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REPORT OF THE PILOT STUDY MEETING

PREVENTION AND REMEDIATION IN SELECTED INDUSTRIAL SECTORS

Small Sites in Urban Areas

Athens, Greece
June 5-7, 2006

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NOTICE

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INTRODUCTION

The Council of the North Atlantic Treaty Organization (NATO) established the Committee on the Challenges of Modern Society (CCMS) in 1969. CCMS was charged with developing meaningful programs to share information among countries on environmental and societal issues that complement other international endeavors and to provide leadership in solving specific problems of the human environment. A fundamental precept of CCMS involves the transfer of technological and scientific solutions among nations with similar environmental challenges.

This document reports on the fourth meeting of the Pilot Study on Prevention and Remediation Issues in Selected Industrial Sectors. The purpose of the pilot study is to define and explore best practices for reducing the health and environmental impact on soil and groundwater from industrial sectors of interest (e.g., metals mining, organic chemical production, gasworks, and fertilizer manufacturing) as well as other unique site "types" (e.g., old landfills, privatization sites [i.e., facilities transitioning from former state ownership in certain categories], mega-sites [i.e., large scale former industrial and mining facilities], and shoreline sediment sites). The pilot study will explore the techniques and technologies for preventing and avoiding discharge to soil and groundwater as well as measurement and remediation for that industry sector or site type. It seeks to engage industry and other private sector organizations at the transnational level in sharing and evaluating technical information. In reviewing case studies as well as experience from the previous CCMS pilot study on contaminated land and other sources, the proposed pilot study may be able to assess or benchmark "what is easy to clean," "what is difficult to clean," and "what is impossible, at reasonable cost, to clean." The unique contribution of the pilot study would be measured by its ability to synthesize information regarding best practices, successes and failures, and uncertainties for the sectors of interest.

The fourth meeting of the Pilot Study was held in Athens, Greece from June 5-9, 2006. This meeting dealt with the issues small (contaminated) sites in urban areas. Twenty-one technical papers fell under the broad topics of small sites with petroleum hydrocarbon contamination, small sites with other organics, risk assessment at small sites, and sites in unique settings (i.e. residential or congested urban areas). Six countries gave Tour de Table presentations–summaries of the state of the development of waste and/or contaminated land programs in their respective countries. The United States is the lead country for the Pilot Study, and 20 other countries participated in the meeting. This report is a set of abstracts of the presentations at the meeting. In addition, a CD containing all presentation materials (e.g. power point slides) from this meeting and the three previous meetings is available.

This report is available online at http://www.nato.int/ccms/ and http://www.cluin.org/athens. CD ordering information can be found at the latter web site. General information on the NATO/CCMS Pilot Study may be obtained from the country representatives listed at the end of the report. Further information on the presentations in this document should be obtained from the identified presenters.

Walter W. Kovalick, Jr., Ph.D.
Director

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OPENING PRESENTATIONS

SOIL REHABILITATION IN THE MUNICIPALITY OF LAVRION: A CASE STUDY

Alecos Demetriades
Greece

1. ABSTRACT

The Lavrion urban area in Greece is about 55 km to the south-east of Athens, and is part of the Lavreotiki peninsula in Attiki Prefecture. The intense mining and metallurgical activities since 3500 BC to the end of the 20th century caused the contamination of soil with Pb, As, Sb, Cd, Cr, Ni, Cu, Hg, Zn, *etc*.

The health related problems and effects of contamination in Lavrion were detected to begin with by cross-sectional epidemiological studies in the 1980's. Their conclusion was that children of nursery and primary school age had a severe problem of lead-poisoning (plumbosis). The last cross-sectional epidemiological study, which was carried out in 1988 on 235 children from Lavrion, showed the seriousness of environmental contamination on the health of children, *i.e.*, (a) 90% of the children had more than 100 micrograms of Pb per litre of blood, the limit set by the World Health Organisation, and (b) 8.4% had more than 20 micrograms of arsenic in 24-hour urine.

Soil geochemistry carried out by the Institute of Geology and Mineral Exploration on approximately 170 km^2 of the Lavreotiki peninsula has shown that about 75% of the area (~130 km^2) is contaminated by toxic elements (As, Cd, Cr, Cu, Ni, Pb, Zn). The subsequent detailed mapping and chemical characterisation of metallurgical wastes, together with the geochemistry of soil cover and house dust, have shown that the whole Lavrion urban area (7 km^2) is seriously contaminated with respect to As, Ba, Be, Cd, Cr, Cu, Ni, Pb, V and Zn. The geochemistry of parent rocks defined the natural background concentrations, before human activities began to contaminate the whole area.

The National Technical University of Athens carried out the chemical characterisation of mining wastes (flotation tailings and pyrite), and tested different rehabilitation technologies in the laboratory, and afterwards applied them on a demonstration scale in Lavrion. The sandy-silty flotation tailings from ore beneficiation were thoroughly mixed with five different mixtures of organic and inorganic stabilisers: (1) phosphate fertiliser and compost, (2) fly ash and compost, (3) biological sludge and fly ash, (4) biological sludge and phosphate fertiliser, (5) biological sludge, and sowed by a mixture of seeds; the same mixture of seeds was planted also in a control section. The plants grew in all five stabilised sections, and the vegetation is successfully being reproduced, thus creating the necessary protective cover for reducing the aerial transportation of material. Whereas the control section remains completely bare. The pyritiferous tailings were encapsulated by (1) synthetic geomembrane, (2) compacted clay, and (3) carbonate material, and subsequently covered by clean soil; a control section was covered only by clean soil. Appropriate lysimeters were constructed below each section to measure the amount, and control the quality, of percolated water. From 1996 to 2001 infiltration of water in the three sections was essentially nil. However, all three methods failed after the fifth year.

Taking into account all available results (geochemical distribution maps of toxic elements, metallurgical processing wastes map, land use map, hazard and child exposure assessment maps, pilot project rehabilitation techniques, *etc.*) an integrated environmental management scheme for the Lavrion urban area was developed on blocks of 50 x 50 m to facilitate the soil cover rehabilitation with different cost-effective techniques. The cost for rehabilitating 7 km^2 has been estimated at about 42 million Euro, if the Municipality does the work with its own employees.

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STATE COALITION FOR REMEDIATION OF DRY CLEANERS (SCRD): NATIONAL OVERVIEW OF CLEANUP STRATEGIES IN THE UNITED STATES

William J. Linn
United States

1. ABSTRACT

The State Coalition for Remediation of Dry Cleaners (SCRD) was established in 1998 with support from the U.S. Environmental Protection Agency Superfund Remediation Technology Innovation Office. The mission of SCRD is to provide a forum for states to share programmatic, technical and environmental information to improve the remediation of dry cleaner sites. Currently there are thirteen member states with dry cleaning solvent cleanup programs. SCRD holds an annual meeting and conducts teleconferences periodically. The SCRD website at http://www.drycleancoalition.org features technical and administrative papers and reference materials on drycleaning site assessment and remediation, including profiles on over 100 sites where remediation has been conducted.

Annual funding for the state programs ranges from $650,000 to $10,000,000 and is generated by gross receipt taxes, registration fees, solvent taxes, deductible payments, license fees, and non-compliance penalties. There are two types of programs: reimbursement funds and state lead funds.

Resource allocation is the single greatest challenge facing the state programs. Chlorinated solvent contamination is widespread and difficult and expensive to remediate. There is pressure from businesses, bankers and real estate developers to rapidly remediate sites. Remediation is complicated by the presence of active businesses, buried utilities, site access and ongoing compliance issues with active drycleaning businesses.

The state programs include over 3,400 sites. Assessment work has been initiated on over 1,300 sites and over 300 remedial systems have been installed. Over 200 sites have been closed. Besides the more conventional remedial technologies, the following technologies have been utilized at state coalition drycleaning sites: chemical oxidation (using potassium permanganate, sodium permanganate, Fenton's reagent, and ozone), diffusive oxygen emitters, co-solvent flushing, in-well stripping, zero-valent iron, biostimulation (using potassium lactate, ethyl lactate, molasses, dextrose, emulsified soy bean oil, HRC®, and ORC®) and bioaugmentation.

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SMALL SITES WITH PETROLEUM HC CONTAMINATION

URBAN GASOLINE STATIONS: NEW TECHNOLOGIES FOR EARLY DETECTION OF LEAKAGES FROM USTS AND REMOVAL OF POLLUTANTS AT LOW CONCENTRATION IN GROUNDWATER

Salvatore Contarini
Italy

1. ABSTRACT

Enitecnologie is active in the area of pollution prevention and remediation of soils and groundwater. In the recent years, particular attention has been devoted to the environmental protection of urban gasoline stations. For this purpose an early leak detection system, combined with an innovative pump&treat apparatus has been designed.

The system is based on two patented technologies which are currently running in pilot plant and demonstration units:

A. A device for hydrocarbon detection in soil named *SOIL ALERT* for the monitoring of USTs (Underground Storage Tanks), based on hydrocarbon selective gas sensors;

B. An innovative "pump & treat" system named *EN-Z-LITE,* for the treatment of contaminated groundwater, based on synthetic zeolites, selective to a number of organic pollutants such as aromatic hydrocarbons, chlorinated compounds, and methyl-tert-butyl-ether (MtBE).

The SOIL ALERT probe, based on a tin oxide semiconductor, allows even small leaks of hydrocarbons to be detected. In fact an underground leak will produce a large increase in interstitial vapor concentration, through soil porosity, long before the spill reaches appreciable amounts. A network of probes, adequately positioned in the surroundings of USTs, can be remotely controlled to provide early detection alerts.

The pump and treat system works by absorption in shape selective zeolites which remove pollutants like hydrocarbons and gasoline oxygenated additives by tailoring adsorbent channel dimensions and hydrophobicity. According to the Enitecnologie patent, the process has been applied to real MtBE pollution cases where different input concentrations were steadily reduced to the $< 10\ \mu g\ L^{-1}$ level.

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INVESTIGATION AND REMEDIATION OF SITES CONTAMINATED WITH PETROLEUM HYDROCARBONS IN LITHUANIA

Ramune Seckuviene
Lithuania

1. ABSTRACT

Lithuania exclusively uses only groundwater for potable water resources.

Petroleum is not only the main source of energy at present-day, however it is considered to be the main source of groundwater contamination in Lithuania. Therefore, the total area contaminated with petroleum hydrocarbons exceeds 3-5 million m^2 and the total area of oil business objects makes up to 6-7 million m^2.

The pollution state of investigated sites is being evaluated by distinguishing the background – "clean area" – and four pollution levels: low, medium, high and very high. From all potential contamination sources, 59% are polluted with petroleum hydrocarbons.

Several methods are used for the treatment of territories contaminated with hydrocarbons in Lithuania. We use *in situ* methods for subsurface and shallow groundwater treatment in such territories, where oil products have reached the shallow groundwater and a free phase oil layer has been detected on it. Hydrogeological Company "Grota" is probably the one who has the biggest experience using the *in situ* site remediation methodology. The most popular and cost-effective method is called "pump and treat", when the free phase oil layer from the shallow aquifer is being pumped out. In Lithuania this method was used in about 10 hard-contaminated sites and is being used nowadays. Another method is vacuum extraction. It is used usually in clayey and small grained sandy deposits where hydrocarbons are adsorbed into the soil. Nowadays, in Lithuania we still have such areas where the free phase oil layer appears. So this is the reason why the "pump and treat" method is more popular.

Ex situ method used in Lithuania is usually for quick topsoil treatment after accidents related with accident spillage of petroleum hydrocarbons.

Requirement for remediation of the territories contaminated with petroleum hydrocarbons depends on the risk to the clean nature and human health.

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THE INFLUENCE OF TIME ON THE DESIGN OF A REMEDIATION STRATEGY FOR SMALL SITES – A COMPARISON OF TWO CASE STUDIES

Paul Garrett
United Kingdom

1. ABSTRACT

Churngold Remediation Limited is a UK specialist remediation contractor who provides ‘design and build’ turnkey solutions for a diverse range of clients. They are currently undertaking two projects on former Petrol Filling Stations, which are both situated within urban areas. The sites share other similarities, including geological and contaminant characteristics and 'risk based' clean-up objectives. The main difference between the two projects is the timeframe, one needs to be remediated within 3 to 4 months, while the other doesn't need to be remediated for a period of 5 years. This presentation explores the differences in methodology and economics, highlighting specific issues to maintain safe operations and the anticipated performances of each system.

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RISK ASSESSMENT AND FOLLOW ON FOR SMALL SITES

BARRIERS AND BRIDGES TO RISK ASSESSMENT AND MANAGEMENT OF CONTAMINATED SITES IN URBAN AREAS: UPPER SILESIA CASE STUDY

Janusz Krupanek
Poland

1. ABSTRACT

The Upper Silesia is a densely populated, urbanized and industrialized area with a long history of environmentally harmful activities. There is located around 1 thousand large sites which are suspected or confirmed as degraded and 5 thousand medium and small sites recognized as potentially contaminated, or as potential sources of contamination. They vary in magnitude, type of contamination, relation to receptors and risks posed. Persistent environmental contamination is caused by production facilities, transportation, building activities, communal and commercial services and individual consumption. The facilities are often located within urbanized areas and the risk for receptors comes from interrelated sources and pathways.

In 2005, there were initiated, by regional and local administration, actions aimed at establishing a system of contaminated land management. Solutions are sought up to effectively assess and manage the problem on regional scale. Initial inventories were carried out by the Upper Silesia regional administration. They are accompanied by international efforts carried out in the context of European Union new legislation concerning mining wastes, soil and groundwater. Pilot studies on regional risk assessment were undertaken to identify and prioritize the following:

- contaminated sites and land,
- problem areas,
- potential sources of contamination.

The preliminary evaluation of these activities shows, that there is a need for a comprehensive approach integrating various aspects of assessment and management of contaminated sites and commercial activities with regard to the past industrial degradation. The integration should take into account: existing knowledge, availability of information, organizational and administrative solutions, assessment and decision support tools, strategic management approaches and operational practices.

The presentation comprises the following:

1. Overview of the Upper Silesia contaminated sites in urban areas,
2. inventory, assessment and understanding of the problem,
3. legal, institutional, environmental, social and economical aspects,
4. management options and approaches.

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BROWNFIELDS REDEVELOPMENT IN ONTARIO, CANADA: TWO CASE STUDIES

Steven V. Rose
Canada

1. ABSTRACT

In 2004, the Province of Ontario enacted legislation to encourage the cleanup and redevelopment of former industrial/commercial lands (Brownfields). New provisions within environmental legislation provide general protection for municipalities, creditors, and others against environmental cleanup orders for historic contamination, as well as protection for owners after they have appropriately remediated a site. Within the Ontario Planning Act, municipalities may designate "Community Improvement Project Areas" that further encourage brownfields development by way of financial incentives in the form of study grants and tax exemption programs. One such program is in active use by the City of Kingston.

Ontario's Record of Site Condition Regulation has created a public registry and regulatory standards which replace former guidelines for environmental quality of soils, groundwater, and sediment. Both the current Standards and the former Guidelines recognize the importance and value of completing a Site Specific Risk Assessment to support actual site remediation targets when a particular site does not meet the inherent assumptions upon which generic cleanup values are based.

Case Study 1 outlines the use of a Site Specific Risk Assessment (SSRA) for the decommissioning of a former food processing facility situated in an area of shallow soil overburden over bedrock at the waterfront of Lake Ontario. Application of an SSRA to this demolition and remediation project identified the actual risk levels posed by petroleum contamination in the subsurface, and was used to develop supporting cleanup targets that were protective of aquatic organisms in the receiving environment.

Case Study 2 identifies the cleanup and redevelopment of a small (0.7 hectare) commercial property located adjacent to a former scrap metal / battery recycling facility with documented contamination by toxic metals and PCBs. Clean up of this property has been completed under the new Ontario regulations and included delineation and remediation of metals-contaminated soils. Redevelopment included registering this property on the provincial Brownfields Environmental Site Registry, a public reference system for environmental records that is parallel to the existing provincial land registry system for land ownership records. Residential construction at this property is in progress.

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EXAMPLES OF HEALTH RISK ASSESSMENT APPLICATION FOR CONTAMINATED SITES IN THE UPPER SILESIA, POLAND

Eleonora Wcislo
Poland

1. ABSTRACT

Risk-based approach to contaminated land assessment and remediation in Poland has been proposed by the Institute for Ecology of Industrial Areas in recent years but it has not been included into any legal regulation. A legal instrument for contaminated land assessment is still soil quality standards. When the concentration of at least one substance exceeds the standards, land is regarded as contaminated.

However, risk assessment was applied in three demonstration projects for guiding remediation or revitalisation activities at contaminated sites in the Upper Silesia, Poland.

For these risk assessments, the general U.S. EPA site-specific human health risk assessment methodology used for Superfund sites was applied.

Two of these projects were performed within the joint projects of the Institute for Ecology of Industrial Areas, the U.S. Department of Energy and the Florida State University, concerning the development of technologies (bioremediation, phytoremediation) for the environmental clean-up of contaminated sites (Czechowice Oil Refinery Project and Phytoremediation Project). The third one – the Warynski Brownfields Project - was funded by the Voivodeship Fund of Environmental Protection and Water Management in Katowice, Poland. Consultancy on the project was provided by experts from U.S. EPA, Region III, Philadelphia, the U.S.

These risk assessments included the baseline risk assessment and the development of risk-based concentrations as remedial goals.

The above-presented demonstration projects were attempts to apply the general U.S. risk-based approach to remediation or revitalisation of contaminated sites in Poland. However, this approach was modified in order to include exposure aspects that were considered unique in this country.

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AN ENVIRONMENTAL MANAGEMENT SYSTEM BASED ON RISK ASSESSMENT FOR PETROLEUM RETAIL STORES

Cem Avcı
Turkey

1. ABSTRACT

An environmental risk occurs when a hazard (e.g. process, activity or substance) has the potential to cause a deleterious impact on the environment surrounding it. That part of the environment which is, or could be affected is known as a receptor. Receptors include humans, flora and fauna, the built environment and water resources. An Environmental Management System (EMS) applied for a facility is one of the major planning tools that may prevent unacceptable operational risks associated with the activities undertaken at the site. The idea behind developing an EMS for gasoline retail stores is to have a system in place that would provide compliance with environmental regulations, development of an effective waste management system, improved management of natural resources, identification of environmental risks associated with facility operations and development of mitigation procedures to prevent potential risks

For this purpose a prototype EMS for a petroleum retail store has been developed. The components of EMS have been developed based on the source-pathway-receptor point of view. The present work incorporates the general concepts of an EMS, prototype EMS for a retail store and sample risk assessment application to an existing retail store

The ideal approach is to keep under control the risks that are associated with potentially unwanted events that may arise in the retail store operations. At the heart of controlling risk approach is the environmental risk assessment (ERA) which should be undertaken to understand the implications for soil, ground water, surface water and air quality of operating a petroleum retail store. The purpose is to identify parts of the operations (forecourt area, underground storage tank area, etc.) that could cause emissions of hydrocarbons and assess the likelihood and the consequences of the release. Some unwanted emission examples are leakage of tanks, leakage from lines, accidental spills from road tankers. The ERA takes into account that despite rigorous operating procedures and mechanical integrity of equipment some product may escape from containment to the media during normal site operations. Effective control and limitation of these releases is a second line of defense after containment. A likelihood of occurrence is attached to the potential spill scenario based on the control mechanisms present at the site.

A detailed assessment of the potential pathways for each unwanted event is subsequently evaluated. The migration pathways for each event were identified using a modified version of the flowchart of ASTM E 1739-95 “Standard Guide for Risk-Based Corrective Action Applied to Petroleum Release Sites”. A ranking of the receptor impacts is developed for each potential pathway associated with potential unwanted events. For the proposed ERA, the risk impact classifications have been developed as follows: a) Confirmed Impact (Identified Immediate Acute Risk), b) High Risk Impact (Potentially Immediate Acute Risk Potential Short Term Threat (0-2 years and/or acute to Human Health, Safety or Sensitive Environmental Receptors)), c) Medium Risk Impact (Potentially Long Term Risk- Long Term Threat (> 2 years and or/toxic) to Human Health, Safety or Sensitive Environmental Receptors) and d) Low Risk Impact (Potentially No Risk): No Demonstrable Long Term Threat to Human Health, Safety or Sensitive Environmental Receptors.

A risk matrix is identified with each unwanted event for each operational area in the retail store and its potential impact based on the risk based corrective action approach. The decision makers are given a ranking for unwanted events in order to set goals in developing preventative measures for lowering the risks associated with the events.

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DIFFUSE POLLUTION OF GROUNDWATER IN URBAN AREAS

David N Lerner
United Kingdom

1. ABSTRACT

With the intensity of human activities in cities, their pattern of landuse is complex and ever changing. There are many small sites which can release pollutants to groundwater, and they usually do. This is because, on average, the management of chemicals on small sites is worse and less regulated than on sites owned by large, sometimes multinational, companies. Even though the sites are small, they are in large numbers. Their distributed nature, and the additive effects of their chemical releases, means that the load of pollutants is diffuse and large.

The impact of multiple small sources on groundwater is illustrated by a range of analyses which have been carried out on the city of Nottingham, UK, including the first validated estimates of groundwater recharge for a city. These are mostly based on BOS, a probabilistic, GIS tool for estimating the risk of pollution of groundwater which can arise from urban landuse. BOS includes (i) a groundwater flow of the aquifer in order to quantify recharge and delineate flow paths and catchments, (ii) a landuse database with details of all parcels of land for dates throughout the 20th century, and (iii) a probabilistic fate and transport model for the behaviour of the pollutants as they move through the unsaturated and saturated zones.

Results are presented for the organic pollutants PCE (tetrachloroethene) a common chlorinated solvents and degreasing agent, and MTBE (methyl tertiary butyl ether) an octane enhancing additive to petrol. The risk analysis shows that both pollutants are expected to be widely distributed in the urban groundwater, although with wide ranges of concentrations depending on the local density of sources.

A separate analysis of nitrate loads to Nottingham's groundwater has identified a wide range of non-agricultural sources including leaking sewers, landfills and industrially contaminated land. Through the use of groundwater and solute modelling tools, the total N load to Nottingham's groundwater was estimated to be 21 kg/ha/y, which is of the same order of magnitude to rural loads under farmland. Overall, it is clear that the multiplicity of small and large sources in urban areas act as diffuse sources of groundwater pollution.

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SMALL SITES IN UNIQUE SETTINGS/MULTIPLE CONTAMINANTS

REMEDIATION OF THE HAZARDOUS WASTE LANDFILL IN KOLLIKEN, SWITZERLAND

Jean-Louis Tardent
Switzerland

1. ABSTRACT

Since 1978, about 250,000 m^3 of hazardous waste (loose deposits, barrels and bags) has been deposited in a disused clay quarry in Kölliken, Switzerland. The responsible operator is a Consortium which has a local government participation of 91%. As a result of repeated complaints from the neighbourhood about unpleasant odours and dust emission, the local municipal council ordered the closure of the landfill in 1985.

The effluent contamination from the landfill presented a threat for an important drinking water source in the region. Since then intensive containment measures have been taken to protect the drinking water from contamination.

Containment methods show reasonable costs for the construction of the systems but will have high consumer costs for the long-term operation. For the Kölliken site such systems have to be maintained for many hundred years, therefore the only solution for a long-term successfully and economically remediation would be a total decontamination. In 2003 the authorities decreed the complete excavation of the landfill by 2012.

For the excavation of the hazardous waste landfill due to commence in 2006, three large halls will be erected: an excavation hall, a manipulation hall for sorting and packing, and a storage hall for the intermediate storage of hazardous waste. All halls will be under-pressurised so that the population living in the immediate vicinity of the landfill site will not be disturbed by emissions. Excavation will thus take place in small areas step by step from top to bottom in the reverse way the landfill was previously filled. A total of 450,000 t of hazardous waste must be excavated and transported to external facilities for treatment.

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ENVIRONMENTAL REMEDIATION TECHNIQUES IN A HEAVILY CONGESTED URBAN SITE

Jeff Westeinde
Canada

1. ABSTRACT

Remediation of contaminated sites in heavily congested urban areas poses unique challenges. This paper will illustrate several innovative techniques utilized on a highly contaminated urban site in downtown Toronto, Ontario, Canada and provide a detailed technical explanation of each methodology.
The site was a former gasoline service station with soil and groundwater contamination to depths of up to 14 meters below grade. The site has approximately 12 different major utilities running in both adjacent roadways at depths of up to 7 meters below grade including water, sewer, gas, cable, fiber optics etc. A fourteen (14) story building and underground parking structure and a 2 story building border the other two property boundaries.

To allow for expedient re-development of the site, an excavation program in conjunction with on site water treatment was selected to remediate the hydrocarbon contaminated site; however, the excavation and remedial methodology had to allow for variable depths and concentrations of contaminated soils. The scope of work also included the installation of an impermeable barrier wall below the water table (at a depth of 11 meters below grade) to ensure the site was not re-contaminated by the surrounding contaminated soils and groundwater present on adjacent sites.

This paper will examine a variety of environmental and geotechnical techniques used on the site to facilitate the safe and efficient removal of contaminates soils from the site including:

- Design and installation of 3,500 m^2 of soldier pile and lagging shoring and 120 m^2 of continuous caisson shoring;
- Design and execute a slot trench program, using a bentonite slurry to facilitate the excavation below water table into a flowing sand formation;
- Installation of an impermeable concrete barrier around the perimeter of the site to eliminate the pathway between off-site impacts and on-site receptors, thus allowing the site to be developed for residential use;
- Excavation, and off-site transportation, of 7,500 m^3 of hydrocarbon contaminated soil to a depth of 11.0 meters. The final three meters of excavation into the water table was achieved without dewatering, by excavating in small manageable cells and backfilling with blast rock, which required no compaction.

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ENVIRONMENTAL MANAGEMENT OF SOIL AND GROUNDWATER IN REGIONS UNDER DEVELOPMENT: IMPLEMENTATION IN FUTURE RESIDENTIAL AREA AT MUNICIPALITY OF EVOSMOS, THESSALONIKI

Stylianos Papadopoulos
Greece

1. ABSTRACT

An environmental management model for soil and groundwater in regions under development has been developed and implemented in the frame of an EC program (LIFE97 ENV/GR/000380). An environmental soil and groundwater investigation took place within an extended area of the municipality of Evosmos, Thessaloniki. The aim of the project was the environmental upgrade of the industrial and professional-use facilities region within the frame of residential development in Evosmos area. The investigation included a multilevel sampling of the subsoil, soil-gas and groundwater. The main soil contaminants were petroleum hydrocarbons.

The performed actions were:

- Monitoring of the contaminated soil by applying biological and physicochemical decontamination methods.
- Monitoring of the contaminated groundwater by applying biological and physicochemical decontamination methods.
- Monitoring of the contaminated surface water by applying biological and physicochemical decontamination methods.
- The post remediation monitoring of the environmental condition of subsoil, surface water and groundwater.

Based on these results the design and the implementation of the appropriate decontamination for the soil took place. The most appropriate decontamination measures for the indicated soil contamination proved to be the *in situ and on site* treatment of the soil with *an enhanced bioremediation method***.** The applied technique of *Bio-Venting* was proved very effective.

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SMALL SITES WITH ORGANIC CONTAMINANTS (NON PETROLEUM)

EXAMPLE OF DEALING WITH THE PAST ENVIRONMENTAL BURDENS IN SMALL SITE IN CZECH REPUBLIC

Kvetoslav Vlk and Vojtech Zikmund
Czech Republic

1. ABSTRACT

As an example of a small site, we chose a case of a relatively small pollution spot, the Coking plant of a huge steel factory – the Vitkovice Steel Works in Ostrava. Vitkovice is a steel plant that was founded in the beginning of 19th century. The location is given by the vicinity of high quality black coal mines of the Ostrava coal basin. The choice has been made so because of an interesting feature. This spot represents ca 1% of the area of the factory, but in the course of investigation it proved to be the most polluted sub-area, representing in the same time the only serious environmental risk.

Therefore the decision has been taken to dismantle the technology by safe methods (naturally – no welding, cutting only by high pressure water jet), to clean all the construction parts on site and to remove by excavation the worst polluted soil around the former basements to prevent possible spreading. This work took place in the period 2001 – 2003. A final study from 2003 confirmed the achievement of these main goals of the remediation.

Remediating the worst spot immediately after the recognition of the high risk it represented, it became possible to shift the rest of the remediation into the future without danger of spreading the pollution. The isolated pollution spots, left on the site, will then be excavated and the whole area turned into a zone of free time, business and light industry by covering most of the surface with fertile soil and vegetation.

This final remedy work will nevertheless be executed in the moment of the building of this new infrastructure and not necessarily now. In this way, i.e. by solving imminent problems in time, it is possible, in some cases, to treat huge problems with relatively small means.

The necessary procedure is represented by thorough investigation, good knowledge of geology and hydrogeology, by modelling the propagation of the pollution plume and by finding the really dangerous pollution sources and their fast elimination. On our case-story we show, that early elimination of the source and time of remediation. is the necessary and right way to minimize environmental risks, costs Generally said, by early measures it is sometimes possible to prevent small areas from growing to the scale of mega-sites and on the other hand, to treat huge brownfields like small sites.

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TECHNICAL APPROACHES TO RAPID SITE ASSESSMENT AND CLEANUP OF DRY CLEANER SITES: FLORIDA CASE STUDIES

William J. Linn
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1. ABSTRACT

In 1994, the Florida legislature established a state-funded program for the identification and remediation of sites contaminated by dry cleaning solvent, the first such program in the United States. The Drycleaning Solvent Cleanup Program is administered by the Bureau of Waste Cleanup of the Florida Department of Environmental Protection. The Program is funded by gross receipts tax, a tax on perchloroethylene drycleaning solvent, a deductible fee and a registration fee. The annual cleanup budget is approximately $10 million. A total of 1,423 sites are eligible for state-funded cleanup.

Site assessment and remediation are conducted by eleven private-sector contractors. In a typical site assessment, soil and groundwater samples are collected using direct push technology and are analyzed on site using a mobile laboratory. The scope of the assessment is changed based on data analysis in the field. Data needed for remedial design is generally collected during site assessment. Most monitor wells are installed during the initial assessment mobilization and consist of small-diameter direct-push installed wells (microwells). Other technologies used in site assessment work include roto-sonic drilling and the membrane interface probe. Assessment work has been completed at approximately 280 drycleaning sites.

To date, remedial systems have been installed at over 120 sites. In addition to the conventional remedial technologies, a number of so-called innovative remedial technologies have been employed at sites including: co-solvent flushing, diffusive oxygen emitters, chemical oxidation (potassium permanganate, Fenton's reagent and ozone), biostimulation (using the following nutrients: potassium lactate, ethyl lactate, HRC®, dextrose, ORC®, vegetable oil, and molasses), bioaugmentation, zero-valent iron, and in-well stripping. Over 100 sites have been closed to date.

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INSTITUTIONAL AND TECHNOLOGICAL APPROACHES ON CLEARING OF POLLUTED TERRITORIES FROM OBSOLETE PESTICIDES AS AN ELEMENT OF PERSISTENT ORGANIC POLLUTANTS

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Russian Federation

1. ABSTRACT

Pesticide impact on health is a serious problem requiring attention of International Community as nowadays amount of pesticides exceeded 1500 names.

Up to date management of pesticides (including stocks of obsolete and unfit chemicals) is regulated by international environmental agreements: the Stockholm Convention on Persistent Organic Pollutants (POPs), the Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal, the International Code of Conduct on the distribution and use of pesticides.

For the practical solution of problem connected with withdrawal from use and liquidation of obsolete pesticides as a part of POPS it is necessary to develop institutional measures including economic, legal and administrative mechanisms as well as technologies allowing to choose the most safe and economically sound method of their disposal.

A. Institutional approaches

Legal regulation of management of wastes of production and consumption

Main principles of state policy in the sphere of management of wastes is adjusted by the Federal Law №89-FZ from June 24, 1998 “On Wastes of Production and Consumption”.

Legal regulation of management of chemicals and their storage.

Federal Law “On Industrial Safety for Hazardous Production Units,”
National standards (GOST) 12.1.007-76, 50587-93;
General Safety Rules for Explosive and Flammable Chemical, Petrochemical, and Oil-Refining

B. Technological approaches

- Size of territory;
- Pollution level of territory;
- Ground and surface water;
- Human factor;
- Potential hazard for ecological systems;
- Environment conditions which can strengthen or weaken the influence of pesticides on polluted territory.

Identification and definition of sequence of disinfection of the territories polluted with pesticides:

- Receiving of information concerning the statistical data on dynamics of mortality
- Characteristic of the polluted territory, source and level of pollution, size of territory
- Assessment of danger of the identified territories polluted with pesticides
- Monitoring of polluted territories and its technical assistance
- Creation of the Register on territories polluted with pesticides

- Development of list of ecologically sound technologies and methods of deactivation of soil containing pesticides
- Deactivation of soil polluted with pesticides

List of advanced technologies on rehabilitation of territories polluted with pesticides.

- *Soil treatment directly on site without its movement "in situ":* liquid-phase sintering; biological treatment; chemical treatment
- *Collection of soil and its movement with further disinfection using special equipment "ex situ"*
- *Biological treatment of polluted soil:* landfill; chemical treatment using "solvated electron" technology; extraction per solvent; high-temperature technology

Using methods of "ex situ" disposal of the wastes

The main ecological parameter for landfill of wastes should be an assessment of opportunity of pollution of drinking water and their influence on the population health.

- Underground landfill
- Storage
- Landfill

C. Existing and Perspective Technologies for Destruction of POPs (Pesticides)

New Technologies

- Gas-cycle hydrogenation
- Electrochemical oxidation
- Molten metal
- Fused salt
- Process of electronic solvation
- Plasmochemical deactivetion
- Hypercritical water oxidation
- Plasma arc
- Underground landfills
- Deep injection

For *recovery of soil from obsolete pesticides* the following methods are successfully used:

- Anaerobic Bioremediation Using Blood Meal
- Bioremediation Using «DARAMEND»
- In Situ Thermal Desorbtion

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SITE REMEDIATION USING CHEMICAL OXIDATION TECHNIQUES

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1. ABSTRACT

In situ chemical oxidation (ISCO) is a rapidly evolving site remediation technology for depletion of organic contaminant mass in source areas as well as for control and treatment of plumes. The choice of ISCO over other remediation methods has been motivated by the ability of chemical oxidation to be engineered to accommodate site specific conditions, to be implemented quickly with commercially available equipment and materials, and to yield measurable results in weeks to a few months. Oxidants such as catalyzed hydrogen peroxide (H_2O_2 with natural or supplemental Fe^{+2}), sodium persulfate ($Na_2S_2O_8$) and potassium permanganate ($KMnO_4$) are capable of achieving high destruction efficiencies for prevalent organic contaminants such as chlorinated solvents, petroleum products, pesticides, and explosives. Oxidant delivery into contaminated soil and groundwater can be accomplished using wells, probes, fracturing, and mixing systems. A body of research and development work combined with experiences gained from field applications of ISCO at well over 100 contaminated sites in the U.S. have enhanced the understanding of ISCO and how it can be implemented alone or used in combination with other remedial technologies (e.g., with surfactant flushing or bioremediation). It is clear that achieving performance objectives at a particular site requires careful selection of a chemical oxidant and delivery system based on the target contaminants and site conditions. During this presentation, highlights of relevant theory, experimental results, and field observations will be given concerning the effective application of ISCO for remediation at contaminated sites.

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"CLUSTERED" REMEDIATION OF DRYCLEANING SITES IN FLANDERS

Leen Bastiaens
Belgium

1. ABSTRACT

On the one hand, drycleaners are typically Small and Medium size Enterprises (SME's) with huge soil and groundwater pollution problems (mainly chlorinated aliphatic hydrocarbons - CAHs) but limited financial means for remediation. They are located in urban areas, often as 'houses in the row' on a small piece of land. On the other hand, the Flemish soil remediation legislation (Vlarebo) describes 'the polluter pays' principle and low target concentrations (sanitation limits PCE, TCE, DCEs and VC are respectively 40; 70; 50 and 5 µg/l). In addition, remediation of CAHs with classical technologies such as pump & treat often fail due to the presence of free phase product (DNAPL). The combination of all these factors leads to enormous problems for the dry-cleaning sector in Flanders.

To prevent the imminent bankruptcy for the sector, efforts have been made to find a solution. On request of OVAM (Flemish Public Waste Agency) a study was performed by Vito (2002-2004) to develop a cost-effective remediation approach for dry-cleaning sites, and the establishment of a fund is ongoing. To goal of the Vito-study was to work out possibilities for a 'standardized' procedure for such sites, including both site characterization and remediation. With the City of Antwerp (Belgium) as example, a demo-project was executed.

During the first step of the project, an inventory of drycleaner locations and the regional geology/hydrogeology was made, as well as an overview of existing consultant's soil investigation reports, and existing and innovative remediation technologies. At least 104 sites were identified in Antwerp, including at least 40 sites where PCE had been used in large quantities.

In the second step, the applicability of three innovative technologies was evaluated for 2 drycleaner sites based on lab scale feasibility testing. Chemical oxidation was not optimal, as very high matrix demands were observed. Soil flushing with solvents (ethanol) or detergents (Faliten), and also anaerobic biodegradation offer interesting possibilities. To realise a fast biodegradation of the CAHs, the addition of a carbon source was required, as well as the addition of a CAH-degrading bacterial inoculum. The naturally present microbial population was only able to convert PCE to cDCE.

Protocols for common site investigation and remediation strategies for drycleaner's sites in a city such as Antwerp were proposed in the third phase of the project. A clustering of 4 to 6 neighbouring drycleaner sites with comparable soil/groundwater geochemistry was proposed. The site investigation, feasibility testings, remediation plan and execution of the sanitation should be performed per cluster, involving one coordinator, one consultant (or consortium) and one contractor (or consortium). A good planning will be essential for such approach, but will lead to a more cost-effective remediation of dry cleaning sites in urban areas.

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CLEANUP OF A SMALL DRY CLEANER USING MULTIPLE TECHNOLOGIES: SAGES DRY CLEANERS

Guy W. Sewell
United States

1. ABSTRACT

Environmental contamination associated with the current or historical operations at Small and Medium-size Enterprises (SMEs) represent a unique set of remedial challenges and clean-up goals for the involved parties. Dense non-aqueous phase liquids (DNAPL) formed from chlorinated solvent releases are one of the most common and challenging environmental problems associated with SMEs. Approaches using combined remedial technologies may hold the best opportunity for SME site management and restoration.

The Solvent Extraction Residual Biotreatment (SERB) technology was demonstrated at the former Sage's Dry Cleaner site in Jacksonville, FL where an area of tetrachloroethene (PCE) contamination was identified. The SERB technology is a treatment train approach, which combines, co-solvent extraction, with microbially mediated enhanced *in situ* reductive dechlorination. During the co-solvent extraction, 34 kL of ethanol, approximately 2.5 pore volumes, were flushed through the contaminated zone, which removed approximately 70% of the estimated 44 L PCE mass. Approximately 2.72 kL of ethanol were left in the subsurface, which acted as a biologically available electron donor. Quarterly ground water monitoring for over three years showed decreasing concentrations of PCE along with the formation of dechlorination daughter products (*cis*-DCE, vinyl chloride, ethene). The observed formation and removal rates, extrapolated to a multi-step concurrent dechlorination process, predict that the dissolved phase chloroethene concentrations could meet regulatory limits in 3 to 30 years, and that the total residual source zone PCE could be biodegraded in 24 to 240 years. Modification to operational design could greatly improve system performance.

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SOIL MANAGEMENT FACILITY – AN EFFECTIVE TOOL FOR THE REMEDIATION OF SMALL URBAN CONTAMINATED SITES

Gullaume Bedard
Canada

1. ABSTRACT

The remediation of small urban contaminated sites has always been a challenge for municipalities, developers, local regulators and remediation consultants and contractors. While wanting to stimulate the redevelopment of Brownfield sites in urban areas and limit the expensive option of using municipal landfills that are already overcrowded with domestic waste, the different parties involved in the environmental industry had to find tools and services to facilitate the recycling, treatment and re-use of soil impacted with different contaminants of concern.

Soil Management Facility (SMF) has been proven an effective answer to this challenge. By applying state of the art ex-situ treatment technologies to treat an array of organic and inorganic contaminants, the SMF contribute to facilitate the remediation of numerous small contaminated sites in urban areas. By encouraging the treatment of contaminated soil to applicable re-use clean-up criteria, local regulators, municipalities and developers were able to reach economies of scale by centralizing the waste management and offset the prohibitive cost of land filling contaminated soil. This approach also contributes to stimulate the development and application of treatment technologies to eliminate the contaminants from the environment and the related future liability related to the direct disposal of contaminated soil into landfills. This approach contributes to offset some of the major concerns that were identified has slowing down the redevelopment process of small urban sites in municipalities in North America and Western Europe. This approach also embraces the global trend in many countries has to limit the use of landfill has a mean to the remediation of contaminated sites.

This paper/presentation will first cover the SMF application and the related ex-situ technologies utilized to treat contaminated soils such as biotreament, soil washing, chemical oxidation, etc. Each SMF operates under strict regulations and requirements for air, water and soil specified by the different government agencies. Our sound environmental approach and design to the treatment of contaminated soil using different ex-situ technologies has led us to have successfully obtained proper certification in many jurisdictions in North America and Western Europe. To this date, SMFs were certified to treat hazardous and non-hazardous soils, sludge and sediments contaminated with organic and inorganic compounds, including:

- Volatile petroleum hydrocarbons (benzene, toluene, ethylbenzene and xylenes (BTEX));
- Petroleum hydrocarbons (Oil and Grease);
- Polycyclic aromatic hydrocarbons (PAHs);
- Chlorinated compounds (pentachlorophenol - PCP, PCE, TCE, etc.);
- Creosote;
- Energetic compounds (TNT, HMX and RDX);
- Poly chlorinated biphenyls (PCBs);
- Sodium and Chloride (Salinity); and
- Heavy Metals (Mercury).

The second part of the paper/presentation will outline several specific case studies of SMF applications in different urban centers in North America and Western Europe and show the benefits of such application for the environmental industry. The implementation and easy accessibility of SMF in urban centers have also contributed to support the implementation of new funding programs by local governments and municipalities to stimulate the clean-up of Brownfield sites. A brief summary of a Canadian initiative, the Revi-Sols Program in Quebec with the collaboration of the City of Montreal, contributed to inject over $75 Million for Brownfield redevelopment. A strong emphasis was given to the program to fund project

that currently recycled and treated contaminated soil. This program clearly demonstrates the value of SMF for the environmental industry.

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IN SITU THERMAL REMEDIATION OF SOIL CONTAMINATED WITH ORGANIC CHEMICALS

Ralph Baker
United States

1. ABSTRACT

In Situ Thermal Remediation (ISTR) refers to a suite of rapidly emerging technologies including Steam Enhanced Extraction, Thermal Conduction Heating (TCH), and Electrical Resistance Heating that have been demonstrated at well over 50 sites to be effective options for difficult-to-treat source zones contaminated with organic chemicals. They are particularly well suited to redevelopment and remediation of sites associated with small and medium enterprises (SMEs) in urban areas, because they afford the ability to treat source zones in settings with access limitations, such as adjacent to or beneath buildings, at depth, and in heterogeneous soil, and do so rapidly and completely, without excavation.

At the Terminal One Site in Richmond, California, TerraTherm recently completed a full-scale field application of In Situ Thermal Desorption (ISTD) – a combination of TCH and vacuum – for treatment of chlorinated volatile organic compounds in saturated low permeability soils (i.e., 10^{-4} m/d). An array of thermal wells heated the 5400 m^3, 6.1-m deep target treatment zone (TTZ), which was located both inside and outside a warehouse building, to 100°C in 100 days. Even though the permeability of the clay soil was very low, steam stripping was the dominant contaminant removal mechanism. Approximately 30% of the pore water present in the TTZ was boiled off and 500 pore volumes of steam were generated and removed over the duration of heating/treatment. This resulted in very high removal rates (e.g., >99% reduction in concentration) and achievement of very low, residential soil cleanup concentrations of <100 µg/kg tetrachlorethene. Extensive post-treatment soil sampling indicated that there was no evidence of translocation of contaminants or downward mobilization of dense non-aqueous phase liquid (DNAPL) during remediation. The site was successfully and cost-effectively remediated within a 9 month period (including construction, operation, and demobilization), and is now being redeveloped as 300 high-value residential units.

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PILOT STUDY MISSION

NATO/CCMS Pilot Study: Prevention and Remediation Issues in Selected Industrial Sectors

1. BACKGROUND TO PROPOSED STUDY

The current NATO Pilot Study on technologies for cleanup of contaminated land was completed in 2002. The pilot study was concluded for several reasons. The primary reason is that general information on technologies, processes, and methodologies for the cleanup of contaminated land and groundwater has been discussed and distributed by the pilot study in its meetings and annual reports. Thus, the goal of the pilot study has been accomplished. There is ongoing interest by participating countries and countries with developing contaminated land programs to continue a dialogue, to focus on specific industrial sectors, and to maintain technical contacts and information flow provided by the current "network" of pilot study participants. Thus, a new pilot study is proposed to allow this long-standing global network on contaminated land to continue.

2. PURPOSE AND OBJECTIVES: NEW PILOT STUDY - SECTORAL APPROACH

Much of the work of the past pilot study on contaminated land has drawn on case studies of technologies applied to a wide variety of industrial and land contamination settings. While useful for explaining the basis for the technology, its costs, and applicability, the information available is not focused on certain problems or site types at a variety of scales, contaminant concentrations, geological conditions, etc. Thus, the current pilot study is a "technologist's" view of characterization and remediation approaches.

Of more relevance to governments, industry, and the remediation services industry is interpretive information about the measurement and clean up of certain contaminants in specific industrial sectors in a variety of hydrogeological settings and levels of severity of risk. In addition, environmental protection has embraced more holistic concepts of preventing problems as a first priority. Thus, methods for preventing pollution (both by process changes and by land use and planning initiatives) coupled with remediation efforts are a priority for new and existing industrial development and for newly industrializing countries. This "integrated" approach can positively affect land and groundwater contamination as well.

Thus, a new CCMS Pilot Study entitled ***Prevention and Remediation Issues in Selected Industrial Sectors*** is proposed. The purpose of the proposed pilot study would be to define and explore best practices for reducing the health and environmental impact on soil and groundwater from industrial sectors of interest (e.g., metals mining, organic chemical production, gasworks, and fertilizer manufacturing) as well as other unique site "types" (e.g., old landfills, privatization sites [i.e., facilities transitioning from former state ownership in certain categories], mega-sites [i.e., large-scale former industrial and mining facilities], and shoreline sediment sites). In reviewing case studies as well as experience from the current pilot study on contaminated land and other sources, the proposed pilot study may be able to assess or benchmark "what is easy to clean," "what is difficult to clean," and "what is impossible, at reasonable cost, to clean."

3. SCOPE OF WORK

The duration of the proposed pilot study is three (3) years. The study would commence by selecting industrial sectors. The pilot study meetings would be devoted to the techniques and technologies for preventing and avoiding discharge to soil and groundwater as well as measurement and remediation for that industry sector or site type. Countries would nominate expert speakers on such topics as industrial operations; problem definition and risk assessment; measurement and monitoring strategies; and remediation approaches for both soil and ground water. These speakers could represent many stakeholders - including industry, government, technologists, and consultants. The pilot study would seek to engage industry and other private sector organizations at the transnational level in sharing and

evaluating technical information. The unique contribution of the pilot study would be measured by its ability to synthesize information regarding best practices, successes and failures, and uncertainties for the sectors of interest.

A typical pilot study meeting would explore topics such as:

- Industry overview and assessment including typical waste stream and contamination issues
- Risk assessment methodologies
- Preparedness and planning issues
- Site characterization and monitoring approaches
- Prevention and remediation strategies including technologies and methodologies
- Institutional, financial, and public participation aspects of prevention and remediation

In addition, countries would be given the opportunity to present a general update of prevention and remediation activities via a *Tour de Table* as well as to provide country-specific industrial sector information. A limited number of countries would be selected to provide these detailed updates at each meeting.

It is proposed that the industrial sector of interest would be matched to the special interests to the potential host country for the meeting. Thus, host countries would have primary responsibility for involving industrial sector representatives and, possibly, developing a field visit to the affected sector.

4. ESTIMATED DURATION

Pilot Study Meetings: September 2003 - September 2005
Completion of Final Report: Spring 2006

5. PRODUCTS

An industrial sector report will be developed after each meeting. These reports will include invited papers from the industrial sector assessments as well as summary information on the monitoring and evaluation of risks and strategies for prevention and remediation. Country update reports will also be included.

6. NON-NATO PARTICIPATION: BALKANS, CENTRAL ASIA AND OTHER DEVELOPING COUNTRIES

In 2001, NATO/CCMS identified key objectives that would assist developing countries. These objectives include:

1. Reducing the impact of military activities

2. Conducting regional studies including cross-border activities

3. Preventing conflicts in relation to scarcity of resources

4. Addressing emerging risks to the environment and society that could cause economic, cultural and political instability

5. Addressing non-traditional threats to security

The proposed pilot study, *Prevention and Remediation Issues in Selected Industrial Sectors*, specifically addresses #4 and also covers aspects of #'s 1, 3, and 5. The proposed pilot study would target specific industrial sectors based upon interests of countries with newly industrializing and developing economies. The study would provide these countries with a base of technical information and with a network of

experts from whom to obtain advice. This proposal offers the opportunity for current pilot countries to continue networking and information sharing, and also provides a focus for discussions driven by partner country needs.

7. REQUEST FOR PILOT STUDY ESTABLISHMENT

It is requested of the Committee on the Challenges of Modern Society that it approve the establishment of the *Prevention and Remediation Issues in Selected Industrial Sectors Pilot Study*.

Pilot Country:	United States
Lead Organization:	U.S. Environmental Protection Agency