

B&B Superfund Site Investigation/Remediation Issues  
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The United States Environmental Protection Agency (US EPA) with support of the California Department of Toxic Substances Control (DTSC) has approved the investigation/remediation plans for the Brown & Bryant Arvin (B&B) Superfund Site in accord with their approaches for providing “protection” of public health and water resources. While those approaches are typically followed for Superfund site investigation and remediation, they do not necessarily provide for reliable protection of public health and the environment; in fact, some aspects have long been known to be unreliable for providing protection of public health and environmental quality for as long as the wastes at the site represent a threat. These issues, with specific reference to long-term protection of public health and water resources for as long as there are hazardous and otherwise deleterious chemicals present at the B&B Superfund site, are discussed below.

#### Overview Qualifications for These Comments

This discussion is based on Dr. Lee’s academic background, and professional expertise and experience in the understanding, investigation, and application of principles and practice of public health and environmental quality protection. Dr. Lee earned his BA degree in environmental health science at San Jose State University in 1955, Master of Science in Public Health degree from the University of North Carolina with emphasis on water quality investigation/management in 1957, and PhD degree in Environmental Engineering from Harvard University with minors in public health and aquatic chemistry in 1960. Over the past five decades Dr. Lee has been active professionally in university graduate-level education, research, and public and professional service, and as a private consultant, in the water quality–public health–environmental quality field. In his diverse professional career he has been involved in numerous capacities, in evaluating the efficacy, reliability, and adequacy of conventional, new, and emerging technologies for providing and assessing protection of public health and the environment, and has closely followed the professional literature on these issues. This has given him a unique prospective on the adequacy of hazardous chemical site investigation/remediation measures for providing effective and reliable short-term and long-term protection of public health and the environment for as long as there are chemicals at a site that can cause adverse impacts to public health and the environment. As part of his professional outreach activities, Dr. Lee he has been active throughout his professional career in developing reports and professional papers on the findings of his university research and consulting work. Many of his and Dr. Jones-Lee’s more than 1100 professional papers and reports on these activities are available as downloadable files from their website [[www.gfredlee.com](http://www.gfredlee.com)].

One of Dr. Lee’s areas of specialization pertinent to the B&B Superfund site investigation and remediation is the development and appropriate implementation of water quality criteria/standards and drinking water maximum contaminant levels (MCL)s for the protection of aquatic life and human health. A summary of that experience is presented in:

G. Fred Lee and Anne Jones-Lee Expertise and Experience in Water Quality Standards and NPDES Permits Development and Implementation into NPDES Permitted Discharges <http://www.gfredlee.com/exp/wqexp.htm>

Lee, G. F., and Jones-Lee, A., "Clean Water Act, Water Quality Criteria/Standards, TMDLs, and Weight-of-Evidence Approach for Regulating Water Quality," *Water Encyclopedia: Water Law and Economics*, Wiley, Hoboken, NJ, pp 598-604 (2005). <http://www.gfredlee.com/SurfaceWQ/WileyCleanWaterAct.pdf>

Through his expertise and work investigating sites containing hazardous and otherwise deleterious chemicals (e.g., hazardous chemical sites, Superfund sites, landfills) Dr. Lee has developed a number of review papers and reports that discuss technical issues that should be evaluated, but are often not adequately addressed, in investigating and managing the threats that such chemicals pose to public health and the environment. One of the most comprehensive of these is his "Flawed Technology" review:

Lee, G. F., and Jones-Lee, A., "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," Report of G. Fred Lee & Associates, El Macero, CA, December (2004). Updated July (2011).

<http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf>

That approximately 50-page review contains about 100 references to the technical literature and discusses many of the significant technical issues and challenges encountered in trying to assess and manage the threats to public health and environmental quality associated with landfilled wastes, including covered waste piles, for as long as the wastes are a threat. Additional papers/reports of Dr. Lee on investigating/remediating hazardous chemical sites for the protection of public health and environmental quality are listed in the appendix to these comments.

Another aspect of Dr. Lee's expertise pertinent to the B&B Superfund site investigation and remediation is his has many years of experience in the potential public health and environmental quality impacts of pesticides. His experience includes research on the transport of pesticides in groundwaters and surface waters. A summary of his expertise in this area and a listing of his papers/reports in this topic area are provided on his website at:

<http://www.gfredlee.com/plandfil2.htm#gwprotection>, and

<http://www.gfredlee.com/pswqual2.htm#pesticide>.

It is with this background that Drs. Lee and Jones-Lee present the following comments on the adequacy of the investigation/remediation approaches that have been adopted at the B&B Superfund site.

#### OU-1 Surface Soils

Asphaltic Concrete Cover. The surface soils at the B&B Superfund site were highly polluted with pesticides/herbicides and other chemicals, especially in areas where waste management, spills, or pond overflows had occurred. Therefore, the US EPA specified, as the first remediation measure, the removal of some of the most contaminated soils and their management off-site or removal to an area of the site and covered with a RCRA cap. The remaining areas of site containing contaminated surface and near-surface soils were then covered with asphaltic

concrete to reduce the contact of the pollutants with water and thereby reduce the transport of pollutants to groundwater or offsite in stormwater runoff.

While those measures provide a significant first step toward reducing the public health threat of pollutants in the surface soils, they are not adequate or sufficiently reliable to provide long-term protection of public health and environmental quality. An asphaltic concrete cover can if properly developed, temporarily reduce the rate at which water enters a polluted soil/waste pile. However, such a cover is not reliable for preventing entrance of water into the underlying soil and attendant leaching and transport of pollutants to groundwater for as long as the pollutants in the soil will be a threat. The significant, pervasive problems that the US Army Corps of Engineers found in the integrity of the asphaltic concrete layer at the B&B site during its site visit for the second five-year review – cracks, rodent burrows, etc. – and reported its review are to be expected when inadequate monitoring and maintenance are provided.

In order for the level of infiltration reduction potentially offered by the asphaltic concrete layer to be achieved, that layer will need to be subjected to routine and thorough inspection and proper repair of all defective areas for as long as the underlying soil contains chemicals that are a threat to public health and the environment. As they exist at the B&B site, those chemicals will remain a threat until they are leached from the soil; the more effective the cover is in keeping water out of the soils, the longer the threat remains. It is expected that such rigorous monitoring and maintenance will be required for a very long time, certainly likely well-beyond the 30-yr postclosure monitoring maintenance period that is typically cited for RCRA/Superfund remediation of hazardous chemical areas, and is including in US EPA B&B site documents. Methodology were not in place in the B&B site remediation requirements for the reliable determination of when monitoring and maintenance of the asphaltic concrete cover could be terminated without compromise of public health or environmental quality. It may, however, be reasonable to consider termination of rigorous monitoring/maintenance of the asphaltic concrete cover if representative samples of the underlying polluted soils were appropriately exposed to water and found to not release hazardous or otherwise deleterious chemicals that would pose a threat to pollute groundwaters.

RCRA Cap. As part of the initial remediation for the polluted surface soils at the B&B site, some of the most polluted soils and surficial wastes were consolidated into an on-site waste pile and covered with a “RCRA cap.” The RCRA cap used to cover some of the most contaminated waste/soils is not a typical US EPA Subtitle D and C landfill cap. The conventional RCRA cap consists of a soil base overlain by a plastic-sheeting layer of HDPE or LDPE covered by a soil layer with vegetated top soil. The cover is sloped so that, in concept, water that percolates through the soils to the plastic sheeting layer will run off to the side of the plastic sheeting layer and not enter the underlying wastes. This type of cover, as well as issues and problems with its efficacy, are discussed in detail beginning on page 20 of our “Flawed Technology” report referenced above. The so-called RCRA used at the B&B site only uses a GLC low permeability layer and does not use a HDPE or LDPE layer. As discussed in our “Flawed Technology” review a GLC layer has many significant long term integrity problems.

As discussed in that review, a properly constructed RCRA cover can be effective initially in retarding the infiltration of water through the cover. However some flaws can be expected in

even newly placed plastic sheeting; over time, even a well-constructed and placed low-permeability plastic sheeting layer in the cover will deteriorate and will allow water to pass through it and leach chemicals from the underlying wastes. A plastic sheeting layer is subject to free radical attack that further diminishes its integrity and ability to prevent entrance of water into polluted soil/wastes under the RCRA cap. While the rate of deterioration of a plastic sheeting layer is not predictable there is no doubt that it will occur and will eventually need to be repaired.

One of the most significant problems with a RCRA cap of this type is that the integrity of the plastic sheeting layer cannot be assessed by inspection of the cover because it is located beneath the surface soil layer and vegetation. Thus, the layer that is key to keeping the waste and polluted soil dry cannot be readily and rigorously inspected for failures much less for the beginnings of deterioration; incipient failures or weakening of the plastic sheeting layer cannot be repaired early to optimize performance of the cover. In Subtitle C and D landfills the failure of the plastic sheeting layer to prevent moisture from entering the wastes will be first detected by the presence of leachate in the landfill leachate collection system underlying the landfilled wastes.

For the capped wastes and polluted soils at the B&B site there is no readily detectable method of determining when the plastic sheeting layer has deteriorated to the point at which it is no longer an effective barrier to water transport through the cover into the wastes/polluted soils. A possible mechanism to improve the detectability of failures of the plastic sheeting layer is to install moisture-detection lysimeters under the cap. Since the area of initial deterioration of the asphaltic concrete cover or RCRA cap will be localized and plumes of moisture would be of limited width, an extensive network of lysimeters would be needed to reliably detect the failure of the cover/cap by measuring moisture that has passed through the cover/cap.

As long as the capped wastes/soils are kept dry there will likely be little or no decomposition of decomposable wastes/chemicals and little leaching and transport of the chemicals from the capped area. However, as water enters the waste/soils, decomposition and transport of leachate out of the capped area can be anticipated. Therefore, as with the asphaltic concrete cover, a RCRA cap is, at best, a stopgap measure to delay the transport of pollutants to the underlying groundwater. This situation has not been discussed in the B&B site documents to enable the public to understand this aspect of the potential long-term effectiveness of the initial approach that the US EPA adopted for the site's surface soil "remediation." These issues need to be discussed and an effective monitoring plan needs to be developed to reliably address these issues, which could include more effective removal of polluted soils and wastes at the B&B site than has occurred thus far.

At other Superfund sites at which the US EPA is the lead for site investigation/remediation, the US EPA will eventually turn the responsibility for site monitoring, maintenance, and ongoing remediation to DTSC. If this is the approach that will be followed at the B&B site, the long-term site management issues after so-called "remediation" need to be addressed by DTSC; the public needs to understand how that agency plans to provide for long-term protection of public health and groundwater quality. Addressing these issues responsibly and fully now will be important for garnering public support for the US EPA's approach for B&B site investigation/remediation.

### Pollutant Transport, Fate, and Persistence

An important but apparently neglected issue that needs to be understood and incorporated into the investigation and remediation approach at the B&B Superfund site is the transport, fate, and persistence of each of the identified site-derived chemicals. An evaluation should be made of the expected manner and rate of transport of each of the site-associated chemicals from their current environments/locations at the B&B site to off-site groundwaters; the fate and persistence of the chemicals and their transformation products in each of the environments in which it is found at the B&B site also need to be defined. Reliable transport, fate, and persistence information is needed to properly evaluate the adequacy of remediation approaches being followed, and future monitoring needed for the site and area. This information is especially important for the monitored natural attenuation of the polluted B-zone waters as well as the wastes and pollutants in soils in the capped/covered areas of the site.

### MCLs as Basis for Evaluation of Public Health and Water Resource Protection

The US EPA B&B Superfund site documents state repeatedly that because the concentrations of B&B pollutants are below drinking water MCLs the water in the Arvin city well and the C-zone is not polluted by the site. Those familiar with how MCLs are developed know that for some hazardous chemicals, such as chloroform and arsenic, the MCL is not based on human health risk but on other factors including cost of treatment. While the claim reflects the standard US EPA position for defining “pollution” associated with Superfund sites, it is not in keeping with the principles of public health protection. For every site-derived chemical, an evaluation needs to be made as to whether the MCL for the chemical is based on human health protection criteria or some other non-health related factor. If a site-derived chemical is present in concentrations above a true health-based criterion, the water should be considered to have been polluted by that chemical. It is important to reliably inform the public about these issues rather than to continue to mislead the public by stating in site reports that the water is “not polluted by a site chemical(s)” simply because a particular numeric value unrelated to public health or environmental quality has not been exceeded.

### Unknown/Unmonitored Potential Pollutants

One of the issues of concern at the B&B Superfund site that has not been defined is whether there are chemicals in the soils and groundwaters at the site whose public health and environmental hazards/impacts are not yet recognized or are not yet known, or for which monitoring is not required. Of particular concern is the potential impacts of transformation products of the chemicals that have been used at the site. There is growing recognition that unmonitored chemicals at hazardous chemical sites can be a significant threat to public health and the environment. This is discussed in our “Flawed Technology” review beginning on page 47:

*“Some of the unmonitored constituents can be adverse to public health at very low concentrations. Dr. Christian Daughton (2005), Chief of the Environmental Chemistry Branch, National Exposure Research Laboratory, Office of Research and Development, US EPA, Las Vegas, Nevada, has discussed the inadequacy of water quality monitoring programs in identifying pollutants in wastes for the range of chemicals that could be impacting public health and the environment. In his presentation he stated,*

***“Further Truisms Regarding Environmental Monitoring***

- *What one finds usually depends on what one aims to search for.*
- *Only those compounds targeted for monitoring have the potential for being identified and quantified.*
- *Those compounds not targeted will elude detection.*
- *The spectrum of pollutants identified in a sample represent but a portion of those present and are of unknown overall risk significance*

Reference: Daughton, C.G., "The Critical Role of Analytical Chemistry," July (2002).

and also in our "Flawed Technology" review, on page 55: according to Daughton (2004a), *"Since the 1970s, the impact of chemical pollution has focused almost exclusively on conventional "priority pollutants," especially on those collectively referred to as "persistent, bioaccumulative, toxic" (PBT) pollutants, "persistent organic pollutants" (POPs), or "bioaccumulative chemicals of concern (BCCs). The "dirty dozen" is a ubiquitous, notorious subset of these, comprising highly halogenated organics (e.g., DDT, PCBs). The conventional priority pollutants, however, are only one piece of the larger risk puzzle."*

Daughton has indicated that there are more than 22 million organic and inorganic substances, with nearly 6 million commercially available. The current water quality regulatory approach addresses fewer than 200 of those chemicals, and in general pharmaceuticals and personal care products (PPCPs) and many other chemicals are not regulated at all. According to Daughton, *"Regulated pollutants compose but a very small piece of the universe of chemical stressors to which organisms can be exposed on a continual basis."*

Background information on unrecognized and unregulated chemicals as environmental pollutants is available at <http://www.epa.gov/nerlesd1/chemistry/pharma/>

Lee and Jones-Lee reviewed issues associated with unrecognized pollutants in:

Lee, G. F., and Jones-Lee, A., "Unrecognized Environmental Pollutants," In: Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ, pp 37 1-373 (2005b). <http://www.gfredlee.com/SurfaceWQ/WileyUnrecognizedPollutants.pdf>

A significant deficiency in the US EPA Superfund Program is its lack of consideration of the fact that hazardous chemical sites often contain a variety of chemicals that, while not meeting the regulatory definition of "hazardous," are or can be hazardous to public health or environmental quality, or be otherwise deleterious to the usability of waters. As discussed in the "Flawed Technology" review cited earlier, of the myriad chemicals in use only a small fraction that can cause public health or environmental quality impacts are regulated. Many others pose hazards that have not yet been defined, or are unrecognized or unknown. Other chemicals that may not necessarily cause direct public health impacts, such as salts and certain taste/odor-causing chemicals can in fact impair the quality of domestic water supply well water and render it unusable for water supply. To the public and water utilities, the assessment of the quality of a water supply includes consideration of the presence of not only "hazardous" chemicals but also offensive tastes and odors and other characteristics that impact the use of the water for domestic water supply. The evaluation of the impact of a hazardous chemical site should include evaluation of whether the site contains chemicals that are transported in groundwater that can render a groundwater unusable for domestic and other purposes. It should never be assumed that

the limited suite of chemicals that are conventionally investigated in a hazardous chemical site (Superfund site) investigation such as that conducted at the B&B Superfund site are the only chemicals that are a threat to public health and water resources quality. The development of remediation approaches, and especially of monitoring requirements for soils and groundwaters in the site area, need to consider whether there are unmonitored hazardous chemicals at the site that are not now regulated or even recognized to be threats to public health and groundwater quality.

#### Remediation of A-zone, B-zone and C-zone Groundwater and Arvin Domestic Water Supply Issues

The US EPA B&B site documents state that the groundwaters at and near the B&B Superfund site are polluted by hazardous chemicals derived from the B&B site. In response to comments on the then-proposed second ROD, the US EPA stated that the city of Arvin domestic water supply well was not impacted by site-associated pollutants. The agency made a similar statement about the C-zone groundwater based on the reporting that the site-derived chemicals present were at concentrations below MCL concentrations. The fact that site-derived hazardous chemicals are present in the Arvin water supply well and in C-zone groundwater shows that there is a hydraulic connection between the site and these areas. The fact that site-derived chemicals have been found in the C-zone groundwater shows that the Corcoran clay is not an effective barrier to the transport of site-derived chemicals to the deeper groundwaters. As discussed earlier, the fact that measured concentrations of monitored pollutants in the groundwaters were below MCLs does not mean that those waters are not impacted by site-associated pollutants.

There is need to develop a comprehensive groundwater transport model for the B&B site area that can reliably predict the transport of B&B site chemicals to offsite groundwaters.

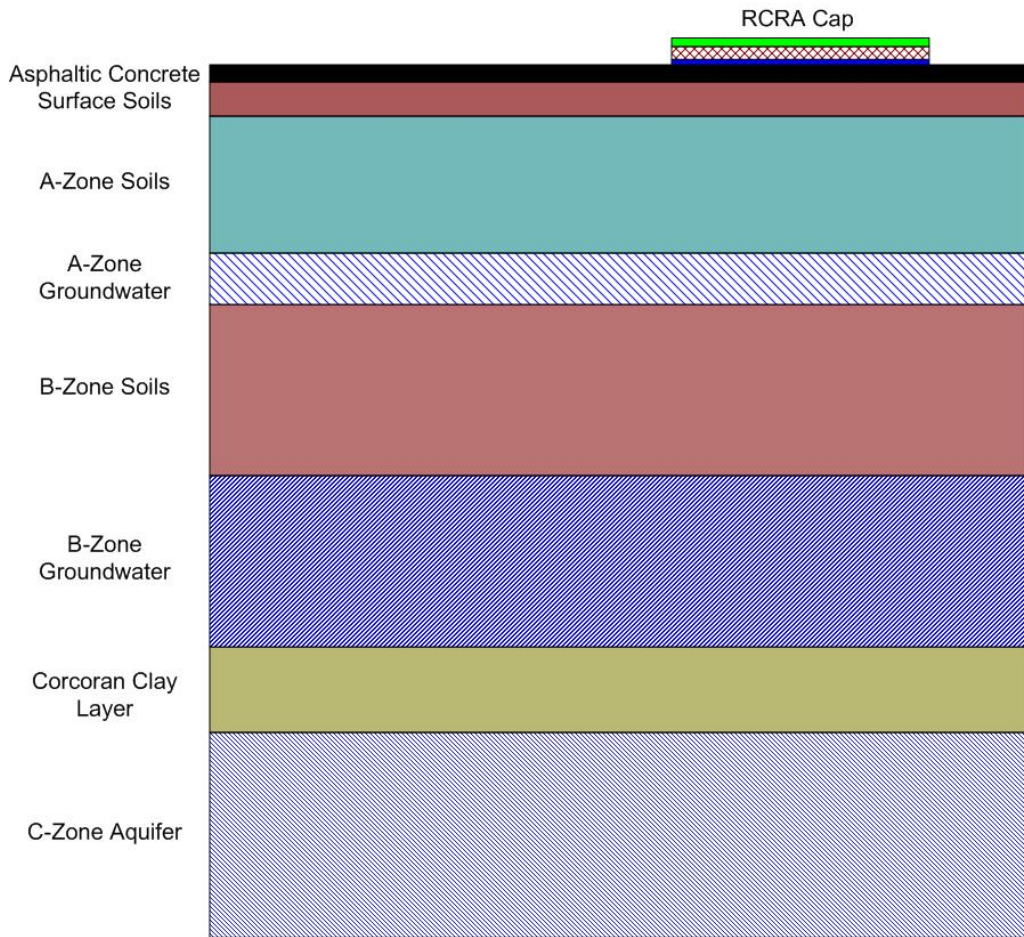
The public is justifiably concerned that the US EPA intends to try to remediate the B-zone polluted groundwater by “monitored natural attenuation” (MNA) instead of installing a pump-and-treat system. While the MNA approach is far less expensive than a pump-and-treat system, it can also be less effective and it may not be protective of groundwater resources. At least a combination of MNA and pump-and-treat should be explored for remediation of the B-zone polluted groundwater. Whichever approach is followed, however, each of the issues discussed herein, especially the persistence and transport issues, need to be adequately addressed.

The city of Arvin domestic well that is being contaminated by B&B Superfund site-derived chemicals should immediately be abandoned; a new well should be placed in an area that does not contain B&B site-associated chemicals, even if their concentrations are below MCLs, and that, based on an area groundwater model, will not be expected to be polluted by the site chemicals. In keeping with principles of prudent public health practice, the existing polluted well should have been replaced years ago when it first become known that site chemicals were present in the well water.

Question on these comments should be sent to Dr. G. Fred Lee at [gfredlee@aol.com](mailto:gfredlee@aol.com).

### Figure 1. Soil/Geological System and Cover/Caps at B&B Superfund Site

(Based on 'Figure 3. Designation of the Soil Layering System' in US EPA, "Proposed Plan Brown & Bryant Superfund Site Operable Unit No. 2, City of Arvin, Kern County, California, US EPA Region 9, San Francisco, CA, June (2007).)  
[[http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/cf0bac722e32d408882574260073faed/0905c64ec5f74d06882572fa002bf7e4/\\$FILE/B&B%20Site%20final%20PPA%2006-07-07.pdf](http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/cf0bac722e32d408882574260073faed/0905c64ec5f74d06882572fa002bf7e4/$FILE/B&B%20Site%20final%20PPA%2006-07-07.pdf)]





Long-term public health and groundwater resource protection issues associated with the development of the monitored natural attenuation remediation, the replacement of the city of Arvin domestic supply well, the implementation of the A-zone pollutant removal program, and other issues will be discussed as additional information is made available by the US EPA; the additional discussion will be appended to this review. Also, when the third five-year review report is made available by the US EPA for our review, we will append our comments on it, as well, to this review.

#### Appendix

Selected papers/reports of Drs. Lee and Jones-Lee's on hazardous chemical site investigation and remediation

Lee, G. F., and Jones-Lee, A., "Issues in Providing Long Term Public Health and Environmental Protection from Redeveloped Brownfield Properties," Report of G. Fred Lee & Associates, El Macero, CA, Nov. 1 (2010).  
<http://www.gfredlee.com/HazChemSites/Brownfield-Issues.pdf>

Lee, G. F., and Jones-Lee, A., "Issues in Monitoring Hazardous Chemicals in Stormwater Runoff/Discharges from Superfund and Other Hazardous Chemical Sites," *Journ. Remediation* 20(2):115-127 Spring (2010).  
<http://www.gfredlee.com/HazChemSites/MonitoringHazChemSW.pdf>

Lee, G. F. and Jones-Lee, A., "Superfund Site Remediation by Landfilling - Overview of Landfill Design, Operation, Closure and Postclosure Care Issues," Published in *Remediation* 14(3):65-91, Summer (2004).  
<http://www.gfredlee.com/HazChemSites/LFoverviewremediation.pdf>

Lee, G. F. and Jones-Lee, A., "Improving Public Health and Environmental Protection Resulting from Superfund Site Investigation/Remediation," *Remediation* 14(2):33-53, Spring (2004). <http://www.gfredlee.com/HazChemSites/remediation-paper.pdf>

Lee, G.F. and Jones-Lee, A., "Evaluation of the Adequacy of Hazardous Chemical Site Remediation by Landfilling," IN: Remediation of Hazardous Waste Contaminated Soils, Marcel Dekker, Inc., NY pp 193-215 (2000).  
[http://www.gfredlee.com/HazChemSites/chem\\_remed.pdf](http://www.gfredlee.com/HazChemSites/chem_remed.pdf)

Lee, G.F., and Jones-Lee, A., "Evaluation of Surface Water Quality Impacts of Hazardous Chemical Sites," *Remediation* 9:87-118 (1999).  
[http://www.gfredlee.com/HazChemSites/eval\\_sfcwaters.pdf](http://www.gfredlee.com/HazChemSites/eval_sfcwaters.pdf)

Lee, G. F., "Redevelopment of Brownfield Properties: Future Property Owners/Users Proceed with Your Eyes Open," *Environmental Progress* 16(4):W3 (1997).  
<http://www.gfredlee.com/HazChemSites/brownfield.html>

Lee, G. F., and Jones-Lee, A., "Hazardous Chemical Site Remediation Through Capping: Problems with Long Term Protection," *Remediation* 7(4):51-57 (1997).

<http://www.gfredlee.com/HazChemSites/pbrwnfld.htm>

Lee, G. F., and Jones-Lee, A., "Superfund Site Remediation by On- Site RCRA Landfills: Inadequacies in Providing Groundwater Quality Protection," Proc. Environmental Industry Association's Superfund/Hazwaste Management West Conference, Las Vegas, NV, pp. 311-329, May (1996). <http://www.gfredlee.com/HazChemSites/eia.htm>

Lee, G. F. and Jones-Lee, A., "Does Meeting Cleanup Standards Mean Protection of Public Health and the Environment?," IN: Superfund XV Conference Proc., Hazardous Materials Control Resources Institute, Rockville, MD, pp. 531-540 (1994). <http://www.gfredlee.com/HazChemSites/hmcrstd.htm>

Lee, G. F. and Jones, R. A., "Redevelopment of Remediated Superfund Sites: Problems with Current Approaches in Providing Long-Term Public Health Protection," Proc. Environmental Engineering 1991 Specialty Conference, ASCE, New York, pp. 505-510, July (1991). <http://www.gfredlee.com/HazChemSites/ASCE-SP-Redevelop.pdf>

Lee, G.F. and Jones, R.A., "A Risk Assessment Approach for Evaluating the Environmental Significance of Chemical Contaminants in Solid Wastes," IN: Environmental Risk Analysis for Chemicals, Van Nostrand, New York, pp. 529-549 (1982). <http://www.gfredlee.com/HazChemSites/SiteSpecificTCLP.pdf>

Lee, G.F. and Jones, R.A., "Application of Site-Specific Hazard Assessment Testing to Solid Wastes," IN: Hazardous Solid Waste Testing, ASTM STP 760, American Society for Testing and Materials, pp. 331-344 (1981). <http://www.gfredlee.com/HazChemSites/hazassesstest.pdf>