



STATEMENT OF QUALIFICATIONS (SOQ, August 2010)

PETROLEUM-IMPACTED SOIL REMEDIATION

The Adventus Group is an applied environmental products company that provides various remediation biotechnologies – including those exclusive to our patent portfolio (see below). We are NOT consultants, and are geared towards supporting client project teams by providing unbiased design, support and selection of the most cost-effective remedial solution or strategy. As appropriate, our proven products may provide significant advantages. Implementation is subsequently provided by partnering with engineering and construction firms.

Our professional staff has over 150 cumulative years of experience in conducting remedial investigations/feasibility studies (RI/FS), remedial design, engineering and modeling (RD), remedial actions (RA) and implementation (support) at sites impacted by the total petroleum hydrocarbons (TPH) and polynuclear aromatic hydrocarbons (PAHs) typically found in petroleum-impacted soils. These projects have included industrial clients, federal, state and local governments, as well as public organizations. Useful knowledge and experience has been gained working at dry cleaner sites, manufacturing facilities, military facilities, landfills, bulk chemical storage facilities, active railroads and airports, Superfund sites, and as part of Brownfield site redevelopment efforts – while offering the following technologies and services:

For Groundwater

Slow release oxygen and nutrient support of indigenous aerobic bioremediation using EHC-O[®] or O-Sox[™], and/or in-well stripping using modified groundwater circulation wells (mGCW).

For DNAPL Stabilization

In situ geochemical stabilization (ISGS[™]) of DNAPL to destroy contaminant mass, rapidly reduce the flux of CVOCs from stabilized DNAPL into the groundwater, and facilitate enhanced remediation of dissolved plumes.

For Soil Treatment

Ex situ, or in situ treatment of soil and sediment using:

- Aerobic DARAMEND[®], which contains controlled release carbon and nutrients. This is typically used to treat PAHs, chlorophenols, and phthalates.
- TERRAMEND[®], which contains controlled-release nutrients. This is typically used to treat TPH.

Miscellaneous

We have significant experience in the area of fate and transport modeling and litigation support.

Representative Project Experience

Adventus Group staff have been involved in hundreds of site applications utilizing our soil and groundwater bioremediation technologies. This SOQ provides a summary of some relevant petroleum-impacted soil project experiences using Aerobic DARAMEND and TERRAMEND.

Detailed project descriptions are available at <http://www.adventusgroup.com/projects/>.

TERRAMEND® Petroleum Treatment Performance

Adventus: Aged Diesel Hydrocarbons, California, 2009

Approximately 10,000 tons of aged diesel contaminated soil (levels averaging 3,000 mg/kg) was treated with 0.5% TERRAMEND by weight, added in place. Levels were reduced by over 80% over a 7 month period, in spite of difficulties early in the project in evenly distributing the amendment and in ensuring aerobic conditions in the fine grained soils with available construction equipment. A switch to appropriate tilling equipment facilitated aeration and improved contact between the petroleum hydrocarbons and TERRAMEND amendment during the latter stages of the project, allowing treatment goals to be achieved.

Adventus: TPH Site, Ontario, 2001

At a site in Georgetown, ON approximately 4,000 tonnes of excavated soil and TERRAMEND amendment was placed on a temporary treatment pad (an HDPE liner overlain by 20 cm of sand) in August 2001, and tilled weekly thereafter until early November. Initial concentrations of 7,000 to 8,000 mg/kg TPH decreased to about 700 mg/kg in mid-September. Winter conditions, followed by a wet spring and equipment malfunctions, prevented the resumption of weekly tilling until mid-June of the following year. By mid-August of 2002, mean concentrations in the treatment cell had decreased to 70 mg/kg.

Aerobic DARAMEND® Petroleum Treatment Performance

The Waste Management facility 'projects' listed here represent ongoing soil treatment approaches, that are used to address a variety of organic contaminated soils at three WM facilities.

Waste Management Inc. CID, Chicago

Waste Management has licensed Adventus' DARAMEND technology since 2000, and has successfully applied it to over 4 million tons of impacted soil, sediment and waste. At the CID facility, PAH impacted soil is treated exclusively using DARAMEND technology.

Treatment is conducted in biopiles consisting of layers of soil and DARAMEND amendment which is sprayed on using a hydroseeder. The biopile is aerated via a series of perforated pipes connected to a blower, creating a closed, circulating system.



Waste Management Inc., Lake Charles, LA and Arlington, OR

At Waste Management’s facilities in Lake Charles, LA, and Arlington, OR all biotreatment is conducted using DARAMEND technology. Compounds that are routinely treated include petroleum hydrocarbons, PAHs, chlorophenols and PCP, phthalates, pesticides, herbicides, organic explosives and leachable metals. In Lake Charles, treatment is applied in biopiles that are mechanically aerated using machinery to mix the soil. An example of PAH impacted soil that has been treated using Adventus technology are provided in **Table 1**.



Table 1. Treatment of PAH-impacted soil using Adventus’ technology at Waste Management’s facility in Lake Charles, LA

Contaminant	Treatment Standards	Baseline Analysis 1 July, 2008	Progress Analysis 25 Aug, 2008	Final Analysis 5 Dec, 2008
Acenaphthylene	NA	NA	<0.61	NA
Anthracene	3.4	33	3.3	<3.2
Benz(a)anthracene	3.4	33	<1.2	<3.8
Bis (2-ethylhexyl)phthalate	28	33	23	19
Benzo(a)pyrene	3.4	33	<1.2	<3.8
Chrysene	3.4	34	4.8	<5.2
Di-n-Butyl phthalate	28	33	<1.7	<5.5
Fluorene	NA	NA	8.5	<3.4
Naphthalene	5.6	409	11	<5.9
Phenanthrene	5.6	34	14	<3.2
Phenol	6.2	33	<1.1	<3.4
Pyrene	8.2	34	3.8	11
Benzene	10	<10	<0.3	<0.32
Toulene	10	<10	0.047	<0.32
Ethylbenzene	10	<10	0.13	<0.32
Xylenes, total	30	<10	0.8	<0.32

Adventus: Petroleum Hydrocarbons, Taiwan, 2009

Approximately 5,000 kg of petroleum-contaminated soils at a site in Taiwan were treated using 1% by weight DARAMEND in an ex-situ treatment cell. Immediately after adding the DARAMEND, soil samples were collected and analyzed for pH and soil moisture content for both the control soil pile and the soil pile amended with DARAMEND.

The soil pH was in the neutral range and ideal for promoting bioremediation. Initial concentrations of petroleum hydrocarbons exceeded 4,000 mg/kg. Both the control and the treatment soil piles were aerated twice a week using a tiller and irrigated to maintain moisture. Soil samples were analyzed weekly for operational monitoring (pH and moisture). Analytical results indicate that there

was a 68% reduction in TPH-D during the first three weeks after DARAMEND was applied. Soil samples collected on week 8 showed the DARAMEND application was successful in achieving the regulatory soil TPH limits of below 650 mg/kg. The overall treatment cost for this project was estimated at \$32 per ton of soil, all inclusive of material and labour.

Adventus: PCP and PAHs Site, Trenton, Ontario

At a site in Trenton, Ontario soil impacted with PCP and PAHs was successfully treated using DARAMEND bioremediation. PCP concentrations were reduced by 98% from 183 mg/kg to 3.3 mg/kg while PAH concentrations were reduced by 95% from 1,774 mg/kg to 95.2 mg/kg in response to treatment. The U.S. EPA under its SITE program evaluated this project. DARAMEND was determined to be among the most effective bioremediation technologies available for use on soils impacted with wood preserving chemicals. Environment Canada also conducted an independent audit of the DARAMEND technology under its' DESRT program with favourable results. Selected data from this site illustrating the high removal rates achievable using DARAMEND on even high molecular weight PAHs is presented in **Figure 1**.

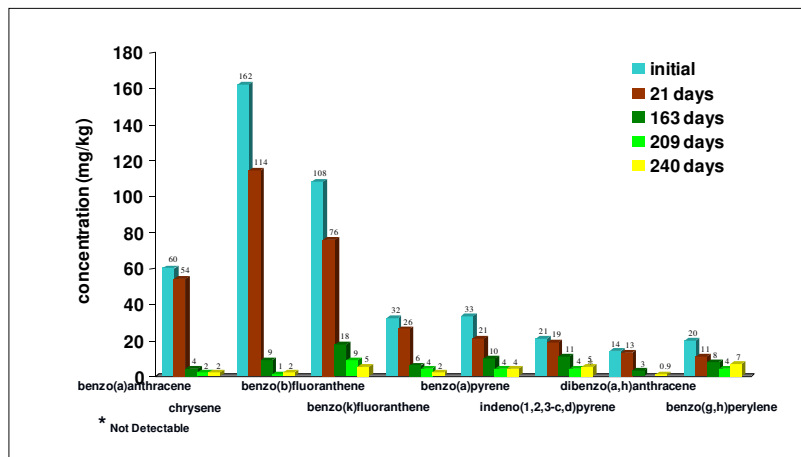


Figure 1. Influence of DARAMEND treatment on high molecular weight PAH concentrations in soil at a site in Trenton, ON.