Public Comment
Low-Threat UST Case Closure Policy
Deadline: 03/19/12 by 12:00 PM

Comments on the DRAFT Low-Threat UST Case Closure Policy*

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SWRCB Clerk

FROM: Kevin D. Brown, PG, CEG**; geobrowr

DATE: March 19, 2012

SUBJECT: Comment re: Low-Threat UST Closure Policy

As presented in the December 8, 2011, *FINAL REQUEST FOR EXTERNAL PEER REVIEWERS OF THE SCIENTIFIC BASIS OF THE TECHNICAL JUSTIFICATION FOR THE PROPOSED LOW-THREAT UST CLOSURE POLICY (from Kevin Graves, P.E. to Gerald W. Bowes, PhD.)

**The views and opinions of the author expressed herein do not necessarily reflect the policies and practices of his employer or any other entity.

General Comments

Policy Statement: *This policy is based in part upon the knowledge and experience gained from the last 25 years of investigating and remediating unauthorized releases of petroleum from USTs. While this policy does not specifically address other petroleum release scenarios such as pipelines or above ground storage tanks, if a particular site with a different release scenario exhibits attributes similar to those which this policy addresses, the criteria for closure evaluation of these non-UST sites should be similar to those in this policy.*

Comment: Due to different release scenarios and mechanisms, the policy should only pertain to petroleum fuel releases at UST sites, and not to petroleum hydrocarbon releases to the environment from refineries, pipelines, terminals, tanker trucks, surface spills, and other sources.

Comment: The "Diesel" and "Free Product Removal" sections of the policy should be removed, as they are actually guidance discussions that can be adequately covered in the updated LUFT Manual.

Comment: The policy liberally references non-peer reviewed technical documents, yet fails to utilize existing regulatory guidance documents, including several important references from the State Water Board, Regional Boards, UC-Davis, etc. Instead, the main conclusions and recommendations relate to studies completed or funded by the major oil companies. This fact should be unacceptable to California's hydrogeologic community.

The Stakeholder Group is largely comprised of oil company representatives and their consultants. This influence outside of the regulatory world gives a much too powerful voice to the polluters – the polluters are essentially the authors of the policy. The document must include the review and use of a healthy balance of studies from all applicable resources, industry and non-industry alike, and the policy writers should be unbiased.

Comment: Self-serving phrases throughout the policy, such as "well documented", "well known", and "well established", have no place in the policy. These comments are trying to influence the reader of the policy that all assumptions are common knowledge and uniformly accepted by everyone. The comments are unnecessary and add little to evaluating whether the policy is valid from a scientific viewpoint.

Comment: The list of technical reports/references is minimal and contains no important and critical references from the United States Geological Survey. There are very minor technical references from the USEPA. The scientific references for MTBE are minimal and incomplete and do not even include previous policy documents from the State Water Board.

Comment: State Board Resolution 88-63, Sources of Drinking Water, lays out the technical rationale for determining how groundwater should be evaluated as a potential drinking water source (TDS, yield, etc.) in California. This policy should not ignored.

Comment: Many groundwater basins and recharge areas require a higher degree of protection because they are or could become highly used in the future, or because they are considered more vulnerable to groundwater quality degradation through individual or cumulative effects.

Comment: Many older water supply wells were constructed years ago and do not meet current DWR standards.

Comment: What about the influence of existing groundwater pumping wells (irrigation supply, industrial supply, municipal supply, etc.) on the shallow and deeper groundwater zones near UST sites?

Comment: What about the role of man-made conduits, such as utility vaults and corridors, tunnels, etc. influencing the movement of shallow groundwater throughout California?

Comment: The policy is silent on commingled plumes. Multiple source areas complicate the exchange and movement of dissolved oxygen in the saturated zone, which inhibits biodegradation of the petroleum chemicals.

Comment: Groundwater has other beneficial uses besides being a source of drinking water. Private wells and irrigation wells – thousands of wells – have been impacted with petroleum hydrocarbons and MTBE throughout California. Private wells are typically located in shallow, less-protected aquifers (where no formal regular monitoring is required). There are sensitive habitats – wetlands, streams, Bay waters – that have impacted by fuel hydrocarbons and oxygenate releases which are not being considered in this policy.

Comment: The fact that petroleum hydrocarbons naturally degrade is not disputable. The rate of degradation with respect to potential health and environmental risks is the primary issue. There is no question that long-term exposure to petroleum fuels at high enough doses can cause adverse health effects. Subsurface petroleum contamination can also lead to the production of explosive gases, among other problems.

Comment: Future beneficial uses of groundwater, considering climate change, pressures on water resources located considerable distances from population centers, etc. have not been considered in this policy.

Comment: Over fifty percent of Californians use groundwater for drinking and other reasons. Promoting the use of local, shallow groundwater basins for irrigation (watering lawns, athletic fields, golf courses, etc.), instead of using pristine water from the Sierras, for example, should be encouraged by the State Water Board and the Regional Boards. Aquifer storage and using recycled water can also serve to lessen the strain on groundwater resources.

Comment: Have there been any scientific and peer-reviewed evaluations of the cumulative impacts to groundwater basins from fuel hydrocarbon and oxygenate contamination in California and/or elsewhere? How have the short- and long-term impacts to groundwater basins from fuel hydrocarbons and MTBE contamination been evaluated?

Specific Comments about the Groundwater Section of the DRAFT Policy

Policy Statement: *It is a fundamental tenet of this low-threat closure policy that if the closure criteria described in this policy are satisfied at a release site, water quality objectives will be attained through natural attenuation within a reasonable time, prior to the need for use of any affected groundwater.*

COMMENT: In general, but not in all cases, petroleum hydrocarbons naturally attenuate in the environment, mainly due to biodegradation (a process where contamination is broken down by microbes into less benign compounds), but also through other processes, such as dispersion, volatilization, and adsorption. For example, in areas where oxygen-limited conditions exist in the subsurface, relying on biodegradation to reduce contaminant concentrations can be problematic.

Because every UST site in California has unique hydrogeochemistry and microbial characteristics, the evidence for and the rate of in-situ biodegradation should be determined at all sites impacted by petroleum hydrocarbons and fuel oxygenates. Such an evaluation could then demonstrate that contaminants will likely be removed from groundwater by natural processes within an acceptable time frame. This concept is especially important for the oxygenates MTBE and TBA, which are largely resistant to biodegradation and rely mainly on dispersion as the primary attenuation mechanism (the contaminant mass is not destroyed or depleted). To date, biodegradation of MTBE and TBA in groundwater has not been convincingly demonstrated.

Multiple lines of evidence should be used at LUFT sites to evaluate passive bioremediation and natural attenuation processes at a site and to aid in remedial investigations and site cleanup (Buscheck et al., 1996). Relying solely on declines in groundwater concentrations in monitoring wells is not sufficient.

Furthermore, the recommendations for intrinsic bioremediation presented in the May 3, 1996, *Recommendation Report to the Senate Bill 1764 Advisory Committee* are reasonable and should be followed at UST sites.

<u>Discussion - MTBE, TBA and other Fuel Oxygenates</u>

MTBE's use as a fuel oxygenate in California, albeit for a relatively short period of time, resulted in the closure of numerous municipal supply wells and significant monetary expenditures to the major oil companies, with legal judgments in the tens of millions of dollars.

TBA is a biodegradation product of MTBE, but was also used to create large quantities of MTBE in California (so some TBA could be present as an artifact in the refined product). TBA was also used independently as an octane booster for gasoline in California.

The lack of a significant discussion about MTBE and TBA in the policy is perplexing, considering much of the published research indicate these oxygenates are largely recalcitrant and less prone to biodegradation processes, particularly in the San Francisco Bay Region. <u>The biodegradation rates of petroleum hydrocarbons and fuel oxygenates vary greatly at LUFT sites, both under aerobic and anaerobic conditions; this is indisputable</u>.

For example, Deeb et al. (2003) stated:

> *Considering the observed persistence of MTBE in subsurface environments around the country, it is unlikely that natural attenuation would be an acceptable sole remedy at most MTBE-impacted sites. While it is apparent that MTBE can biodegrade under both aerobic and anaerobic (iron-reducing, sulfate-reducing, methanogenic) conditions, the significant biodegradation of MTBE in aquifers has not be commonly observed. Thus, it is important not to extrapolate laboratory MTBE degradation rates to the field, especially when estimating whether degradation will be rapid enough to sustain significant plume shrinkage over time. Finally, although the potential for success of intrinsic biodegradation as well as other attenuation mechanisms is extremely site-specific, in certain hydrogeologic settings (flat gradients, groundwater flow rates less than 0.1 foot per day), natural attenuation without active remediation may be a feasible alternative for MTBE remediation.*
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> *However, the removal from water of tert-butyl alcohol (TBA), an impurity in MTBE-blended fuels and an MTBE breakdown product, can be problematic using some conventional technologies such as air stripping and granular activated carbon. These limitations may generate additional problems for water purveyors, regulators, and site managers.*
>
> And …*TBA is of special concern because it is more difficult to remove from water than MTBE and has low regulatory standards for drinking water and discharge.*

From the June 8, 2005, MTBE document published by the State Water Board:

> ***The essence of this document is the understanding that the standard approach for dealing with petroleum releases employed over the past decade will not suffice for MTBE, because unlike traditional petroleum constituents such as benzene, MTBE moves quickly to pollute water and is slow to degrade in the subsurface environment. Response time is critical for MTBE. A quick response to a release greatly increases the ability to check the spread of the MTBE and to clean up the mass of the release. Because time is critical, regulators will need to prioritize their cases and give first attention to those that pose the greatest risk to groundwater. It is also expected that there will be more need for vertical definition of MTBE plumes and more reliance on active cleanup technologies, such as soil vapor extraction, in situ groundwater remediation, and groundwater pump and treat systems, than there has been for non-MTBE petroleum.***

<u>MTBE References</u>

- ✓ The June 11, 1998, Lawrence Livermore National Laboratory (LLNL) report titled: *An Evaluation of MTBE Impacts to California Groundwater Resources*.

- ✓ The 1998 University of California, Davis report titled: *Impacts of MTBE on California Groundwater*, *a report to the Governor and Legislature of the State of California*.

- ✓ The October 13, 1998, memorandum from staff toxicologist Ravi Arulanantham, Ph.D. to Steve Morse, Chief of the Toxics Cleanup Division of the San Francisco Bay Regional Water Quality Control Board, titled: *Technical Rationale and Recommendation to Eliminate the Use of Methyl tertiary Butyl Ether (MtBE) and Similar Oxygenates to Maintain Existing and Future Groundwater Beneficial Uses*.

- ✓ Kolhatkar, R., J. Wilson, and L.E. Dunlap. 2000. *Evaluating Natural Biodegradation of MTBE at Multiple UST Sites*. In Proceedings of the Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water. National Ground Water Association/API, Houston, TX, November 15-17. pp. 32-49.

- ✓ *MTBE Contamination in Groundwater: Identifying and Addressing the Problem*. May 21, 2002. House of Representatives, Committee on Energy and Commerce, Subcommittee on Environment and Hazardous Materials, Washington, DC.

- ✓ The June 8, 2005, document from the State Water Resources Control Board titled: *Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates*.

- ✓ *USGS:* *http://sd.water.usgs.gov/nawqa/vocns/mtbe/bib/*

- ✓ *http://cluin.org/contaminantfocus/default.focus/sec/Methyl_Tertiary_Butyl_Ether_%28MTBE%29/cat/Environmental_Occurrence/*

Comments on the Technical Justification for Groundwater Media-Specific Criteria (with a Review of the DRAFT Policy, where needed)

General Comment: This section discusses the five "classes" of low-threat groundwater plumes. It would be helpful to have illustrations of each class/scenario, where appropriate.

General Comment: The contaminant concentrations are arbitrary and capricious. The policy concentrations have no scientific validity and are based on unsupported assumptions, such as the effective solubility of free-phase benzene. Benzene typically composes less than one percent of the volume of gasoline. Why is the effective solubility important?

Class 1 Site: *The "short" stabilized plume length (<100 feet) is indicative of a small or depleted source and/or very high natural attenuation rate. The 250 feet distance to a receptor from the edge of the plume represents an additional 250% "plume length" safety factor in the event that some additional unanticipated plume migration was to occur.* In addition, this class has the following attributes:

- *a. The contaminant plume that exceeds water quality objectives is less than 100 feet in length.*
- *b. There is no free product.*
- *c. The nearest existing water supply well and/or surface water body is greater than 250 feet from the defined plume boundary.*

Comment: Does a petroleum hydrocarbon and/or fuel oxygenate plume need to be fully defined, both laterally and vertically? The short answer is **YES**! This is an appropriate recommendation that should be highlighted as a critical part of adequate site characterization and production of a defensible Conceptual Site Model (CSM). To what concentrations should the hydrocarbon/oxygenate plumes be defined (i.e., ND? 1 µg/L? 5 µg/? some other value?).

The definition of "receptor" was not provided; is it a water supply well, a surface water body, etc.?

Class 2 Site: *The "moderate" stabilized plume length (<250 feet) approximates the average benzene plume length from the cited studies. The maximum concentrations of benzene (3,000 µg/l) and MTBE (1,000 µg/l) are conservative indicators that a free product source is not present. These concentrations are approximately 10% and 0.02%, respectively, of the typical effective solubility of benzene and MTBE in unweathered gasoline. The potential for vapor intrusion from impacted groundwater must be evaluated separately as per the vapor intrusion section of the Policy. The 1,000 feet distance to the receptor from the edge of the plume is an additional 400% "plume length" safety factor in the event that some additional unanticipated plume migration was to occur. Also note that California Health and Safety Code §25292.5 requires that UST owners and operators implement enhanced leak detection for all USTs within 1,000 feet of a drinking water well. In establishing the 1,000 feet separation requirement the legislature acknowledged that 1,000 feet was a sufficient distance to establish a protective setback between operating petroleum USTs and drinking water wells in the event of an unauthorized release.* In addition, this class has the following attributes:

a. The contaminant plume that exceeds water quality objectives is less than 250 feet in length.
b. There is no free product.
c. The nearest existing water supply well and/or surface water body is greater than 1000 feet from the defined plume boundary.
d. The dissolved concentration of benzene is less than 3000 µg/l and the dissolved concentration of MTBE is less than 1000 µg/l.

Comment: Several of the cited plume length studies, most notably Rice et al. (LLNL, 1995) and Buscheck et al. (1996) did not present the actual data used to calculate the benzene plume lengths, and neither study included an evaluation of MTBE plume lengths. The plume lengths discussed in the LLNL report were taken from modeling studies. Two of the cited studies (Mace, et al., 1997; Groundwater Services, Inc., 1997) were conducted for LUFT sites in Texas and Florida, respectively, two states with vastly different soil, bedrock, and groundwater conditions than California. Furthermore, the Texas study included the evaluation of hundreds of bedrock aquifer sites where petroleum hydrocarbon plumes would be expected to be short (with the exception of karst aquifers). The Rice et al. (1995) study specifically excluded bedrock sites in California.

In the January 1997 ***Response to U.S. EPA Comments on the LLNL/UC LUFT Cleanup Recommendations and California Historical Case Analysis***, LLNL stated, "They found that 90% of the plumes lengths determined, using best professional judgment, were less than 340 feet at the 10 ppb groundwater concentration limit, and less than 380 feet at the 1 ppb limit (SWRCB, 1996)." Benzene was the chemical of concern - MTBE was not evaluated.

The peer-reviewed study of plume lengths at 500 petroleum UST sites in the Los Angeles area is widely accepted as representative of plume lengths at California UST sites (Shih et al., 2004). The Shih et al. (2004) study listed MTBE, TBA and benzene as having the greatest threat to drinking water resources in the Los Angeles region (ranked in order of importance), yet TBA is not discussed at all in the policy. The maximum plume lengths for benzene (at 5 µg/L), MTBE (at 5 µg/L), TBA (at 10 µg/L) and TPH-gasoline (at 100 µg/L) from the Shih study were 554 feet, 1,046 feet, 635 feet, and 855 feet, respectively.

How was the 3000 µg/L benzene concentration determined? For benzene, a known carcinogen, the MCL is 1, so the proposed concentration number is 3,000 times (three orders of magnitude) higher. For shallow groundwater that is a non-drinking water source, Region 2's ESL for benzene is sensibly set at 530 µg/L. How was the 1000 µg/L MTBE concentration determined? The ESL for MTBE is 5 µg/L (for a drinking water source). What is the technical/scientific rationale behind the selection of these trigger values?

Class 3 Site: *The "moderate" stabilized plume length (<250 feet) approximates the average benzene plume length from the cited studies. The on-site free product and/or high dissolved concentrations in the plume remaining after source removal to the extent practicable (as per the General Criteria in the Policy) require five years of monitoring to validate plume stability/natural attenuation (i.e., to confirm that the rate of natural attenuation exceeds the rate of NAPL dissolution and dissolved-phase migration). The potential for vapor intrusion from free* *product or impacted groundwater must be evaluated separately as per the vapor intrusion section of the Policy. The 1,000 feet distance to the receptor from the edge of the plume is an additional 400% "plume length" safety factor in the event that some additional unanticipated plume migration was to occur, and is consistent with H&S Code §25292.5 as discussed above.* In addition, this class has the following attributes:

a. *The contaminant plume that exceeds water quality objectives is less than 250 feet in length.*
b. *Free product has been removed to the maximum extent practicable, may still be present below the site, but does not extend off-site.*
c. *The plume has been stable or decreasing for a minimum of five years.*
d. *The nearest existing water supply well and/or surface water body is greater than 1000 feet from the defined plume boundary.*
e. *The property owner is willing to accept a deed restriction if the regulatory agency requires a deed restriction as a condition of closure.*

Comment: Why is the 250 feet plume length appropriate? What is the technical rationale behind the "five years of monitoring to validate plume stability/natural attenuation" and "decreasing for a minimum of five years?" There appears to be little technical or scientific validity in choosing these values.

Class 4 Site: *The "long" stabilized plume length (<1,000 feet) approximates the maximum MTBE plume length from Shih et al. (2004). The potential for vapor intrusion from impacted groundwater must be evaluated separately as per the vapor intrusion section of the Policy. The 1,000 feet distance to the receptor from the edge of the plume is an additional 100% "plume length" safety factor in the event that some additional unanticipated plume migration was to occur, and is consistent with H&S Code §25292.5 as discussed above.* In addition, this class has the following attributes:

a. The contaminant plume that exceeds water quality objectives is less than 1000 feet in length.
b. There is no free product.
c. The nearest existing water supply well and/or surface water body is greater than 1000 feet from the defined plume boundary.
d. The dissolved concentration of benzene is less than 1000 μg/l and the dissolved concentration of MTBE is less than 1000 μg/l.

Comment: See above comments. The benzene and MTBE concentrations are arbitrary.

Class 5 Site: *An analysis of site specific conditions determines that the site under current and reasonably anticipated near-term future scenarios poses a low threat to human health and safety and to the environment and water quality objectives will be achieved within a reasonable time frame.*

Comment: "An analysis…" – what does this mean? Who completes the analysis?

Protection of Beneficial Uses and Region Board Basin Plans

The DRAFT policy ignores a very important State Water Board policy, **protection of beneficial uses**.

Existing and potential beneficial uses for surface water bodies and groundwater basins, listed in all of nine Regional Water Board's Basin Plans, must be considered regardless of specific use plans. For water bodies not specifically listed in the Basin Plan, the tributary rule generally applies. This means that upstream water will, at a minimum, have the same beneficial use as the downstream water. For groundwater, this depends on the degree of hydraulic communication between water-bearing zones.

Beneficial uses assigned to groundwater basins identified in the Basin Plan do not distinguish between shallow groundwater and deeper aquifers. Shallow groundwater is generally assumed to be in hydraulic communication with a deeper aquifer when a substantial, competent aquitard is not identified or when data, such as from aquifer pumping tests, are not available. Therefore, in such cases, shallow groundwater will typically be assigned the same beneficial uses designated for the groundwater basin.

Additionally, State Board Resolution 88-63 indicates that all groundwater is presumed to have drinking water beneficial use, with certain exceptions. Shallow groundwater is assumed to have potential drinking water beneficial use unless exceptions are demonstrated and the shallow groundwater is not reasonably expected to be in hydraulic communication with a deeper aquifer. In certain instances, the use of a deeper aquifer as a source of drinking water may be considered impractical due to the threat of degradation, such as salt-water intrusion, excessive pumping, or pre-existing poor quality (e.g., high total dissolved solids/TDS).

Basin Plans sensibly require that taste and odor criteria be considered for protection of drinking water resources. This is especially an issue for petroleum contamination, since the concentration of contaminants in the groundwater may, in theory, not pose a toxicity problem but the water may be completely unpalatable. The compounds collectively incorporated under "TPH" or related breakdown products that could be removed by silica gel cleanup are usually the culprit (vs. BTEX). MTBE drinking water standards are based on taste and odor criteria. An RP may not need to aggressively cleanup groundwater that is unpalatable for drinking, but you at least need to know where it is to manage it properly. Consideration of taste and other thresholds for impacts to drinking water and gross contamination and nuisance concerns is required under the Region Board's Basin Plans.

Peer Review

A December 8, 2011, letter from Kevin Graves, P.E. (Manager of the UST Program Section in the Division of Water Quality of the State Water Resources Control Board) to Gerald W. Bowes, Ph.D. (Manager, Cal/EPA Scientific Peer Review Program in the Office of Research, Planning and Performance of the State Water Resources Control Board) requested an external peer review of the proposed Low-Threat UST Closure Policy. The letter included eight attachments and stated, *Peer reviewers are asked to review the scientific basis and scientific portion of the technical justification for proposed Policy and determine whether the technical justification and literature cited, are based on sound scientific knowledge, methods, and practices.*

Mr. Graves specifically asked that solicited peer reviewers have expertise in: Geology and Hydrogeology; Petroleum Fate and Transport in Soil and Groundwater; Natural Attenuation of Petroleum; Vapor Intrusion, and; Risk Assessment/Toxicology.

Four peer review letters comment letters were received by the State Water Board's Scientific Peer Review Program. I have the following comments:

- What was the selection process?
- All four of the comment papers were prepared by professional engineers who are professors at esteemed universities.
- Based on a review of their resumes/curriculum vitaes, it does not appear that any of the reviewers are recognized experts in the geology or hydrogeology fields (none of the reviewers are California –licensed geologists or hydrogeologists). Since California has a very unique geologic setting, the lack of an expert hydrogeologist on the peer review panel is a significant mistake that deserves further scrutiny and discussion.
- Why weren't recognized experts in California hydrogeology, especially those with expertise in petroleum fate and transport in groundwater, asked to comment on the policy? Was the United States Geological Survey consulted? The University of California at Davis with their renowned researchers/professors?
- Three of the comment letters mainly address groundwater and vapor intrusion (i.e., Pedro Alvarez, Elizabeth Edwards, and Robert Spear), while the fourth (Mark Widdowson and John Little) only addressed vapor intrusion. Only Pedro Alvarez and Robert Spear commented on direct contact (minor comments only).
- What assurance will be given that the issues pointed out in the peer review letters will be properly incorporated into the revised policy?
- Are there any potential conflicts of interest? What is the relationship of the peer reviewers and members of the Stakeholder Group, if any?