**DRAFT**
**MTBE BLUE RIBBON PANEL**
**Meeting Minutes**
**March 25-26, 1999**
**Sacramento Convention Center**
**Sacramento, California**

## OPENING REMARKS

The third meeting of the Blue Ribbon Panel to review the use of Methyl Tertiary Butyl Ether (MTBE) and oxygenates in gasoline was held March 25-26, 1999, at the Sacramento Convention Center, in Sacramento, California. Dan Greenbaum, Health Effects Institute, welcomed the Panel and then introduced the Secretary for the California Environmental Protection Agency, Winston Hickox. Mr. Hickox discussed the importance of the MTBE issue and the upcoming announcement by California Governor Gray Davis regarding the future use of MTBE in California. Mr. Hickox encouraged the Panel to complete its work and expressed hope that the Panel determinations will be in concert with the work done in California, and help California with a solution. Mr. Hickox noted that this Administration has been open to input from a large variety of interests.

Some Panel members were represented by substitutes (Blake Early, American Lung Association; Janet Hathaway, Natural Resources Defense Council; Evelyn Washington, EPA Office of Water; and Sammy Ng who will permanently replace Anna Virbick on the Panel).

## PRESENTATIONS

### MTBE Impacts to California Groundwater Resources

The first presentation was given by Dr. Anne Happel, Lawrence Livermore National Laboratory (LLNL), along with colleagues Brendan Dooher, and Edwin Beckenbach. The detailed paper summarized the work that has been conduced at LLNL, which has been provided to the California Governor's Office, legislature, and public entities. The report's objective was to perform qualitative analysis of environmental data concerning the effects of MTBE on California's groundwater. The report identified point source contamination of leaking underground storage tank sites, and used a risk-based approach. Dr. Happel's report drew three major conclusions:

- MTBE is a frequent and widespread contaminant in shallow groundwater throughout California - greater than 10,000 leaking underground tank sites with MTBE.
- MTBE plumes are more mobile and recalcitrant than benzene plumes.
- MTBE has the potential to impact regional groundwater resources and may present a cumulative contamination hazard. MTBE contamination of public drinking water

supplies may be a progressive problem. Water resource management on the regional scale will become increasingly relevant.

The occurrence data were detected at leaking underground storage tank (LUST) sites, showing the maximum concentration of MTBE. The data set was provided voluntarily by the oil industry before MTBE was required to be tested at LUST sites. In 1997, legislation passed requiring the regional water boards to report MTBE detections on a quarterly basis to the State. Concentration levels detected at the LUST sites ranged between 5 - 1000 ppb. (75 percent had MTBE concentrations greater than 5 ppb; 54 percent had MTBE concentrations greater than 200 ppb.; and 37 percent had MTBE concentrations greater than 1000 ppb). Although there were a large number of LUST sites with MTBE the maximum concentration levels varied greater among LUST sites.

The frequency of MTBE detection is approximately 78 percent, indicating that if petroleum is detected in the groundwater at the LUST site, there is 78 percent chance that MTBE will be detected. (The statewide data are 75.3 percent MTBE detection, which confirms the accuracy of that number). However, there are still many sites that have not reported their MTBE detection data. The testing data includes only LUST sites that are active. The estimated number of impacted sites is 12,000. Data were also shown to support the claim that MTBE is more mobile and recalcitrant than benzene. It was noted that MTBE and benzene plumes disassociate over time, which indicates that MTBE plumes are more mobile.

Current work is being undertaken by LLNL, as a subcontractor for the State Water Resources Control Board, to initiate a state wide geographic information system to identify and manage the threat of MTBE contamination to state water resource supplies in order to prevent future contamination of public drinking water wells. The database provides detailed information from leaking tank sites, public water supplies, water board case workers, leak detection systems, maintains information on water production and water quality, as well as allowing oversight management by any interested parties.

Statewide data have been gathered for both public drinking water wells and leaking underground fuel tank sites. There are approximately 11,000 public drinking water wells throughout California, with only 40 percent (approximately 4000 wells) of the wells tested to date. Forty of those sites are impacted (e.g. have MTBE detects). However, there are still a large number that have not yet been tested. There are approximately 15,000 leaking underground fuel tank (LUST) sites in California. More than 4000 LUST sites have MTBE detects, and 813 sites have no MTBE detection. However, there are approximately 9,990 sites that have not reported data. Once the database is completed, it will allow for queries by category of concentration, location, etc. The two main questions of concern from this information are what is the maximum concentration level at the site, and what is the distance to a drinking water well?

Numerous questions were asked by the Panel to clarify technical data and identify holes in the data due to lack of available information. The discussion topics included: the limited amount of MTBE incidents (29) reported, the variability of data depending on where monitoring wells are placed, contamination levels at MTBE detection sites, disassociation and mobility of MTBE and BTEX in plumes, depth of plumes, geographic differences among states, etc.

**Underground Storage Tank Programs in California**

Mr. James Giannopoulos, Principal Engineer at the California State Water Resources Control Board (SWRCB), gave a presentation on the California Underground Storage Tank Program, and the status of compliance since the December 22, 1998 deadline. The presentation was given and prepared by both James Giannopoulos and Allan Patton. Concerns about MTBE lead to legislation that was implemented making it illegal to deposit fuel into underground storage tanks after December 22, 1998, that were not upgraded. This legislation transferred compliance responsibility and non-compliance liability to distributors both working for industry and jobbers, which gave the State Water Control Board full compliance with the deadline.

It is estimated that in California 70 percent of the 50,000 tanks at 20,000 sites are new double-walled systems, and the remaining 30 percent are upgraded systems. Because leaks from updated tanks were reported, Governor Wilson requested the SWRCB to review existing databases of underground storage tank contamination to determine if there is a leak history with underground tank systems meeting the standards. A panel was established to look at underground storage tank systems to determine if they were capable of preventing the release of oxygenates.

Allan Patton was the chairman of the Panel and drafted the final report which recommended:

- SWRCB should conduct field-based research to find sources and causes of leaks;
- Industry should establish training programs for UST installers, operators, and inspectors;
- SWRCB should adopt regulations requiring more training;
- California should adopt tougher licensing requirements for installers;
- SWRCB should adopt regulations to reduce fraud and false reporting;
- Fuel additives should be tested for compatibility before use;
- Compatibility testing standards should account for environmental-type releases;
- SWRCB should require periodic testing of secondary containment;
- SWRCB should focus guidance on "critical components;"
- SWRCB should issue guidance to local agencies regarding dispenser pan retrofits; and
- SWRCB should improve enforcement tools available to local agency staff.

Mr. Patton presented information on existing treatment technology for MTBE in drinking water. Three teams were created to: examine compatibility (tank corrosion from MTBE); conduct file reviews on new or upgraded tank sites; and review most recent reports from the leaking underground storage tank information system (LUSTIS) to determine source and detection of releases. More information on the individual reports can be found on the internet at www.swrcb.ca.gov.

The reported findings include leak detections at some new and upgraded tank sites caused by poor installation and operation or maintenance problems. Suggested short-term improvements may include training inspectors, installers, and tank operators. It was determined that MTBE may be originating from sources other than the tanks. Because of the characteristics of MTBE, occasional spill-overs from operational errors will show up in shallow ground water. The compatibility data showed that MTBE with other gasoline components is not a major concern. However, compatibility information is often hard to find because some companies consider it to be proprietary information.

One of the most significant findings of the research was the unknown competence of the leak detection systems to perform the intended job. The basis for this conclusion was from the 1,200 cases, of which only 4 percent were discovered by leak detection alarm. The remainder (96%) were discovered upon removal of the tank. Currently no provision exists to test if secondary containment is working. Mr. Giannopoulos closed discussing the steps included in tank site closure, which are tank removal, measure concentration level, conduct remediaton if necessary, and evaluate water supply.

Panel members commented that the leaking underground storage tank situation has greatly changed from several years ago. Further explanation was requested about the policy recommendation, which stated "Even a small failure rate of the more than 50,000 upgraded tanks, we believe constitutes a good water quality reason to eliminate MTBE from gasoline." It was confirmed by Mr. Giannopoulos that the report suggests eliminating MTBE from gasoline. In response to a question requesting cost estimates for tank upgrades, Mr. Giannopoulos stated that the range is $60,000 - $200,000, with an average upgrade cost of $100,000. These tank upgrade costs were confirmed by Bob King of Sunoco, and he stated that remediation costs could increase the costs even further. In response to the question, are significant volumes of gasoline being lost in California due to leaks in pipelines and tankards, Mr. King stated that catastrophic accidents are dealt with immediately, whereas undetected leaks become large problems because they are not detected as quickly. Because the number of California UST sites has decreased (from 60,000 to 20,000), releases are more significant because of the higher volume going through each site. In response to the question, what are the prospects of the suggestions being implemented, it was noted that many recommended solutions are being pursued independently, and other solutions will be implemented by the Governor and the legislature.

**MTBE Drinking Water Treatment Technology Options**

Mark Beuhler, Southern California Metropolitan Water District, provided background information about drinking water treatments nationwide. Some generalizations included:

- Large water systems across the country are surface water and medium or small size water systems are usually ground water.
- Surface water is only treated for microbes or bacteria - there is no treatment for chemicals in surface water facilities.
- Ground water receives no treatment or only a small amount of chlorine.
- MTBE's molecular weight indicates it is a small molecule.
- Henry's constant measures how easy it is to strip out MTBE from water.

Mr. Beuhler focused on the ultimate fate of MTBE once treated with a certain process. There are different technologies for MTBE removal. The proven/practical types of technologies for MTBE removal are: air stripping, advanced oxidation, and activated carbon. (There are unproven and expensive technologies as well, which include membranes, biological, and new technologies).

In California, a MTBE Research Partnership (Western States Petroleum Association, Oxygenated Fuels Association, Association of California Water Agencies) was created between the petrochemical industry and the water industry. The Partnership mission is to identify, prioritize, plan, and sponsor practical research related to the protection of and treatment or removal of MTBE contamination from drinking water supplies. The Partnership's main issues include avoiding further contamination, determining the mechanisms of release, determining the fate of the contamination in the sub-surface, and evaluating what cost effective removal technologies are available today to remove MTBE from drinking water.

Mr. Beuhler made some final comments regarding MTBE clean up technologies. Currently, the "technology of choice" is air stripping with a packed tower and offgas treatment. However, some caveats to air stripping include increased cost, large packed towers (referred to by public and media as "toxic towers of death"), and other very specific technologies, which only treat one chemical. Activated Carbon is the most expensive technology. Advanced Oxidation becomes the technology of choice when treating a large surface water area (above 6,000 gal/min.) Regardless of technology method chosen, there may be by-products from the treatment technology that need to be evaluated. The potential by-products are bromate, aldehydes, assimilable organic carbon, t-butyl alcohol, t-butyl formate, and acetone. It was stated that potential MTBE sources, such as two-cycle engines on reservoirs must be eliminated. Mr. Beuhler reinforced that in addition to ground water, surface water needs must also be addressed. Due to the large amount of boats on the reservoirs, and the two-cycle engine, which emits fuel with MTBE unburned, the boating community is very involved with surface water issues. There are issues with the public when large treatment structures are imposed on housing communities, and there may be no site to put the treatment technology. It was noted that there is no MCL (maximum concentration level) that MTBE should be treated down to.

In summary, the Partnership's work concluded that the best technologies for treating ground water wells are: (1) air stripping with offgas, and (2) advanced oxidation, ozone/hydrogen

peroxide, or Activated Carbon. The best technology for treating surface water would be ozone/hydrogen peroxide (if bromide is not present). Remediation involves separate technologies with high concentrations and lower volumes.

Questions raised by the Panel members were related to the cost of treatment technologies for other contaminants (TCE, heavy metals, pesticides, etc.), and if other contaminants are currently being treated. Mr. Beuhler confirmed that MTBE is more difficult to remove than most other contaminants.

**Remediation Technology**

Mike Kavanaugh, Malcolm Pirnie, Inc., gave a brief overview of the issues related to remediating a site once a release has occurred. Questions posed to the Panel include:

- How large is the problem?
- Can existing and proven technologies clean up MTBE (are tools available)?
- Are there emerging technologies that are more cost-effective?
- Are there changes in the remediation strategy because of the presence of MTBE; and
- What impacts does MTBE have on overall remediation costs?

The range of treatment challenges for MTBE include refinery spills, LUST sites, drinking water treatment, and surface water treatment. The treatment options for soil are soil vapor extraction, soil heating, and excavation. The treatment options for groundwater are pump and treat, air sparging, multiple phase vacuum extraction.

Mr. Kavanaugh noted that there are a continuum of remedial actions needed, noting some case studies of different treatment technologies. Of the technologies, enhanced biodegradation has the greatest potential for achieving cost effective clean ups. The geology of the location greatly effects the cost of remediation, specifically due to the rate of natural attenuation. There are many promising technologies including In-situ chemical oxidation, In-situ biodegradation, Phytoremediation, and Stream Enhanced Extraction.

Many reasons were provided to explain the critical need for early response to UST releases in order to reduce the costs of cleanup for MTBE. Early detection and treatment is necessary because:

- MTBE migrates at the rate of water
- Plume volume increases non-linearly with time
- Remediation costs are proportional to plume volume
- Most cost effective approach – pollution prevention paradigm (upgrade programs, early detection, and rapid response)
- Soil only - soil vapor extraction (SVE)
- Groundwater - minimizes plume size

Mr. Kavanaugh concluded his presentation by noting that there are technologies available to meet remediation cleanup levels, and that MTBE impacts on remediation costs are site specific. There are many emerging technologies that show the potential to reduce costs. Also, tank upgrades and enforcement will reduce the number and magnitude of releases. Mr. Kavanaugh closed by stating that the most cost-effective strategy is pollution prevention through tank upgrades and early response to releases.

The Panel members engaged in various discussions about the potential of the different technologies available, and the different sources of contamination around the country. There was discussion about the potential for small spills, and the spill size that constitutes a problem. The level of detection that would be acceptable by the public was discussed. Many members commented about the cleanup technologies for different geologic regions of the county and plume stabilization (shallow groundwater tables, soil depth, etc.). The Panel was concerned about the number of sites that are still in need of remediation.

**Health and Environmental Assessment of MTBE, University of California Report**

***Evaluation of MTBE as a component of Reformulated Gasoline (RFG)***

Pamela Franklin, UC Berkeley, summarized the research in the California study on the air quality impacts of MTBE as a component of RFG, as related to California. The main objective of the research was to evaluate published literature of vehicle emissions from conventional fuels, oxygenated fuels and reformulated fuels. In addition, Ms. Franklin answered questions that she received by reviewers on her research. Ms. Franklin noted that no specific oxygenate is mandated in any of the oxy-fuel or RFG programs. Key results from the laboratory study showed an increase of pure MTBE, and MTBE byproduct emission (isobutylene, formaldehyde) at high temperatures when MTBE was a component of RFG. The pure MTBE byproducts methanol and tert-butyl formate (TBF) were not observed as byproducts of MTBE-fuel at elevated temperatures. The combustion byproducts that were observed were consistent for both laboratory studies of pure MTBE, and vehicles and non-road studies of gasoline with MTBE.

Oxygenated fuels versus conventional gasoline showed reduced carbon monoxide exhaust emissions and total hydrocarbons by the dilution effect. RFG versus conventional gasoline showed emission reductions of total hydrocarbons, benzene, and aromatics. Additionally, oxygenated fuels reduce evaporative emissions, ozone forming potential of emissions and improve effectiveness of the catalytic converter. CaRFG2 with MTBE versus non-oxygenated CaRFG2 showed similar reductions in ozone forming potential and mass emissions of total hydrocarbons, benzene, and aromatics. However, this formulation showed that MTBE fuel increases direct (exhaust) formaldehyde emissions.

Ms. Franklin identified the key questions that were submitted by reviewers and addressed the questions for the Panel. The presentation included the scientific support used for the basis of the

conclusions. Discussions were held on advanced technology vehicles playing a role in emission reductions. Ms. Franklin finished her presentation by noting that although significant improvements in vehicle technology are having an effect, it is insufficient to rely on fleet turnover to reduce CO emissions and ensure compliance with CO standards. Oxygenates are needed to reduce emissions from high-emitting vehicles, and other fuel benefits from oxygenated fuel have been ignored such as, reduced particulate matter emissions and emission reduction benefits in off-road vehicles. Overall, Ms. Franklin noted that fuel formulations changes should be viewed as one part of a complete program to address automotive emission problems in California.

Panel comments addressed the issue of whether the non-oxygenated CaRFG2 components will include the same cap limits, noting that the largest change in the fuel is an increase in branch paraffins to increase octane number. The proportion of the vehicle miles traveled (VMT) by advanced vehicle technologies, which means model year mid-1990 vehicles, amounts to approximately 50-70 percent of the VMTs. The average fleet turnover is approximately twelve years. The need was expressed for particulate matter emissions studies on different fuels, which is needed to make decisions on future fuels that are being considered. It was reiterated that because MTBE studies did not separate out the MTBE, it cannot be proven that MTBE contributes to air quality benefits. However, it is known that there are other fuel formulations (fully compliant CaRFG2 without MTBE) that can achieve the same benefits. Panel members noted the over compliant fuel used in California (RFG with MTBE), and questioned if the additional benefits would be lost in a fuel formulation change.

***Health Effects***

John Froines, UCLA, gave a summary of the report on health effects of MTBE by looking at major products of combustion and identified 10 out of 21 compounds that deserve further study. Time activity patterns and occupational exposure studies were conducted. California has limited data on MTBE contamination in (private) drinking water wells and, therefore, this information was not included in the report. People react at levels below irritant thresholds when there is a perceived fear. One of the issues to address is the fact that the MTBE issue will exist because of the potential health fears.

Issues regarding metabolism of MTBE are still unknown. However, there is some evidence to indicate that organs with cancer also showed distribution of MTBE. There is some biological basis for toxicity and animal carcinogenicity of MTBE. The acute effects have been controversial (headaches, dizziness, nausea, etc.); however, the conclusion in the report states that there is positive evidence for acute effects associated to occupational exposures from MTBE. Concerns were also raised because formaldehyde is an irritant (CA reference level 70 ppb) at low acute levels. It was concluded that health complaints can not be explained adequately or dismissed.

There are no data to assess the effects from MTBE exposure on asthma, which expressed the need for epidemiological studies. There is no evidence that MTBE increases the rate of asthma because there are no data. The conclusion was that, for both developmental and reproductive toxicity at doses found in the ambient environment, MTBE should not be considered a significant health concern. At this point more research is needed, but the evidence for MTBE genotoxicity is limited. (There is no human data on carcinogenicity of MTBE). However, there was evidence of cancer in two rat types and one mouse type. This concludes that MTBE is an animal carcinogen with the potential for human cancer. However, the significant uncertainty in animal cancer findings indicates that more work is need on these issues. Dr. Froines concluded his presentation with information gathered on ethanol. He stressed that it is important to avoid the kneejerk reaction and rush to ethanol because of complaints of MTBE. There are significant issues need to be addressed related to vapor pressure, acetaldehyde, PAN, etc. It is difficult because of time constraints. Dr. Froines suggested that short term testing on PAN be conducted because there is little information on the effects of ethanol on the developing nervous system. It is important to focus on potential effects from substitute compounds as the Panel and California move forward.

Panel members requested further explanation on ethanol issues that need to be researched. Pharmacokinetic studies will be completed by API, but the outcome will not be known in time for the Panel to use. In response to the question, how the results of the report compare to the Proposition 65 results, Dr. Froines answered that the committee decision was very close and could have gone either way. Therefore, people should not draw too large of a conclusion based on the vote because it could have gone either way. There are issues of uncertainty regarding carcinogenicity of MTBE, and the wide spread growth of MTBE use in CA. Questions were raised regarding the level of evidence required to make decisions on carcinogenicity. Evidence as of yet does not demonstrate that animal data has potential relevance to humans. It was clarified that MTBE as a gasoline component can be considered a low potency carcinogen with high exposure based on risk assessment studies. It was noted that health based ethanol information is limited, and that exposure modeling on ethanol is needed in order to get a sense of the magnitude of potential risks. In response to comments regarding ethanol and other ethers, Dr. Froines noted that there is very limited health data available for alternative ethers (ETBE, TAME, etc.), and because ethanol is competitive with MTBE more health-based (inhalation) studies should be completed.

***Water Contamination***

Gramm Fogg, UC Davis, gave an assessment of the large amount of information presented to the Panel, and addressed some questions related to impacts on groundwater. The approach was to look at actual data on existing LUST sites. Over 3,000 out of 5,738 LUST sites (approximately 55 - 78 percent) have confirmed MTBE detections according to the database. There were 35 (out

of 2,988) tested drinking water supply wells reporting MTBE detect, which represents only a partial sampling of water supply wells in the state (not all have been tested). It is estimated that 60-160 public water supply wells have MTBE detections. The most likely sources are LUSTs, above ground tanks, pipelines, surface spills and atmospheric sources. California has little information on private wells impacted by MTBE. Most public water supply well detects are due to LUST sources, therefore detects indicate substantial risk. In California there are many fine soil materials and MTBE diffused into the clays causing remediation to be problematic. The simple models have over predicted the success of clean up in California. Contamination of the Lake Tahoe Basin (11 wells off line, large plumes, deep migration, growing risk and cost) represents a view of what is to occur in the future. Tank upgrades can not be relied upon to sufficiently reduce the number of future LUST MTBE sites. It was stated that statewide monitoring of groundwater quality and characterization of aquifer vulnerability are badly needed.

John Reuter, UC Davis, discussed fate and transport of MTBE in surface water (lakes and reservoirs). Dr. Reuter covered the extent of MTBE contamination in the surface drinking water supplies in California, and the sources for contamination in the Sierra Nevada as well as the fate and potential toxicity of MTBE to aquatic organisms. Conclusions were drawn from 105 water bodies with half having MTBE detections. Over the water bodies tested, Lake Tahoe had the highest detection level of MTBE (20-25 ppb), and occurred in an area of Lake Tahoe with heavy boat use. There was detection of plumes in Lake Tahoe which extended over 2,000 feet. Dr. Reuter covered the different potential sources of MTBE (atmospheric fallout, runoff, groundwater flow, fuel spills, and recreational vehicles). In California, lakes and reservoirs are generally not in highly urbanized areas. Two stroke engines on boats are the biggest source of contamination of MTBE in lakes and reservoirs, which has caused increased management of the water bodies in order to prevent further contamination. From a management perspective MTBE volatilizes at the air water interface. As the boating season ended, a 50 percent decline in MTBE was found on the lake. MTBE does not stay a long time in lakes, so if you could control the boat engines, number of boats, or the MTBE in the fuel there is a workable solution. Finally, there is no evidence that MTBE accumulates in lakes from year to year. Conclusion on aquatic biota appears to be unlikely at levels that have been detected.

Panel comments included the range of vertical gradient effects over time, evidence of aquatic toxicity beyond fish, aquatic toxicity in saltwater, length of time for plume development, and cost analysis for worst case scenario. Dr. Fogg stated that most of the MTBE in groundwater has not yet been detected.

**California Department of Health Services**

Dave Spath, California Department of Health Services (DHS), Division of Drinking Water, spoke about the California guidance and regulations related to drinking water, and further explained the State regulatory approach to require water systems to monitor for MTBE as an unregulated contaminant. In 1997 an unregulated monitoring requirement was adopted through legislation to require DHS to adopt primary and secondary standards for MTBE. In early 1999,

DHS adopted a 5 ppb secondary maximum contaminant level (MCL) to address odor and taste concerns. The primary standard will be based on risk assessment by the Office of Environmental Health Hazard Assessment (OEHHA), and will most likely be 13 ppb based on carcinogenic risk. DHS is obligated to accept the risk assessment from OEHHA. Water systems are very concerned about the public perception caused from well closures. Another unique California issue is that water systems must report the concentration of chemicals in their supply on an annual basis. It was noted that California can enforce the secondary standard.

Comments from the Panel include issues with recouping costs associated with clean up, reporting of all chemicals to consumers in California, secondary standard enforceability in California, public recognition of MTBE because of low taste and odor threshold, taste data and detection levels, water systems changing to ozonation for treating water, water utilities fear of public perception.

**South Lake Tahoe Public Utility District**

James Jones and Rick Hydrick, South Lake Tahoe Public Utility District, presented a brief case study of the experiences with MTBE in Lake Tahoe. Twelve of the thirty-three wells in Lake Tahoe have been closed due to contamination or threat of a nearby MTBE plume. The District policy is to allow no detectable concentrations of MTBE in drinking water. There are claims by non-water people that a risk based assessment process should be used, but the risks are so unknown that this process would not work. It is suggested that MTBE be phased-out over time. However, the District disagrees with this approach because of the immediacy of the problem. Tank systems are leaking and are poorly operated, maintained, inspected, and monitored. Estimated clean up costs are in the range of $5-8 million. There is no guarantee that a release will not happen with new equipment. Acquifers can be contaminated beyond use from various situations such as over fills, drive-offs, leaking fittings, tank tightness, unmaintained monitors, all of which can go easily unnoticed. MTBE is unmanageable from a water quality perspective for the following reasons:

- Pumping influence moves it quickly
- Propensity to dive and spread
- Nearby plumes shut down wells
- Taste and odor threat will shut down well before health risks
- Smelly water equates to unhealthy water, which will result in loss of public trust

The District concludes that the threat of MTBE is immediate and is becoming ubiquitous in air and water. The District claims that MTBE is a fast moving durable chemical, and it will take time for health threats and the regulatory process to act. Immediate action is requested because the problem is widespread, unexplained, and places both private and public drinking water wells at risk.

Mr. Jones spoke about the water system impacts the public. The contamination affects water system operations by straining the other remaining production wells. Therefore, additional staff and costs are needed to deal with the problems, and water conservation will be needed. Other concerns are unreliable remediation, discharges from sewage plant including MTBE, reclaimed water with MTBE detections, etc. Design improvements are needed, as well as improved maintenance, inspections, etc. Lake Tahoe is an indication of what problems will occur in the future in other areas. The District is planning a local groundwater management plan to accelerate the process to protect the groundwater aquifer. The District requested that U.S. EPA use emergency powers to ban MTBE in order to prevent additional contamination problems.

The Panel questioned if the District has attempted to work with the gasoline suppliers to get non-MTBE gasoline in Lake Tahoe, and addressed that the industry supply problem requires time to change from an oxygenated fuel.

**California Senator Mountjoy**

Governor Gray Davis has issued an Executive Order to phase out the use of MTBE in California because of the hazard to the health of the people of the State. The timing of the phase out is three years and eight months, with an immediate start of the phase out. The Governor has requested that the Federal government grant an immediate waiver of the oxygenate mandate, with hopes that the oil companies will begin producing MTBE-free fuel. There is a severe problem with air and water, and the Governor is doing this in a way that will not detract from air quality or increase the price of gasoline. The public hearings held under the California EPA heard from the public regarding MTBE. The Senator expressed regret that there was not more research into the chemical prior to its use. Because of the knowledge that exists today, Senator Mountjoy feels that the Federal government should not continue the oxygenate mandate. Ethanol use was also questioned by the Senator, and he expressed the need for further ethanol studies. The Governor stated, "we aught to lift the mandate of requiring certain chemicals in fuel from the Federal government, set the levels (parameters) of the fuel, and let the oil companies and manufacturers come up with the method by which that fuel would be clean." The Senator stated that California will be asking the Federal government to help with the clean up costs. The State needs to find out the extent of the problem in order to determine the contamination clean up needs. In conclusion, the Senator stated that in order to protect the health and safety of Californians, the use of MTBE was studied and the Governor decided to exit the program because it was considered a health hazard to the people of the State. The Senator expressed support for the Feinstein/Bilbray legislation. In closing, the Senator stated his intention of no deterioration to air quality, no gas lines, and stable fuel prices. Senator Mountjoy stated that California hopes to work with the Blue Ribbon Panel and the Federal government as we move to improve the air quality of the country and protect the health and well being of the people.

**City of Santa Monica**

Craig Perkins, City of Santa Monica, addressed the serious challenge of contamination of the

Santa Monica City wells. In 1995, MTBE was discovered in the drinking water wells by routine lab results. By happenstance MTBE was detected. The California Department of Health Services recommended in 1996 that water agencies begin testing for MTBE, which has since become a requirement. The MTBE concentration was increasing and spreading to other wells. The contamination of MTBE in Santa Monica has resulted in more than eighty-percent of the water being brought in from outside sources (e.g., Colorado River, Northern California). Residents were faced with twenty-five percent water surcharges, and the City decided to cut off the potential of MTBE reaching the customers. Forty-nine percent of the total water supply was lost.

Real world impacts of MTBE detection:

- Rapid and near complete loss of drinking water supplies
- Travels quickly and combines with water
- MTBE characteristics
- Loss of public confidence
- Environmental Justice
- Clean up costs range between $100 – 150 million and could take up to ten years

Panel comments included the sources of the Santa Monica contamination due to tanks and fuel lines, tanks are only part of the system, the need for stronger UST regulations, recovery costs from responsible parties, remediation options, and tert-butyl alcohol (TBA) remediation options.

**Public Perspectives**

Invited public perspectives were given from Bonnie Holmes of the Sierra Club, Azibuike Akaba of the Communities for a Better Environment, and Jodi Waters of the Oxybusters.

**Panel Work**

The Panel members were asked to review the summaries of the following topics to arrive at agreement on what is accepted and what needs further clarification: (air quality, water contamination, air quality water toxicity of fuel blending, prevention and remediation, fuel supply and price). The goal is to create five page statements in each area to determine what is known.

**Tosco Corporation**

Duane Bordvick presented Tosco's perspective on fuel blending and clean air. Tosco is a large user of MTBE (close to 40,000 barrels per day) and has over 5,000 retail outlets nationwide. Tosco asked the State to phase out MTBE, and requested flexibility to move away from the use of MTBE. Tosco felt the continued use of MTBE would cause problems including (clean up, taste and odor threshold, public concern, etc.). Tosco supports the Governor's decision to phase

out MTBE. Clean gasoline can be made without MTBE. There is a demonstration project underway to produce gasoline with ethanol instead of MTBE. This was done to demonstrate that gasoline can be produced that meets standards and receives customer acceptance. Non-oxygenated gasoline is also produced without MTBE or ethanol with the right equipment and in limited volumes. Tosco believes that it is not in the best interest of the company to continue to rely on MTBE as an oxygenate or blendstock in gasoline. Infrastructure changes are necessary; however, the minimization of MTBE use is necessary. Tosco does use and will continue to use ethanol as part of the solution. Additional refinery equipment will be needed, and some distribution system changes will also be necessary. Federal legislation to eliminate the oxygenate mandate is necessary and will provide significant cost benefits in phasing out MTBE. MathPro completed a study showing a combination of the most cost-effective options to phase out MTBE, which can only be taken if the Federal oxygenate mandate in California is lifted. In conclusion, California will phase out MTBE over three years, the next step is to eliminate the Federal oxygenate mandate (Feinstein/Bilbray). Other states will most likely follow the lead of California.

**Chevron Products Company**

Al Jessel presented the position of Chevron, and noted that the Governor's decision is supported by Chevron. Chevron is the largest producer of California Cleaner Burning Gasoline (CBG). Chevron wants MTBE out of gasoline because of customer demand and the erosion of public confidence. MTBE environmental concerns (e.g., soluble in water, low odor and taste threshold, no biodegradation) are real and Chevron wants flexibility to produce MTBE-free gasoline. However, flexibility is needed from the Federal oxygenate mandate. Chevron can remove MTBE from California gasoline relatively quickly if California is relieved of the Federal oxygenate mandate. CARB and EPA allow more flexibility in the blending of reformulated gasolines while retaining the expected emissions benefits and if permits for needed refinery and logistics systems projects can be obtained quickly. Chevron plans to remove MTBE from gasoline and is producing 700 million gallons of non-oxygenated gasoline which, meets or exceed all CARB performance standards (VOC, NOx, and potency-weighted toxics), and CARB prescriptions for benzene and RVP, as well as exceeding the performance standards of Federal RFG (Phase I or Phase II). Chevron is limited to where that gasoline can be distributed because of the non-attainment status of Los Angeles, Sacramento, and San Diego. Chevron is ready to move out of MTBE gasoline, and has received congressional recognition from Federal government for California to govern its own fuel qualities. The Bilbray/Feinstein legislation rests on these issues.

Mr. Jessel stated that it is difficult to remove MTBE from gasoline. MTBE has good properties for making CBG because of octane, distillation, RVP, dilution, and compatible with current gasoline distribution system. Replacement of MTBE will require more than one strategy, including ethanol-blended and non-oxygenated gasoline, capital investment, increased operating costs, and possible loss of CBG production.

Chevron's perspective on ethanol-blended CBG is that it can be done with refinery investments. If there is no release from the oxygenate mandate, oxygenated fuel will be required in seventy percent of California gasoline, pentanes will need to be removed for volatility (7.0 RVP maximum) control, terminal investments will be needed in order to splash blend ethanol at the terminal, strains will be put on the transportation systems (ethanol transportation to California terminals in ample quantity), and there is no local market for removed pentanes, which still causes a shortage in production with the removal of eleven percent MTBE.

Non-oxygenated gasoline can be produced in large volumes without capital investments; however, making all gasoline non-oxygenated is very difficult because of the lack of octane and distillation issues. The optimum solution is a combination of ethanol-blended and non-oxygenated gasoline. More flexibility is needed relating to fuel certification and the reactivity benefits of ethanol need to be further explored (National Academy of Sciences report). In summary, Chevron wants more flexibility to reduce or eliminate MTBE in CBG.

**Kern Refining**

Chad Tuttle presented the perspective from a small independent refinery in the central valley of California. Mr. Tuttle asked the Panel to consider the manufacturing impacts related to its work and the flexibility the small refinery's need to remain competitive and viable. The small and independent refineries account for 1/3 of all domestic fuel produced in the State, and produce jet fuel, asphalt, and off road diesel fuel. Kern has been involved in CBG and the mandate caused a very large investment to the company. Mr. Tuttle asked the Panel to consider the impact on small refinery's when considering flexibility.

There were many comments and questions from the Panel on these three presentations regarding the capability of production of non-oxygenated and MTBE-free gasoline. Comments varied and included the following topics:

- benefits from passage of Feinstein/Bilbray legislation
- flexibility in regulations and streamline permitting
- realistic time frame for producing non-oxygenated and MTBE-free gasoline
- effects on refining caused by upcoming regulations on low sulfur and eight-hour ozone
- being cautious when changing to ethanol without examining the potential health or environmental problems
- supply and transportation of ethanol
- replacement of the eleven percent MTBE
- maintenance of air quality standards with regard to national gasoline changes
- actual benefits versus statutory requirements
- maintaining performance standards of gasoline outside of California
- refinery employee exposure rate changes
- volume of MTBE does not equal volume of ethanol
- MathPro analysis includes subsidy and assumes the current 7.0 psi.

- alkylate supply
- financial incentives to produce non-oxygenated or ethanol-blended gasoline
- margin of inefficient return with gasoline reformulation changes
- refinery capabilities (other than Tosco and Chevron) to produce MTBE-free gasoline
- effects of California refinery system to effect the decision in the rest of the country
- segregation of gasolines (Chevron will not supply an ethanol-blended gasoline and non-ethanol blended gasoline into the same service station)
- augmentation to the current distribution system will be needed to transport non-oxygenated and ethanol-oxygenated gasolines
- California gasoline will be distributed to other neighboring states (Arizona)
- industry documents on environmental fate and transport of ethanol
- current testing methods are not designed for testing alcohols (ethanol)

**Panel Discussion**

The Panel then held a discussion on the matrix, which consists of the Panel's comments on the five topic areas (air quality, water contamination, air quality water toxicity of fuel blending, prevention and remediation, fuel supply and price). The matrix is to be used as a tool to determine what needs still exist and what is commonly understood by the Panel members. Mr. Greenbaum questioned whether the topics that are included in the matrix are in fact the correct topics to be used.

Panel members stated that the "big picture" questions that need to be addressed or added to the matrix include:

- Air and water quality performance standards to prevent backsliding
- Public right to demand no contamination in groundwater - consumer rights issue/public acceptance
- Prevention Remediation
- Identify framework for decision making
- Lawyers are needed because of federal legal constraints and regulatory risks
- Not trading known for unknown with regards to health and safety (alternatives)

Air Quality

- Performance standards for the fuel would capture air quality benefits
- fuel specifications and environmental impacts of fuel blending (impact of mixing fuels would cause RVP increase)
- Are there elements of the cap system in California which allow the marketplace to figure out how to produce the fuel in California versus nationwide?
- Address the human behavior aspect, lack of proper vehicle maintenance can cause significant problems
- Focus on the role of oxygenates on CO benefits and reactivity

- Need to determine the baseline (statutory minimums or real world averages)
- Prevent backsliding of air quality benefits

Water Contamination

- Sources of contamination
- Specify drinking water surface, groundwater, etc. (geologic vulnerability) Public wells and private wells are different -
- Framework for protection of water resources
- Threat to groundwater resources
- Distinction between groundwater and surface water
- How much does each additional year of using MTBE impact groundwater resources - solution treatment or remediation
- Cumulative effects on contamination
- Groundwater contamination in RFG and non-RFG areas
- Impacts depending on spill size, shallowness of well
- Air deposition
- How to incorporate consumer acceptance into decision

Air Quality, Water, Toxicity and Blending Characteristics of Fuel Additives

- Level of uncertainty of the health effects data
- Sensitive MTBE population
- Known versus probable carcinogen
- Public education on handling gasoline
- Could this increase employee exposure
- Ensure gasoline is safe to get into water
- Ethanol supply
- Ethanol behavior with BTEX compounds (retention)
- Sensitive sub-populations allergic to ethanol
- Ethanol may increase in acetaldehyde and PAN
- Analytic methods for testing ethanol – requires different testing
- Ethanol data in Midwest from tank sites
- Increase use of alkylates (any potential health concerns)
- Ensure blending in tanks does not lead to volatility increases to prevent loss of air quality benefits

Prevention/Remediation

- Prevent gasoline releases into water supplies
- Prevention of gasoline from entering water supplies
- EPA regulates only a portion of storage tanks
- Above ground storage tanks are not regulated

- Identify all possible sources of leaks
- EPA has no statutory authority to regulate ASTs
- EPA must enforce compliance of LUSTs
- Public spill prevention
- UST training/education
- Clean up prioritization

At the next meeting the Panel will delve into fuel supply and alkylate issues to gain further detail. Mr. Greenbaum suggested any additional questions be forwarded to Karen Smith at EPA. From this point, the Panel will build teams to answer the questions, and identify what questions need further clarification.

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**March 25-26, 1999**
**Sacramento, California**

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