"Bioremediation" as a Removal Response Action at OPA Sites

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"Bioremediation"

The United States Environmental Protection Agency (EPA) recommends that natural attenuation be evaluated by as a viable option when assembling an appropriate removal action plan for a site with petroleum-contaminated soils. Natural attenuation processes include biodegradation, adsorption, dispersion, and volatilization. Numerous studies have indicated that the natural, in-situ biodegradation process, often called intrinsic bioremediation, is a primary mechanism for the attenuation of petroleum hydrocarbons. Biodegradation is the only natural attenuation mechanism that has the potential to destroy the contaminants in-situ with nontoxic inorganic end products.

"Bioremediation" implemented as a removal response action at certain OPA Sites in EPA Region III utilizes simple yet effective techniques and locally available equipment and materials to accelerate the process of intrinsic bioremediation, aggressively incorporating the natural attenuation processes of biodegradation, adsorption, dispersion and volatilization with solidification, aeration, organic loading, and composting of oil-contaminated soil and debris.

Natural Attenuation, usually a ***passive remedial approach***, includes aerobic bio-degradation, anaerobic bio-degradation, dispersion, volatilization, and adsorption.

Natural Attenuation, as the ***aggressive removal approach***, includes solidification, aerobic bio-degradation, dispersion, volatilization, adsorption, organic loading, nutrient amendment, moisture amendment, composting and anaerobic bio-degradation.

Voodoo versus Science

In and around the Allegheny National Forest in northwestern Pennsylvania, there are well in excess of 250,000 oil wells that have been drilled and produced for the primary and secondary recovery of Pennsylvania grade crude oil since its discovery near Titusville by Col. Edwin L. Drake in 1859. Over the years, as production declined, environmental regulations became more stringent and operating costs increased, many of the wells in northwestern Pennsylvania were simply abandoned. In some cases, entire oil production facilities were abandoned. In the process of abandonment, some of the wells were plugged, but many were not. As much of the infrastructure of the oil production industry had not been maintained, discharges of oil had became commonplace by the mid 1970's. From then until the present, EPA's emergency response program has had a significant presence in northwestern Pennsylvania.

Following the onset of federal removal response activities in the northwestern Pennsylvania oil fields in the mid 1980's [*NW PA Major Oil Spill Project (1985-1987)*], many discussions in informal settings arose between the Federal On-Scene Coordinator (FOSC) and the local oil production industry concerning the fate of oil-contaminated soil surrounding well-sites. Historically, EPA had generally selected off-site disposal as the option for the disposition of oil-contaminated soil. Quite often during the course of these informal discussions, local oil production industry representatives vigorously vocalized their opinions, in a manner probably best described as bar room brawls and back alley debates, that such off-site disposal and the associated costs of solidification, transportation, backfill, stabilization and site restoration was unnecessary. The basis of their argument focused upon the long history of production in northwestern Pennsylvania and the associated oil spillage from thousands of oil production facilities over the years: if the oil had not degraded naturally, it would still be apparent, and the geographic area would be a giant oil slick and not a hunter and fisherman's paradise. The FOSC took the concerns expressed by the local oil production industry under consideration and determined that it was time for a practical application of "bioremediation" at a removal response action.

In October 1985, at one of the many federal removal response actions implemented as part of the *NW PA Major Oil Spill Project*, the FOSC conducted a removal response action at a medium oil spill that had severely impacted a freshwater marsh in McKean County (Pollution Incident Control #1-6-0006). To cleanup and mitigate the effects of this oil spill, the FOSC determined that bioremediation would be the removal response action. A berm was constructed around the oil-contaminated area to isolate it from the surrounding area. The berm was then filled with water from the adjacent creek, creating a lagoon which was initially inoculated with

"oil-eating" microbes and nutrients in December 1985. Over the course of the winter , although, no efforts were implemented to introduce or maintain aerobic conditions, analytical results indicated some bioremediation had taken place. Bioremediation, as a removal response action, resumed in May 1986, with nutrients added and aerobic conditions aggressively maintained until the end of the growing season in the Fall of 1986. Analytical data (science) from samples collected during this removal action indicated that concentrations of petroleum hydrocarbons had been effectively reduced in the water column (from approximately 128,000 mg/kg in November 1985 to approximately 36,040 mg/kg in June 1986) while "bioremediation" activities were being implemented. Samples continued to be collected through the August 1986, indicating that bioremediation continued to effectively reduce the concentrations of petroleum hydrocarbons in the water of the lagoon. Complimented with the physical removal of oily scum and debris from the surface of the lagoon, in October 1986, the FOSC determined that the removal action had successfully mitigated the effects of the massive oil spill, directed that the bermed lagoon be breeched and drained of water, returning the wetland to its preremoval conditions. After lying fallow all Winter, by the Spring of 1987, the area once inundated with oil was observed to have been conveniently and naturally revegetating with native plant species, and was fully revegetated by the end of the Summer of 1987.

From 1987 to 1995, continuing EPA's presence in the northwestern Pennsylvania oil fields, one of the FOSCs involved in the aforementioned NW PA Major Oil Spill Project further encouraged local oil producers to "bioremediate" oil spills at their operating oil production facilities. The FOSC was aware that even though numerous studies indicated that the natural attenuation processes were a primary mechanism for the attenuation of petroleum hydrocarbons there had not been much practical application of biodegradation at oil spill sites. The FOSC was also aware that research studies are not generally recognized as an appropriate removal response activity. Therefore, to eliminate any perception that research was being conducted as a function of federal removal response activities, sampling and analysis was not implemented. Instead, the practical application of "bioremediation" as a removal response action was based upon qualitative observations (voodoo) with certain assumptions that the numerous research studies would provide the quantitative (science) substantiating the success of the removal response action. The FOSC aspired to use the information available from the numerous research studies to develop a simple, economic and low maintenance "bioremediation" technique which would be in acceptable to State regulatory agencies and readily adopted and implemented by the oil production industry.

Removal actions without an enforcement instrument, such as the "Bryner Experiments" in McKean County and the Mayburg Mountain Minor Oil Spill in Forest County, were successfully completed with the responsible parties implementing "bioremediation" in a practical manner. It should also be noted that the voodoo (no science) version of the practical application of "bioremediation" was successfully implemented to "bioremediate" oil spills at the Czech Embassy and the High Rise Condo Oil Spill Sites in Washington, DC..

In 1995, the FOSC responded to a minor oil spill in the Allegheny National Forest; the North Fork Minor Oil Spill. As part of the federal removal response activities, two (2)

abandoned, leaking oil wells were cleaned-out and plugged. The oil-contaminated soil from the well-sites was incorporated into an on-site treatment area dubbed a "bio-pod" by the FOSC, as the practical application of "bioremediation" was selected as the on-site disposal option in lieu of traditional off-site disposal at a landfill. Following solidification, organic loading, and routine, periodic rototilling (to aerate), the oil-contaminated soil naturally attenuated and, over time, became capable of supporting a vegetative growth cover. Although, the implementation of 'bioremediation" at the North Fork Minor Oil Spill Site to complete the cleanup was deemed successful by the FOSC, there was no analytical data (science) gathered to substantiate that the crude oil had actually been "bioremediated." The success of "bioremediation" was assumed and solely based upon qualitative observations such as appearance of the soil in the biopod, the reduction of petroleum odors emanating from the soil, and the growth of a vegetative cover on soil which once was oil-contaminated.

The level of success experienced at the North Fork Minor Oil Spill Site led to expanded application of this on-site treatment method at other OPA sites in northwestern Pennsylvania. However, upon consultation with EPA Regional management, the FOSC determined that the practical application of "bioremediation" would now be blinded by science, with samples collected and analytical data used to evaluate the effectiveness of "bioremediation" as a removal response action at OPA Sites.

The previously mentioned *North Fork Minor Oil Spill Site*, is an example where "bioremediation" techniques were implemented as a removal response action with successful results based upon voodoo (qualitative observations). "Bioremediation" as a removal response action at other OPA Sites (abandoned oil production facilities) in northwestern Pennsylvania such as *Park & Hungiville, Allegro Oil and Gas Inc.* , *Melvin Farm, Avery Farm*, *Hess Farm*, *Onofrio Estate, Barrett Wells, McCracken Farm, and Johnston & Matthews Farm* provide examples of successful results based upon science (quantitative data). The following provides a synopsis of these OPA Sites where "bioremediation" was implemented as a removal response action:

North Fork Minor Oil Spill, Allegheny National Forest, McKean Co., PA

In 1995 EPA responded to a leaking oil well in North Fork Creek, which is a tributary to Chappel Creek, which ultimately is a tributary to the Allegheny River. A comprehensive reconnaissance located two (2) of the twelve (12) abandoned oil wells depicted on 1930's vintage maps. Substantial amounts of oil-contaminated soil surrounded the well-sites. EPA performed a removal action to mitigate the threat to navigable waterways and the environment. As an alternative to offsite disposal, a "biopod" was created to "bioremediate" the oil-contaminated soil. The abandoned oil wells were plugged in 1996 the oil-contaminated soil was solidified, organic matter was added, and rototilling was conducted to homogenize the oil-contaminated soil. By the end of the growing season, a vegetative cover was established and no further actions were taken.

Park & Hungiville OPA Site, Rixford, McKean County, PA

In1994 EPA responded to abandoned oil wells leaking into Knapp Creek, a tributary to

the Allegheny River. Nineteen (19) abandoned oil wells were cleaned-out and plugged. Initially, oil contaminated soil was bioremediated on a well-site specific basis. In 1995 more wells started leaking, EPA resumed removal response activities, an additional thirty-four (34) wells were plugged and Biopods were created to handle increasing quantities of oil-contaminated soil from the numerous well-sites. EPA Regional manager, Removal Response Section Chief Charles Kleeman, after an on-site tour of the nearby North Fork Minor Oil Spill OPA Site, recommended that quantitative data, despite the additional cost, be utilized to substantiate the FOSC's qualitative observations and effectively keep the armchair quarterbacks at bay. Over the course of the federal removal response action, oil- contaminated soil was recovered from the various well-sites, and incorporated into biopods #1, #2 and #3 on-site. These biopods were reconfigured several times to prevent runoff and to keep the oil-contamination at the surface where a rototiller could properly aerate the affected soils. Samples were collected routinely and analyzed for Total Petroleum Hydrocarbons (TPH) to evaluate the effectiveness of "bioremediation."

-Biopod #1: established in August of 1994, TPH concentrations were reduced from approximately 105,080 mg/kg to approximately 10,950 mg/kg by October of 1994. By mid-summer of 1995 additional quantities of oil-contaminated soil had been incorporated into the biopod and TPH concentrations increased to approximately 91,200 mg/kg by September of 1995. In June of 1996, "bioremediation" continued and TPH concentrations were reduced approximately 47,750 mg/kg by September of 1996. In April of 1997 "bioremediation" continued and TPH concentrations remained steady at approximately 44,150 mg/k to the middle of July, at which time the contents of the Biopod #1 were incorporated into Biopod #3.

-Biopod #2: established in May of 1996, TPH concentrations were reduced from approximately 6,000 mg/kg to approximately 1,200 mg/kg by September of 1996. The biopod was reconfigured in April of 1997, and TPH concentrations remained relatively stable at approximately 1,200 mg/kg by May of 1997. This biopod was observed to have been conveniently and naturally revegetated with native plant species by the end of the Summer of 1997.

-Biopod #3: established in July of 1997, TPH concentrations were reduced from approximately 44,150 mg/kg to approximately 10,000 mg/kg by October of 1997. However, the biopod was observed to have been conveniently and naturally revegetated with native plant species in the spring of 1998. Samples were collected in August of 1998 confirming the TPH concentrations to be approximately 10,000 mg/kg.

-Biopod #4: In 2001 another well started leaking, EPA resumed removal response activities, plugged the well and Biopod #4 was created to treat the quantity of oil-contaminated soil generated from the removal response. Since August 2001, TPH concentrations have been reduced from approximately 11,200 mg/kg to 2,990 by the middle of September. The biopod will be seeded and mulched at the end of the growing season.

Allegro Oil and Gas Inc. OPA Site, Shinglehouse, Potter County, PA

In1992 EPA responded to oil spills from an oil production facility leaking into Wapsena Hollow, a tributary to Osweyo Creek, which is a tributary to the Allegheny River. After the facility was abandoned in 1995, and the owner/operator failed to comply with EPA's Administrative Order, one hundred seven (110) abandoned oil wells were plugged and sixteen

(16) tanks were inerted, cleaned out and dismantled. Oil-contaminated soil and debris from various oil spills, well plugging and tank cleaning consolidated into biopods on-site.

Biopod #1672: established after the removal of tank #1672 in the summer of 1997. The total TPH concentrations were reduced from approx 891,500 mg/kg to approximately 12,000 mg/kg by the end of the summer when the operations were suspended for the winter. After reconfiguration of the Biopod in the spring of 1998, samples were collected in June 1998, establishing a baseline sample of approximately 8,260 mg/kg. Over the summer of 1998, the biopod was rototilled on a routine periodic basis, and analysis of the samples indicated the TPH was reduced to approximately 1,535 mg/kg by the middle of September 1998. Based upon some stratification observed, Biopod #1672 was again reconfigured and sampled in October 1998, establishing a winter 1998/1999 baseline of approximately 12,447 mg/kg. Bio-ops resumed in the spring of 1999. Bio-ops resumed in July of 1999, and continued through the middle of September 1999. Analytical data indicates concentration of TPH in biopod 1672 had been effectively reduced from approximately 891,000 mg/kg to approximately 440 mg/kg over the course of two seasons.

Biopod #1163: This biopod was established at the massive oil spill downgradient from well #1163 in the summer of 1997. Over the course of the summer of 1997, the TPH was reduced from a baseline of approximately 550,000 mg/kg to approximately 23,550 mg/kg by the time bio-ops were suspended in October 1997. After reconfiguration of the biopod in the spring of 1998, samples were collected June 1998, establishing a 1998 baseline of approximately 82,000 mg/kg, and bio-ops resumed. Over the summer of 1998, the biopod was rototilled on a routine periodic basis, and analysis of samples indicated that TPH was reduced to approximately 42,600 mg/kg in September 1998. The biopod was again reconfigured and rototilling continued, taking advantage of some "Indian Summer" weather conditions. Subsequent analysis indicated that the TPH has been further reduced to approximately 26,995 mg/kg by the end of October 1998, when bio-ops were suspended. Cultivating/tilling ops resumed in the Spring of 1999. Samples were collected every two weeks through the middle of September 1999. Analytical data indicates the concentration of TPH in Biopod 1163 had been effectively reduced from approximately 550,000 mg/kg to approximately 5,300 mg/kg over the course of one and one half seasons.

"BS" Biopod: This biopod was established form the residual oil debris from tank cleaning operations known as bottom sediments ("BS") towards the end of the summer of 1997. This biopod had a TPH baseline of approximately 613,000 mg/kg. Organic matter and native soil was added to solidify the oily debris and the biopod was allowed to lie fallow over the winter of 1997/1998. After reconfiguration in the spring of 1998, samples were collected in June, establishing a 1998 baseline of approximately 90,050 mg/kg. Over the summer, the biopod was rototilled on a routing periodic basis, and analysis of samples indicate that the TPH was reduced to approximately 17,300 mg/kg as by the end of September 1998, when bio-ops were suspended for the winter of 1998/1999. Bio-ops resumed in the spring of 1999. After observations and sampling analysis indicated some stratification of oil-contamination, the biopod was screened and reconfigured in July of 1999. Bio-ops continued and samples were collected every two weeks through the middle of September 1999. Analytical results indicate that the concentration of TPH in the "BS" biopod have been effectively reduced from approximately 613,000 mg/kg to approximately 5,700 mg/kg over the course of one and one half seasons.

"BS-II" Biopod: This biopod was established, concurrent with tank cleaning operations, in the summer of 1998. Samples collected after solidification with native soil and organic matter in August 1998 established the baseline concentration of approximately 65,700 mg/kg. The biopod was rototilled periodically, and subsequent analysis of samples collected indicate that TPH had been reduced to approximately 11,770 mg/kg by October 1998, when bio-ops were suspended for the winter of 1998/1999. Bio-ops resumed in the spring of 1999. After observations and sampling analysis indicated some stratification of oil-contamination, the biopod was screened and reconfigured in July of 1999. Bio-ops continued and samples were collected every two weeks through the middle of September 1999. Analysis indicates concentration of TPH in the "BS-II" biopod have been effectively reduced from approximately 60,700 mg/kg to approximately 4,800 mg/kg over the course of one and one-half seasons.

Melvin Farm OPA Site, Bradford, McKean County, PA

In1997 EPA responded to abandoned oil wells leaking into Foster Brook, a tributary to the Allegheny River. Sixteen (16) abandoned oil wells plugged, one (2) tanks inerted, cleaned-out and scrapped. Oil-contaminated soil was initially bioremediated on a well-site specific basis. Following solidification of tank sludges with native soil and organic material, a biopod was created, and oil-contaminated soil from the well-sites was incorporated into the bio-pod. The bio-pod was periodically rototilled and sampled. Analytical results indicate that TPH concentrations of approximately 568,000 mg/kg in April of 1998 were reduced to approximately 226,000 mg/kg by October of 1998. The biopod was expanded to maximize rototilling efficiency, organic material was added, and the "bioremediation" continued in the Spring of 1999. Analytical results indicate that TPH levels of approximately 140,000 mg/kg in April of 1999 were reduced to approximately 56,000 mg/kg by September of 1999. "Bioremediation" resumed in July of 2000, with analytical results indicating that TPH concentrations of approximately 84,200 mg/kg reduced to approximately 9,920 mg/kg by October 2000. The biopod was again reconfigured in the June 2001, remixing oil-contaminated soil from the lower portion of the biopod to the surface, and reestablishing a baseline of approximately 46,000 mg/kg. Nutrient and moisture amendments were added to the bio-pod during the 2001 growing season and by the middle of September 2001, TPH concentrations were observed to have increased to approximately 73,000 mg/kg. The OSC believes that the increase TPH is may be a function of the nutrient and water amendments, and will further evaluate this with EPA-ERT Dr. Harry Allen and USDOE/NETL Dr. Harry Edenborn.

Avery Farm OPA Site, Custer City, McKean County, PA

In1999 EPA responded to an oil spill from an abandoned leaking oil well into East Branch Tunungwant Creek, a tributary to the Allegheny River. A review of old lease maps and a comprehensive on-site reconnaissance determines that abandoned oil production facility is comprised of eleven (11) oil wells, one (1) tank and one (1) oil/water separator that have discharged or posed substantial threats to discharge oil into the East Branch Tunungwant Creek, its tributaries or shorelines. Federal removal response activities commenced and the abandoned oil wells were cleaned out and plugged, and the storage tank and oil/water separator were dismantled and scrapped. Oil-contaminated soil and tank sludges were solidified with native soil and organic material, incorporated into a biopod and rototilled on a routine, periodic basis. Soil

in this biopod was periodically sampled and analyzed. Analytical results indicate that TPH concentrations in May of 1999 of approximately 126,200 mg/kg were reduced to approximately 62,650 mg/kg by September of 1999 when "bioremediation" was suspended for the winter. Beaver activity in the area restricted access to the biopod until August of 2000. Subsequently, "bioremediation" resumed, and analytical results indicate that TPH concentrations of approximately 14,000 mg/kg in August of 2000 had been reduced to approximately 11,100 mg/kg by October 2000. Observations of the sparsely revegetated bio-pod in the Spring of 2001 indicated bioremediation had not effectively reduced the TPH sufficiently enough, therefore, the biopod was reconfigured to homogenize the contents and bio-ops resumed in June of 2001 with an approximately 38,000 mg/kg TPH reduced to approximately 17,300 mg/kg by the middle of September 2001.

Hess Farm OPA Site, Custer City, McKean County, PA

In1999 EPA conducted a removal evaluation of an abandoned oil production facility adjacent to the Avery Farm. A review of old lease maps and a comprehensive on-site reconnaissance determines that abandoned oil production facility is comprised of four (4) oil wells, one (1) tank and one (1) oil/water separator that have discharged or posed substantial threats to discharge oil into Sheppard Run, its tributaries or shorelines. Sheppard Run is a tributary to East Branch Tunungwant Creek, which is a tributary to the Allegheny River. Federal removal response activities commenced and the abandoned oil wells were cleaned out and plugged, and the storage tank and oil/water separator were dismantled and scrapped. Oil-contaminated soil and tank sludges were solidified with native soil and organic material, incorporated into a biopod and rototilled on a routine, periodic basis. Soil in this biopod was periodically sampled and analyzed. Analytical results indicate that TPH concentrations in May of 1999 of approximately 130,700 mg/kg were reduced to approximately 19,000 mg/kg by September of 1999. Beaver activity in the area restricted access to the biopod until August of 2000. Subsequently, "bioremediation" resumed, and analytical results indicate that TPH concentrations of approximately 14,300 mg/kg reduced to approximately 1,620 mg/kg by October 2000. Observations of the sparsely revegetated bio-pod in the Spring of 2001 indicated bioremediation had not effectively reduced the TPH sufficiently enough, therefore, the biopod was reconfigured to homogenize the contents and bio-ops resumed in June of 2001 with an approximately 10,000 mg/kg TPH. The TPH level has remained somewhat constant over the course of the summer, with approximately 12,100 mg/kg TPH indicated by analytical results as of the middle of September 2001.

Onofrio Estate Site, Bradford, McKean County, PA

In1999 EPA conducted a removal evaluation of an abandoned oil production facility. Federal removal response activities were implemented to mitigate the effects of a discharge of oil from two (2) aboveground storage tanks into a pit that threatened to overflow into an unnamed tributary to the West Branch Tunungwant Creek, which is a tributary to the Allegheny River. A review of old lease maps and a comprehensive on-site reconnaissance determines that abandoned oil production facility was comprised of approximately two hundred (200) oil wells and equipment appurtenant to production. Comprehensive reconnaissance and evaluation of the abandoned facility resulted in the location and determination that sixty-two (62) abandoned oil

wells and four (4) tanks had discharged or posed substantial threats to discharge oil into the West Branch Tunungwant Creek, its tributaries or shorelines. Federal removal response activities continued and the abandoned oil wells were cleaned out and plugged, and the storage tanks were dismantled and scrapped. Oil-contaminated soil and tank sludges were solidified with native soil and organic material, incorporated into a biopod and rototilled on a routine, periodic basis. Additional quantities of oil-contaminated soils were added incrementally, as they were recovered from well sites Soil in this biopod was periodically sampled and analyzed. Analytical results indicate that TPH concentrations of approximately 409,000 mg/kg in May of 1999 were reduced to approximately 79,750 mg/kg by September of 1999. The "bioremediation" resumed in July of 2000, with TPH concentrations of approximately 70,950 mg/kg reduced to approximately 12,000 mg/kg by October 24, 2000. Observations of the sparsely revegetated bio-pod in the Spring of 2001 indicated bioremediation had not effectively reduced the TPH sufficiently enough, therefore, the biopod was reconfigured to homogenize the contents and bio-ops resumed in June of 2001 with an approximately 51,185 mg/kg TPH reduced to approximately 19,7500 mg/kg by the middle of September 2001.

Barrett Wells OPA Site, Bradford, McKean County, PA

In 2000, EPA conducted a removal evaluation of an abandoned oil production facility. Federal removal response activities were implemented to eliminate the substantial threat of the discharge of oil from two (2) abandoned oil wells into an unnamed tributary to Foster Brook which is a tributary to the Allegheny River. Oil contaminated soil and debris from around the well-sites and dead oil and paraffin removed from the wells was solidified with native soil and organic material, and incorporated into a biopod and rototilled on a routine, periodic basis. Soil in this biopod was periodically sampled. Analytical results indicate that TPH concentrations of approximately 80,500 mg/kg in July of 2000 were effectively reduced to approximately 4,060 mg/kg by October 2000.

McCracken Farm OPA Site, Foster Township, McKean County, PA

In 2000, EPA responded to an oil spill from an abandoned leaking oil well into Foster Brook, a tributary to the Allegheny River. After a review of old lease maps and a comprehensive on-site reconnaissance the OSC determined that twenty-five (25) wells on the abandoned oil production facility along with five (5) tanks and two (2) oil/water separators had discharged or posed substantial threats to discharge oil into Foster Brook, its tributaries or shorelines. Federal removal response activities commenced and the abandoned oil wells were cleaned out and plugged, and the storage tanks and oil/water separators were dismantled and scrapped. Oil-contaminated soil and tank sludges were solidified with native soil and organic material, incorporated into biopods and rototilled on a routine, periodic basis.

-Biopod #1: In June 2001 Biopod #1 was created to treat the quantity of oil-contaminated soil and debris generated from the removal response. Since June 2001, TPH concentrations have been reduced from approximately 219,730 mg/kg to 17,700 by the middle of September.

-Biopod #2: In July 2001 Biopod #2 was created to treat the quantity of oil-contaminated soil and debris generated from the removal response. Since July 2001, TPH concentrations have been reduced from approximately 112,485 mg/kg to 23,200 by the middle of September.

Johnston & Matthews Farm OPA Site, Bradford, McKean County, PA

In 2001, EPA responded to an oil spill from an abandoned leaking oil well into Bovaird Run, a tributary to the Allegheny River. After a review of old lease maps and a comprehensive on-site reconnaissance the OSC determined that eight (8) wells on the abandoned oil production facility along with one (1) tank had discharged or posed substantial threats to discharge oil into Bovaird Run, its tributaries or shorelines. Federal removal response activities commenced and the abandoned oil wells were cleaned out and plugged and the storage tank was dismantled and scrapped. Oil-contaminated soil and tank sludges were solidified with native soil and organic material, incorporated into biopods and rototilled on a routine, periodic basis.

-Biopod: In July 2001, the Biopod was created to treat the quantity of oil-contaminated soil and debris generated from the removal response. Since July 2001, TPH concentrations have been reduced from approximately 78,890 mg/kg to 73,600 by the middle of September.

Current/Future Removal Response "Bioremediation" Plan of Action

Based upon the success of "bioremediation" substantiated by both voodoo (qualitative observations) and science (sample and analysis), the FOSC plans to continue to implement on-site "bioremediation" as a practical removal response tool in lieu of off-site transport and disposal at oil spills from abandoned oil production facilities in northwestern Pennsylvania and other OPA Sites within EPA Region III where applicable.

The FOSC will continue to consult with Dr. Harry Allen, the Environmental Response Team's bioremediation expert, and with an independently-funded research microbiologist, Dr. Harry M. Edenborn, of the United States Department of Energy, National Energy Technology Laboratory to examine the spatial distribution (areal and vertical) and seasonal (temporal) fluctuation in the hydrocarbon-degrading microbes native to the soils in northwest Pennsylvania to characterize incident-specific, geographic and locational aspects of an oil spill to determine the best location to site the bio-pod and provide optimum conditions (organic load, nutrient and moisture amendments) for the hydrocarbon-degrading microbes, increasing the effectiveness and efficiency of "bioremediation" as a removal response action at OPA Sites.

Future plans also include continued consultation with EPA's Environmental Response Team Dr. Harry Allen concerning the implementation of a phased bioremediation approach which includes active (regular tillage for soil mixing and aeration) and passive (phytoremediation with petroleum-tolerant plants) treatment of oil-contaminated soil as an effective removal response action at OPA Sites in the northwestern Pennsylvania oil fields.

Attachments: