



Prepared on behalf of International HCH and Pesticides Association (IHPA)

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**Aim**

The aim of this newsletter 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 also other persistent toxic pollutants not covered under the POPs conventions. 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. One can subscribe and read IHPA Newsletter (3-4 times/yr free of charge) at: <http://www.iHPA.info/subscription.php>

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**Note from the Editor**

The Newsletter completed one year and three issues have already been published. The response for the Newsletter has been positive and we are pleased to have a co-editor Ms. Lindita Tafaj from Albania joining to help future publications. We welcome her offer to help in the publication. In this issue she has already contributed the first country paper on Albania. In future we hope to include one country status report.

The New Year began with the clouds of war gathering over the Gulf region. Any war will have a dire consequence on the already weakened world economy and this will have a resounding negative impact on international assistance. Africa will bear the brunt of this negative impact. The sequential effect will be obviously felt on the environment clean up directly linked to POPs, ODS and GHG emissions and international waters. Hopefully activities in POPs already started by various organizations will continue.

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**1. Country report ♦ Albania**

*This report is intended to give the status and the opinion if any, is not attributable to the Newsletter (submitted by Lindita Tafaj, M.Sc., Chemist, Department of Environment and Health, Institute of Public Health, Rr. Aleksander Moisiu, Nr. 80, Tirana, Albania  
Tel: +355 4 370057, Fax: +355 4 370058, Mobile: +355 69 2332784, Email: [ltafaj@albmail.com](mailto:ltafaj@albmail.com)*

Following the political-social events during the 90 ♦s in Albania, lots of enterprises and other constructions, such as depots of pesticides belonging to former agricultural cooperatives, were destroyed. This uncontrolled phenomenon had important impacts on the environment and potential adverse effects on human health.

An evident example of this undesirable practice is the former Chemical Enterprise located in Porto-Romano, Durres, ALBANIA, which used to produce lindane and some other chemicals, such as sodium dichromate. The Chemical Enterprise was destroyed, as above mentioned, at beginning of 90 ♦s.

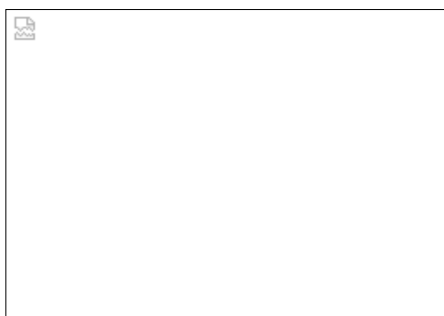
While in operation, it had been for years a source of pollution because of a low-level technology and the mishandling of technological residues. The problem of pollution was evidently aggravated after the destruction when all the technological residues, mostly technical hexachlorocyclohexane (HCH), but also other chemicals, were left outside. In 1998 there were about 250 tons of residues of technical HCH, packed in about 10,000 very damaged sacks. In September 1998 the biggest part of the technological remains was repacked and removed to a depot, but the area is still highly contaminated due to a long-term soil contamination and lots of residues of building material originating from the destroyed plant. These materials have also been used for building dwellings in the contaminated area during the 90 ♦s.

Actually, the site of the former plant is of most immediate concern regarding the environmental pollution and long-range trans-boundary air pollution. Several thousands of people living in the near surroundings of the plant, some families residing within its territory in the half-destroyed buildings, children playing on the contaminated soil make the concern about the pollution even more serious in the perspective of human health problems. High levels of HCH isomers, as well as HCH degradation compounds such as chlorobenzene has been found in soil, water and cow milk samples. High levels of  $\beta$ -HCH have been found also in the blood of persons living in the territory of the plant and in its surroundings.

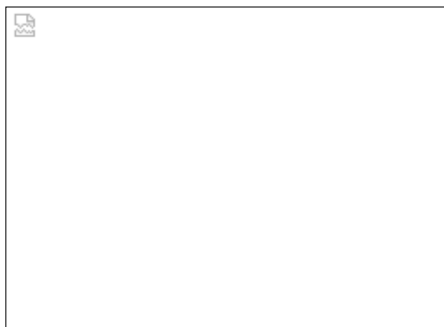
The former Chemical Plant-Durres is identified from a UNEP Post Conflict Environmental Assessment and State of the Environment Report in 2000 as one out of five environmental ♦ hot-spots ♦ in Albania. The area is considered to be one of the worst environmental hot-spots in the Balkans.

The immediate resettlement of the people living in or near the plant is an obvious necessity, in order to minimise the negative health effects. There are also needed environmental remediation actions, accompanied with comprehensive studies of soil and water contamination in the contaminated area.

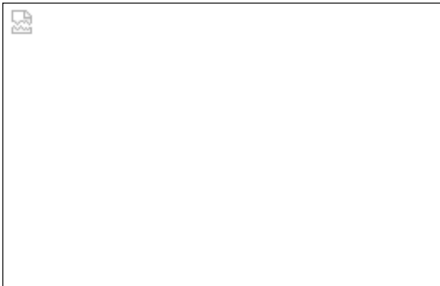
For competing with the environmental pollution situation, the strengthening of national institutions dealing with environmental problems is a challenge that Albania is meeting and will hopefully cope with in a near future, with a constructive support from international organisations.



Ruins of lindane plant at Durres.



Piles of lindane waste at site. (photo 1998).



Residential houses close to the plant.

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## 2. US EPA website - Technology Innovation News Survey

The December 1-31, 2002 Technology Innovation News Survey in the CLU-IN web site. The Survey contains market/commercialization information reports on demonstrations, feasibility studies and research; and other news relevant to the hazardous waste community interested in technology development.

The latest survey is available at: <http://www.clu-in.org/products/tins/>

### 3. Some of the selected ones are given below:

#### 3a. Chlorinated solvent cleanup with edible oils:

*Solutions Industrial and Environmental Services Inc., Raleigh, NC, and Terra Systems, Inc., Wilmington, DE, have developed edible Oil Substrate (EOS ♦, U.S. Patent #6,398,960), a novel, cost-effective approach for enhancing the in situ biodegradation of chlorinated solvents.*

The EOS ♦ process involves the injection into the subsurface of inexpensive, long-lasting, emulsified food d-grade oil. Naturally occurring microorganisms use the added substrate (oil) as an energy and carbon source to enhance the reductive dechlorination of the solvents. Remediation requires the selection of the oil most appropriate to a particular site and distribution of the oil throughout the contaminated zone to provide good contact between the oil and the chlorinated solvent.

Contact: Ann M. Borden, 919-873-1060, [aborden@solutions-ies.com](mailto:aborden@solutions-ies.com).

#### 3b. New technology for the treatment of mercury contaminated water and soils

*Zhuang, J. Ming (Noram Engineering and Constructors Ltd.) and Tony Walsh; Tak Lam (Squamish Water Treatment Plant, Nexen Inc.).*

A new technology involving lignin derivatives has been developed for the treatment of mercury-contaminated water and soil. Lignin derivatives encompass an abundance of oxygen-containing functional groups, such as phenolic, alcoholic, and enolic structures. The structures will form lignin/metal macromolecular complexes with high stability through ionic and coordinate covalent bonding, which provides the basis for the application of lignin derivatives in the removal of metal contaminants from water and in the immobilization of leachable metal in soil or sediment. Tests have confirmed that lignin derivatives are capable of combining with such metal ions as chromium, copper, lead, zinc, mercury, nickel, and aluminum. In the new water treatment process, lignin derivatives dissolved in mercury-contaminated water complex with mercury in an exceptionally stable form of a lignin/mercury colloid. The lignin/mercury colloid then is coagulated through the addition of a flocculating agent, such as ferric chloride. Under optimized conditions, a clean effluent emerges with a residual mercury level of less than 1mg/L, together with a non-leachable ferric sludge. In the new soil stabilization process, a solid adsorbent of ferric lignin is blended with mercury-contaminated soil. This solid adsorbent can stabilize the soil by complexing with mercury, greatly reducing mercury leachability. The stabilized soil qualifies for disposal as a non-hazardous waste.

#### 3c. Enzymes in plant metabolism of PCBs and PAHs

*Chroma, L.; M. Mackova; P. Kucerova; C. In Der Wiesche; J. Burkhard; T. Macek, ICT, Dept. of Biochemistry and Microbiology, Technicka 3, Prague, Czech Republic.*

Recent studies have shown that plants are able to transform polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), but little is known of the enzymes involved in these metabolic processes. The researchers screened several in vitro cultures of different plant species for their ability to transform PCBs or PAHs and compared the total extra- and intracellular peroxidase activity. The study showed both peroxidative and oxidative enzymatic systems to be partially involved in the detoxification mechanism of chosen xenobiotics in plants.

#### 3d. Effects of randomly methylated-β-cyclodextrins (rameb) on the bioavailability and aerobic biodegradation of polychlorinated biphenyls in three pristine soils spiked with a transformer oil

*Fava, F.; V.F. Ciccotosto, DICASM, Faculty of Engineering, Univ. of Bologna, Bologna, Italy.*

The low bioavailability of polychlorinated biphenyls (PCBs) in soils often results in their slow and partial aerobic biodegradation.

Supplementing soils with cyclodextrins can enhance the process. Pure cyclodextrins are expensive, and the authors explored the use of a less costly technical-grade mixture of randomly methylated-β-cyclodextrins (RAMEB) for the aerobic bioremediation and detoxification of three soils spiked with a PCB-containing transformer oil and inoculated with an exogenous aerobic PCB-biodegrading bacterial co-culture. When the soils were treated in slurry- and solid-phase laboratory conditions, significant depletions of the PCBs were observed in all microcosms of the three soils after 90 days of treatment, with more pronounced yields of PCB dechlorination and detectable decreases of the original soil ecotoxicity observed in the slurry-phase microcosms. The studies showed that RAMEB, which was metabolized slowly by soil microorganisms, enhanced the presence of PCBs and PCB-cometabolizing bacteria in the soil/water phase, suggesting that RAMEB enhances aerobic biodegradation of PCBs by increasing pollutant bioavailability in soil microcosms.

#### 3e. Bioremediation treatment for cleaning up toxic chemical contaminated soil in field trials

*Ha, Dang Thi Cam, et al., The 22nd International Symposium on Halogenated Environmental Organic Pollutants and Persistent Organic Pollutants (POPs), 11-16 August 2002, Barcelona, Spain.*

Researchers have been working on the detoxification of dioxin-contaminated soils at old U.S. military bases in Vietnam by studying the distribution of native microbial populations at contaminated sites and testing their hypotheses in laboratory and field trials at different scales. German research has shown that there are many genes encoded for enzymes involved in PCDDs, PCDFs, and PCBs degradation in bacteria and in several fungal genera. This paper identifies representative microbial genera capable of degrading dioxins in field trials.

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## 4. Review (NATO Document)

New, emerging and/or less expensive solutions for the destruction of land contaminated with pesticides- State-of-the-Art

Review by John Vijgen, International HCH & Pesticides Association.

### NATO/CCMS Pilot Study Fellowship Report

#### Evaluation of Demonstrated and Emerging Remedial Action Technologies for the Treatment of Contaminated Land and Groundwater (Phase III)

Abstract

This NATO/CCMS Fellowship Report describes the current international development on pesticides seen in the framework of the POPs Convention (9 of the 12 POPs are pesticides), and a status of the "emerging technologies" related to remedial actions towards pollution problems caused by pesticides.

As technology development of pesticides remediation has been more an incidental case-to-case development in a limited number of countries, only minor progress of new technologies has been achieved during the last many years. The pesticide related contaminated land problems are till present not very well known. However "obsolete pesticides" - meaning stocks of old pesticides, and contaminated soil around these stocks, have gained political attention in the last years. The political focus is especially Africa, in Central and Eastern Europe (CEE) and in the Newly Independent States (NIS).

Emerging of new technologies can play an important role as an important contribution to the final treatment and/or destruction of large number of pesticides/POPs stockpiles, including polluted soil in the areas of stockpiling. However, such a technology breakthrough can only be established within a framework of an international strategy, which stimulates further development, public acceptance and creates a sufficient financial framework to the support for the individual technology to pass the barrier into commercial operation. An interesting example for such a development programme can be found in ACWA (Assembled Chemical Weapons Assessment), which

is the US programme for testing alternative technologies for the destruction of chemical weapons.

This report is not trying to make any effort to present all existing treatment technologies for pesticides, but is focused explicitly to new alternative solutions. Incineration technologies have consequently been omitted. The technologies examined are presented in 11 Fact Sheets that have been developed together with a series of annexes containing detailed information on the various projects on pesticides, PCB's or related components. As far as it was possible, a brief evaluation has been made and the technologies are divided into 4 categories. One group comprises four direct applicable technologies with considerable experience. A second group comprises three applicable technologies on the stage of "breaking through and/or start of commercialisation". A third group includes four technologies that - given the right financial circumstances - could be full scale within approx. 5 years, and finally a fourth group with one technology only is in the stage of laboratory scale testing, thus making an assessment of proximity to full-scale implementation without meaning in the present context.

The Fellowship Report documents that there are alternative technologies available for the destruction and remediation of pesticides waste and contaminated soils. In this context the report can also make a contribution to a better awareness and understanding of the problems of obsolete pesticides and to give a better insight on the state of the art of alternative and emerging technologies for the treatment of pesticides waste and contaminated soils (there are a number of fact sheets on selected topics).

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#### 5. News:

##### **Strong support from the Cabinet of the Ministry of Consumer Interest , Health, and Environment , Belgium for the June Kiev International Forum.**

In a letter to Mr. Jonh Vijgen from H.E. Jef Tavernier, The Belgian Federal minister of Consumer Interests, Health and Environment gives strong support for the Establishment of an Obsolete Pesticides Stockpiles programme/Fund for Central and Eastern European Countries and New independent States. The letter is reproduced here for the benefit of the readers.

"Dear Mr. Vijgen,

Answering your letter of March 13, I want to express the following view in this matter.

*I share your opinion that in order to solve the problems caused by obsolete stocks of pesticides in Eastern Europe a special initiative by the European Union is needed. Due to the important work of your organization it became clear what is at stake here. These pesticides pose indeed severe threats to human and wildlife health and to the environment. The nitrofen contamination that occurred in the spring of 2002 in the eastern part of Germany , illustrated that they even present a threat to our own food safety.*

*The necessary funding of programmes and actions dealing with these pesticides should be made operational at a European level , since in my opinion the European union should take the lead in dealing with this important issue. Therefore I support the idea of a specific Fund unless the European Commission could put forward other already existing funding channels that could guarantee similar results.*

*We strongly support the next Forum conference in June (Kiev, Ukraine). The necessary steps will be taken to make sure that our country is represented to take part in the discussions and to contribute to the recommendations of this meeting."*

Signed by H.E. Jef Tavernier, The Belgian Federal Minister of Consumer, Health and Environment.

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#### 6. Excellent opportunity for UK industries to apply for research funds on bioremediation:

The UK LINK Bioremediation Programme supports the development of technologies to provide UK industry with the multidisciplinary capability necessary to enable commercial exploitation of biotechnology for the clean up of contaminated land, air and water. Foreign owned companies with research facilities in the UK are eligible taking into account the net benefit to the UK e.g. exploitation of results in UK, manufacture of products developed in UK. Last date for submission is June 6, 2003.

The following focus areas have been identified:

- 1) To understand and exploit natural attenuation in groundwater and soil;
- 2) To improve engineered in situ bioremediation, interfacing microbiology with engineering and hydrogeology;
- 3) To translate the results of laboratory studies into the field (scale-up);
- 4) To position bioremediation within a risk management framework;
- 5) To develop the ability to monitor in situ microbial processes;
- 6) To understand the constraints on in situ microbial processes;
- 7) To integrate bioremediation with other technologies;
- 8) To quantify human health impacts of bioremediation and develop surrogate testing;
- 9) To address socio-economic issues perception of bioremediation technologies and decision-support mechanisms.

Full information and application forms may also be found at <http://www.clarrc.ed.ac.uk/link>

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#### 7. Green Women:

These are not women from another planet. It is a non-governmental non-commercial organization founded in 1995 in Kazakhstan under the initiative of the women - journalists specializing in coverage of ecological problems in MASS MEDIA. Mission of "Green women" is to promote entrainment of wide groups of the population of Central Asia in process of the solution of ecological problems by increasing the level of knowledge, enlightenment and formation of ecological intellection. If you are interested please check out this interesting website <http://www.greenwomen.freenet.kz>

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#### 8. Arsenic Poisoning:

In the past issues we highlighted contamination of drinking water by natural arsenic due to man made activities. In Bangladesh, according to the World Health Organisation, the contaminated water may have affected as many as 80m people in the country's population of 140m. Many are already developing arsenic sickness, which, if left untreated, eventually causes serious damage to the lungs liver and kidneys. The issue apparently has gone to court in the UK as who should be blamed.

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#### 9. Pesticides in bottled water.

Those who travel in India by train or by road one item is a must to carry i.e. bottled water. This bottled water is a big business and is produced by many well known national and multinational companies. The bottled water industry has received a jolt with the findings of the Centre for Science and Environment (CSE) that most brands contain pesticides above permissible level. As the Ministry of Science and Technology has confirmed this, suitable remedial action needs to be initiated. The CSE said that the WHO guidelines covered only five of the 20 pesticides tested by them under the European norms. The WHO was silent on "deadly" pesticides like chlorpyrifos, endosulphan, phosamidon and malathion. In fact, the WHO had no guidelines for organophosphate pesticides, the CSE has alleged.

The controversy will go on but it is encouraging to see that the government taking seriously the allegations of pesticide contamination of bottled water which is survival kit for adults, elderly and children on the move and in their homes. Recently it was reported by a NGO in Bangalore . Grahak Shakti, one of the most active consumer rights organisations in the City, says the alarming reports about pesticide residue being found in bottled water in the media were distorted.

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#### 10. Events;

1. Next the major meeting on POPs is the 7th International HCH and Pesticides Forum in Kiev. Details can be obtained from <http://www.hchforum.com>
2. Contaminated Land, April 29, 2003, Society for Chemical industry, London. The meeting will discuss ♦soil guideline value-, exposure assessment, total petroleum hydrocarbons, bioaccessibility of arsenic in UK soils etc. For information contact: [Fiona.pibworth@soci.org](mailto:Fiona.pibworth@soci.org).

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