

Oil Refinery Partnership Meeting
May 17-18, 2000
Denver, Colorado

Summary Report

Prepared for:

U.S. Environmental Protection Agency
Technology Innovation Office

Prepared by:

Science Applications International Corporation
Reston, Virginia

June 12, 2000

Meeting Background and Goals

This day and a half meeting was an outgrowth of two conference calls that took place on June 7th and 9th, 2000. The purpose of this meeting was to bring stakeholders together, brainstorm on topics of mutual interest, and to discuss the possibility of forming a partnership among some or all of the meeting participants. During the meeting, examples of ongoing federal and industry efforts were provided and the group began to discuss its focus and purpose.

The purpose of this report is to present a summary of the discussions held during the meeting and to outline the major conclusions and recommendations. This report is organized by the main topics of the conference, which are as follows:

1. Cooperative Partnerships
2. Site Strategies for NAPL Management
3. Discussion
4. Summary and Wrap-up

An overview of the major results of the workshop are summarized below:

- c The group wishes to continue pursuing the possibility of forming a partnership.
- c Texaco has offered its Casper, Wyoming site to the group for the testing of various technologies.
- c There was general agreement on a need for cost and performance data for cleanup technologies.

Specific action items identified at the workshop include:

1. EPA will compile information on cleanup technologies particularly for large scale NAPL removal and distribute to the group.
2. EPA will attempt to identify cost and performance data gaps for various technologies.
3. SAIC will send out a form to all participants requesting a summary of their remediation expertise at oil refinery sites.
4. EPA will create a letter outlining the group's focus, so that participants can justify their involvement to their management.
5. EPA will work with Texaco on setting up a date for a site visit in the next 2-3 months to Texaco's Casper, Wyoming site.
6. Kathy Yager will distribute an email to the group soliciting possible refinery sites to be included in the long-term monitoring project being done by her office. The project is going to apply geostatistics/statistical approaches to determine if fewer wells can be sampled less frequently without compromising the quality of monitoring data.

Dr. Kovalick of EPA's Technology Innovation Office (TIO) gave a brief welcome and asked everyone to briefly introduce themselves. He was followed by Randy Breeden (EPA Region 8) and Kathy Yager (EPA TIO) who outlined the meeting background and goals (see beginning of the summary notes). They also reviewed the meeting agenda (see Appendix 1). Attendees included representatives from US EPA and various oil companies, environmental consultants, and a state regulatory representative. For a list of attendees and their contact information, see Appendix 1.

1. Cooperative Partnerships

There were two presentations addressing partnerships. Both of these presentations were from federal government representatives. The presentations are summarized below.

Successes, Challenges and Strategies of Public/Private and Public/Public Partnerships US EPA Technology Innovation Office - Walt Kovalick Jr., Ph.D.

Dr. Kovalick discussed TIO's experience with public-private partnerships as well as lessons that have been learned that can help with future opportunities. He outlined six partnerships that TIO has been involved with in the past, several of which are still in existence. The partnerships are Clean Sites Public Private Partnership, Bioremediation Action Committee, Environmental Technology Verification, Remediation Technologies Development Forum, Federal Remediation Technologies Roundtable, and EPA State Dry Cleaners Remediation Project. Dr. Kovalick also discussed lessons that TIO has learned in forming partnerships as a result of the above endeavors. Some of the lessons that were learned were:

- “relationships” first, then joint technology work
- cooperation among disparate industries is new
- communications of benefits is essential
- “in-kind” resources are important.

Interagency DNAPL Consortium: Future Public-Private Cooperation? US Department of Energy (DOE), Oak Ridge National Laboratory - Tom Early

This presentation dealt with technology evaluation for removal of dense non-aqueous phase liquids (DNAPLs) at Cape Canaveral. The consortium that is involved with this project consists of the Department of Defense, DOE, National Aeronautics and Space Administration, EPA, and the Navy. He discussed why the consortium was formed, the technologies chosen for cleanup, the roles and responsibilities of the participants, challenges that were encountered and lessons that were learned. The goal of the project is to test the best technologies that meet basic standards of 90% removal of mass and MCL for groundwater. A cost evaluation and performance evaluation will be performed for each of the three technologies that were chosen. They are about to start the third phase and will have more information available regarding results from the various technologies at the Battelle conference in

Monterey, CA.

The consortium chose not to pool money, instead participants were responsible for various tasks. One disadvantage of this method is a situation in which one participant responsible for a specific task runs out of money to complete the task. In some cases, another agency may be able to offer additional funds to complete the task, however transferring money among agencies can be very complicated. Also, actual costs of implementation are typically more expensive than originally predicted.

One lesson learned was that it may be beneficial to establish a relationship between the vendor and the Technical Advisory Group (TAG), wherein the vendor could use the TAG knowledge and the TAGs could use a vendor's product with little or no financial cost. This would be an alternative to purchasing a vendor's product outright. The consortium discovered that the vendors were able to use the expertise and knowledge of the consortium members to refine their technologies. For more information regarding Mr. Early's presentation, please see the handout he distributed in the meeting or contact Alina Martin (SAIC) for the electronic version.

2. Site Strategies for NAPL Management

NAPL Strategies for the Future

US EPA Technology Innovation Office (TIO) - Walt Kovalick Jr., Ph.D.

Dr. Kovalick discussed the potential to address vadose zone semi-volatile contamination, contamination in low permeability zones and contamination at depths below those amenable to excavation. He also expressed the belief that problematic sites, such as sites where there are large petroleum hydrocarbon releases, could drive demand for solutions. In looking to the future there needs to be a way to integrate technical capabilities with regulatory endpoints. There is a need for encouragement and incentives to allow interested parties to pursue the use of innovative technologies in cleanup of contaminated sites. Along these lines EPA implemented a Guidance for risk sharing under the Superfund Reform Initiative where EPA agrees to pay up to 50% of the cost of a failed innovative remedy if a backup remedy must be implemented. Dr. Kovalick also discussed opportunities for joint activity such as the Federal Remediation Technologies Roundtable (FRTR). He distributed a draft of the *Action Plan for Accelerating the Maturation of Promising In Situ DNAPL Treatment Technologies* that was created by the FRTR. Information on the FRTR can be accessed at www.ftr.gov. He concluded his presentation by discussing the next steps for this group which were to determine the goals of the group, identify projects of interest and possibly participate in the FRTR National Action Plan.

***Site Strategies for NAPL Management, Conoco/CRC Denver Refineries
ThermoRetec Consulting Corporation - John Meyers***

Mr. Meyers provided a presentation of his work with Randy Breeden of US EPA Region 8 at the Conoco/CRC Denver Refinery site. He presented the results of a technical approach he has used for the last year at the Conoco site. He discussed the site investigation for characterizing the three-phase product recovery and the development of the methodology for the endpoints. They have not yet assigned numbers to the endpoints, but the methodology is established. The objectives of the project were to:

- Estimate the nature and extent of product (quantitatively)
- Identify product type, distribution and properties
- Estimate the mobility of free-phase product
- Design a conceptual pilot product recovery system

The goal of the project was mobility control. The presumptive remedy for the site was water flooding and the investigative approach that was utilized was Rapid Optical Screening Technology (ROST) which is a qualitative tool. The ROST is a great tool to determine where there is product and where there is not. However, it falls short in telling how much product there is.

Mr. Meyers attempted to come up with a correlation between the qualitative ROST intensity and the measurable product saturation of the soil. After determining the mobility of a product, it is then possible to determine which technology can reach the desired cleanup level. At this time the cost of pump and treat at the site is \$500,000 a year. The goal is to get to a residual level that would allow the pump and treat to be turned off. Sentinel wells would be put in for continued monitoring because it is an active refinery. It is Conoco's understanding that no other organization has gone to this level of detail in characterizing a site. See the meeting handout for detailed graphs and maps of the project's results. For further information, contact John Meyers or Randy Breeden.

***Navy's Technological Approach to Petroleum Contamination
Naval Facilities Engineering Service Center (NFESC) - Steve Eikenberry and Kathy Greene***

The Navy is the largest petroleum consumer in the world. This presentation provided an overview of a number of sites that NFESC works at and the various innovative technologies that they have used. They no longer consider bioremediation as an innovative technology because it has been accepted as a viable cleanup technology by practitioners. They also discussed an acoustic leak detection system that determines if there are leaks in pipes. It is still being tested on pipes made with a variety of different materials. A wealth of information regarding the NFESC's work and various technologies that they use and/or developed is provided on the CD-ROM that was distributed at the meeting. Also, see the meeting handout of their presentation for more information. An electronic copy can also be obtained from Alina Martin (SAIC) via email.

Stochastic Approach to Evaluating Environmental Data
US EPA, Office of Research and Development, National Risk Management Research
Laboratory - Carl Enfield

Mr. Enfield's discussion centered on a site where all the freely mobile contaminants have been removed, however, because of contaminants being dissolved it is not possible to reach the endpoints. By looking at this problem from a data standpoint, it might be possible to determine ways to address this problem. Mr. Enfield proposes utilizing data from a particular situation to make stochastic sense in order to forecast what will happen in other situations. By solving one simple problem and adding that to the solution of another simple problem and so on, one should be able to solve a complex problem. By using existing data, it may be possible to forecast what a remediation technology may do. An electronic copy of the presentation can be obtained from Alina Martin (SAIC) via email.

3. Discussion

The discussion session focused on asking questions of the group in order to determine whether the group should continue, the participants' needs, the group's focus, and the next steps.

Dawn Kaback (Concurrent Technologies Corporation) asked the group to provide input on their needs. Len Racioppi (ExxonMobil) responded that one critical need is to figure out how to frame the problem better so that the appropriate or best technology can be chosen. Important questions that need to be addressed include the following: what are the technologies that can be used and why, and when and how is something done. John Meyers (ThermoRetec Consulting Corporation) added that it is important to understand the driver behind the need for remediation.

Questions & Comments *[The following list contains questions outlined by EPA to facilitate discussion and comments that were made during the discussion. The discussion surrounding the various questions and statements follows that question or statement if it was addressed.]*

- How do you define the problem of source removal vs. dissolved plume?
- What drives the need for product recovery? There is a need for a decision criteria framework for evaluating need or extent of source removal.
- Weigh the chance and cost of future releases against the cost of source removal now.
- What are the national objectives at petroleum release sites? Industry's interest is in cleanup technologies. They would like to get cost/performance data for existing technologies. This would be useful in discussions between industry and regulators. There is also a need for leak detection systems. This is an area that needs more and better technology.

- What technical information/data needs to be collected to base site removal on? The biggest yield comes from risk reduction.
- Identify risks before/after implementing an enhanced technology.
- Industry would like recognition that product that is in wells is not necessarily mobile.
- How do you measure and define performance?
- Get a better understanding of the technologies that are available. Randy Breeden (EPA Region 8) suggested that a future meeting provide a day for scientists to come present their proven technologies. These would be technologies that have already been used and have results. He also would like to see two or three sites offered in order for the group to assess a site's characteristics, investigate the available technologies, and through a partnership with EPA, external scientists, and industry scientists design a system, evaluate the results and present them to the group. Randy said that Texaco is planning on offering their Casper, Wyoming site to test various technologies. See the summary and wrap-up session for discussion on this topic. Mark Lyverse (Chevron) suggested that the group try to leverage existing technologies. Chevron has used the six-phase test and can offer their expertise in that area. The group is very interested in technologies that are effective on large sites and sites where the soil has very low permeability such as clay and fractured bedrock. There is very little data available in these areas.
- A site demonstration should be tailored to meet specific needs as an incentive for industry. The following questions were raised regarding a site demonstration: what would the scale be, what would the endpoints be, and how does a field demonstration fit into RCRA.

The discussion session concluded with Kathy Yager (EPA TIO) discussing a project her office is working on to evaluate the use of geostatistical techniques to identify spatial and temporal redundancies in ground water monitoring programs. The plan is to evaluate three sites with existing monitoring networks, apply geostatistics/statistical approaches and determine if fewer wells can be sampled less frequently without compromising the quality of monitoring data. It may be possible to include a refinery site as one of the three sites, or expand the project to four sites. An email will be sent to the group soliciting possible sites for the long-term monitoring project.

4. Summary and Wrap-up

This session started with Texaco tentatively offering its Casper, WY site to the group to be used for evaluation of various cleanup technologies. Randy Jewett (Texaco) and Jeff Hostetler (TriHydro Corporation) provided background information on the site. The site is located on the North Platte River. The refinery started production in the 1920s and produced about 30,000 barrels a day. Production stopped in 1982 and in 1995 Texaco started clearing the site. There were some

environmental issues because product was leaking into the river. Last year they finished removing all property related buildings and pipes on the site, above and below ground. There is still buried waste on the site. Last year they installed a Waterloo barrier system right at the water's edge and at some points 40 feet out into the river to catch product leakage. There is essentially no source left to leak. Even if a proposed cleanup technology does not work, the barrier wall would prevent any product from reaching the river.

The site is about 200 acres, rectangular in shape and roughly 3/4 of a mile wide and 1 mile long. Most of the site sits over an alluvial aquifer with depths varying from 10-45 feet. The thicker parts of the aquifer are fairly homogeneous composed mainly of well graded sands and gravels (eastern end) while the thinner part of the aquifer is not as well developed and the material is finer and more heterogeneous (western end). Product on the site ranges from weather gasoline to heavy oils. The eastern end of the site was a storage area for lighter oils and the western end had a coking operation and heavier oils. There are French Style drains which date back to the late 1950s. Just inside the Waterloo barrier there is a 2500 foot groundwater extraction trench which is used primarily for hydraulic differential between surface water elevations in the river and ground water elevations on the inboard side of the barrier.

Their system can pump up to 12,000 gallons a minute out of the trenches. Now that the barrier is in place, however, they only run the system at about 400 gallons a minute because they no longer have a 60-70% contribution of water from the river. From 1997-99 Texaco recovered about 200,000 gallons of free-phased hydrocarbons. An additional 40-50,000 gallons was recovered from pipes when they were removed. The current O & M costs at the site are \$1.1-1.3 million a year. The regulatory driver is a RCRA consent order that has been in place since 1996. At this time the order is in flux and will probably stay that way for the next one to one and half years. As the site stands now there are about 50 acres that are still contaminated and they do not know how much is left in the subsurface. A cleanup cost or plan has not been developed yet. The ultimate goal is to achieve closure and sell the site.

In the discussion surrounding the Casper site several points were raised. These were:

1. There should be more site characterization performed at the site before implementing any cleanup technologies.
2. There should be a framework set up among participants before any technologies get implemented.
3. The chosen remediation technology will be tested on a portion of the oil refinery site, not the entire site.

At the meeting's conclusion the group was polled to determine their interest in continuing their involvement with the group. Listed below is each industry or representative's response. EPA Region 8

and TIO are very interested in staying involved. They can provide meeting facilitation services and technical support through the use of contractors.

Mark Adamski, BP Amoco. BP Amoco is very interested in continuing with the group and may have a site to offer that has LNAPL issues. The site is located in Texas City in clayey soil with no significant migration problems.

Tom Early, DOE Oak Ridge National Laboratory. DOE primarily focuses on DNAPL issues and therefore is only interested in observing. They do not wish to be an active participant.

Kathy Greene, Naval Facilities Engineering Service Center. NFESC is very interested in continuing their involvement with the group. They have a lot to offer to the group because they have experts in numerous technologies, have sites all over the world and all of their information is open to the public.

Jeff Hostetler, TriHydro Corporation. Mr. Hostetler would like to stay involved.

Randy Jewett, Texaco. Texaco is very interested in staying involved and as mentioned previously is offering a site for technology evaluation.

Mark Lyverse, Chevron Research and Technology Co. Chevron is very interested in staying involved. They probably do not have a site to offer, but they would offer their experience with the six-phase heating technology.

John Meyers, ThermoRetec Consulting Corporation. Mr. Meyers would like to continue to participate.

Len Racioppi, ExxonMobil Environmental Remediation. Mr. Racioppi was not in attendance during this portion of the meeting. Randy Breeden or Kathy Yager will contact him to determine ExxonMobil's continued involvement.

Paul Rogers, Defense Energy Support Center (DESC). DESC is very interested. DESC is responsible for cleanup costs at all defense sites all over the world. DESC is responsible for all spills that happened after 1992. Spills that happened prior to 1992 are the responsibility of the respective service.

Steve Shoemaker, DuPont Corporate Remediation Group. Mr. Shoemaker is interested in both the decision making process of the group and appropriate technology use. DuPont's concerns are primarily with DNAPLs.

Ali Tavelli, Wyoming DEQ, Solid and Hazardous Waste Division. Ms. Tavelli is interested in

maintaining her involvement in the group.

Lynn Wood, EPA Office of Research and Development. Mr. Wood is interested in staying involved with the group.

Dick Woodward, Sierra Environmental Services, Inc (SES). Mr. Woodward is definitely interested in staying involved with the group. SES can offer its expertise with French Limited.

APPENDIX 1

- A. Meeting Agenda**
- B. List of Workshop Attendees**

EPA's Oil Refinery Partnership Meeting
Final Agenda
Wednesday, May 17, 2000
Denver, Colorado
8:30 a.m. - 5:00 p.m.

Welcome/Introductions

8:30 AM - 8:45 AM **Walt Kovalick, US EPA Technology Innovation Office (TIO)**

Meeting Background and Goals

8:45 AM - 9:00 AM **Kathy Yager, US EPA Technology Innovation Office (TIO) and
Randy Breeden, US EPA Region 8**

Cooperative Partnerships

9:00 AM - 9:30 AM **Successes, Challenges and Strategies of Public/Private and
Public/Public Partnerships - Walt Kovalick, US EPA Technology
Innovation Office (TIO)**

9:30 AM - 10:00 AM **Cape Canaveral DNAPL Technology Evaluation Project - Tom
Early, US Department of Energy, Oak Ridge National Laboratory**

Site Strategies for NAPL Management

10:00 AM - 10:30 AM **Risk Sharing and Innovative NAPL Management Strategies - Walt
Kovalick, US EPA TIO**

10:30 AM - 10:45 AM **Break**

10:45 AM - 11:25 AM **Conoco/CRC Denver Refineries - John Meyers, ThermoRetec
(Conoco) and Randy Breeden, US EPA Region 8**

11:25 AM - 11:55 AM **The Navy's Technological Approach to Petroleum Contamination,
Steve Eikenberry and Kathy Greene, Naval Facilities Engineering Service Center**

11:55 AM - 1:15 PM **Lunch**

1:15 PM - 1:45 PM **Stochastic Approach to Evaluating Environmental Data - Carl**

Enfield, US EPA NRMRL

Partnership Goals/Discussion of Issues (All Participants)

1:45 PM - 3:45 PM 2 Breakout Sessions

- **Site Issues**
 - Abandoned vs. active refineries**
 - Source removal vs. source control**
 - LNAPL & DNAPL**
 - Technology focus vs. enforcement focus**

- c **Legal Issues**
 - Legal agreements**
 - Confidentiality**
 - Cost sharing**

- c **Information Sharing**
 - Project inventory**
 - Cost and performance data**

- c **Technology Evaluation**
 - Technology workshops**
 - Endpoint assessment**
 - Treatment trains**
 - Scale-up issues**
 - Decline curve analyses**

- c **Regulatory Issues**
 - Endpoints**
 - Enforcement**

- c **Management Issues**
 - Endpoints**
 - Cost/benefit analyses**

3:45 PM - 4:00 PM Break

4:00 PM - 5:00 PM Breakout Sessions Discussion Summaries

EPA's Oil Refinery Partnership Meeting
Final Agenda
Thursday, May 18, 2000
Denver, Colorado
8:30 a.m. - 12 noon

8:30 AM - 10:45 AM **Summary and Wrap-up Session**

- **Do we go forward from here?**
- **Identify potential projects/sites**

10:45 AM - 11:00 AM **Break**

11:00 AM - 12:00 PM **Action Items/Next Steps**

List of Workshop Attendees

Name	Affiliation	Address	City	State	Zip Code	Phone	Fax	Email
Mark Adamski	BP Amoco	Mail Code 3.432, 501 WestLake Park Blvd.	Houston	TX	77079-2696	281-366-2192	281-366-7945	adamskmr@bp.com
Randy Breeden	US EPA Region 8	999 18th Street, Suite 500	Denver	CO	80202	303-312-6522	303 312 6064	breeden.randy@epa.gov
Tom Early	Oak Ridge National Laboratory	P.O. Box 2008	Oak Ridge	TN	37831-6038	865-576-2103	865-574-7420	eot@ornl.gov
Stephen Eikenberry	Naval Facilities Engineering Service Center	1100 23rd Avenue	Port Hueneme	CA	93043-4370	805-982-3584	805-982-5226	eikenberryse@nfesc.navy.mil
Carl Enfield	US EPA	26 West Martin Luther King Drive, MS 235	Cincinnati	OH	45268	513-569-7489		enfield.carl@epa.gov
Kathy Greene	Naval Facilities Engineering Service Center	NFESC Code 411, 1100 23rd Avenue	Port Hueneme	CA	93043-4370	805-982-5284	805-982-4304	greeneka@nfesc.navy.mil
Jeff Hostetler	TriHydro Corporation	920 Sheridan Street	Laramie	WY	82070	307-745-7474, Ext. 1209	307-745-7729	jhostetler@trihydro.com
Randall Jewett	Texaco Group Inc.	2255 North Ontario	Burbank	CA	91504	818-736-5562	818-736-5559	jewetrw@texaco.com
Dawn Kaback	Concurrent Technologies Corporation	999 18th Street, Suite 1615	Denver	CO	80202	303-297-0180, Ext. 111	303-297-0188	kabackd@ctc.com
Walter Kovalick	US EPA TIO	1200 Pennsylvania Ave. (5102G)	Washington	DC	20460	703-603-9910	703-603-9135	kovalick.walter@epa.gov
Mark Lyverse	Chevron Research and Technology Co.	P.O. Box 96	North Bend	OH	45052	513-353-2194, Ext.23	513-353-4664	mlyv@chevron.com
Alina Martin	SAIC	11251 Roger Bacon Drive	Reston	VA	20190	703-318-4678	703-736-0826	martinali@saic.com
John Meyers	ThermoRetec Consulting Corporation	1726 Cole Blvd., Bldg. 22, Ste. 150	Golden	CO	80401	303-271-2116	303-277-0110	jmeyers@thermoretec.com
Len Racioppi	ExxonMobil Environmental Remediation	1900 E. Linden Avenue	Linden	NJ	07036	908-474-6684		len.m.racioppi@exxon.com

Paul Rogers	Defense Energy Support Center	ATTN: DESC-FQ, 8725 John J. Kingman Rd., Suite 4950	Fort Belvoir	VA	22060-6222	703-767-8318	703-767-8331	progers@desc.dla.mil
Steve Shoemaker	DuPont Corporate Remediation Group	6324 Fairview Road	Charlotte	NC	28210	704-362-6638	704-362-6636	stephen.h.shoemaker@usa.dupont.com
Ali Tavelli	Wyoming DEQ, Solid and Hazardous Waste Division	122 West 25th Street, Herschler Building, 4-W	Cheyenne	WY	82002	307-777-5447	307-777-5973	atavel@state.wy.us
Joel Wolf	SAIC	11251 Roger Bacon Drive	Reston	VA	20190	703-318-4684	703-736-0826	wolfjoe@saic.com
Lynn Wood	US EPA ORD	P.O. Box 1198	Ada	OK	74821-1198	580-436-8552	580-436-8582	wood.lynn@epa.gov
Dick Woodward	Sierra Environmental Services, Inc.	9431 W. Sam Houston Pkwy., South	Houston	TX	77099	713-774-1605	713-774-1602	rwoodward@mindspring.com
Kathy Yager	US EPA TIO	2890 Woodbridge Avenue, Bldg. 18 (MS101)	Edison	NJ	08837	732-321-6738	732-321-4484	yager.kathleen@epa.gov