been involved in the implementation of other environment projects, such as SAICM QSP Project, CIDA POPs Project and five national projects.

The selection and contracting of qualified consultants, both local and international, facilitated the successful implementation of the project by transferring knowledge to employees of institutions involved in project implementation.

An important issue which facilitated the implementation of the projects was the compliance and contribution of the Government and partners who have agreed to support the project implementation.

In accordance with the findings, international experts and international institutions involved in the management of POPsconsiderthe Moldova projects a success in terms that most objectives were achieved as planned. As a result the Moldovan experience has been considered and taken as an example by Ukrainian and Byelorussian governments, which follow almost the same approach applied in Moldova.

Key decisions and political changes that hindered implementation

In terms of decisions that have stopped or affected negatively the project implementation, it can be mentioned that at the initial planning stage activities related to reviewing/developing the legal framework on POPs have to be grouped in a single consulting contract instead of smaller contracts and specific assignments.

Also in this regard,an insufficient cooperation of the MoE’s staff with hired international consultants for the activities on revising and drafting the legal framework on POPs has to be highlighted. Although finally it was feasible to draft the laws and regulations related to POPs, unfortunately they failed to be approved in time. These activities will be promoted by the Ministry of Environment in 2011-2012.

During the full size project implementation time frame from March 2006 to December 2010 the government has been reshuffled three times. Also, Minister's position and Ministry's staff has been changed. These changes influenced the progress of the project in a certain way given that the draft laws and regulations on amendments to the legislative framework on POPs was not possible to be promoted on grounds of political instability in the past two years that has led to early parliamentary elections.

Sustainability

The results of implementation of some project tasks make up the ground for further reduction and elimination of POPs impact on the environment and people's health in the Republic of Moldova and the neighbouring regions.

Collection of pesticides from circa 350 damaged warehouses and more than 40 illegal burial places, their repackaging and centralized storage in 35 guarded district warehouses, has substantially narrowed the direct impact of these chemicals on people and the danger of their scattering in the environment. By eliminating abroad and disposing of 1,296 tonnes of pesticides out of existing 3,350 tonnes, 38% of these stockpiles have been removed and more than one third of the country has been cleaned-up of these dangerous wastes. Controlled storage of pesticides remained in 22 central warehouses makes the establishment and carrying out of elimination of these stockpiles easier.

The results of national inventory of POP contaminated areas and the database including a digital map with more than 1,600 sites, which are mainly the warehouses with pesticides, stations for preparation of solutions, burial places of obsolete pesticides, in the next few years, will help the central and local authorities to estimate the dangers, prioritize the problems and start the measures to remediate and reduce their impact on population. Also, the results of pilot remediation activities, undertaken by the Ministry of Environment under the WB funded projects will serve as a model for approaching and solving this type of problems.

Similarly, the results of national inventory of dielectric oil from about 30 thousand units of electrical equipment, will serve as a ground for creation and development of a system for PCBs safe management, of the plans for maintaining, cleaning up and phasing out of PCB contaminated equipment by 2020, as requested by the country's international obligations. These activities are regulated by the Regulation on PCBs, prepared under this project and approved by the Government in February 2009.

Some project results allow us to start and undertake a number of non-projected activities in the frame of this project. Thus, the feasibility study on PCB contamination and possible remediation measures, prepared in 2007 along with dismantling and elimination of PCB contaminated capacitors from Vulcanesti 400kV station conditioned the launching and implementation by the end of the project, in November 2010, the clean-up of this station. The activities were funded by project's savings and funds of Moldelectrica State Enterprise, as the owner of this station.

The analytical capacities of two laboratories of the State Hydrometeorological Service and of the Ministry of Agriculture and Food Industry have been consolidated. After being fitted with up-to-date equipment and standards for content analysis of POP environmental components and training the laboratory staff in European scientific centers, these laboratories are now among the best in the region. Currently, they constitute an important part of national network for monitoring the POPs and other chemicals in environmental components.

The legal and normative acts developed will ensure, after being approved, the functionality in Moldova of a system for POPs sustainable management, based on related international practice and requirements of international agreements, and will be an important link in the national system for chemicals management.

SESSION 13. POPS MANAGEMENT AND DESTRUCTION

UNDP/GEF PROJECT "DESIGN AND EXECUTION OF A COMPREHENSIVE PCB MANAGEMENT PLAN FOR KAZAKHSTAN"

Abenov Almat, UNDP Kazakhstan

The UNDP/GEF Project "Design and Execution of a Comprehensive PCB Management Plan for Kazakhstan" will implement a comprehensive PCB management plan for Kazakhstan. The overall objective is to ensure that there is a modern fully-enforceable PCB regulatory system in place including a systematic capacity development for sound PCB management in the country. Within the lifecycle of the project, a certain amount of PCB containing waste will also be disposed, namely an approximate amount of 107 PCB transformers and 200 tonnes of PCB capacitors.

Project expectations:

- Creation of legal base in the field of PCB management.
- Distruction of 850 tonnes of PCB wastes (93% of transformers) and 200 tonnes of other wastes from small holders.
- Establishment of safety storage system through the creation of temporary PCB storage facilities.
- Increasing potential for environmentally sound management of the PCB life-cycle through elaboration and approval of PCB management plans on 20 enterprises.

Project activities and results:

1. **Regulatory and administrative institution strengthening**
   - ✓ Following normative and legal acts were elaborated:

   - Regulation on Inventory of Equipment with Oil or Synthetic Fluids Filling for determining PCB Presence
   - Rules on Storage and Transportation of Wastes Containing Polychlorinated Biphenyls
   - Regulations on electrical equipments phase-out.

     Currently the documents are under harmonization in public associations (KAPUR, AGMP, Kazenergy).

2. **Capacity building for sound PCB management, identification of additional PCB sources**

1. Elaborated the following documents:
   - ➢ PCB Management Guideline
   - ➢ *PCB Management Plan*
2. Special workshops were held for the Ministry for Emergency situations, Arcellor Mital Temirtau, Kazakhmys, and also regional seminars in the West and North regions of RK

   It's planned:
   - ➢ *To provide technical aasistance on elaboration PCB manakgement plans for Kazakhmys Ltd, Akksu Ferro-alloys Plant, Alatau Zharyk Company etc.*

Enhanced Laboratory Capacity:

1. Laboratories' database created (List of laboratory equipments, analysis methodology, accreditation sphere)
2. TOR for tender on selection of company providing training in Czech Republic developed

It's planned:

- ➢ To enter PCB analysis methodologies into register of the State Measuring Standard
- ➢ To enter the Tester into register of SMS
- ➢ To hold training seminars in Astana and Brno
- ➢ To carry out risk evaluations of the PCB contamination in Atyrau

3. **Replacement, setting-up safe dismantling of 850 tonnes of PCB transformers and their safe disposal**
   - PCB management plan for AMT developed and sent to AMT for approval
   - Two-stage cooperation on destruction of 107 PCB transformers was agreed

- TOR for destruction of first 64 tonnes of PCB developed.

4.Regionally organized secure storages and disposal of PCB capacitors

- TOR for selection storage facility elaborated.
- Negotiations with small PCB holders is going on selection, packaging and transportation of 200 tonnes of PCB wastes.

Barriers and discussion inputs:

Legal barriers:

- Lack of legislation base

Technical barriers:

- Unavailability of laboratory services, and analysis methodologies.
- Not clarified system of PCB waste storage.
- Usage of the most suitable technologies for destruction of PCB wastes in Kazakhstan.

Economical Barriers:

- Lack of funds of small holders for handling PCBs.

PCB TREATMENT IN THE FUTURE

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The aim of this paper is to share some thoughts about the development of the PCB elimination into the future.

Europe is now close to the final elimination of its PCB waste, with a deadline set at the end of 2010 for most countries. Existing facilities have been used to decontaminate not only PCB filled equipment, but also the equipment filled with light contaminated oil.

Also, because land transport was the cheapest and easiest way, most of the equipments to be decontaminated were shipped in drip trays, but filled with liquids. So all of the operations were done on a single location.

This philosophy will have to be changed into the future and this will be done for the following reasons:

- There is a significant difference in approach between PCB containing equipment and PCB light contaminated equipment
- Sea transport requires (cheaper and easier) equipment to be shipped drained and liquids to be shipped in UN approved containers.
- Local content and possibilities have to be developed, taking into account sometimes limited tonnages to be found in some countries

Let me now develop these themes.

1.PCB/PCB light contaminated equipment

The source of all the trouble we are facing is at the start the filling of electrical equipment with what at the time seemed to be a wonderful synthetic fluid: PCB sold with various compositios under a variety of nice commercial names: Askarel, Chlorophen, etc…

For those equipments filled at the origin with that type of liquid, whatever has been said or will be said at this conference, there is no other ecological, economical, respectful of human health way to dispose of those equipment, and recycle the valuable materials in it, than what has been done up to now: thorough decontamination of the equipment in closed vessels, dismantling of the equipment and thermal treatment of the liquid and solid residues.

Chemical treatment of the residue is both very expensive (cost of the consumables) and produces residues which you have to dispose of.

There is no oil to recycle, and the paper/wood fraction is expensive and difficult to treat, as well as non-recyclable.

There is also no possibility (and it is forbidden by the Stockholm convention) to flush clean PCB filled electrical equipment, and to reuse it afterwards.

The situation is totally different with equipment filled with mineral oil which has been accidentally contaminated with PCB.

The reasons are:

- Effective and environmentally sound techniques do exist for flushing the electrical equipments. They could even be utilized while transformers are in operation (mainly for big power transformers). For smaller ones, workshops could be run primarily in those areas where those operations take place.
- Equipments such as transformers could be reused after flushing and close monitoring of the oil quality.
- After decontamination, the oil can be recycled (or used as substitute fuel) locally. There is no need for export to dangerous waste incinerators.

2.Development of local capabilities

In the light of what was said before, we could see local developments in 2 directions :

- For PCB filled equipment, except for very large tonnages, the objective should be to prepare the equipments for disposal in existing facilities in Europe or elsewhere, provided the necessary guarantees are given (See further Quality Chart). The main reason is the cost of the necessary investments to reach the required quality level. Just some figures. A PCB decontamination plant, with a Year capacity of 8 – 10 kT/year would require an investment of +/- 10 M €. For an incineration plant for dangerous waste, with a plant capacity of 50 kT/year, the investment would probably be in the range of 100 M €.

– For equipment filled with light contaminated oil, alternative and affordable techniques do exist. Some have been presented here. The main advantages are the following :
  - The needed investments are much lower than the figures mentioned above
  - Many equipments could be reused after adequate treatment, minimizing replacement cost.
  - The shop could be linked to f.ex. a transformer repair shop, maximizing local content and using local skilled labor.
  - The treated oil could be reused or recycled locally.

3.Quality chart

Treatment of PCB filled equipment is a tricky business. The quality of this molecule, its stability, the long presence of the fluid in the equipment makes it difficult and costly to decontaminate the recyclable materials.

All this has to be done respecting closely 3 aspects which are critical in all respects :

– The health of the workers should be protected. They should not be unduly exposed to PCB or other health dangerous substances
– The emissions if PCB to the environment should be limited to the minimum and closely monitored
– The quality of the recycled material should be such as to guarantee a concentration of max 50ppm (lower for some countries) on the metal.

To guarantee this, a number of European treatment centers have voluntarily agreed to define and sign a Quality Chart. Following this chart, all those centers commit themselves to the respect of these quality requirements, and all agree to submit themselves to an external control. This control has been subcontracted to an Inspection company present worldwide. A common procedure has been defined by all parties involved, together with our control body.

Of course, this “certification” could be extended to non-European treatment centers. The most important aspect is that all signers agree to respect this Quality Chart.

This is also a clear sign to all authorities and customers that strict control is necessary, that it is implemented, and that it gives confidence to everyone that treatment is done correctly, safeguarding human health and environment.

INTERNATIONAL TREATMENT OF HAZARDOUS WASTE

Christoph Rittersberger
Séché Environnement & Trédi

Séché Environnement was created in 1985 in France and has since developed, notably via the acquisition of Trédi in 2002, into an international waste management specialist. The majority of the company is held by its chairman, Joël Séché.

In 2010 the turnover was slightly above 400 million € turnover with an expected growth rate of 7% for 2011. Two thirds of the activities stem from hazardous waste, one third from non-hazardous waste.

In France, the activities cover about 20 sites, whereas internationally there are activities in Hungary (hazardous waste landfill), Germany (hazardous gas treatment), Spain (solvent recycling), Mexico (PCB treatment), Argentina (PCB treatment), New Zealand (logistics office), Gabon (hazardous waste landfill & platform) and Congo BZ (hazardous waste landfill & platform).

We are active for local authorities, industry and supranational organisations, such as World Bank, UN-agencies and FAO. We specialize in all activities subject to authorisation, such as platforms, treatment, transport, decontamination, energy recovery, material recovery, thermal treatment and landfilling. Each type of waste is met by the adapted treatment.

International hazardous waste treatment is governed by various reglementations, such as the Basel Convention, Stockholm Convention and Montreal Protocol. One of the major challenges is the reduction of transboundary movements of hazardous waste. One of the answers of Séché is a safe and secure platform, assuring security, traceability, packaging, grouping, transit, cleanup and treatment.

The transit platform is flexible and mobile and adapted to receive expired drugs, hospital waste, PCB-waste, pesticides, gas cylinders, contaminated soil etc.

It provides for secure storage, optionally for on-site treatment and prepares waste for transport to a secure and safe treatment center locally, meeting international standards, or internationally.

The aim is the rapid protection of the population and the environment by grouping POPs and other hazardous waste on the platform.

Sustainable development means treatment and disposal of hazardous waste as close as possible to their source of generation. Our answer is to add units for treatment on site of the platform: examples are hospital waste, pesticides, PCB, gas cylinders (arsine, methyl bromide, ozon depleting gases) and contaminated soil (by pesticides, PCB, PAH, heavy metals). We remain flexible towards all different treatment technologies, including non-combustion.

As for PCB, our priorities are decontamination and reuse of transformers, energy and material recovery of worn transformers and energy use of leftover and pure PCB. We design, build and operate the platform and modules of treatment. The technology used is selected from the BAT of the moment and accepted by stakeholders.

One example is Trédi's site in Izeaux where we rehabilitate and put into reuse transformers with low PCB content.

Another example is the mobile unit for decontamination on site of PCB transormers in use by Trédi Argentina.

For the dechlorination on site of PCB oil, we use a mobile and flexible unit.

Finally, we export hazardous waste only if the State of export does not have the technical capacity and facilities to dispose of them. This is necessary for pure PCB and PCB contaminated porous pieces such as wood and paper. Our plants, such as Trédi Saint-Vulbas in France, have DRE >99,9999% and DE >99,99%.

We also assist countries by transfer of know-how and technology: we train local people, encourage local employment and have created 'Ecopoles' in Gabon and Congo. This started with hazardous waste landfills with a capacity of 500.000 m^3.

In the EECCA countries, we have a long experience of POP export from Iran, Syria, Hungary, Poland, Greece, Bulgaria, Serbia, Croatia, Bosnia & Hercegovina, Slovenia, Kosovo and Romania.

Recent or current World Bank projects include Moldova and Bielorussia. In preparation of future projects we have inspected POP sites in Armenai, Azerbaïjan, Pakistan, Russia and Kazakhstan.

As for development, we participated in the Montreal Protocol conference 2007 in Ashgabad/ Turkmenistan and in the World Bank conference on POPs in Tajikistan 2009.

Finally, we develop our activities into arms destruction: in France we participate in the army project SECOIA and in Germany our specialised subsidiary UTM works with the army and authorities on specific equipment.

REAL LIFE PCB TREATMENT PROJECTS WITH ORION'S PHILOSOPHY AND TECHNOLOGY

Dirk Jan Hoogendoorn

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About Orion

Orion B.V. is an internationally operating company specialized in the treatment and handling of Polychlorinated Biphenyl's (PCB's). Orion was founded in 1985.

Orion's mission is to be recognized as a reliable partner in safeguarding the environment by safe and cost-effective removal and destruction of PCB containing equipment.

Our procedures foresee in packing the PCB-waste on location and sending it in containers to the Netherlands for destruction in our treatment facility in Drachten.

Of course Orion is not unique in providing this kind of service, but as a dedicated and specialized company we have (a need for) an unique and different philosophy.

Our vision is to transfer know-how and expertise to local partners aiming to enable each country to have a company trained in the handling of PCB waste. In our experience the advantages are:

- "In country" competence to handle PCB waste and PCB calamities;
- Trust, understanding and good communications between the local company, the environmental authorities, the owners of the PCB waste and Orion;
- Much employment and revenues remain in the local economy;
- Local temporary storage is created, so PCB waste disposal is also available to owners of small PCB waste amounts;
- Fast and professional domestic intervention in case of a calamity.

Finding a local partner

Orion looks for partnership with existing local companies in the area of hazardous waste collection. This way we use the local expertise in a country and we try to avoid to disturb the local market with competition.

When Orion start to study a new country we introduce the company to the local government (Competent Authorities) and ask them for a list of suitable and licensed organizations for the collection, storage and transport of PCB containing waste. Most of the time the Dutch government is able to support Orion during this Introduction.

The next step is to ask PCB-waste owners like the local power companies and the industry for recommendations of PCB-waste collectors. By matching these lists we aim to find a licensed and service oriented partner in each country outside the Netherlands.

The type of company that we usually form a partnership with are industrial & hazardous waste collectors or transformer-service companies.

Cooperation between Orion and her partners

The local partner is supported by Orion when needed. Mostly this will be in the field of marketing, technical support and logistic services. During the first projects Orion can send a specialist to assist to local partner. Most of the support is done by e-mail and telephone. When the local partner has sufficient know how Orion is satisfied and will no longer send technical specialists to assist during the projects.

This period of extra support normally last from 1 to 3 years. This depends on the level of existing experience at the local partner and the speed of the market development.

It sometimes happens that personnel from the local partners comes to train at Orion's facility.

Export documents

TFS documents

Orion opens Trans Frontier Shipment (TFS) Documents for a country for one year from our local partner to Orion. The procedures for obtaining these documents are very familiar to Orion and our requests have been rewarded by all the different competent authorities up till now.

Duly Motivated Request

To obtain the TFS documents for a project, the competent authorities have to give their written statement in which they allow the export of PCB-waste to the Netherlands, because there is no capacity for destruction of PCB-waste in their own country. To obtain this statement the assistance of the local partner is very welcome.

Example from Bulgaria – working with a local partner

In 2004, to prepare for the enlargement of the EU the Dutch trade minister has visited all the potential new country-members of the EU, including Bulgaria.

During this visit, Orion, among other Dutch exporting companies, joined the minister. This week we were introduced to the Bulgarian ministry for environment. The Ministry has introduced us to Balbok. After two more visits to Bulgaria, Orion has signed the contract for partnership with Balbok in 2005 and the first PCB-project was finished in 2006.

Balbok is specialized in hazardous waste in Bulgaria. For PCB-waste they did not have a partner with the recycling options Orion could offer.

During the last 3 years Orion and Balbok developed a very nice cooperation. Exchange of logistic and technical knowledge, both ways is working out very nicely. Orion has assisted Balbok during the first project with a sales visit at the client and supervision of the first PCB-project at the client's factory.

Balbok has assisted Orion in obtaining the TFS documents and the transport permits.

Balbok works according to the high international standards for the handling, treatment and storage of hazardous waste. Because of their impeccable reputation, the PCB-project runs very smooth and the confidence of the clients and the authorities is very high. This partnership helps to strengthen the reputation and the services of both partners.

Both companies are very enthusiastic about this partnership and both the economy and the environment of Bulgaria and The Netherlands benefit from this cooperation.

Example from Belgium – Technology licensing

In 1990 we licensed our technology to (now) Sita Decontamination. They operate a very successful PCB treatment centre near Brussels and are a well respected colleague of Orion.

PCB waste treatment with Orion's technology

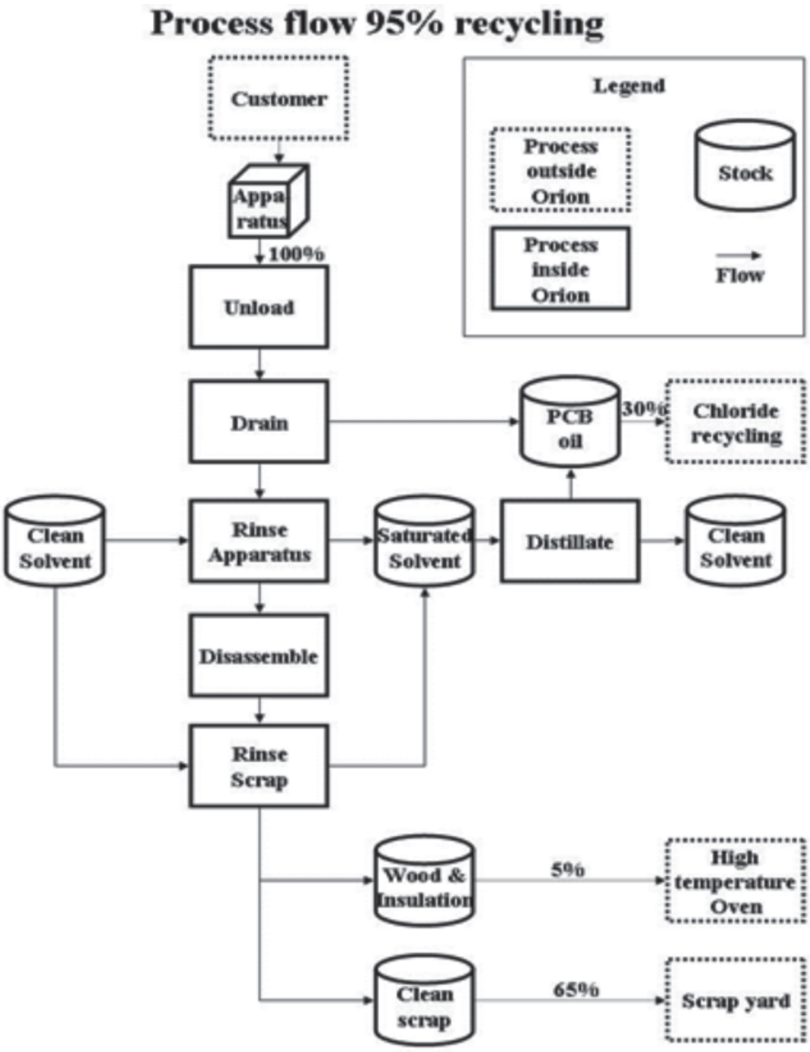
Our treatment technology is comparatively low cost to build and operate. Orion is using this technology already for over 20 years. One of Orion's unique features is to use no heating for the rinsing/washing nor for the distillation of the solvents. This is safe, easy to use and very cost effective.

Transformers

PCB-containing transformers are drained and the inside is cleaned with solvents. After this cleaning operation, the transformer is opened and all the parts are separated. Copper, aluminum and sheet metal are rinsed with fresh solvents. The cleaned metal parts are sent to smelters as base materials for new metals, and the solvents are cleaned by vacuum distillation. We can recover approximately 95% of all materials, the only exception being insulating materials, which cannot be cleaned.

Capacitors

PCB-containing capacitors are recycled in a similar fashion to transformers. The capacitors are drained and opened, after which the metal case is rinsed with solvents. Approximately 50% of the materials are recovered. The remaining 50% consists of insulating materials and aluminum foil, which cannot be cleaned.



Why Orion does offer its technology

- To fulfill our mission: "Towards a cleaner world".
- This is a logical next step to cause empowerment of local facilities and operators.
- As an answer to the demands for local treatment facilities.
- It is a comparatively low cost set up both to build and to operate.
- Last but not least to earn money.

Technology and know-how that Orion licenses:

Orion's technology as it is used in our plant at Drachten for dismantling of transformers, capacitors and cleaning of the metal parts

1) Access to Orion's proven and approved technology and know-how for the following facilities:

- Specifications for liquid proof and PCB resistant floors as used at our plant;
- Specifications for construction of cranes as used at our plant;
- Specifications for ventilation and air treatment systems as used at our plant;
- Specifications for Fire protection measures and detection systems as used at our plant;
- Lay-out of our treatment centre with area's for:
  - PCB-waste reception,
  - draining and rinsing,
  - (intermediate) storage for liquids, metals and solids,
  - dismantling,
  - solvent distillation,
  - offices,
  - locker rooms, showers and restrooms for workers;

- Specifications of required personal protection equipment as used at our plant;
- Specification of the equipment and materials we use at our plant in Drachten like:
    - shredders and separators
    - shears
    - cutters
    - tap-sets
    - pumps
    - hoses
    - sawing machines
    - vacuum chambers
    - solvents
    - distillation equipment for solvent recuperation
    - monitoring systems
    - tanks
    - containers for storage and ADR transportation
    - etceteras
- Safety plans and procedures for *environmental* protection as used at our plant;
- Safety plans and procedures for *worker* protection as used at our plant;
- Emergency and contingency plans and procedures as used at our plant;
- Quality control plans and procedures as used at our plant;

2) Education, training and visits to Orion's dismantling facility at Drachten, the Netherlands. Travel and housing expenses to be paid by the client.

3) 200 hours of advice during the first year after purchasing the license are included for each client. Travel and housing expenses to be paid by the client.

PROGRESS OF RADICALPLANET® TECHNOLOGY (RPT): (ESTABLISHMENT OF A COOPERATIVE STRUCTURE TO DEAL WITH OBSOLETE PESTICIDES IN EUROPE)

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Abstract

RPT uses a mechano-chemical principle to destroy Obsolete Pesticides. The treatment occurs in a hard vessel where steel balls and a detoxification reagent, such as CaO, are placed prior to the Introduction of the wastes. The vessels are then sealed and placed on the RadicalPlanet machine for rotation. As the steel balls crash into each other, the bonds of the POPs and CaO molecules are broken by mechanical strong impact energy (non-combustion method). This process transforms these compounds into their "***radical***" state by use of the "***planet***ary ball mill" principal. Chlorinated hydrocarbons are chemically altered into $CaCl_2$ and non-chlorinated organic compounds. No effluent or off-gases are generated from this treatment process. The toxic equivalent of the end products is less than 1 pg-TEQ/g and the destruction removal efficiency (DRE) is over 99.9999%. Full-scale applications of this technology have been conducted in Japan. This technology has been introduced in 9TH & 10TH IHPA Forum and has published on 'USEPA Guide Book' and 'GEF STAP Guidance' on POPs Disposal Technology in 2010. RPT is already acknowledged for asbestos destruction method and will be utilized to deal with not only the destruction of POPs wastes but also the creation of more attractive industries. RPT may use for production of powdered alloy and for effective collection process of rear-earth metal from IT wastes. As the chemical bonds of polymer, benzene ring and lignin structure are cut by use of RPT, Bio-Fuel may be produced from hard cellulose with no use of sulfuric acid. Then RPT needs to establish a cooperative structure in order to have pilot plant tests (demonstration) of POPs destruction and to deal with POPs treatments in a European country in 2012. Now RPT is looking for friendly European Companies invol

Key words: Ball Milling, POPs, Strong Impact Energy, Non-Combustion, Asbestos, Cellulose, Bio-fuel, Cooperation Structure

1. Technical description (Highlight of technology)

RadicalPlanet Technology (RPT) uses a mechano-chemical principle. The main equipment is a "High Energy Planetary Ball Mill" which has high rotation & revolution speeds and strong impact-energy. The treatment occurs in three hard vessels where steel balls and a detoxification reagent, such as CaO, are placed prior to the Introduction of targets. The vessels are then sealed tightly and placed on the RadicalPlanet machine for rotation. As the steel balls crash into each other, the bonds of the POPs and CaO molecules are broken by mechanical strong impact energy (non-combustion method). RPT does not use metal sodium, magnesium and hydrogen. Chlorinated hydrocarbons (ex. POPs) are chemically altered into CaCl2 and non-chlorinated organic compounds. No effluent or off-gases are generated from this treatment process. The toxic equivalent of the end products is less than 1 pg-TEQ/g and the destruction removal efficiency (DRE) is over 99.9999%. As the end products are extremely activated fine powdered particles and cohere strongly together with each particle after treatment, these end products do not scatter in opening the vessel's cap. The products are safe chemically and useful materials. After treatment of soil they may be useful for new re-fresh safe soil, load materials, and new high functional hard concrete materials.

1) Destruction efficiency:

RPT is a batch and closed process. As the chemical reaction vessel is closed tightly, no effluent or off-gases are generated from this treatment process. In RPT the destruction efficiency may be easily calculated by the analytical data of initial and final materials. The samples of gases, water and soil on the operational site should be analyzed in terms of safety. The final target contents & final toxic-equivalent of dioxin reached uniformly in any position of the vessel below government remediation criteria and had better become much less than the criteria. RPT has the qualification to be less than 1 pg-TEQ/g and the destruction removal efficiency (DRE) is over 99.9999% in the performance of POPs. Mechanical phenomena in a batch process are a quite good repeatability under the same treatment condition.

2) Overall Throughput:

a) Main Machine: A-500 type machine combined with a 540kW motor will be applied generally in actual/commercial process. Electric power source is AC 440V, 3 phase, 60Hz. Diesel generator can be operated depending on the condition of countries. Overall throughput depends on the capacity of the motor power, because the rotation and revolution speeds increase with the increase of the motor capacity. The impact energy increases as the square of the rotation speed. The treating time decreases as inverse of the impact energy. It is important that the high power motor will be selected in order to increase the throughput.

b) Targets: Overall throughput depends on the category, state and concentration of targets. The solid target & soil in the doubly-packaged vinyl bags and in steel-can sealed tightly, if the target evaporates easily, will be put into the vessels with CaO-packaged bags. And the liquid and emulsion target capped tightly in the glass bottles will be put into the vessels with CaO bags. The volume of vessel is totally 1,500 liters per one charge/cycle. The best combination between the targets, CaO bricks, steel balls and free space should be selected in order to perform perfectly and effectively. Table-1 shows the standard capacity (general throughput) and the estimated cost (electrical, CaO and workers prices) in POPs materials and asbestos.

c) Design of Actual Treatment: If the amount of targets and the period of treatment performance are cleared, the number of the machine will be decided roughly by using of the capacity table (Table-1). In the application of multiple machines, they will operate generally in alternate shifts. The number of spare vessels contributes also in desired overall throughput. The demonstration of the existing E-200 machine attached 230 kW motor will be prepared in order to introduce the A-500 (Make to Order). The throughput of existing E-200 machine is approx one quarter of that of A-500 type.

3) Maintenance and System Reliability:
The system reliability to cope with various situations to be encountered in actual implementation will be fully proven by the demonstration. Replacement of consumables, such as steel balls and reaction vessels, replaces separately from the operation of main machine and never requires system shut down in RPT. The life of main machine will be over 17 years as same as general industrial machines with periodical machine checks. The pre- & post-systems are combined with equipments which are commercially available. The reliability of ancillary system will also be proved by demonstration.

4) Secondary Contamination:
The chemical destruction reaction occurs uniformly in the vessels closed tightly. Effluent and off-gases are never generated from this treatment process. Even if the targets includes evaporate heavy metals, heavy metals never reduce to metals because the destruction condition is always kept under the oxidizing environment in closed vessel. If heavy metals evaporate in the vessel, they are absorbed onto the activated surface of the fine powdered CaO particles at the state of metal-oxides. As the end products are extremely activated fine powdered particles and cohere strongly together with each particles themselves after treatment, these end products do not spatter or release to surrounding environment in opening the vessel's cap. Dust collectors with activated carbon filters will be prepared and operated in the end products collection process in terms of safety.

Table-1. Standard Capacity & Estimated Cost by use of A-500 Type

Category of POPs			Capacity		Energy Consumpton		Workers	Running Cost (included CaO)
			t/d	t/y	kWh/t	€/t	€/t	€/t
Obsolete Chemicals	HCH	100%	4.2	**1,300**	1,920	380	90	**550**
		5%	9.1	**2,700**	880	180	40	**250**
	DDT	100%	5.2	**1,500**	1,550	310	70	**430**
		5%	11.1	**3,300**	730	140	30	**200**
	PCB	100%	1.6	**500**	5,660	1,130	230	**1,600**
		5%	6.2	**1,800**	1,460	290	60	**400**
Misplaced Disposal	Stabilizer (PCB)	2%	2.4	**700**	3,850	770	150	**1,100**
	Soil (Dioxin)	0.5%	16.0	**4,800**	400	80	20	**120**
	Ash (Dioxin)	0.1%	9.3	**2,800**	740	150	40	**190**
	Asbestos (Chrysotile)	*100%*	*20.0*	***6,000***	*350*	*70*	*20*	***90***

*Motor Capacity: 540kW, 24 hours operation, E-Price: 0.2€/kWh, Worker: 3 persons x 3 shifts

5) Soil Texture/Content after Treatment:
The products are safe chemically and useful materials after treatment of soil. The products of high-content POPs chemicals may consist of CaCl2 (approx 47%), non-Chlorinated organic compounds (approx 10%) and residues (approx 43%) based on CaO. The former is useful for Calcium-Apatite or Anti-freezing agent and the later is useful for fuel which never generates dioxin. The products of Soil & Wastes polluted by POPs may consist of CaCl2 (approx 0.5%), non-Chlorinated organic compounds (approx 0.3%), and soil (approx 70%) included CaO (approx 28%, CaO/SiO2= 0.4). These products may be useful for new re-fresh safe soil, load materials, and new high functional hard concrete materials. If the target includes heavy metals, they may stable at metal-oxides inside the network structure of Ca-Si-O molecular under the suitable solidification process by pouring minimum water in the products.

2. Differentia from the other Mechano-Chemical Destruction (MCD) Method

1) *RPT is a batch process*. Three vessels, in which the destruction reaction occurs, are separated from the main machine and the next three vessels set on the main machine continuously. The good features in a batch process are: (1) Quality control (QC) in RPT may be stabled in top priority rather than that in continuous processes. (2) The chemical reaction occurs uniformly in the closed vessel. (3) Final content may be controlled to reach below government remediation criteria. (4) The operational conditions may be changed depending on the target status/conditions. (5) Safety control (SC) may be reliable. (6) The vessels are closed tightly and shut out the atmosphere. (7) Effluent and off-gases are never generated in the treatment. (8) The vessels may be stopped immediately and kept on the safe and closed position in the case of emergency. (9) The designs of the vessel and steel balls are quite simplified because they are consumable things which have suitable spares and replaced separately from the operation of main machine.

2) *RPT uses a high energy planetary ball mill* machine. Planetary ball mill has mainly the feature that the mill can produce extremely strong impact energy rather than any other ball mill equipments. The good features in strong impact energy machine are: (1) The Chemical reaction may occur under the high impact energy (practical scale) condition even if the reaction never occurs under the low impact energy (laboratory scale) condition. (2) The magnitude of impact energy increases with the increase of the machine size. (3) Molecular bonds (structures) of target materials may be cut off and become to the "Radical State in Chemical". (4) On the "Radical State", the safe and cheap CaO brick may be used for the de-chlorination reagent in order to destroy POPs targets.

3) ***RPT uses CaO bricks*** for the de-chlorination reagent. The features in CaO bricks are: (1) CaO bricks are safe, cheap and one of natural materials. (2) As CaO bricks hold always the vessel on oxidizing environment, heavy metals are never reduced to metals and hydrogen explosion never occur. (3) Even if heavy metals contain in the targets, heavy metals will be changed to metal-oxides and it is very difficult for heavy metal-oxides to evaporate to the surrounding environment. (4) The end products consist of safe elements based on the natural materials and they may be improved from powdery form to more solid form.

4) ***RPT is a clean process***. The inside surface of vessel is polluted by target materials at the start of treatment but the surface is clean up by detoxification reaction with CaO at the end of treatment. Then main machine keeps always on a clean state. The end products, which are very fine powdered particles, cohered and clumped strongly together, never scatter to surrounding environment in the powder collection process.

3. What kind of capability does RPT have?

RPT may use popularly for the destruction of not only POPs wastes but the other target, such as PVC (poly vinyl chloride), Plastics, Cellulose, glycerin, Lignin in hard cellulose, hazardous chemicals and so on. In this case these highly-polymerized compounds become to lower molecular compounds. By the application of RPT, Plastics may re-use to the low molecular compounds for chemical materials or to fuel after solving in popular cheap solvent. Cellulose and Lignin may be favorite low molecular compounds which are never necessary sulfuric acid in bio-fuel making process. In other case, inorganic materials and metals, such as Asbestos, Super special alloys, Rear earth metals and Metal paint, are also changed to "Activated (Radical) State", reacted with other subjects and made new materials. Asbestos may loose the specific asbestos toxicity, form spherical & amorphous and transform to the new useful structures, such as construction materials and hard concrete materials. Super special alloys may form new materials easily. Rear earth may be unnecessary conc.-nitric acid in the dissolution process. Metal paint contained PCB and other metal may form easily and destroy to separate materials easily. RPT is useful for the popular and specific industrial processes.

Extras: Asbestos Treatment by the use of RPT

In Japan, RadicalPlanet Research Institute has developed a new approach to remediation of asbestos-containing materials. By high-energy mechanical grinding in a "planetary" ball mill, the asbestos fibers are broken down into rounded particles. First tests demonstrate overall efficiency of this technology. Unlike the two acknowledged technologies for asbestos treatment: cementing (mixing with cement) and thermal decomposition, the RadicalPlanet mechanical destruction relies on a deferent philosophy: the recycling of asbestos materials as concrete material, road construction and wave-dissipating blocks etc.

1) **Destruction**: By the application of RPT Asbestos fibers break down to spherical amorphous particles (aspect ratio is approx 1: round shape). Mg-Si-O (sharp needle shape) system is transformed to spherical amorphous particles (0.1μm). X-ray diffraction analysis, Dispersion analysis and SEM (Scanning Electron Microscope) results prove the quite fine spherical amorphous formation. These are never re-constructed to asbestos composition

2) **Transformation**: By the application of RPT with additional materials such as CaO and Blast Furnace Slag (BF-Slag), all targets become "Activated (Radical) State". After solidification process by pouring water, physical property of end powdered particles is improved from powdery-form to new material-form which consisted of Ca-Al-O, Ca-Si-Al-O, Ca-(Mg)-Si-O and Si-O system compounds. These products are controlled by additional objects, are useful for the hard (over 400 kg/cm2) and the vegetated (pH=8~9) concrete.

3) **New trials**: Additional trials are planned to

assess use of asbestos as reagent to treatment of POPs, the primary use of the planetary ball mill. This idea is based on the fact that BF-slag has as the same destruction efficiency of obsolete POPs Chemicals as that of CaO bricks is in the application of RPT. In other words, asbestos may destroy Obsolete POPs Chemicals by use of RPT at the same destruction efficiency as that of CaO bricks.

Then permitting procedure for use in Europe will be initiated if suitability can be proven.

4) **In near Future:** RPT needs to establish a cooperative structure in order to have pilot tests (demonstration) of POPs destruction and to deal with POPs treatment in a European country in 2012. Now RPT is looking for friendly European Companies involved in end treatment of hazardous wastes and desired to make new industry.

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PLASMA-THERMAL METHOD OF DESTRUCTION OF OBSOLETE PESTICIDES AND OTHER ORGANIC POLLUTANTS

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Abstract

A method for the destruction of solid and liquid obsolete pesticides in a three-jet plasma reactor with typical reaction temperatures 3000-5000 K was described. The high temperature of the process allows the destruction of the complex molecules of toxic substances. As a result simple substances and acids are produced. Acids are neutralized in the alkaline environment of wet filter.

Key words: Arc Plasma, Plasma Reactor, POPs Processing

1. Introduction

Human activity is associated with the permanent emergence of a very wide range of toxic organic wastes. The majority of these waste have industrial origins and can divided into two main classes: waste resulting from the production cycle, and waste consisting discarded industrial products and materials.

Of particular concern are the so-called Persistent Organic Pollutants (POPs) which are most dangerous and can migrate to ground water.

2. Waste Processing and Technologies

2.1 Waste burning

The most widely used treatment is thermal methods of toxic organic wastes. Common practice is e.g. direct combustion in industrial furnaces and boilers. This pertains mostly to liquid and solid waste with moderate and high calorific value and a minimum content of halogens. However, the combustion conditions in these furnaces and boilers do not always match the parameters that are necessary for complete combustion of organic waste leading to large emissions of harmful substances into the atmosphere. As a result, exhaust gases may contain dangerous products of incomplete chemical burning. This is due to the fact that the process of neutralization of organic waste by thermal methods is carried out at temperatures sensitive to the formation of other harmful compounds.

The combustion of chloroorganics at insufficiently high temperatures, in addition to nitrogen oxides and carbon monoxide, may lead to the formation of phosgene, dibenzofurans, dioxins, furans, polychlorinated benzopyrene, polyaromatic hydrocarbons, oxides of sulfur, soot and other very toxic productsin quantities exceeding the maximum permissible concentration in addition to nitrogen oxides and carbon monoxide.

Chloroorganic waste processing is a serious problem.The amount of waste of production and consumption that contain chloroorganiccompounds is millions tonnes. They include end-of-life products of chloroorganicpolymers, used chlorinated hydrocarbon solvents (including additives), dielectrics (polychlorinated biphenyls) obsolete pesticides, residues of chloroorganicproduction.

Dumping chloroorganicwaste at landfills and disposal should be completely excluded because of their poor biodegradability and the possibility of oxidation of many of them by air oxygen under the influence of sunlight to form secondary toxic products (phosgene, etc.).

2.1 Plasma technology for waste processing

An alternative process of direct combustion of organic waste is based on thermal plasmatechnology. The use of electric-arc plasma with mean temperatures up to 5000 K allows to effectively carry out the destruction of organic compounds into atoms and ions with very high speeds and a high degree of conversion [1]. In addition, the destruction of complex compounds in the plasma is very efficient and occurs in the absence of oxygen, providing the opportunity to successfully carry out plasma pyrolysis reaction, which in some cases have advantages over combustion. The amount of gaseous products of pyrolysis of organic waste to be treated is much smaller than that of products resulting from traditional technologies based on combustion. This leads to a drasticreduction in the amount of flue gas to be cleaned.

Plasma technology is a very flexible tool because it allows to operatein a wide temperature range with almost any chemical composition of wastes and chemicals needed for processing this waste. Plasma technology allows oxidation and reduction reactions, as well as pyrolysis reactions in a neutral environment.

Plasma technology allows the conversion of organic waste into energy in a scenario that, for each specific type of waste can be considered optimal, both in terms of energy efficiency and environmental safety [2, 3]. Efficient automation of the process is possible since for varying waste stream parameters the plasma generators can be easily feedback controlled, and there is a possibility to change the temperature and enthalpy of the plasma flow in real time and, if necessary, the chemical composition of the plasma can be adjusted. The increase in the minimum temperature in the reaction zone leads to a complete degassing of the inorganic ash residue.When toxic components are present, plasma technologies allow to introduce into the reactor a neutralizing agent in the right place at the optimum temperature.

Furthermore, the small inertia of the process minimizes the risk of harmful emissions in case of emergency, with the ability to quickly stop the process.

It is possible to change the final composition of the products of plasma thermal treatment of organic and organochlorine by-products by using different plasma-forming gases and additives.

The use ofwater vapor as a plasma gas instead of air has several advantages. First, excluding the participation of atmospheric nitrogen in the reaction zone eliminates therisk of the formation of toxic nitrogen compounds. Second, the amount of exhaust gas is 3-4 times lower than in the case of air plasma, which accordingly reduces the size and cost of the gas cleaning system.

When treating hazardous organic solid waste in a plasma reactor, the intensity and effectiveness of the destruction of toxic components to the state of simple oxides and safe salts depend on the following parameters:

- the temperature of plasma flow generated by arc plasma torches;
- the treated material dispersion (size of granules);
- the plasma flow rate relative to the treated material particles (which affects the plasma flow and the material particles convectional heat transfer coefficient);
- the ratio of plasma flow enthalpy power to material consumption rate;
- the effectiveness of material and plasma flow mixing.

3. Experimental plasmachemical set-up

Based on these principles and within the framework of the NATO Science for Peace Programme projectSfP 983056 «Destruction of Pesticides using Thermal Plasma Technology»a three-jet plasma reactor with electric arc plasma generators with total capacity of 200 kW was developed, which can use plasma-forming gases of different composition and is easily tunable for processing various types of toxic organic waste, including waste belonging to the group of POPs.

The heart of the plasmachemicalreactor is a three-jet mixing chamber which is equipped with three electric-arc plasma torches. In this case, the processing is characterized by highlyturbulent plasma flow, which is formed in the three-jet mixing chamber, thus ensuring high-intensity mixing of the plasma flow and the substances to be treated. A shock cooling (quenching) module is used to avoid the formation of secondary toxic products.

The sampling gas analysis system includes sampling tubes, vacuum pump. Also to prevent any environmental disasters and control exhaust gas composition Ion Mobility Spectrometer RAID-S2 (Bruker, Germany) is used. It is normally used to detect chemical agents in the air to provide an alarm at a predefined concentration level.

The plasma set-up includes the power supply system and arc ignition system, the system of gas and water supply, and the system for remote monitoring and control of operating parameters.

The process diagram (**Figure 1**) and the technical documents for the experimental set-up for the plasmachemical treatment of pesticides were developed, and an experimental reactor was built in Minsk (Belarus).

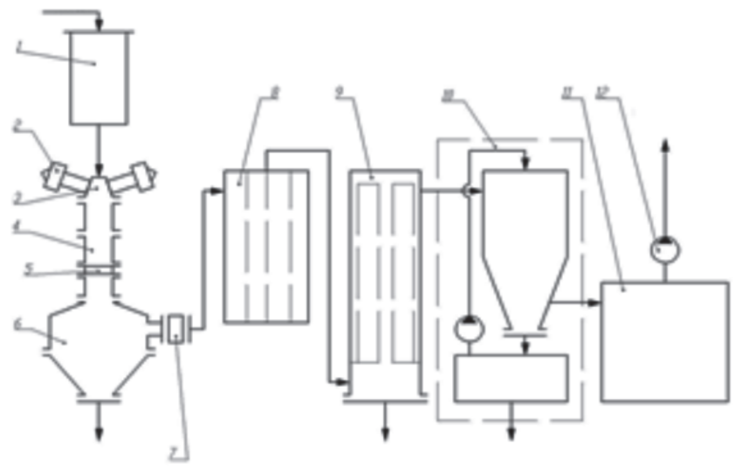

Fig.1 Process diagram
1 – Loading system, 2 – Plasma torch, 3 – 3-jet mixing chamber,
4 – Plasma reactor,
5 – Quenching module,
6 – Bunker,
7 – Insulator, 8 – Heat exchanger,
9 – Bag filter, 10 – Scrubber,
11 – Ion exchanging filter,
12 – Exhaust fan.

The loading system (1) is designed for dosing and feeding pesticides. It may have two options. One represents an injector for the loading of liquid materials. The second one includes a powder dosing unit for the loading of solid materials.

Plasmachemical destruction of pesticides takes place at high temperature in the plasma reactor (4). It consists of three plasma torches (2), three-jet mixing chamber (3), plasma reactor (4), quenching module (5) and bunker (6). DC plasma torch PDS-3 was developed in A.V. Luikov Heat and Mass Transfer Institute (Belarus). It generates plasma jet with temperatures up to 6000 K. In the mixing chamber, the plasma flow is mixed with loaded material. The heterophase flow forms a reaction zone in the reactor channel where pesticides are destroyed with high temperature. Aiming to avoid the formation of dioxins in the quenching module the flow temperature should be reduced quickly. The bunker is used to collect the solid phase.

After leaving the plasma reactor the exhaust gas goes first through the heat exchanger (8) and then through the system of mechanical filtration (9) and alkaline absorption cleaning (10)where solid inorganic impurities and gaseous NO, HCl, H_2S, etc. are removed. The final purification of exhaust gas occurs in the Ion exchanging filter (11), then the gas is emitted to atmosphere by the exhaust fan (12). As a result, the exhaust gas from the plant does not contain any toxic components.

4.Simulation of pesticide processing

As a rule conduction of experiments with toxic substances is a complicated and dangerous process. To decrease risk for people health and avoid environment pollution it is very important to do a model of the experiment.

On the first stage of investigation we used simulators such as liquid aromatic hydrocarbons - benzene (C_6H_6) and chloroorganic pesticide - Hexachlorobenzene (C_6Cl_6). This pesticide was banned globally under the Stockholm Convention on persistent organic pollutants. We developed a model of plasma reactor by using special software Chemkin 4.0 (Reaction Design). The main parameters of the model are listed below:

- Diameter of the reactor – 0.1 m;
- Length of the reactor – 0.5 m;

- Heat efficiency of the reactor – 70 %;
- Plasma forming gas – Air (N_2 : O_2 = 8 mole:2 mole);
- Equilibrium temperature in the reactor – 1000-3000 K;
- Pressure – 1 atm.

Calculation of equilibrium concentration of products of pesticides processing is done for different mole fraction of reacting substances and different temperature. As an example, **Figure 2** shows the result of simulation of Hexachlorobenzene (C_6Cl_6) processing. The inlet mole fraction of reactants is N_2:O_2:C_6Cl_6 = 16:4:1.We suppose to obtain CO, CO_2, HCl, Cl, H, H_2, N_2, NOx. Some of substances are not shown because of low concentration. At the temperature up to 2000 K almost all Cl is bounded with H into HCl. It should be cleaned in scrubber. Low concentration of NOx (mole fraction less than 0.02) can be explained by lack of oxygen in the reaction mixture. All oxygen gets bound with carbon.

5. Experimental Result

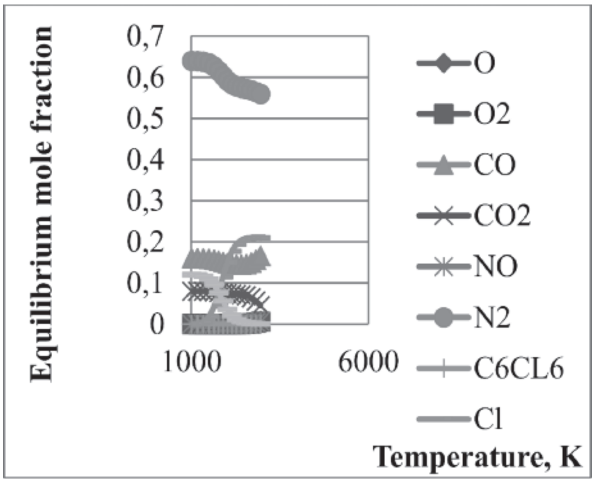

Fig. 2. Reaction products

The commissioning of experimental plasma set was done. All elements and systems of plasma set-up were tested to satisfy the technical requirements. First experiments with plasma reactor were conducted.

An automation system was developed to control the following operational parameters: plasma torche power (current strength and arc voltage), plasma forming gas consumption, temperature and consumption of water in cooling system, exhaust gas temperature. Plasma flow average temperature in the reactor was calculated by calorimetric method.

First tests were performed with chloroorganicpesticides, at the following parameters:

- flow rate material to be processed: 4 g/s;
- total electric power of three plasma torches: 165 kW;
- total effective thermal power: 108 kW;
- total compressed air flow supplied to the reactor through the plasma torches: 15 g/s;
- reactor inlet plasma flow temperature: 3820 K;
- reactor exhaust gas temperature (after quenching): 800 K.

Tests were conducted with dichlorodiphenyltrichloroethane ($C_{14}H_9Cl_5$). Ion mobility spectrometer RAID S2 was used to monitor original substance in exhaust gas. Solid residues were controlled with Mobile IR:FT-IR Spectrometer (Bruker, Germany). The original substance wasn’t detectedwith a concentration above 360 nL/L. Also chlorine (Cl_2) was not 2X detected above 2600 nL/L; sulfur dioxide (SO_2) was not 2X detected above 400 nL/L; cyanide wasnot detected above 1060 nL/L.

6. Conclusion

One of the promising methods of toxic organic pollutants processing is plasma technology. We propose to use three-jet plasma reactor to realize the process. Plasmachemical reactors have no fundamental limitations on the power. Depending on the level of power and the working environment different types of electrodes can be used in the plasma torches. This makes it possible to obtain a plasma of different chemical composition and easily tunable to the disposal of various wastes. According to tests the thermal efficiency of the plasma torch in the temperature range 3000-5000 K is 60-70%.

Based on the results of the experiments, a pilot plant is being developed for the safe plasmachemical processing of pesticides and toxic waste.

Acknowledgements

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THERMAL DESORPTION FEASIBILITY STUDY OF HCH TREATMENT IN A CONTAMINATED LANDFILL, SABIÑÁNIGO, SPAIN

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Abstract

For over two decades the landfill of Sardas (Sabiñánigo, Spain) was used for the dumping of municipal, construction and industrial wastes. All of these were discharged directly onto the ground, consisting of Eocene marls. Amongst the industrial wastes deposited were alkaline residues from the manufacture of chlorine, including HCH both in powder and in free phase form (DNAPL), which is currently seeping from the landfill as leachate.

The site was investigated through joint funding by the Regional and National administrations. This consisted in the drilling of more than forty monitoring and pumping wells and the environmental characterisation of both soil and groundwater.

At present, there are several ongoing pilot tests for soil and groundwater remediation. These include chemical oxidation with Fenton reagent and sodium persulphate, chemical reduction of zero-valent iron nanoparticles and thermal desorption (TD). Among which it is worth pointing out the results of the pilot thermal desorption for 43 tonnes of soil.

EMGRISA's thermal desorption plant, has shown to be very efficient for the treatment of these types of materials both in fuel consumption and emissions. This is due to some of its special features such as: pre-drying the soil by a heat interchange system using the postcombustion gases; energy recovery by recirculation of gases in the combustion chamber; advanced filter system; etc.

The pilot trial tested different pre-drying and desorption temperatures resulting in reduction rates of HCH and organochlorines over 99%, keeping plant emissions within legal limits.

Key words: Lindane, HCH, remediation, thermal desorption, landfill, Sabiñánigo, Aragón

Introduction

The Sardas landfill in Sabiñánigo, at the north of Aragon, is a former erosion gully located at a 200-meter distance from the river Gállego and has a volume of aproximately 330,000 m3 of waste.

The landfill was closed in the nineties but only the surface and perimeter were sealed. However, the absence of a basal seal and also defects in the seals applied, caused the generation of alkaline leachates (pH 13) with high concentrations of HCH and organochlorides, including the presence of DNAPL.

Before sealing the landfill and during the construction of a road, part of the frontal zone (35,000 m^3) was removed and deposited directly on the ground at the lower part of the site which is out of the closured landfill.

The site was investigated through joint funding by the Regional and National Administrations, resulting in the drilling of more than forty monitoring and pumping wells and the environmental characterisation of both soil and groundwater.

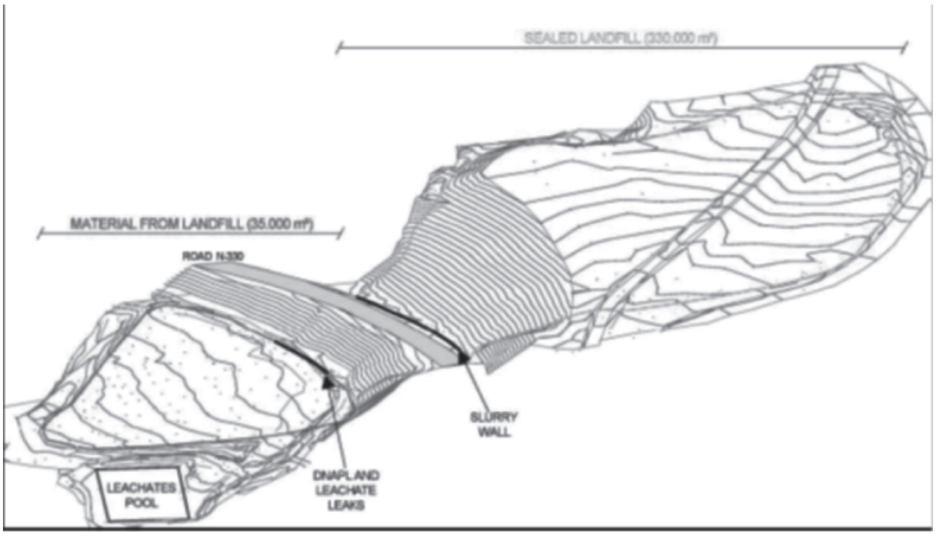

Figure 1. SITE SCHEME

At present there are several ongoing pilot tests for soil and groundwater remediation including the following

• **Chemical oxidation and chemical reduction** with Fenton reagent and sodium persulphate. Laboratory groundwater treatment tests. Zero-valent iron nanoparticles. Laboratory groundwater pilot tests and field trial for soils.

• **Thermal desorption (TD).** Laboratory test and large scale pilot test for soils.

A conceptual site model is being considered that will aim to determine the best solution to the environmental problems, including the possible improvement of the isolation of the landfill, removal of DNAPL and treatment of affected soil and groundwater.

It is worth highlighting the results of the pilot TD for 43 t of soil, resulting in reductions of organochlorides of over 99% and keeping plant emissions within legal limits.

Thermal desorption (TD) Technology developed by EMGRISA

Figure 3. TD plant - General view.

Figure 4. Post-combustion chamber

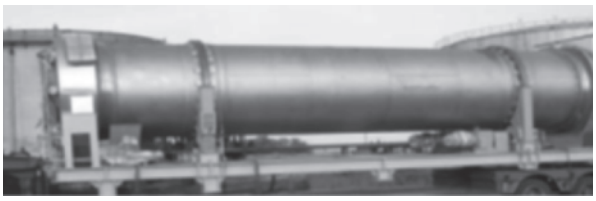

Figure 5. Rotary pre-drying owen

TD uses heat to increase the volatility of contaminants so that they can be removed (separated) from the solid matrix (typically soil, sludge or filter cake). Soil is heated in a chamber in which water, organic contaminants and certain metals are vaporized. A gas or vacuum system transports vaporized water and contaminants to an off-gas (i.e., air emission) treatment system.

There are numerous technologies based on using conventional combustion processes that heat and desorb chemicals in a single chamber system.

Desotermia, owns and operates a TD facility, based on a technology developed by Emgrisa that is characterized by:

- Drying material in a separate chamber by heat exchange with gases from the post combustion chamber.
- Chamber of desorption with energy recovery through the recirculation of gases from the combustion chamber.
- Treatment of the volatilised gases by oxidation, carried out via independent combustion and post combustion chambers.
- Gas treatment through cyclonic separation, baghouse and neutralization with an acid scrubber (lime).
- Cooling through condensation of gases and vapours.
- Condensate treatment and reuse of process water.

This system has the following advantages:

- High rates of soil treatment (up to 30 t / h depending on the properties the soil).
- Low energy consumption (from 5 kg of fuel per ton treated depending on the characteristics of the soil).
- Adaptability to different soil types and contaminants.
- High efficiency of eliminating ground contamination.
- Air emissions with very low concentrations.
- Condensation and use of the humidity of the ground.

Figure 6. Thermal Desorption plant.

Pilot test

In order to perform the pilot test in the TD unit, 43 tonnes of soil were supplied from the two different horizons which were identified at the site.

In relation to the physical appearance, the overall colour of the material is grey with internal mottled dark brown and black strands. The texture is of a plastic nature and the grain size varies from large lumps to small lumps, the former originated from the superior horizon and the latter obtained from the deeper horizon. In both horizons there exists a large quantity of stones and rocks, which in the deeper horizon are mixed with clayey material. In the superior horizon in addition to the stones there is also fill material consisting of pieces of wood, rags, rubble, etc.

In order to obtain a greater understanding of the treatment process, samples of the soil were taken at different drying and desorption temperatures. These were collected halfway and at the end of the treatment process with the following range of temperatures:

- Drying: 60 - 120 º C
- Desorption; 200 - 350 º C

The temperature refers to the solid material. In order to evaluate the characteristics of the treatment, this was done through the intermediate extraction of dust collected via cyclones used for the recirculation of gases between the combustion chamber and the desorption unit.

Elimination of HCH

The treatment was performed in two periods of approximately three hours each in which soil was fed into the plant. Samples were collected from soil introduced into the treatment system as well as soil collected after being subjected to different temperatures. During the experiment, the gases in the chimney were analysed.

Table 2 summarizes the analyses of HCH's completed after the treatment of the soil at different desorption temperatures maintained during the test.

Figure 4. Post-combustion chamber

Table 1. Analyses of the soil prior to treatment (mg/kg)

Parameter	SCL-Silt	SCL-Fill
Dry matter	86.1	89.6
Humidity	13.9	10,4
HCH		
α-HCH	00	34
β-HCH	38	40
γ-HCH	1.3	<1.0
δ-HCH	1.1	<1.0
ε−HCH	2.9	2.1

Table 2. Averages gas measurement (mg/Nm_3, corrected to 11% dry O_2)

HCH	**220ºC**	**250ºC**	**320ºC**	**345ºC**
α-HCH	<0.0010	<0.0010	0.0260	0.0130
β-HCH	0.0150	0.0083 0.	0210	0.0730
γ-HCH	<0.0010	<0.0010	<0.0010	0.0014
δ-HCH	<0.0010	<0.0010	<0.0010	<0.0010
ε−HCH	<0.0010	<0.0010	<0.0010	0.0020
ΣHCH	**0.015**	**0.0083**	**0.047**	**0.0894**

The following is observed from the above tables:

- In every case the efficiency of removal is in the order of 99.9%.
- The values are lower than the generic reference levels for the protection of human health set out in Annex V of the Royal Decree 9/2005, by which the list of potentially contaminating activities of soil and the criteria and standards for the declaration of contaminated soils are established (1 mg/kg for alpha, beta and gamma HCH in the case of industrial use).
- Almost the same level of efficiency is obtained for desorption temperatures from 220 to 345°C, probably due to the low presence of the gamma isomer in the untreated soil to begin with. The low content of this isomer indicates that the source of the HCH contamination was probably due to the by-products originated from the production of lindane.

Apart from the analytical results indicated above, the following changes were observed showing the success of the trials:

- Change in the colour of soil from greyish yellow mottled black to a uniform light brown.
- The distinctive odour associated with the untreated soil is removed.
- The treated material looks like a natural soil.

It needs to be emphasized that a large proportion of the total volume of soil consisted of small rocks and rubble of many different sizes and prior to treatment those with a dimension over 40 mm were separated. The rocks and stones of a smaller size which also formed a large proportion of the total mass were treated in the system.

Gas emissions

The pilot test was undertaken in accordance to the criteria established in Spanish Royal Decree 653/2003 on waste incineration whereby the conditions of oxidation of evaporated gas from the treated soil and the gaseous emissions to the atmosphere are established, considering the presence of chlorine:

- Residence time of the gases after the last injection of oxygen (post-combustion chamber) of 2 seconds at a temperature of 1,100 ºC.
- Gas emissions complying with Annex V of the Royal Decree 653/2003.

Table 3. Averages gas measurement (mg/Nm^3, corrected to 11% dry O_2)

Parameter	1st test	2nd test		Reference (RD 653/2003)
COV	12.75	14.29	20	semi-hourly
Nox	93.02	116.78	200	average daily
CO	71.67	109.99	100	semi-hourly
HF	0.24	0.22	1	average daily
HCl	5.13	6.17	10	average daily

The treatment plant has a continuous emissions measurement system in the stack, and was operational during the pilot trial. Table 3 shows average values of the measurements taken.

In spite of the chlorine content in the untreated soil, the HCl emissions were always below the established limit for waste incineration and as such, it was not necessary to neutralise the gases through the use of the plant's acid scrubber.

The system measures indirectly particle emissions through the degree of opacity. The average results in both tests were in the order of 0.5%. Dioxins were not measured during the test. However, the concentration of the other compounds measured, and particles in particular, suggests that they would be within regulatory limits.

Conclusion

The results reported above support TD as an ideal technology for remediation of land contaminated by HCH's, with an efficiency of remediation of over 99%. The cost of treatment of the site considering 50,000 tonnes of contaminated material would be around € 50 per tonne treated. This is less than the cost of sending it to a security landfill, with the additional benefit of eliminating annual monitoring, and other potentially adverse environmental factors associated with landfills.

The treatment can be undertaken on site, thereby eliminating the need of transport of contaminated material and at the same time leaving the site free of HCHs. The cost also includes plant commissioning and decommissioning.

The technology of Desotermia ensures the complete oxidation of HCH's contained in the contaminated material in compliance with the requirements of the specific waste incineration (RD 53/2003) regulation, with the recirculation of heat generated in this oxidation of the treated material for desorption as a special feature.

In this particular case study, there was an important content of non-contaminated gravel and bulky material, mixed with the soils. Implementation of pre-treatment prior to desorption would be feasible since it the amount of material to be treated and therefore, would result in a reduction in overall cost.

APPLICATION OF COPPER MEDIATED DESTRUCTION TECHNOLOGY FOR TRIAL DEHALOGENATION OF PESTICIDES CONCENTRATES IN JAWORZNO DUMP SITE IN MOBILE FULL SCALE UNIT

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Abstract

The Jaworzno site is represented as a Rudna Gora Central Waste Landfill in Poland, Central Europe. It is adjacent to City Jaworzno, having two parts: waste landfill area is about ~ 14 ha owned by Organika-Azot Chemical Plant, and area adjacent to the chemical plant with area of ~ 6 ha, owned by City of Jaworzno. Total area of 20 ha is considered as the greatest hot-spot in the world, with estimated 190-200 thousand tonnes of various recent harmful chemicals: organochlorinated pesticides - OCPs (like DDTs and metabolites, x-HCHs), other pesticide by-products, as well as post-synthesis waste like polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs). The pesticide production waste – mainly α-HCH with some β-HCH and γ-HCH are deposited in pure powder state, together with other harmful substances, like salts and cyanide-containing solutions, metallic compounds, etc.

The Copper Mediated Destruction technology was recently developed and patented by Czech scientists, as a novel BAT (best available technology) for POPs destruction of various organic compounds, like PCDD/Fs, PCBs, OCPs. This technology was proposed as a one of candidate for complex Jaworzno remediation procedure. The system was installed in Organika-Azot in pilot arrangement as a mobile full scale unit and particularly as a prove of technological efficiency. A laboratory pre-test was run prior full-scale unit tests. Destruction efficiency reached over 99.99 % and CMD scalability over to factor 10000, allowing applicability for the whole dump site.

Introduction

The reaction mechanism revealing the detoxification of persistent organic compounds, especially hexachlorobenzene (HCBz), polychlorinated biphenyls (PCBs), polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) with the use of a new copper mediated destruction method [1-4] was recently presented at international conferences in Prague, Brno, Sofia, Tokyo, and many exhibitions. Currently, the technology is patented [1]. Since 2008, new reaction system in mobile arrangement was designed and manufactured, together with laboratory facilities, necessary disposal of by-products, hygienic purification and office background.

The present contribution is focused on pilot testing of CMD unit in pilot locality Jaworzno, within the project FOKS (Focus On Key Sources of Environmental Risks) [5]. The pilot dehalogenation of chlorinated pesticides with dominant content of HCH compounds and DDTs and their metabolites was performed.

Apparatus and experimental conditions

As an integral part of operational mobile unit, the laboratory unit was designed and used for pilot testing of all testing loads, with the aim: (i) verification of the destruction efficiency of each batch, (ii) optimisation of reaction conditions and reactor operation with a view to ensuring maximum operating safety of the whole system. With a suitable combination of reaction systems, there was verified scalability, playing key role for the economic optimization of the operation. The capacity of laboratory reaction system is ≈0,5 dm^3, the full-scaled mobile unit ≈600 dm^3.
All dechlorination experiments were performed in the closed, mixed reaction system (see Fig 1). Reactor volume in mobile construction is approximately 0,6 m^3 and its size depends on the size of ISO container (dimensions: 2,5x2,5x6,0m).

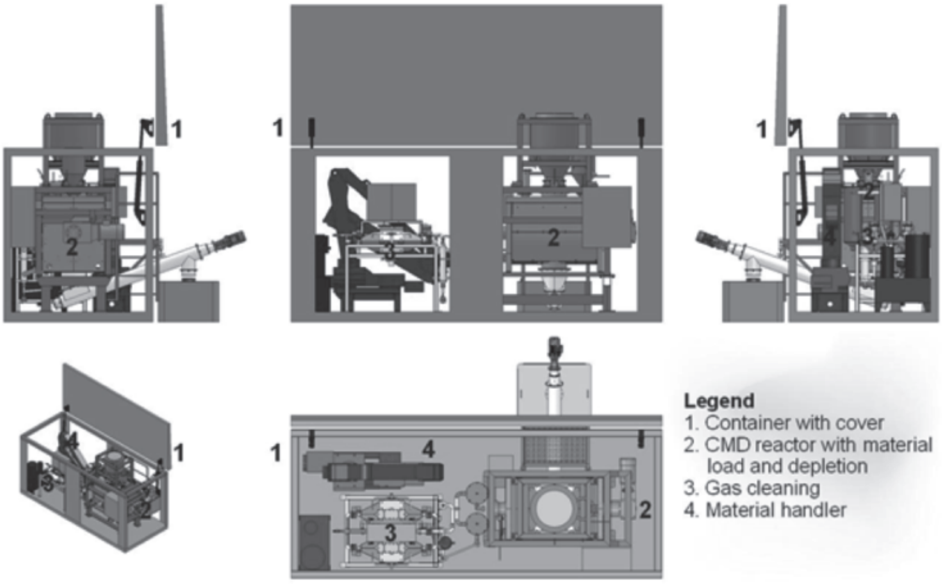

Fig 1. Design of own CMD reaction system installed in ISO container

The experiments were performed under the following conditions, as given on the patent:

– reaction temperature 250-300 °C,
– reaction time 4-6 hours,
– oxygen deficient atmosphere,
– atmospheric pressure,
– copper content in the reaction system within the range 100-200 ppm, in dependence to total content of dehalogenated pesticides.

A scheme for remediation, as applied for Jaworzno site and target compounds (pesticides and other POPs) was preliminary designed as given on the Fig 2 [6], supported with other recent findings [7-9].

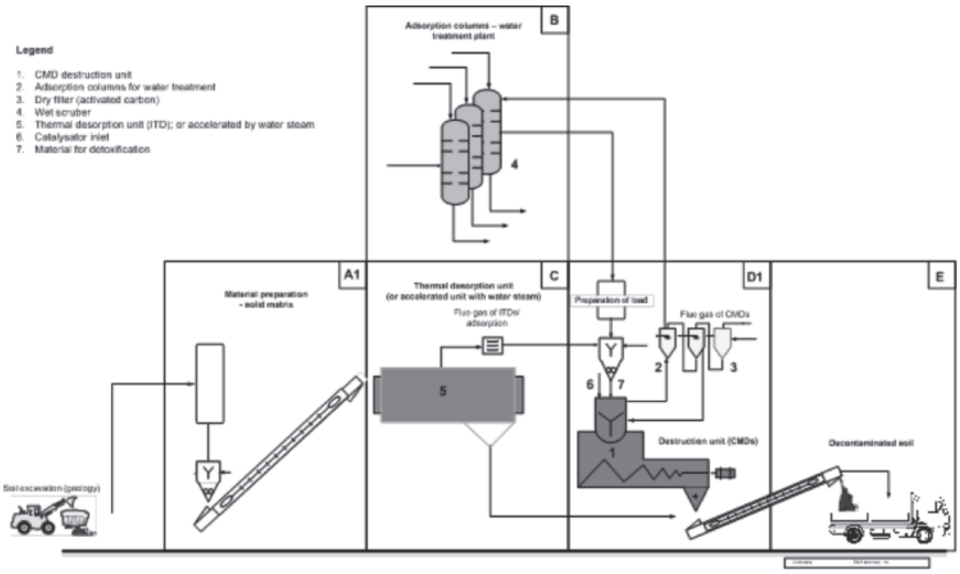

Fig 2. Overall scheme of possible CMD applications for remediation practice

Solid wastes were received directly from central dump site, concentrates were selectively isolated from heterogeneous pile composition, consisting solid parts, soil and concentrate pesticides. After isolation, materials were then utilized (e.g. fly ash or active carbon) as a part of dehalogenation reaction and loaded into reactor by dosing head.

Fig 3. Pilot full-scale installation in Jaworzno

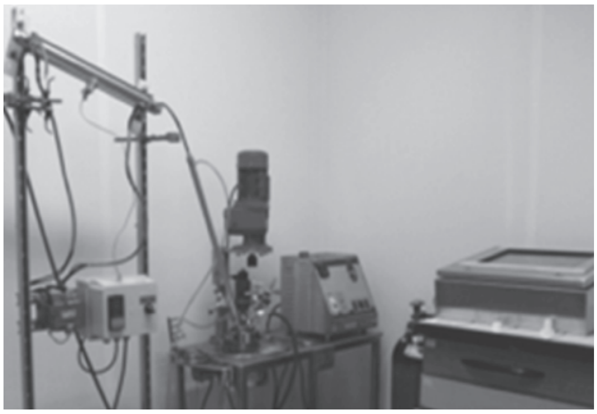

Fig 4. The laboratory unit with control panel

For simple arrangement, mainly at early stage, handling and destruction of concentrates was realized. Thus, the presented application represents the initial phase of testing on site in Jawozrno, is not associated with pre-concentration by Thermal Desorption Unit. Application of thermal desorption is another set of results that were not at the time of this publication available.

Results of dechlorination experiments

Each set of materials was laboratory tested prior and after dehalogenation experiment.

The Destruction Efficiency (%) was evaluated from laboratory experiments.

The following table provides an overview of experiments on laboratory reactor I. Experiments are ordered chronologically.

Table 1. Overview of dehalogenation experiments on laboratory reactor

Experiment	OCP IN	Matrix	OCP	Spec.	Acid	PR	DE%
	% x 100						%
1	0,19	Carbon	Lindane	0	citric	-	99,9981
2	0,18	Carbon	Lindane	0	citric	-	99,9982
3	0,12	Carbon	Lindane	0	citric	-	99,9988
5	0,10	Carbon	Lindane	0	citric	-	99,999
6	0,04	Damp carbon	Lindane	Spec.	citric	-	99,9996
8	0,10	Dry carbon	Lindane	Spec.	citric	-	99,999
10	1,57	Carbon	Lindane	0	citric	260	99,9843
11	0,04	Carbon	Lindane	Spec.	0	260	99,9996
12	0,03	Carbon	Lindane	Spec.	citric	270	99,9997
13	0,54	Carbon	Lindane	Spec.	succinic	270	99,9946
14	0,26	Carbon	Lindane	Spec.	succinic	270	99,9974
15	0,09	Carbon	62082	Spec.	citric	300	99,9991
16	10,21	Fly ash Zentiva	62082	Spec.	citric	300	99,8979
17	13,26	Fly ash CMD-1	62085	0	citric	300	99,8674
18	0,31	Fly ash CMD-1	62085	Spec.2	citric	300	99,9969
19	662	Fly ash	62085	Spec.2	citric	300	93,3836
20	36,09	Fly ash CMD-1	62082	Spec.	succinic	300	99,6391
21	65,37	Carbon	Mixture	Spec.	citric	325	99,3463
22	1,69	Carbon	HEXA	Spec.	citric	300	99,9831
23	0,10	Carbon	62085	Spec.2	citric	300	99,999
24	2,35	Carbon	62085	0	citric	325	99,977

The legend:
OCP from load (% x 100) - residual OCP (HCH) content after dehalogenation. Considering very low values with several zeros, they were multiplied 100x so that values are in the range from 0.03 to 660, Matrix: Fly ash CMD-1 is a rest after experiment CMD-1 from the working unit, OCP: Load used for the dehalogenation. Number is the number of well, Spec.:
Presence/absence of alkaline catalyst, Acid:
Acid used in the catalyst mixture
PR: Temperature of the heating shell of P,
DE% Destruction efficiency (%).

Following table describes dechlorination conditions at full-scaled unit. Due to legal limitations for trial test, there were realised only limited number of experiments, as given in the table below.

Table 2. Results from full-scale unit

	No.	Σ Load	Total OCP	M OCP	Matrix	DE
Sample		kg	g/kg	g		%
CMD-2 S	62085	170	477	2480	Fly ash	99,79%
CMD-3 S	62085	190	477	2480	Fly ash	99,57%
CMD-4-S	62101	210	743	3715	Fly ash	99,81%
CMD-5-S	62101	200	743	3864	Carbon	99,96%
CMD 6 -S	62099	210	598	1794	Carbon	99,91%
CMD-7- S	62085	215	477	2480	Carbon	99,97%

Conclusion

Used apparatus of CMD reactor is single-purpose vessel, reaching over 99,99% destruction efficiency, without pressure regime. Apart from other methods, CMD operates under atmospheric pressure.

The CMD has great advantages over to other destruction techniques, mainly:

- independence of DE % on level chlorination (easy optimization from laboratory experiments to full-scale unit),
- suitability for precursors, like chlorinated benzenes, phenols, that acts as a precursor of highly chlorinated compounds, like dioxins,
- no reactive media, like high amounts of alkaline or acids,
- no explosive media,
- no condensation reactions.

It seems to be featured as novel BAT technology. Nowadays, it is commercially available.
The scalability to both mobile and stationary applications reaches up to 1e5. However, for majority applications the maximum and sufficient volume is estimated to 10m^3, with parallel cycling of units.

From recent and current studies, the CMD is useful for following applications/material, with relevant aspects:

- ***Fly ash***

Incineration of waste in the Czech Republic and other countries is at different stages of BATs; technological process of combustion is always associated with the formation of PCDD/Fs on fly ash. The rate of contamination of fly ash by PCDD/F and heavy metals depends on the quality of the combustion process and combustion technology. Incinerators are often of obsolete types, particularly by the burning of municipal or hazardous (industrial) waste PCDD/Fs are formed in a concentrated form. In the world, there are landfilling methods considered as to be used as just temporary solution. Therefore, featured CMD technology is kind of solution for this purpose for POPs dehalogenation and material recycling.

– ***Old Ecological Burdens***

Dealing with soils and waters contaminated by persistent organic pollutants is associated with old ecological burdens. Using the unit is associated with the use of insulating element, such as indirect thermal desorption (Block C, Fig. 2). Water cleaning is associated with the absorption of persistent substances in packed columns, mostly on activated carbon (Block B, Fig. 2).

– ***Concentrated materials***

These materials may come from the old ecological burdens where the material is stored in an isolated form or unseparated heterogeneous form of old burdens. They may further come from a programmed collection of hazardous waste (e. g. oil containing PCBs). These materials are dosed into the CMD reactor so that they are first mixed with solid reaction matrix (usually activated karbon) and then transferred into the reactor.

Acknowledgement

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DESTRUCTION OF PERSISTENT PESTICIDES BY MEANS OFHYDROTHERMAL TECHNOLOGY

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Econvex Technologies is an emerging company with a specialization in developing innovative and proprietary solutions for the destruction of chemical waste. The management and shareholders of Econvex have a wealth of experience with waste treatment.

Pesticides can be completely destroyed in an elegant way, by so called hydrothermal treatment. In closed reactors of the right steel, at temperatures around 374 degrees C and a pressure of 221 atmosphere, these pesticides decompose into simple molecules like CO2, water, and sodium or calciumsalts and small hydrocarbons like ethane and propane. This after the addition of some chemical products that will prevent excessive formation of hydrochloric acid.

The residence time under these conditions is a matter of one or two hours. Reactors with a content of 14,000 liters have already been built for other processes. Hydrothermal technology can there-fore be considered as a proven technology.

The energy consumption is relatively low compared to the incineration of pesticides. The hydrothermal process consumes only 15% of the energy required for incineration at temperatures of 1,200 Degrees C. This due to the fact that the hydrothermal process operates in the critical phase of water, so no evaporation is required. Water at these conditions dissociates and aggressive hydrogen and oxygen are formed and these products attack the chemical structure of the pesticide.

The hydrothermal reactors, pumps, heat exchangers can be designed and constructed in such a way that the pesticides can be destroyed at the location where the materials stored or buried in a landfill, by means of mobile units build in transportable containers.

By using a mobile unit, excessive transport with crossing country borders and long lead times to get permits can be avoided.Companies that currently incinerate these pesticides can also make use of this technology. Lower energy costs,virtually no slacks and less operating costs in the form of scrubbers can be achieved.

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ENVIRONMENTALLY SOUND MANAGEMENT OF STOCKS OF OBSOLETE PESTICIDES IN THE RUSSIAN FEDERATION– AN ARCTIC CONTAMINANTS ACTION PROGRAMME (ACAP) PROJECT

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Abstract

Russia has one of the largest stocks of obsolete pesticides globally, estimated at 40,000 tonnes. In 2001, one of the six permanent working groups of the Arctic Council, Arctic Contaminants Action Programme (ACAP), initiateda project to improve management of obsolete pesticides stockpiles in 12 priority regions in Northern Russia. The project consists of three Phases:

Phase I – Inventories of obsolete pesticide stocks in the selected priority regions of the Russian Federation;
Phase II – Repackaging, screening analyses and storagecondition improvement. Identification of environmentally sound destruction technologies and their availability
Phase III – Implementation of a demonstration project for the environmentally sound destruction/disposal of obsolete pesticides.

6500 tonnes of stocks of obsolete pesticides have been discovered so far during the inventory over the ten regions in the Northern Russian Federation (Altai Krai, Arkhangelsk, Komi Republic, Magadan, Omsk, Tyumen, Altai Republic, Sakha(Yakutia), Tomsk, and Krasnoyarsk Krai. Most of the stocks have been repackaged and transported into interim storage facilities to protect the environment and human healthwhile awaiting environmentally sound destruction. Russia is still lacking environmentally sound destruction capacity and consequently, the only option at the moment in Russia is safe interim storage. Due to this lack of final destruction capacity, landfilling in hazardous waste dumpsites "polygons",has been a common practice. It is unlikely that pesticides disposed of in this manner can ever be retrieved for final destruction. According to recent studies made in Russia, destruction capacity is under development, although the environmental performance of these technologies has not been fully documented.It may therefore take long time before environmentally sound destruction capacity will be commercially available in Russia.

KEYWORDS: OBSOLETE PESTICIDES, ARCTIC COUNCIL, ACAP, RUSSIA

Framework for action. Arctic Council is a voluntary organization of like-minded Arctic countries. One of its six permanent working groups, the Arctic Contaminants Action Programme (ACAP) has been given a mandate to implement projects to eliminate pollution in the Arctic. The projects are ideally based on findings of another Arctic Council Working Group, Arctic Monitoring and Assessment Programme (AMAP). All eight Arctic countries and six indigenous peoples' organizations participate in the work of ACAP either on the working group or project level.

ACAP is carrying out practical and technical projects to reduce the pollution of the Arctic. Currently it has 8 project areas on obsolete pesticides in the Northern Russia, environmentally sound management of PCBs in Russian Federation, brominated flame retardants in the Arctic countries, mercury releases, comprehensive hazardous waste management strategy preparation for selected Northern Russian regions, short-lived climate forcers (black carbon), reduction of releases of dioxins and furans in Russia, and circumpolar project to reduce exposure of the indigenous peoples' communities to contaminants.

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Inventory and safe storage of stocks of obsolete pesticides in the Russian Federation. Reducing releases of obsolete pesticides from legacy stocks is the objective of several international projects throughout the world. The Arctic Contaminants Action Programme (ACAP) has been carrying out such a project in the Northern territories of the Russian Federation since 2001. The project was developed as a response to the environmental information presented by the Arctic Monitoring and Assessment Program (AMAP) of the Arctic Council. The major Russian river systems, with the exception of the Volga River, flow to the North, contributing significant amounts of pesticides into the Arctic Basin (see Figure 1). This project is currently carried out with the participation of the Russian Federation, Finland, Norway, and Sweden.

Russia has a large stock of obsolete and prohibited pesticides now officially estimated at more than 40,000 tonnes. The existing data, prior to this project, indicated the presence of 3000 tonnes of obsolete pesticides in the northern regions. As the data were based on existing documentation only, it was expected that the comprehensive inventories based on actual warehouse investigations would provide higher results. In addition, the existing information contained only agricultural pesticides, and this ACAP Project obtained information on other stockpiles, such as veterinary chemicals, forestry, and sanitary pesticides.

At preparatory phase of the Project, ACAP identified 11 Russian priority regions that directly impact the Arctic. These priority regions include Arkhangelsk (including the Nenets Autonomous District), Komi, Krasnoyarsk Krai (including the Taymyr and EvenkyAutonomous Districts), Magadan (including the Chukchi Autonomous District), the Republic of Sakha, Tyumen, Kamchatka (including the Koryak Autonomous District), and Murmansk. Sub-arctic regions include Altai Krai (including the Altai Republic), Kurgan and Omsk. Also Tomsk was included for it has a hazardous waste management landfill.

Sources. The reasons for the accumulation of obsolete pesticides in the Northern Russian territories are as follows:

- Pesticides stored too long, i.e., exceeding their shelf-life
- Changes in product registration and approval, which often happens without a transition period
- Excess quantities and qualities provided by off-farm authorities (Soviet legacy pesticides)
- Damage or loss of identity due to poor storage conditions

Environmental concentrations. Over the past years the Arctic Monitoring and Assessment Program (AMAP) has studied the presence of several pesticides in Arctic biota, water, and air. In 1997, AMAP presented evidence of high levels of a number of pesticides in Arctic animals. In 2002 even more specific information from Russian areas was published, including observations of fresh sources of DDT and toxaphene in the Kara Sea and adjacent areas, suggesting either continued use of DDT and toxaphene or leakage from old stocks. Studies of the cord blood of pregnant women in various indigenous communities in the Arctic showed elevated levels of many of these priority pesticides, indicating transport over long distances.

The project

This ACAP project was initiated to collect inventory information and ensure environmentally sound management of obsolete pesticides stockpiles in Northern Russia to remove the threat to public health and the environment. The project consists of three phases:

Phase I – Development of inventories in twelve selected priority regions of the Russian Federation, to include identification where feasible, but at least screening analysis for the presence of mercury, arsenic and chlorinated organics.

Phase II

- Improvement of temporary storage conditions, including repackaging and labeling, and consolidation of stocks of waste pesticides. It was decided that none of these pesticides would be considered for reuse.

- Assessment and selection of the best available technologies and methods for destruction/disposal of pesticides stocks.

Phase III – Implementation of a model demonstration project for the environmentally sound destruction/disposal of obsolete pesticides.

The inventory activities have been carried out using local experts in collaboration with the local administration, in co-operation with the Ministry of Natural Resources and Ecology and coordinated by the Russian Federation focal point to the Stockholm Convention Centre for International Projects. Funding has been provided by governments of Canada, Finland, Norway, Sweden, the USA, and the local administrations.

The amount of pesticides addressed in the course of the project is presented in table below. The project is still on-going in Krasnoyarsk. In two of the regions the pesticides have been disposed of at KrasnyBor landfill against the project principles on region's own initiative. It is, however, likely that in all regions more pesticides may be found in the future activities.

Lessons learned

In nearly every region the project has operated the amount of obsolete pesticides after detailed inventories have been significantly higher that the beforehand estimated amount. Presumably stockpiles of obsolete pesticides will be found here and there after completion of the project. The responsibility issues are unclear, and there is a fear for punishment, either economical or of other type.

Table:Status of inventories in spring 2011. Activities in Murmansk and Kamchatka have not started.

	Estimated stocks (t)prior to ACAP activities	After detailed inventories (t)	Current stocks in the region
Altai Krai	4000	4972	4972
Arkhangelsk	41	63	5
Komi Republic	14	23	0
Krasnoyarsk	300	220*	220*
Magadan	16	23	0
Omsk	464	540	540
Tyumen	40	314	314
Altai Rep.	23	217	217
Sakha(Yakutia)	30	77	77
Tomsk	181	121	?
Total	4809	6570	6345

*) Inventory in progress

In most of the cases transporting obsolete pesticides to a disposal site or future destruction facility requires crossing the borders of Russian regions. Crossing border of the regions with obsolete pesticides requires ecological passportisation, which may have a significant cost implication. Thus, the cost of passportisation in the Russian Federation appears to - at best - equal to the international price level for environmentally sound destruction costs itself (based on European price level). However, in cases where there are several types of pesticides a passport is naturally required for each type of pesticide separately, increasing the costs even more. At worst the cost for waste passportisation has been estimated at four times higher than the destruction itself.

Russia still does not have capacity to destroy obsolete pesticides in an environmentally sound manner. Consequently, the only option at the moment in Russia is safe interim storage. Due to this lack of final destruction capacity, landfilling in hazardous waste dumpsites "polygons", has been a common practice. It is unlikely that pesticides disposed of in this manner can ever be retrieved for final destruction, without substantial extra costs.

While export to hazardous waste management facilities abroad has been demonstrated to be an option (destruction of obsolete pesticides stock of Republic of Karelia (RF) in Finland in 2008), it can not be considered a long term solution. Use of facilities for chemical weapons destruction upon them becoming available has also been discussed, however, it appears too expensive technology to be economically feasible. Super-critical water oxidation technology has also been in promising development in Russia, although far from the market. In a recent study made under National Plan of Action Arctic (www.npa-arctic.ru Creating a System of Obsolete and Prohibited Pesticides Destruction in the Russian Federation with the Use of Innovative Technologies") pesticides destruction technologies were reviewed based on their suitability and availability in Russian Federation. The report suggested creation of mobile incinerator facilities in Russia to overcome the challenges related to pesticides transportation as well as well and permanent facility permitting. It appears that these facilities might become operational in 2012. The environmental performance of these technologies has not been fully documented.

DISPOSAL OF OBSOLETE PESTICIDES IN LITHUANIA

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The authority "APVA", which is part of the Lithuanian Ministry of the Environment has put out a pesticide project to tender. The goal was the remediation of twelve different locations in Lithuania, where pesticides have been buried or incinerated. SAVA GmbH & Co. KG has won this tender and executed the project.

Pesticides, contaminated soil and similar waste types from production and storage of pesticides have been disposed abroad, because at the time there was no environmentally sound disposal facility for this kind of waste in Lithuania.

Some basic data:

Owner of pesticides:	APVA
Responsible for project:	UAB TOKSIKA
Finance:	4 % EU, 26% Lithuanian Ministry of the Environment
Beginning of project:	01.03.2008
Beginning of field work:	05.05.2008
End of field work:	15.07.2009
End of project:	31.06.2009

Task:

- Collection, packaging, transport and disposal of 2,000 tonnes of pesticides and 6,215 m³ contaminated soil at twelve different locations across the country. Those sites have been set up in the middle of the seventies as regional landfills for no longer needed pesticides. The pesticides were stored in concrete underground pits. As the pits were not waterproof, a lot of contaminated soil has been removed as well. The twelve storages are located in rural areas, mostly in the forest, so that they are not easy to reach.
- All works have been carried by SAVA and have been supervised by TOKSIKA. SAVA made every second week so called "Progress Report" and afterwards Final Report approved by Employer.
- In total, 28,000 drums with 2,000 tonnes of obsolete pesticides as well as approx. 200 tonnes of heavily contaminated soil have been disposed at SAVA, further 750 tonnes of contaminated soil have been transported to the RIS KNAPSACK for hazardous landfill. Less contaminated soil (190 trucks) has been brought to BAO AkcijuSabiedriba in Latvia for biological soil treatment.

Concept SAVA:

- Mobilization: Beginning of work two months after signing of contract (preparation of temporary construction sites in Žygmantiškių and Baušiškių, transport of personal, tools, packing material to Lithuania).
- Notifications: SAVA has been supported excellently by the German (GOES) and Latvian authorities.
- Health and Safety Plan: All employees are trained according to the Health and Safety Plan. Everybody is informed about the risks.
- Packaging of pesticides: The pesticides in every storage are packed into tested and approved UN containers.
- Transport (RHENUS SVORIS, Lithuania): The packed pesticides have been packed into tilt trucks with capacity of 19-24 t and afterwards exported to SAVA. RIS Knapsack and BAO.

Project partners:

As part of the project, extensive soil analysis has been made by UCL, which is part of the Rethmann group. All logistic have been also carried out by the Rethmann group, RhemusSvoris in Vilnius. Furthermore, the contaminated soil was brought to the own landfill Knapsack.

Further projects executed by SAVA:

- 2 projects in Poland (already finished)
- Moldova (in progress)
- Belarus (in progress)
- Algeria (in progress)
- Nepal
- Mali


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