



Reference: Chemical Site 2013 -2020

France



**Former Insecticide
Production Site
(Industry: Confidential)**

*Organo-chlorine
Pollutant Impact*

Project Description:

- A former Insecticide Production Site was bought by an Pharmaceutical Industry Client. In the Context of a new site development Project a complete Site Remediation was started in 2012.
- Site Contaminations are principally different isomers of Hexa-chloro-cyclo-hexane (alpha-, beta-, gamma-, etc.), Chloro-benzenes (Mono-, Di-, Tri, tetra-, etc.), Chloro-phenols and Dioxins (PCDD/F).

HPC Services: TERQ (HRA) and Remediation Planning:

- Realization of site investigations & different TERQ (Toxicological Exposure Risk Quantifications) & HRA: Health Risk Assessments for Definition of SS-RG: Site Specific Remediation Goals and Limit Values for the existing Pollutant Cocktail and different sensitive site use Scenarios: → Soil, Air, Dust, Water, etc.
- The TERQ reports and Remediation Plan were validated by the Authorities ensured legal & financial Budget Safety.
- Remediation organization and supervision: Excavation, HW: Hazardous Waste separation (Triage), Pure HW (HCH) Packaging and elimination, Environmental Monitoring, etc.

Project Data:

- Production starting in 1948 to 1974, after use for a Chemical Industry Waste Water Treatment Plant.
- In 2011 – 2012 realization of Site Investigations and in 2012 – 2014 performing of different TERQ and Remediation Plan by HPC (cf. Project Description).
- The TERQ reports were approved by the Authorities (Industrial Inspectors, Health Authorities, the Industry and third party Experts).
- Project Value: Confidential

Country & Location:

- France

Client:

- Pharmaceutical Industry

Contact:

- Dr. Frank P.M. KARG
Scientific Director of HPC-Group
CEO of HPC INTERNATIONAL / France
Member of Bord of Directors
HPC Germany & Court Expert.
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Spain: Confinement Engineered Landfill

Reference: Spain:
**Former Lindan Pesticide
Production Landfill 19 ha:**



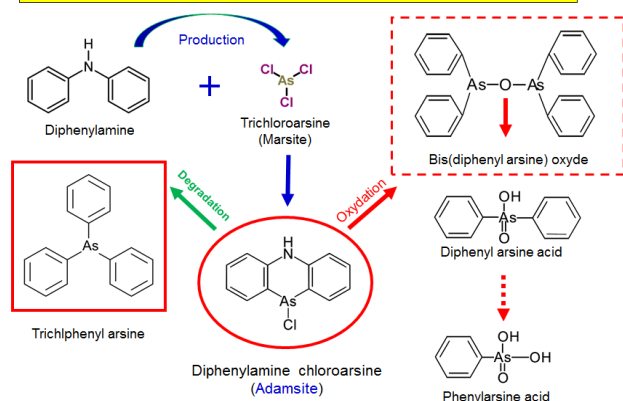
Activities of HPC:

- **Contaminated Site Investigations:**
POP Pesticides (Lindane, HCH in Soil, and Groundwater.
- **Confinement by Engineered Landfill**
validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable **Remediation Technologies.**
- **Remediation Realization:**
Remediation organization and supervision: Excavation, HW: Hazardous Waste separation (Triage), Pure HW (HCH) Packaging and elimination, Environmental Monitoring, etc.



Client: Confidential
Amount: Confidential
Contact: Dr. Frank P. M. KARG / Scientific Director of HPC-Group, CEO of HPC International / France, Member of Bord of Directors HPC Germany & Court Expert.
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Production & Environmental Chemistry of Adamsite (DM)



**Reference: Confidentiel Site:
South-Est of France**

**Former Production Site of CWA
(Chemical Warfare Agents):
Organo-arsenics, etc., Pesticides &
Explosifs, etc.: 165 ha**



Activities of HPC:

- **Contaminated Site Investigations: Explosifs** and other Pollutants in Soil, Soil gas and Groundwater.
- **Detection of CWA** on site by IMS.
- **Research on Environmental Chemistry of CWA** (metabolites, initial products, etc.)
- **TERQ: Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.**
- **Development of Remediation Strategy & Design**, validated by the Authorities.
- **Remediation Assistance**

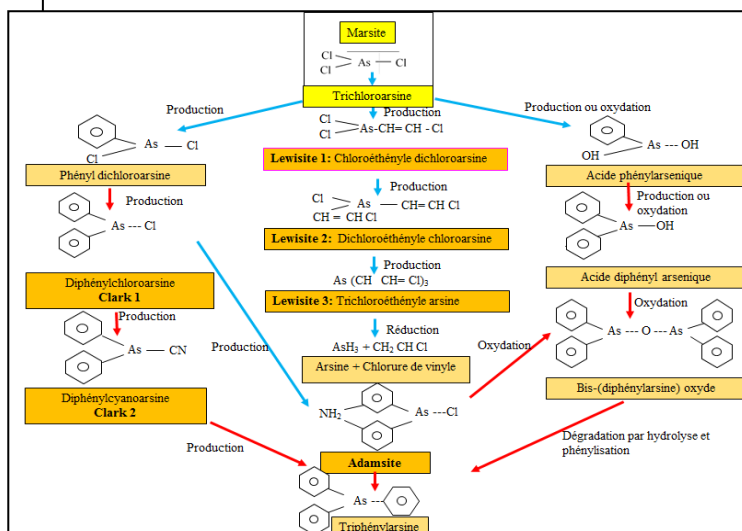


Client: Confidentiel

Amount: Confidentiel

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Former Production Site of CWA (Chemical Warfare Agents):

Organo-arsenics, etc., Pesticides & Propellants, Explosivs: 270 ha

The diagram illustrates the chemical pathways of Diphenylamine (DPA) and Trichloroarsine (TCA) in the formation of Adamsite (Diphenylamine chloroarsine).

Central Reaction: Diphenylamine (DPA) and Trichloroarsine (TCA) react to form Diphenylamine chloroarsine (Adamsite). This reaction is labeled "Production" with a blue arrow.

Chemical Structures:

- Diphenylamine (DPA):** N(c1ccccc1)c2ccccc2
- Trichloroarsine (TCA):** Cl[As](Cl)Cl
- Diphenylamine chloroarsine (Adamsite):** Cl[As](c1ccccc1)c2ccccc2
- Bis(diphenyl arsine) oxide:** O=[As](c1ccccc1)(c2ccccc2)[As](c3ccccc3)(c4ccccc4)
- Diphenyl arsine acid:** O=[As](c1ccccc1)(c2ccccc2)O
- Phenylarsinic acid:** O=[As](c1ccccc1)O
- Trichlorophenyl arsine:** Cl[As](c1ccccc1)(c2ccccc2)c3ccccc3

Pathways:

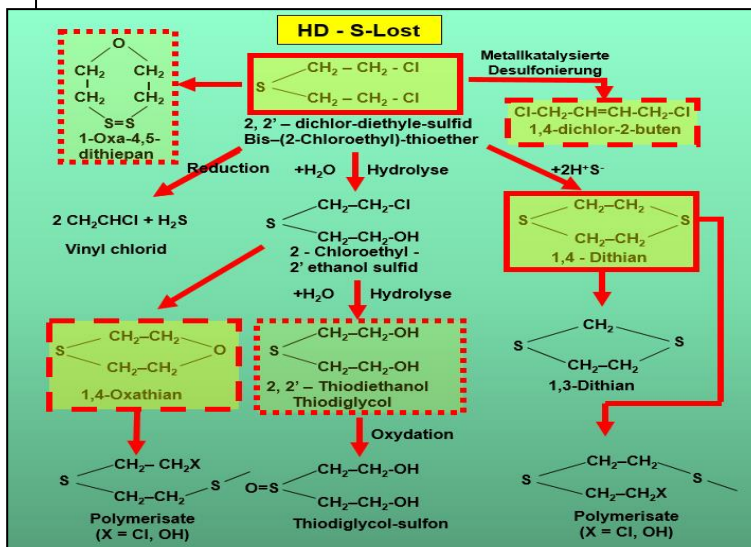
- Production:** DPA + TCA → Diphenylamine chloroarsine (Adamsite).
- Degradation:** Diphenylamine chloroarsine (Adamsite) → Trichlorophenyl arsine.
- Oxidation:** Diphenylamine chloroarsine (Adamsite) → Diphenyl arsine acid → Phenylarsinic acid.
- Intermediate:** Bis(diphenyl arsine) oxide is shown as an intermediate in the oxidation pathway, leading to Diphenyl arsine acid.

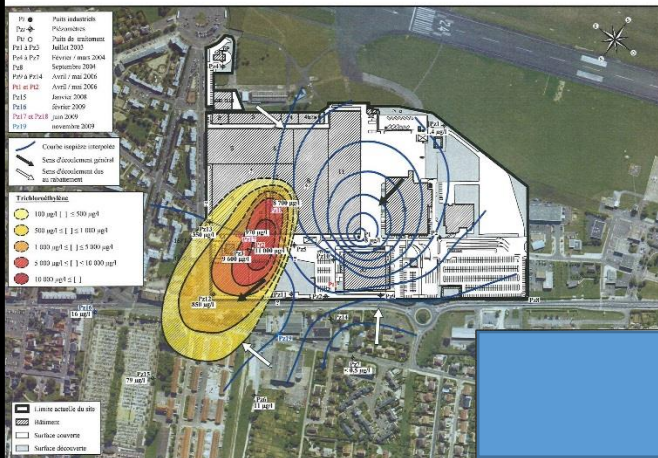
- **Contaminated Site Investigations: Explosifs** and other Pollutants in Soil, Soil gas and Groundwater.
- **Detection of CWA** on site by IMS.
- **Research on Environmental Chemistry of CWA** (metabolites, initial products, etc.)
- **TERQ**: Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **Development of Remediation Strategy & Design**, validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable **Remediation Technologies**.
- **Pyrotechnical Investigations**.
- **Risk Assessment for Health, Environment and Pyrotechnic Risks & definition of Nitrocellulosis Remediation Goals**.
- **Remediation and Decontamination Assistance** (Nitrocellulosis, Explosifs, Pesticides & CWA as HD Sulfur Mustard etc.)



Amount: 1.3 Million Euros

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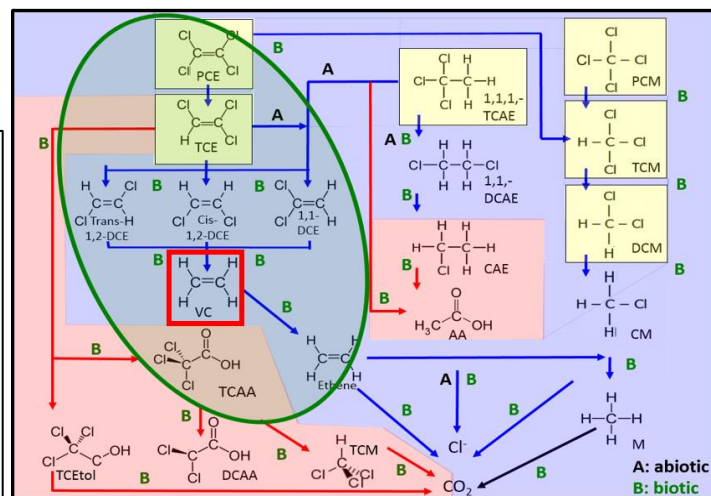


Activities of HPC:

- **Contaminated Site Investigations:** Chlorinated Solvents & CrVI in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **Remediation Realization: 2014 – 2020)**

Reference: Confidential Site: Middle of France

Military High Tech Production Site:
TCE, PCE, DCE, VC and CrVI: 22 ha
In-situ-DNBA-Remediation

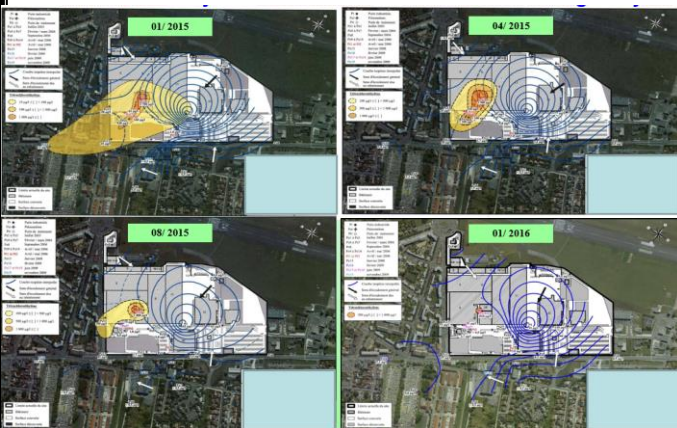
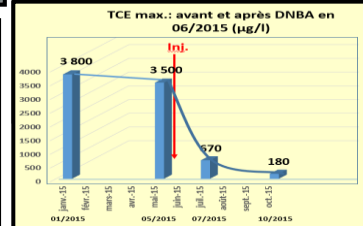


Client: Confidential

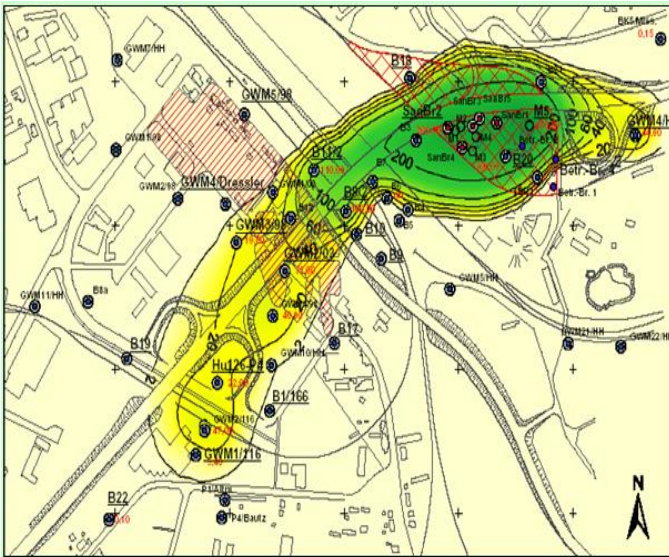
Amount: Confidential

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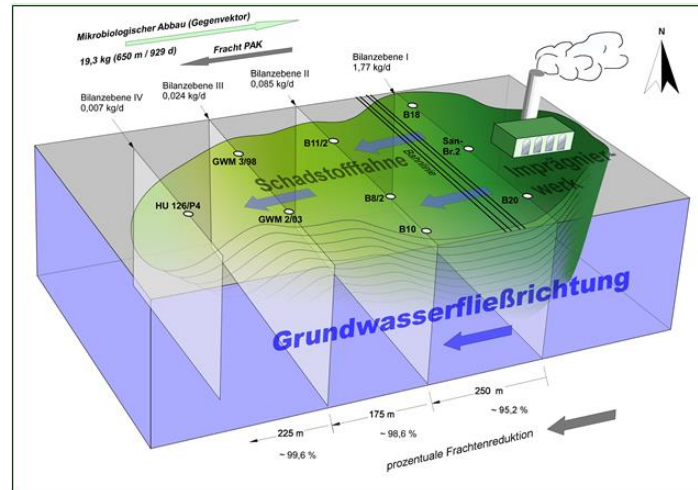
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Germany: Site Remediation Chemical Site



Reference: Germany:
Tar Impregnation Facility:
About 340 ha: DNBA-in-situ-
Remediation of Groundwater



Activities of HPC:

- **Contaminated Site Investigations:**
PAH, BTEX, TPH, HET & Aromatic Amines in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation)**, validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **Remediation Realization: 2016 – 2021 (in running) by use of in-situ oxidizers**

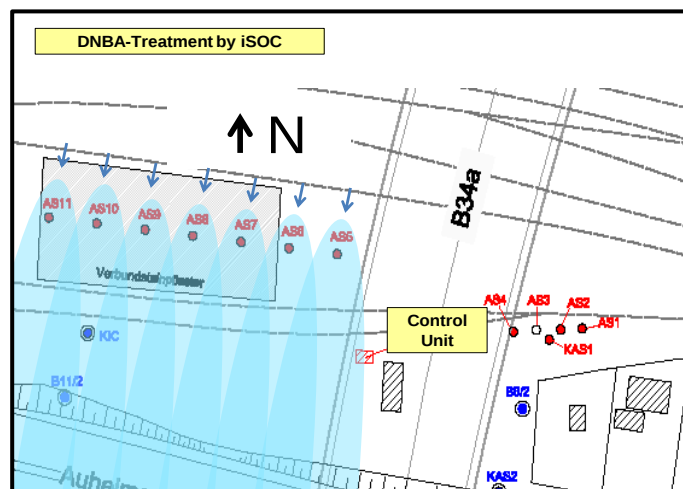
Duration: 2016 – 2020 (on-going)

Client: Confidential

Amount: Confidential

Contact: Frank KARG: +33 6 07 34 69 16

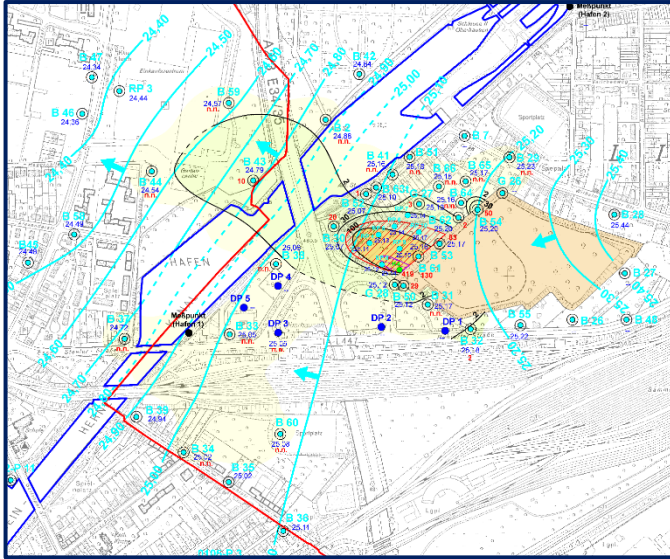
frank.karg@hpc-international.com



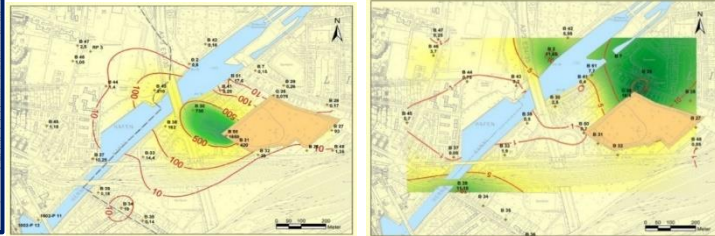
HPC INTERNATIONAL:

France (Roscoff), Germany (Duisburg),
Hungary (Budapest), Balkan (Pristinal),
Algeria (Skikdah)

Germany: Site Remediation Chemical Site



Reference: Germany :
**Industrial Waste Dump with PAH,
TPH, Phenols, BTEX, NSO-HET
Contaminations:**
**DNBA-in-situ- Remediation of
Groundwater**



Activities of HPC:

- **Contaminated Site Investigations:**
PAH, BTEX, TPH, HET & Aromatic Amines in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = **HRA:** Health Risk Assessment and Definition of **SS-RG:** Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.
- **Technical & Economic DNBA Feasibility Study** for applicable Remediation Technologies.
- **Remediation Realization:**
2017 – 2020 (in running) by
use of in-situ oxidizers

DNBA investigations in Oberhausen /Germany Left: Benzene in groundwater, Right: microbiological nitrate respiration for pollutant degradation. Enforced by DNBA (Microbiological Dynamization)

Client: Confidential

Amount: Confidential

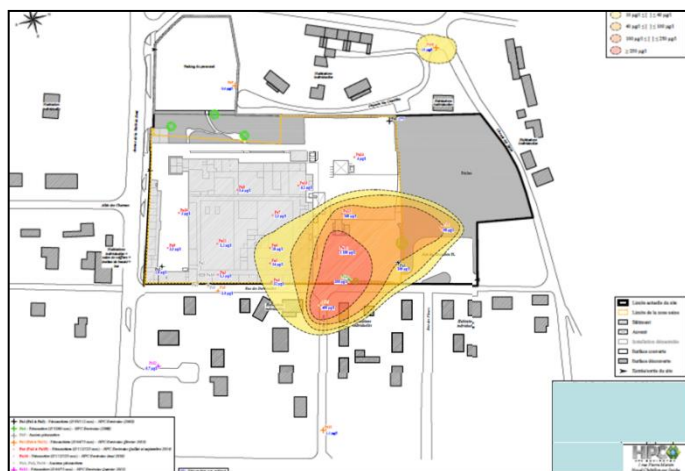
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HPC INTERNATIONAL:

France (Roscoff), Germany (Duisburg),
Hungary (Budapest), Balkan (Pristinal),
Algeria (Skikdah)



December 2017: PCE max: 6 800 µg/l (GW)

Site in France
Groundwater, Soilgas and Soil
Remediation: Pollution by
TCE, PCE, DCE, VC and BTEX:
In-situ-DNBA-Remediation of
Groundwater & Soilgas

Before



DNBA-Treatment

After



October 2019: PCE max: 26 µg/l (GW)

Activities of HPC:

- **Contaminated Site Investigations:** Chlorinated Solvents & BTEX in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities. SVE: Soil Vapor Extraction treatment.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **DNBA-Remediation Realization: 2017 – 2020 (in running)**

PCE degradation in less than 2 years of in-situ Microbiological DNBA Groundwater Remediation, by use of HPC PCR-site specific selected Bacteria Consortium and site specific developed substratum & nutriment

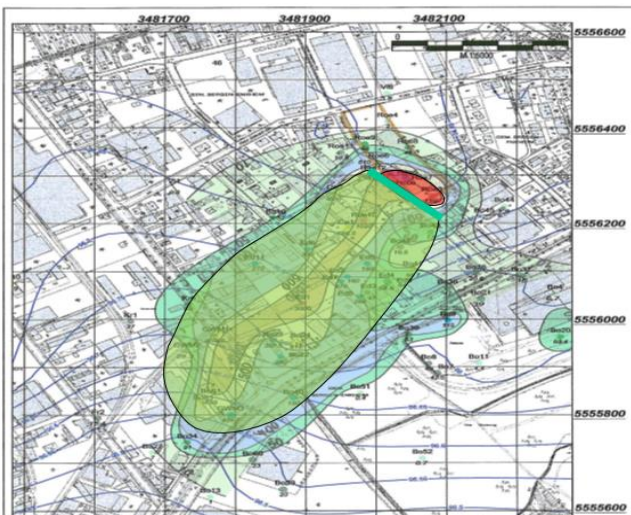
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Reaction	Reaction equation of the TCE-degradation and use of Electron-Acceptors	Eh Range in [mV]
Oxygen consumption	$C_2HCl_3 + O_2 \rightarrow C_2Cl_2O_2H \rightarrow 2 CO_2 + 3 H^+ + 3 Cl^-$	> 820 → 700
Nitrate reduction	$3 C_2HCl_3 + 2 NO_3^- + 6 H^+ \rightarrow 3 C_2Cl_3O_2H + N_2 \rightarrow 6 CO_2 + N_2 + 9 H^+ + 9 Cl^-$	< 740 → 500
Nitrate reduction	$3 C_2HCl_3 + 2 NO_3^- + 6 H^+ \rightarrow 3 C_2Cl_3O_2H + 2 NH_3 \rightarrow 6 CO_2 + 2 NH_3 + 9 H^+ + 9 Cl^-$	< 600 → 520
Manganese redaction	$3 C_2HCl_3 + 3 MnO_2 + 6 H^+ \rightarrow 3 C_2Cl_3O_2H + 3 Mn^{2+} \rightarrow 6 CO_2 + 3 Mn^{2+} + 9 H^+ + 9 Cl^-$	< 520 → -50
Iron reduction	$3 C_2HCl_3 + 3 Fe^{3+}(OH) + 6 H^+ \rightarrow 3 C_2Cl_3O_2H + 3 Fe^{2+} \rightarrow 6 CO_2 + 3 Fe^{2+} + 9 H^+ + 9 Cl^-$	< -50 → -200
Sulfate reduction	$2 C_2HCl_3 + SO_4^{2-} + 10 H^+ \rightarrow C_2H_4 + 2 CO_2 + H_2S + 6 H^+ + 6 Cl^-$	< -75 → -220
Methanogese	$2 C_2HCl_3 + 4 H_2O + 4 H^+ \rightarrow 2 CH_4 + 2 CO_2 + 6 H^+ + 6 Cl^-$	< -220 → -500

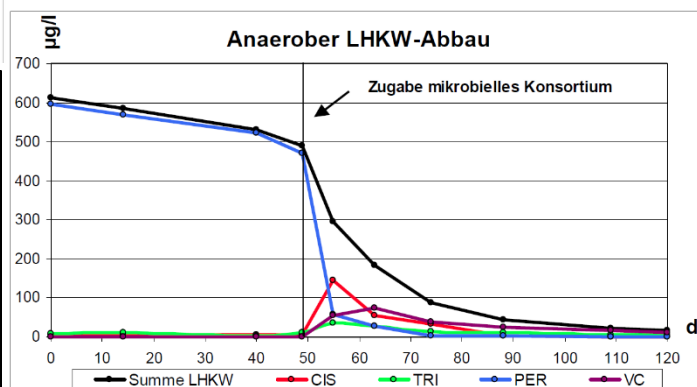


Germany

Groundwater Remediation: Pollution by TCE, PCE, DCE and VC (Vinyl Chloride) In-situ-DNBA-Remediation of Groundwater

Activities of HPC:

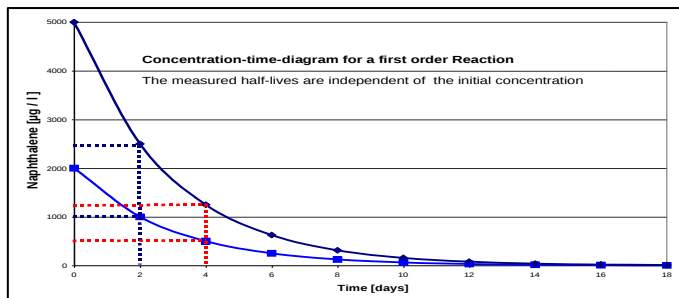
- **Contaminated Site Investigations:** Chlorinated Solvents (PCE, TCE, DCE and VC) in Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **DNBA-Remediation Realization: 2013– 2016**



TCE, PCE, DCE and VC degradation in less than 3 years of in-situ Microbiological DNBA Groundwater Remediation, by use of HPC PCR-site specific selected Bacteria Consortium and site specific developed substratum & nutriments

Client: Confidential

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HPC INTERNATIONAL:

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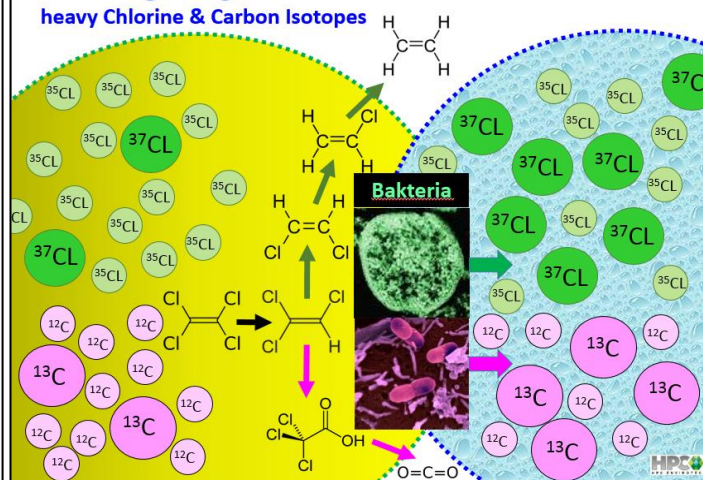
France

**Groundwater & Soilgas (Vapor)
Remediation: Pollution by TCE,
PCE, DCE and VC (Vinyl Chloride)
In-situ-DNBA-Remediation of
Groundwater and
SVE: Soil Vapor Extraction**

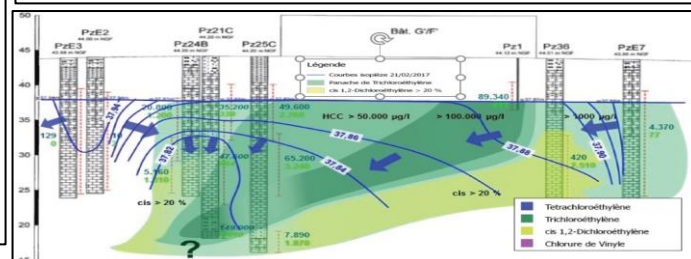
Activities of HPC:

- **Contaminated Site Investigations:** Chlorinated Solvents (PCE, TCE, DCE and VC) in Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies including Groundwater flow and pollutant transfer and degradation Modelling.
- **DNBA- & SVE-Remediation Realization:** starting 2019 – 2021 (on-going)

Microbiological Degradation of PCE & TCE and Accumulation of heavy Chlorine & Carbon Isotopes



TCE, PCE, DCE and VC microbiological degradation proof by stable Isotope Fractioning ($^{12}\text{C}/^{13}\text{C}$ & $^{35}\text{Cl}/^{37}\text{Cl}$) and determination of in-situ Degradation Rates of chlorinated solvents (in $\mu\text{g}/\text{l}/\text{day}$).



Client: Confidential

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HPC INTERNATIONAL:

France (Roscoff), Germany (Duisburg),
Hungary (Budapest), Balkan (Pristina),
Algeria (Skikdah)



Feasibility Study of Agent-Orange Dioxin Treatment in Vietnam

Ministry of Natural Resources & Environment (MONRE) / Office 33 (Dioxin & POP)
Contact Name: Dr. Frank KARG / HPC Envirotec SAS – France

Domaine d'activité

Montant du projet

Durée du projet

Site Remediation & Decontamination

Confidential

2014 - 2015



Blue, etc.).

To ensure future Environmental Public Health, site Remediation & Decontaminations are necessary to minimize bio-accumulation in Food & Feed Chain and to reduce negative toxicological Impacts.

Site Remediation & Decontamination can ensure new site Development and new Real Estate Projects.

Project Description:

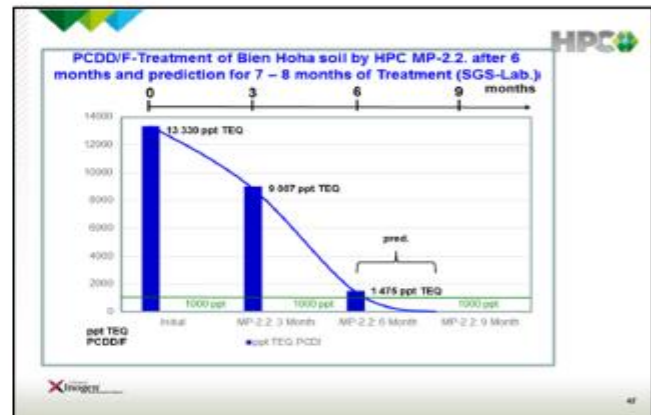
A feasibility Study was realized for the Office 33 / Ministry of Natural Resources & Environment (MONRE) concerning the soil treatment for decontamination of Agent Orange Dioxin (PCDD/F) pollution since the Vietnam War.

Based on Dioxin contaminated Soil Samples from the Bien Hoa Air Base in Vietnam chemical & microbiological Treatment Options were tested. The decontamination treatment procedures, results and reports were verified and controlled by Vietnamese and UN Experts (UNDP & GEF).

The positive results of the Feasibility Study were presented during an Agent Orange Dioxin Congress in Hanoi, in March 2015. The results were very positive concerning Dioxines, Pesticides and toxic Metabolite Treatments

Motivation:

- Since the Vietnam War, lots of large areas are contaminated in Vietnam with Agent Orange Dioxins, Pesticides, toxic Metabolites (as Chloro-phenols, etc.) and other pollutants (as Arsenic from Agent



Services:

- Technical & Economic Feasibility Study of Soil Decontamination via combined chemical and microbiological Treatments.
- Dimensioning of the developed treatments for on-site, off-site and in-situ treatments to ensure minimum treatment costs.
- Development of best bio-chemical Decontamination Treatment Ingredients.
- Development of Cost effective and safe site Decontamination Technology.

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
Office of the National Steering Committee 33

Date: June 24/2015

From:
Dr. Nguyen The DONG
General Director of Office of National Steering Committee 33
Vice Director of Vietnam Environmental Administration

To:
HPC Envirotec S.A.S.
1 rue Pierre Marzin
Noyal Châillon sur Sarthe
CS85001
35230 SAINT ERBLON / France

Tel: +33 607 346 916 (cell)
+33 299 131 450 (office)
Fax: +33 299 131 451
Email: hpc@hpc-envirotec.com
Web: http://www.hpc-envirotec.com
Member of HPCOCE (www.hpcocce.com)

Dear Dr. Karg Frank,

I would like to thank you for your cooperation with Office 33/Dioxin Project to carry out Technology Demonstration for Dioxin treatment under the Project entitled "Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam"

As far as you know, there are very limited technologies selected for demonstration this time. Of which, the Chemical - Biological Technology proposed by your side showed its potential and application which does not require complicated equipment with low cost and easily manipulated. Up to the purposes, the technology shall need further site specific application tests for exp for complicated materials, such as Dioxin or As contaminations and then applied for treatment basing on identification of contaminated sites.

Up to the purposes, concentration and characteristics of contaminated materials, your technology can be considered for application on POP/Dioxin in Vietnam. The application shall need further tests for site treatments for exp specific case based on identified contaminated sites. Such prior site specific tests are a normal approach for each site decontamination.

Vietnam Government welcome all participation and contribution from individuals, international organizations and Government to support all activities on environmental remediation and protection including contamination from herbicides/dioxin. Office 33 has a long time in cooperation with international partners such as USAID, Sweden, France, Germany, UNDP. Based on fruitful cooperation between Office 33 and HPC so far, hopefully that further cooperation shall be developed with HPC and any partner from EU as well.

All the best to you,

Sincerely,
Dr. Nguyen The DONG

Certificate of MONRE : Ministry of Natural Resources & Environment's Office 33 concerning HPC's capability of bio-chemical Dioxine Treatment.

BỘ TÀI NGUYÊN VÀ MÔI TRƯỜNG
VĂN PHÒNG BAN CHỈ ĐẠO 33

Hà Nội, ngày 24 tháng 6 năm 2015

Từ:
TS. Nguyễn Thế Đông
Chánh Văn phòng/Ban Chỉ đạo 33
Phó Tổng cục Trưởng, Tổng cục Môi trường

Đến:
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Email: hpc@hpc-envirotec.com Web: http://www.hpc-envirotec.com
Member of HPCOCE (www.hpcocce.com)

Kính gửi TS. Karg,

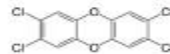
Lưu vào trong cuốn sổ tay thí nghiệm của Ông đã phối hợp với Văn phòng Ban Chỉ đạo 33 và Ông để "Xử lý dioxin tại các vùng ô nhiễm nặng" do GEF/UNDP tài trợ, tiến hành thí nghiệm công nghệ xử lý dioxin tại Việt Nam trong thời gian qua.

Như Ông đã biết, công nghệ Hòa Sinh của HPC thực hiện là một trong số ít công nghệ được lựa chọn để thí nghiệm xử lý đất bị ô nhiễm dioxin tại sân bay quân sự Biên Hòa, miền Trung và miền Đông ở Việt Nam. Kết quả bước đầu thí nghiệm công nghệ có tiềm năng xử lý dioxin tại Việt Nam với chi phí thấp, dễ áp dụng. Công nghệ cũng có thể tiến hành thí nghiệm bổ sung để tìm hiểu khả năng xử lý những đối tượng phức tạp hơn ô nhiễm hợp với kinh nghiệm và kỹ thuật của Ông và AS.

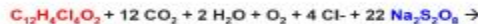
Tại vào mục đích xử lý, năng độ ô nhiễm và đặc tính của đối tượng cần xử lý, công nghệ này cũng có thể xem xét để xử lý POP/Dioxin ở Việt Nam cũng như tiến hành các thí nghiệm phối hợp đối với các đối tượng xử lý cụ thể. Đây là cách tiếp cận thông thường khi tiến hành xử lý ô nhiễm tại các điểm cụ thể.

Chính phủ Việt Nam luôn hoan nghênh và ủng hộ sự tham gia và đóng góp của các cá nhân, tổ chức quốc tế và chính phủ các nước hỗ trợ Việt Nam xử lý và bảo vệ môi trường trong đó có ô nhiễm dioxin có nguồn gốc từ chất diệt cỏ do Mỹ sử dụng trong chiến tranh ở Việt Nam. Chính phủ Việt Nam có quan tâm đặc biệt với các dự án như USAID, Thụy Điển, Pháp, Đức, UNDP. Với những kết quả hợp tác đã đạt được giữa Văn phòng Ban Chỉ đạo 33 và HPC, tôi hy vọng rằng chúng ta tiếp tục hợp tác lâu dài và cụ thể hơn trong tương lai, hơn nữa với EU.

Sincerely,
Dr. Nguyen The DONG

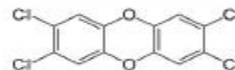


2,3,7,8-Tetrachlorodibenzodioxin ($C_{12}H_4Cl_4O_2$)

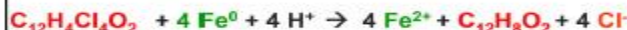


Clients Benefits:

- Obtain Decontamination Treatment options which could be used on-site or in-situ by the use of simplified agricultural machinery with Vietnamese Partners.
- Obtain Decontamination Treatment options to ensure the lowest Decontamination Costs.
- Obtain Decontamination Treatment options useable on other sites, contaminated by Agent Orange Dioxins, Pesticides and other POP. HPC Envirotec SAS is certified for these Treatments in Vietnam by the MONRE's Office 33.



2,3,7,8-Tetrachlorodibenzodioxin ($C_{12}H_4Cl_4O_2$)



Some related References:

- Karg, F. (2011): Closed Landfill Recovery Technology and Real Estate & Urbanization Management on Contaminated Sites: International Methodology for Environmental, Health and Investment Safety (with special regard to sites contaminated by Agent Orange and other pesticides used by the U.S.-Air Force in Vietnam): Vietnam Urban Environment and Industrial Zone Association (VUREIA). Congress: Assessment on present situation and selection of domestic solid waste technology suitable to conditions in Vietnam. Hanoi: October 21, 2011.
- Karg, F. (2011): Dépollution microbiologique de TCE & PCE via la BAND (Bio-Atténuation Naturelle Dynamisée) Microbiological Decontamination of Aquifers polluted by TCE & PCE via DNBA : Dynamized Natural Bio-Attenuation. Congres : Maîtrise des risques des sites contaminés par des hydrocarbures chlorés. Chloro-Net Solothurn / Switzerland 03/11/2011.
- Karg, F. (2011): TERQ: Toxicological Exposure Risk Quantification for Heterocyclic PAC and Aromatic

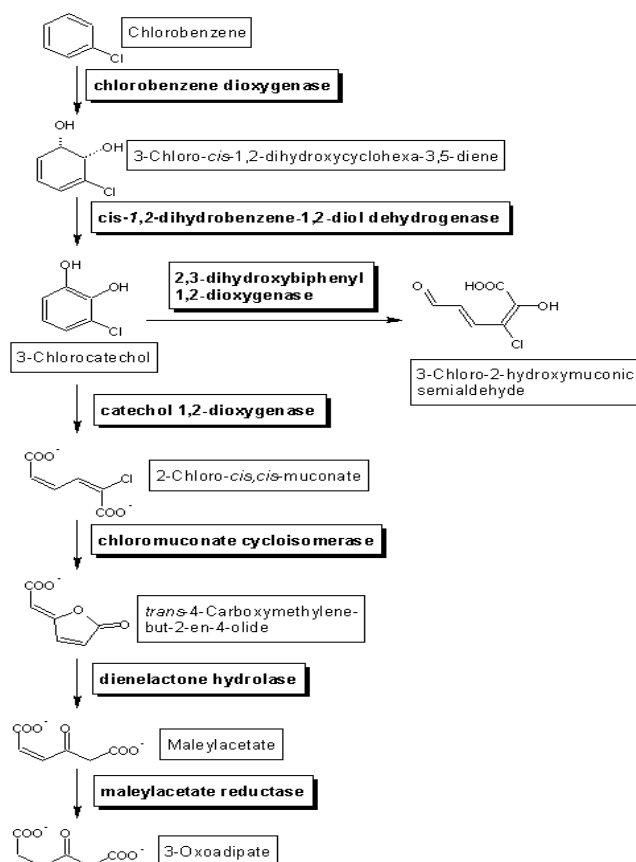
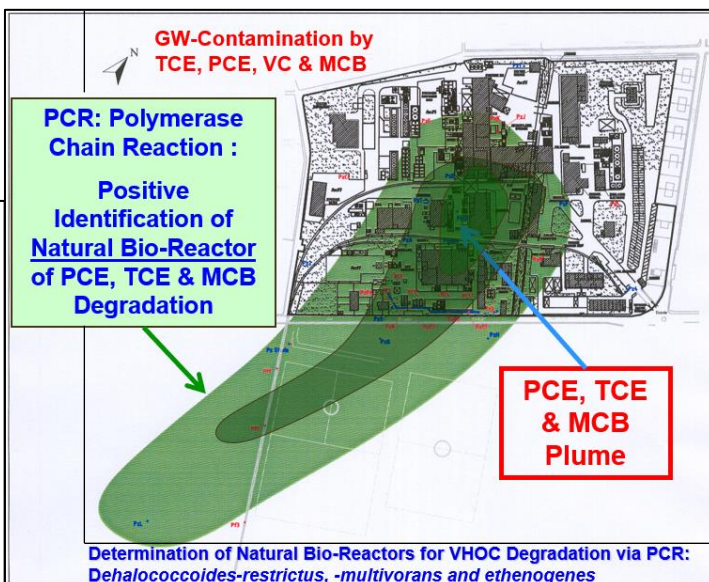


Reference: Persan (ex-Great-Lakes-Chemicals / CHEMTURA

FlameRetardants Production Site:
Chlorobenzenes, PAH, BTEX, TCE,

Activities of HPC:

- **Contaminated Site Investigations:**
Chlorinated Solvents & Chlorobenzenes in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation)**, validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **Remediation Realization:**
2014 – 2016



Amount: Confidentiel

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HPC INTERNATIONAL:

France (Roscoff), Germany (Duisburg),
Hungary (Budapest), Balkan (Pristina),
Algeria (Skikdah)



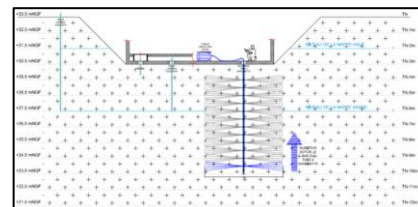
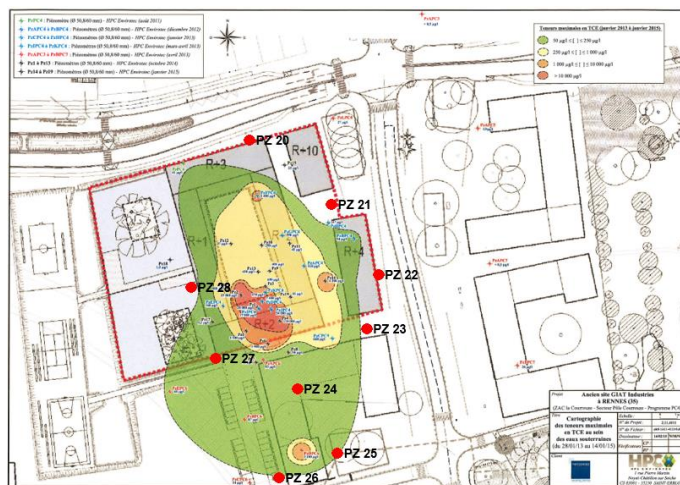
Reference: France Former Armament & Military Industrial Site: TCE, PCE, DCE and VC In-situ-DNBA-Remediation

Project:

- In-situ-DNBA Soil & Groundwater Remediation was decided on, the former GIAT Armament Industrial site, prior to construction of School Buildings and to ensure future acceptable Risks.

Activities of HPC:

- **Contaminated Site Investigations:** Chlorinated Solvents & CrVI in Soil, Soil gas and Groundwater.
- **TERQ:** Toxicological Exposure Risk Quantification = HRA: Health Risk Assessment and Definition of SS-RG: Site Specific Remediation Goals.
- **DNBA In-situ Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable Remediation Technologies.
- **Remediation Realization: 2015 – 2016 (in running)**



Client: Confidential

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Remediation Operations after Site Shut-Down: Hydrocarbons, PCB & Radioisotopes: France

Client: Confidential

Service area	Value	Project duration
Cessation of activity	100 000 Euros	2006



HPC Services:

- Surveys of soils contaminations and excavations (with sampling of soils and soil air), sampling of groundwater (within the piezometers) and surface water (ponds and rivers), sampling of sediments,
- Analysis of the samples by the laboratory.
- Tank emptying from solvents, sulfuric acid and hydrocarbons (Decommissioning)
- Grouping and disposal of various chemicals in approved centres
- Dismantling and evacuation of Pyralene transformers substations
- **Radioisotope Monitoring**

Project Description:

(About 5 ha) site hosted for nearly 60 years facilities associated with the manufacture of leather for the shoe industry, leather goods, furniture, automotive and **aviation**.

After the declaration of cessation of activities, HPC Envirotec was commissioned (under the control of a judicial expert) to ensure the evacuation of hazardous products and carry out studies of Diagnostic and simplified risk assessment type (for future use of the land of residential, tertiary or industrial scenarios). Site investigations have been conducted concerning soils, dusts and plants (seeking of radioelements: alpha, beta and gamma emitters), followed by quantification of health risks **associated with exposure to radioisotopes**.

Service purposes:

The on-site investigations the following pollutants:

- Presence of Heavy metals and Metalloids hydrocarbon, phthalates, solvents, acids, bases...

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frank.karg@hpc-international.com



Decontamination & Decommissioning and Clean-up operations: Hydrocarbons & Uranium France

Client: confidential

Service area	Value	Project duration
Follow up of tank dismantling and site decontamination	83 000 €uros	4 months



Project Description:

The site, located in the Eure, was occupied by Army barracks until 1998 and then remained without activity until 2007.

Following an environmental study of the site, an area impacted with hydrocarbons on a former petrol station was found as well as a DFO tank located in the basement of a building, an area of retention clay impacted by domestic fuel and the soil of a cellar **contaminated by Uranium**.

As part of the redevelopment of the whole site for the construction of collective housing, green spaces and recreation, HPC Envirotec was commissioned for a delivery of conception and rehabilitation.

Service purposes:

The on-site investigations and operations assessed the following pollutants:

- **Presence of Hydrocarbons and Uranium**

HPC Services:

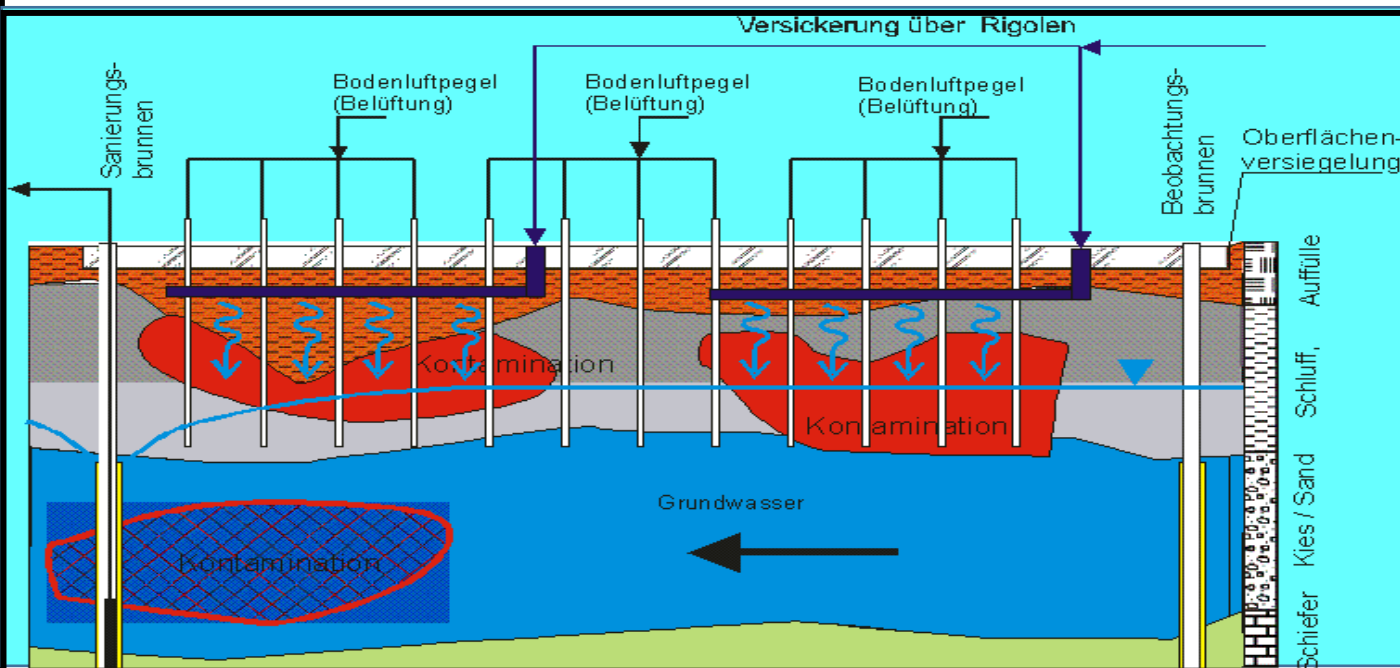
- Excavation, sorting and disposal off-site of the materials impacted by hydrocarbons,
- Degassing, emptying, cleaning, cutting and disposal off-site of the DFO tank.
- Excavation and disposal off-site of materials impacted by domestic fuel oil
- **Decontamination by Excavation, evacuation and treatment off-site of Uranium-contaminated soils**

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Germany: In-situ-DNBA Site Remediation

Reference: East Germany:
Former Gas Work Plant:
About 6 ha:
DNBA-in-situ-Remediation



Activities of HPC:

- **Contaminated Site Investigations:**
PAH, BTEX, TPH, HET & Aromatic Amines in Soil, Soil gas and Groundwater.
- **DNBA In-situ Soil & Groundwater Remediation (microbiological Dynamized Natural Bio-Attenuation),** validated by the Authorities.

- **Technical & Economic Feasibility Study** for applicable Remediation Technologies & Remediation Realization.
- **Remediation Realization:**
2013 – 2014

Client: Confidential

Amount: Confidential

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Algérie: Réhabilitation Site de l'Industrie Chimique Référence: Confidential

Client: Confidential / Montant: Confidential



HPC INTERNATIONAL S.A.S.

1 rue Pierre Marzin

Noyal-Châtillon sur Seiche CS83001

35230 SAINT ERBLON / France

Contact: Dr. Frank KARG

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Activités d'HPC : 2016

- Etude de Faisabilité technico-économique de projet:
- Méthodologie :
Decommissioning, Démantèlement, Démolition,
Dépollution: Nettoyage sécurisé des unités de production,
désamiantage, démontage « propre » et sans risque, et
- Gestion de tous les déchets générés par l'opération.





France

Reference: Agricultural Site 2016-2017



Mining Contamination by Heavy Metals

Pb, Cd, Hg
Pollutant Impact

Project Description:

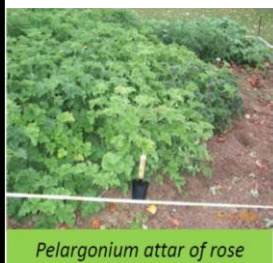
- Agricultural Land was contaminated by Mining Heavy Metals (Lead, Cadmium, Mercury)

Site Remediation Planning:

- Realization by Phyto-Remediation & Phyto-Extraction via Pelargonium Plants.
- Extraction of Pelargonium Odorant Oils for Fragrance Production (600 – 900 US\$/kg).



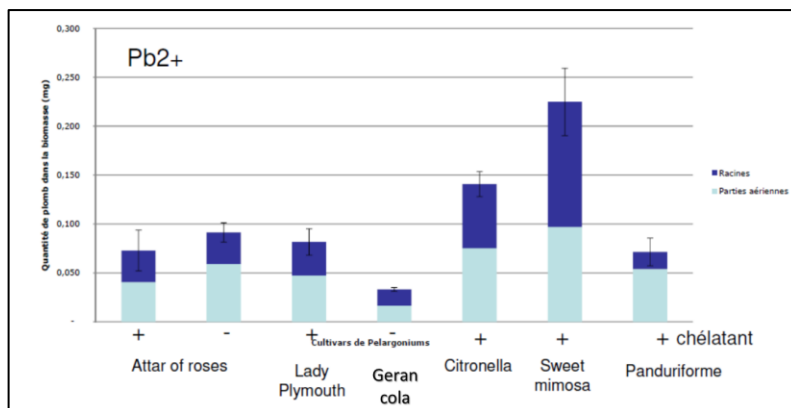
- Extraction of Pelargonium Odorant Oils for Fragrance Production (600 – 900 US\$/kg).



Pelargonium attar of rose

Pelargonium Atomic Snowflake

Pelargonium Lady Plymouth



- Heavy Metal accumulation in Plants (Pb, Cd, Hg)

Project Data:

- Project Value: Confidential

Country & Location:

- France

Client:

- Confidential

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Kosovo: Site Remediation Mining Sites



Reference: Kosovo Mining sites and Pollution by Mining Waste Heavy Metals Remediation by Waste Recycling



Activities of HPC:

Zinc, Lead, Cadmium etc. Depollution

Reserve quantification for National
Privatization & Investment Project for
Mining Industry

Remediation Treatment Feasibility Study
by Mining Waste Tailing Recycling

Client: Confidential

Amount: Confidential

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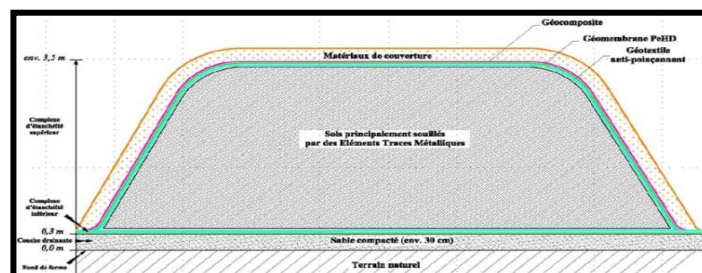
France: Confinement Engineered Landfill

**Reference: France:
Former Military Industry Sites
(GIAT) 32 ha:**



Activities of HPC:

- **Contaminated Site Investigations:**
Heavy Metals, PAH, BTEX, TPH, in Soil, Soil gas and Groundwater.
- **Confinement by Engineered Landfill**
validated by the Authorities.
- **Technical & Economic Feasibility Study** for applicable **Remediation Technologies.**
- **Remediation Realization:**
2013 – 2014



Client: Confidential

Amount: Confidential

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Germany

**Reference
2011 -2016**



**Lime Sludge & Phenol +
PAH Landfill**

**Germany
DNBA-In-situ Remediation**

Project Description:

- In the area of the former lime sludge landfill, PAH lime sludge from the phenol and cresol production had been deposited upon official authorization. For the landfill body which is forested today, a toxicological exposition risk quantification (TERQ) was carried out with regard to the future use as park and recreational area. The current investigations deal with groundwater as subject of protection in the downgradient area of the landfill.

HPC Services:

- Historical review and elaboration of an investigation program, Risk assessment for groundwater as subject of protection on the site and downgradient of the landfill,
- Toxicological exposition risk quantification (TERQ) for the area of the landfill body,
- Feasibility study on various remediation methods (comparison of alternatives),
- Toxicological exposition risk quantification (TERQ) for the groundwater downgradient area.
- **Remediation investigations/remediation:**
- Feasibility study for application DNBA (Dynamized Natural Bio-Attenuation), Investigation concept for establishment of a remediation plan. Application of innovative remediation methods as DNBA

Project Name:

Confidential

Client: Confidential

Purpose:

Remediation of groundwater contamination, evaluation of the landfill body with regard to health risks

Contract Volume:

Confidential

Project Duration:

Since 1994 (ongoing)

Project Managers:

U. Hintzen, Dr. F. Karg

Field of Service:

Recycling/investigation of contaminated land

Project Data:

- Contaminants BTEX, PAH, phenols, TPH

Contact:

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Remediation Of the Hazardous Waste Treatment Site in Israel

Project name:

Confidential

Country:

Confidential

Location:

Confidential

Client:

Confidential

Contact:

Mrs. Michal Bar Tov, Tel.: 00972 56 233095

Motivation:

Remediation of the only Israeli Hazardous Waste Site due to environmental problems and public resistance

Volume:

about 5 Mio. USD

Duration:

Start in 06/2000, Duration estimated with 5 - 10 Years

Field of concern:

Management and Treatment of hazardous waste

Project data:

- Area size about 300 000 m²
- Contam. underground about 400 000 t
- Waste volume about 600 000. t

Project description:

The Hazardous Waste Treatment Site has been operated since 1980. Beside other hazardous waste especially residues from pesticide-, insecticide- and herbicide production in metal drums as well as acidic tar in open ponds have been dumped in non secure condition. Resulting contamination of the underground has been established. Besides the remediation, an improvement of the treatment and dumping procedures towards European Standards is necessary.

Scope of Work:

- Historical Survey
- Field Study
- Development of concepts for the remediation and adapted treatment technologies
- Detailed Planning and Tendering
- Supervision of the Remediation

Advantage for the Client:

- Execution of the public and political intention
- Avoidance of legal suits by the public
- Adaptation of current treatment methods and dumping technologies according to safe European Standards
- The Hazardous Waste Treatment Site Ramat Hovav will be fit for future operations



Germany: Site Remediation



Project Description:

TM15- trimercapto-s-triazine™, was used for Mercury binding as Mercury (Hg). The binding process is nearly irreversible.

Application was done by spraying through soil a solution of TMT15 + Activators. Verification of efficiency was achieved through leaching tests of treated soil..

The Treatment was applied after a site specific technical & economic Feasibility Study, starting with Laboratory- & Field Tests &. on-site pilot tests with 20-30 t batches and by use of specific additives (to improve treatment technology parameters: spray volumes, TM15® concentration, application speed, mixing, etc.).

In total 1 830 t of Hg-contaminated soil and rubble (concrete, masonry, cement, etc.) from facility's building demolishing were treated (by 1.8 – 5.3 mol. Sulfur/l TMT15).

Average "income" concentrations were about 50 ppm Hg (but locally very high concentrations of some thousand mg/kg Hg). Leachate of non-treated material showed 0.02 to 0.1 mg/l of Mercury concentrations.

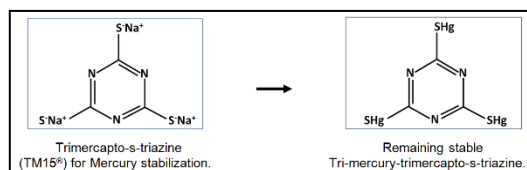
Per 7.5 t contaminated material about 160 l of TMT15® Solution was applied during 10–12 minutes. Each treated contaminated material Layer thickness of rubble and soil was 0.3 m each. After treatment, Leachate tests showed Hg-concentrations of < 0.001 mg/l

Mercury Industrial Site

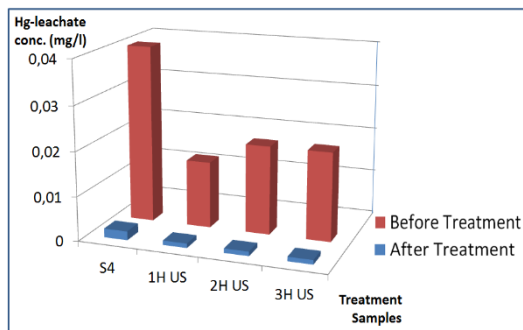
Germany: Site-Remediation In-situ TMT15-Stabilization of Mercury in Soil

Project Name:

Remediation by in-situ-
Stabilization of Mercury via
TMT15 + Activators.



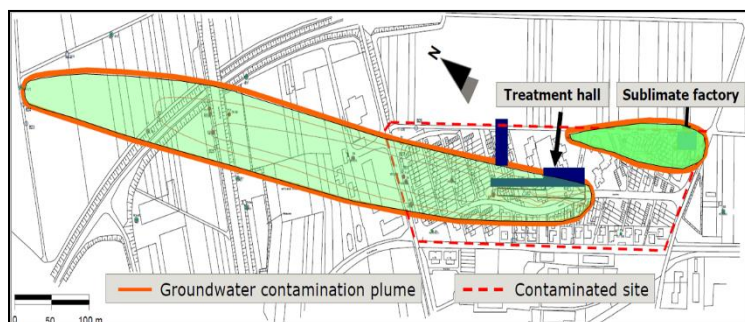
The reaction formula is: $3\text{Me}^+ + \text{TMT15}^{\circ} \rightarrow \text{Me}_3\text{TMT15}^{\circ}$



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Germany: Site Remediation



Project Description:

Pumped Groundwater was successfully treated by amalgamating metal Alloys, based principally on Copper & Zinc (type of Brass-Alloy).

“In-come” (before treatment) average Hg-concentrations of 60 µg/l (up to 250 µg/l) were treated down to < 0.01 µg/l.

Reduction of bivalent soluble Mercury (Hg²⁺) by “Cost friendly” mossy tin alloys perfectly remove Hg from contaminated Water.

Different mossy tin Alloys can be used for Mercury elimination in Water if the Alloys are free of Lead. The usable Alloys shows Copper parts of 50 to 60 %, Zinc parts of 40 to 50 % and Lead less than 0.02 %.

The reaction of inorganic Mercury binding is a reduction of positive Hg(II) to Hg(0) via zero valent Zinc:



Inorganic Mercury (HgCl₂, HgOHCl, etc.) was reduced on the mossy tin (Cu/Zn-Alloy) surface to Hg⁰ and the Mercury becomes incorporated in the Copper matrix by amalgamation.

Mercury Industrial Site

Germany In-situ Treatment of Mercury in Groundwater

Project Name:

Remediation by in-situ-Binding of Mercury.

For on-site-water and Groundwater Treatments realistically around 50 – 100 g of Hg can be fixed per kg Alloy and the equivalent Zinc amount is dissolved into water.

Best results by amalgamation were shown with Retaining of more than 95% of mercury with a flow velocity of 9.5 m/d, using a 2 cm thick Alloy filter, and 99.93% with a flow velocity of 19 m/d, using a 6 cm thick Alloy filter.

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Feasibility Study of Agent-Orange Dioxin Treatment in Vietnam

Ministry of Natural Resources & Environment (MONRE) / Office 33 (Dioxin & POP)
Contact Name: Dr. Frank KARG / HPC Envirotec SAS – France

Domaine d'activité

Montant du projet

Durée du projet

Site Remediation & Decontamination

environ 70,000 €

2014 - 2015



Blue, etc.).

To ensure future Environmental Public Health, site Remediation & Decontaminations are necessary to minimize bio-accumulation in Food & Feed Chain and to reduce negative toxicological Impacts.

Site Remediation & Decontamination can ensure new site Development and new Real Estate Projects.

Project Description:

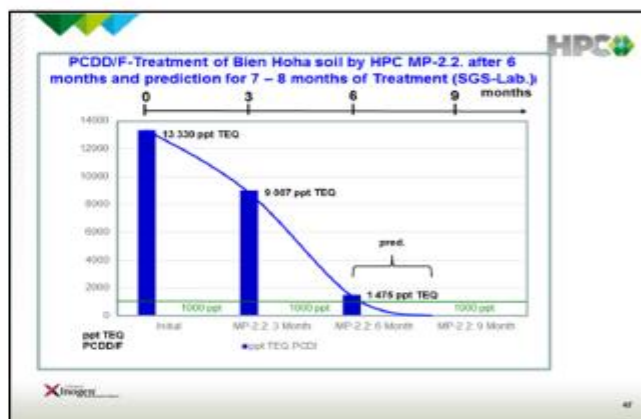
A feasibility Study was realized for the Office 33 / Ministry of Natural Resources & Environment (MONRE) concerning the soil treatment for decontamination of Agent Orange Dioxin (PCDD/F) pollution since the Vietnam War.

Based on Dioxin contaminated Soil Samples from the Bien Hoa Air Base in Vietnam chemical & microbiological Treatment Options were tested. The decontamination treatment procedures, results and reports were verified and controlled by Vietnamese and UN Experts (UNDP & GEF).

The positive results of the Feasibility Study were presented during an Agent Orange Dioxin Congress in Hanoi, in March 2015. The results were very positive concerning Dioxines, Pesticides and toxic Metabolite Treatments

Motivation:

- Since the Vietnam War, lots of large areas are contaminated in Vietnam with Agent Orange Dioxins, Pesticides, toxic Metabolites (as Chloro-phenols, etc.) and other pollutants (as Arsenic from Agent



Services:

- Technical & Economic Feasibility Study of Soil Decontamination via combined chemical and microbiological Treatments.
- Dimensioning of the developed treatments for on-site, off-site and in-situ treatments to ensure minimum treatment costs.
- Development of best bio-chemical Decontamination Treatment Ingredients.
- Development of Cost effective and safe site Decontamination Technology.

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
Office of the National Steering Committee 33

Date: June 24/2015

From:
Dr. Nguyen The DONG
General Director of Office of National Steering Committee 33
Vice Director of Vietnam Environmental Administration

To:
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35230 SAINT ERBLON / France

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Fax: +33 299 131 451
Email: hpc@hpc-envirotec.com
Web: http://www.hpc-envirotec.com
Member of HPCOCE (www.hpcocce.com)

Dear Dr. Karg Frank,

I would like to thank you for your cooperation with Office 33/Dioxin Project to carry out Technology Demonstration for Dioxin treatment under the Project entitled "Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam"

As far as you know, there are very limited technologies selected for demonstration this time. Of which, the Chemical - Biological Technology proposed by your side showed its potential and application which does not require complicated equipment with low cost and easily manipulated. Up to the purposes, the technology shall need further site specific application tests for exp for complicated materials, such as Dioxin or As contaminations and then applied for treatment basing on identification of contaminated sites.

Up to the purposes, concentration and characteristics of contaminated materials, your technology can be considered for application on POP/Dioxin in Vietnam. The application shall need further tests for site treatments for exp specific case based on identified contaminated sites. Such prior site specific tests are a normal approach for each site decontamination.

Vietnam Government welcome all participation and contribution from individuals, international organizations and Government to support all activities on environmental remediation and protection including contamination from herbicides/dioxin. Office 33 has a long time in cooperation with international partners such as USAID, Sweden, France, Germany, UNDP. Based on fruitful cooperation between Office 33 and HPC so far, hopefully that further cooperation shall be developed with HPC and any partner from EU as well.

All the best to you,

Sincerely,
Dr. Nguyen The DONG

Dr. Nguyen The DONG

Certificate of MONRE : Ministry of Natural Resources & Environment's Office 33 concerning HPC's capability of bio-chemical Dioxine Treatment.

BỘ TÀI NGUYÊN VÀ MÔI TRƯỜNG
VĂN PHÒNG BAN CHỈ ĐẠO 33

Hà Nội, ngày 24 tháng 6 năm 2015

Từ:
TS. Nguyễn Thế Đông
Chánh Văn phòng/Ban Chỉ đạo 33
Phó Tổng cục Trưởng, Tổng cục Môi trường

Đến:
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Kính gửi TS. Karg,

Lưu ý rằng trong các thí nghiệm đã phải hợp với Văn phòng Ban Chỉ đạo 33 và Ông TS. Nguyễn Thế Đông tại các vùng ô nhiễm nặng do GEF/UNDP tài trợ, tiến hành thí nghiệm công nghệ xử lý dioxin tại Việt Nam trong thời gian qua.

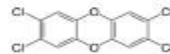
Như Ông đã biết, công nghệ Hòa Sinh do HPC thực hiện là một trong số ít công nghệ được lựa chọn để thử nghiệm xử lý đất bị ô nhiễm dioxin tại sân bay quân sự Biên Hòa, một trong ba điểm nóng ô nhiễm dioxin ở Việt Nam. Kết quả bước đầu cho thấy công nghệ có tiềm năng xử lý dioxin tại Việt Nam với chi phí thấp, dễ áp dụng. Công nghệ cũng có thể tiến hành thí nghiệm bổ sung để tìm hiểu khả năng xử lý những đối tượng phức tạp hơn ô nhiễm hợp với khu vực nông và dự án hòa giải và AS.

Tuy vào mục đích xử lý, năng độ ô nhiễm và đặc tính của đối tượng cần xử lý, công nghệ này cũng có thể xem xét để xử lý POP/Dioxin ở Việt Nam cũng như tiến hành các thí nghiệm phù hợp đối với các đối tượng xử lý cụ thể. Đây là cách tiếp cận thông thường khi tiến hành xử lý ô nhiễm tại các điểm cụ thể.

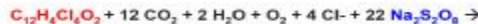
Chính phủ Việt Nam luôn hoan nghênh và ủng hộ sự tham gia và đóng góp của các cá nhân, tổ chức quốc tế và chính phủ các nước hỗ trợ Việt Nam xử lý và bảo vệ môi trường trong đó có ô nhiễm dioxin có nguồn gốc từ chất diệt cỏ do Mỹ sử dụng trong chiến tranh ở Việt Nam. Chính phủ Việt Nam có quan tâm đặc biệt hợp tác với các đối tác như USAID, Thụy Điển, Pháp, Đức, UNDP. Với những kết quả hợp tác đã đạt được giữa Văn phòng Ban Chỉ đạo 33 và HPC, tôi hy vọng rằng chúng ta tiếp tục hợp tác lâu dài và cụ thể hơn trong tương lai, hòa giải và với EU.

VĂN PHÒNG BAN CHỈ ĐẠO 33

Nguyễn Thế Đông

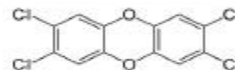


2,3,7,8-Tetrachlorodibenzodioxin (C₁₂H₄Cl₄O₂)

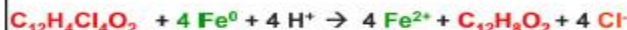


Clients Benefits:

- Obtain Decontamination Treatment options which could be used on-site or in-situ by the use of simplified agricultural machinery with Vietnamese Partners.
- Obtain Decontamination Treatment options to ensure the lowest Decontamination Costs.
- Obtain Decontamination Treatment options useable on other sites, contaminated by Agent Orange Dioxins, Pesticides and other POP. HPC Envirotec SAS is certified for these Treatments in Vietnam by the MONRE's Office 33.



2,3,7,8-Tetrachlorodibenzodioxin (C₁₂H₄Cl₄O₂)



Some related References:

- Karg, F. (2011): Closed Landfill Recovery Technology and Real Estate & Urbanization Management on Contaminated Sites: International Methodology for Environmental, Health and Investment Safety (with special regard to sites contaminated by Agent Orange and other pesticides used by the U.S.-Air Force in Vietnam): Vietnam Urban Environment and Industrial Zone Association (VUREIA). Congress: Assessment on present situation and selection of domestic solid waste technology suitable to conditions in Vietnam. Hanoi: October 21, 2011.
- Karg, F. (2011): Dépollution microbiologique de TCE & PCE via la BAND (Bio-Atténuation Naturelle Dynamisée) Microbiological Decontamination of Aquifers polluted by TCE & PCE via DNBA : Dynamized Natural Bio-Attenuation. Congres : Maîtrise des risques des sites contaminés par des hydrocarbures chlorés. Chloro-Net Solothurn / Switzerland 03/11/2011.
- Karg, F. (2011): TERQ: Toxicological Exposure Risk Quantification for Heterocyclic PAC and Aromatic

Russia:

Former Chemical Warfare Agents Facility



Russian Federation

Project name:

Confidential

Country:

Russian Federation

Location:

Confidential

Customer:

Confidential

Information:

www.cwunitdestr.ru

Reason:

Destruction of a former
CW agents production facility

Contract value:

160.000 €

Project duration:

04/2000 – 06/2002

Service area:

contaminated site investigation
and remediation

Project data:

- 7 buildings for production and storage of CW agents
- 650 samples of materials contaminated by CW agents
- 2000 single results

Project description:

The former Lewisite production facility at the location has to be destroyed by the Russian Federation within the scope of CW conventions. To prepare the destruction an evident study was necessary to examine the contents of CW agents within the building materials and the soil in surrounding of the buildings. The data of investigation are the base for planning of the destruction and for the selection of a safe decontamination technology. A pilot plant will be built up on site for the favour technology.

Services:

- International cooperation with Russian, French and British experts
- Historical study
- Assistance for security and emergency plan
- Organisation and instructions for sampling works under personal protection equipment
- Data evaluation of the chemical analyses
- Presentation of contamination maps for the building materials and the soil in surrounding of the buildings
- Site investigation report
- Assistance for selection of a safe decontamination technology

Customer benefits:

- Professional organisation and guidance referring to EU standard
- complete planning, organisation and evaluation of all works and data by one hand

Germany: Site Remediation



Military Property

Germany

Projektname:

Confidential

Country:

Germany

Location:

Confidential

Customer:

Confidential

Contact person:

Ms. Freygang

Reason:

Conversion

Risk to the water works

Project volume:

85.000 €

Project duration:

Demolition 1999/2000,
Groundwater remediation until 2002

Field of services:

Contaminated site investigation and remediation

Project data:

- ca. 5,2 ha remediation area with ammunition findings
- Part of the area high contaminated by PHC and BTEX that render immediate remedial action necessary
- Additional groundwater contamination with VCHC
- Site is situated within the groundwater protection zone of the water works

Project description:

Dismantling, demolition and waste disposal services on the former Soviet Military Property (Military barracks), securing of the water supply of the town of Rathenow

Services:

- Preparation of dismantling and demolition plan
- Preparation of all permission plans and detailed planning
- Preparation of works tender documents
- Assistance to the client during the tender procedure
- Waste management during the dismantling and demolition activities (site supervision, representative of the client, definition of waste disposal paths accompanying analytical coverage, quantity surveying and cost control.
- Preparation of the final documentation
- Additional groundwater survey
- Groundwater modelling and delineation of the contamination plume
- Remediation investigation
- Feasibility study
- Permission planning

Customer benefit:

- Efficient combination of demolition and waste disposal
- Reliable investigations of the causes of the contamination
- Technical reliability concerning the requirements of the control authorities



Project Management (In-situ treatment) Former industrial Landfill



Project description:

The site was used between 1960 and 1977 as internal landfill for a chemical production facility (various production specific wastes were dumped and burned in the landfill).

A detailed site investigation was carried out, followed by a Health Risk Assessment to quantify the risk for human health generated by the identified contaminants.

With regard to this Project, HPC was mandated with the General Project Management of the remediation works, including project preliminary and detailed design, and supervision of the works.

Missions:

- Preliminary design (definition of different remediation scenarios),
- Detailed design (definition and analysis of different remediation options and coordination with administration (DREAL, etc.),
- Evaluation of site emissions and calculation of health risks,
- Elaboration of documents for the RFP(Q) / Analysis of technical and financial proposals / Contract elaboration for selected company,
- Scheduling / Piloting / Coordination and direction of the remediation works,
- Monitoring of ground- and surface water (spring outcrops, rivers...)
- Natural Bio-Attenuation study (NBA).

HPC : Selected Performance (2004 - 2010) :

- Off-site treatment of the polluted soils (about 1 700 tons in authorized landfill,
- Realization of hydraulic barrier (13 deep wells for lowering the groundwater table) and 44 additional wells for the treatment of the groundwater,
- Soil, groundwater and surface water treatment in mobile unit.

Client benefits :

The taking into account of site specific conditions (contaminations down to more than 20 m) allowed to client to remediate the site without any additional costs with regard to the first cost calculation. Compliance with the project schedule.

Project name:
Confidential

Country / Location:
France / Region of South Alps

Client:
Confidential

Field of activity:
Site Remediation

Contacts:
Nicolas Jauhier
Nicolas.Jauhier@hpc-envirotec.com

Reason:
Health Risk not acceptable

Contract Value:
1 685 k€

Project duration:
6 years (2004 - 2010)

Main contaminants:
Arsenic, COHV, HAP,
Phenols

Key data:
Realization of hydraulique barrier (13 deep wells) completed by 44 additional wells for groundwater treatment

Siège social
Grand Ouest
02 99 13 14 50

Antenne Ile-de France
01 80 79 02 00

Antenne Lorraine
03 87 15 47 59

Antenne PACA
04 88 19 20 80

www.hpc-envirotec.com



APRÈS AVALIATION DES
SÉRIOSITÉ
CONFORMITÉ DES TRAVAUX
DE REMÉDIATION

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DE REMÉDIATION

www.ine.fr

Germany: Site Remediation

US-Army Waste Landfill Bamberg Germany



Project description:

Relocation of waste and contouring of landfill body,
surface sealing

Services:

Examination and implementation of a plan for
quality assurance, sampling and soil-mechanical
examinations, geotechnical consulting, supervision
of refilling of tip material and ground material

Customer benefits:

- Expert technical consulting by experienced
experts

- **Dr. Frank P.M. KARG**
Scientific Director of HPC-Group
CEO of HPC INTERNATIONAL / France
Member of Bord of Directors
HPC Germany & Court Expert.
➤ frank.karg@hpc-international.com
➤ Phone: +33 607 346 916



Project name:

Confidential

Country: Germany

Location: Confidential

Customer:

Confidential

Contact:

Mr Lindner, Project Manager
Tel: (0921) 606 29 66

Reason: Ground water protection

Building sum / manufacturing cost 1,500,000 €

Project duration:

1995 - 1998

Service area:

Geotechnical investigation

Project data: 5 ha tip area