TCLP Not Reliable for Evaluation of Potential Public Health and Environmental Hazards of PCBs or Other Chemicals in Wastes: Unreliability of Cement Based Solidification/Stabilization of Wastes

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The Toxicity Leaching Characteristic Procedure (TCLP) is used by some to estimate the potential hazard that chemicals in solid wastes represent to public health and the environment. This use is done mechanically without understanding the origin of this procedure and the severe limitations and unreliability of this procedure in estimating public health and environmental hazards of the potentially hazards of chemicals in solid wastes. Also of concern is that Portland cement based solidification/Stabilization of solid wastes is being used based on TCLP testing of the so-called stabilized wastes. The authors have been involved in evaluating the potential hazards of chemicals in soils, sediments and solid wastes for over 40 years. This experience has included extensive studies on the leaching of chemicals in solids as they may impact of public health and the environment. Over the years we have repeatedly observed the misuse the TCLP to characterize the potential leachable chemicals in solids/wastes including cement based "stabilized" wastes. This experience has included developing several reports that discuss the misuse of the TCLP in environmental evaluation. Sections of several of our reports are presented in this report.

Evaluation of the Potential Impact of Electronic Wastes in MSW Landfills

The impetus for developing this discussion is a statement by US EPA headquarters in June 2009 that attempted to justify allowing the deposition of electronic wastes in municipal solid waste (MSW) landfills. We have developed a discussion of this issue in,

> Lee, G. F., and Jones-Lee, A., "Electronic Wastes and MSW Landfill Pollution of Groundwater," Report of G. Fred Lee & Associates, El Macero, CA, September (2009).
> http://www.gfredlee.com/Landfills/ElectronicWasteCom.pdf

As discussed by Lee and Jones-Lee (2009) the US EPA (Petteway, 2009) claimed that based on the results of the TCLP, electronic wastes can be safely disposed in MSW landfills and not contribute to pollution of groundwaters by heavy metals. Lee and Jones-Lee (2009) have presented the following discussion of the unreliability of the US EPA position on this issue.

"*The use of the US EPA TCLP regulatory limit as a measure of the concentrations of heavy metals in MSW leachate that would not cause groundwater pollution ignores the purpose and limitations of the TCLP test, and circumvents the proper evaluation of the amount of leaching of heavy metals in a MSW landfill that can cause a groundwater to contain sufficient concentrations of lead and several heavy metals to be a threat to cause a human health threat to those who use a MSW-leachate-polluted groundwater. The senior author (G. Fred Lee) has been involved in several million dollars of research on the leaching of various potential pollutants from solids including solid wastes, and on how to properly evaluate the water quality* *significance of leached pollutants on various uses of a water including drinking water. Lee and Jones published a number of papers and reports on those findings, including:*

> *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*

and

> *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*

The ASTM paper was judged to tie for first place as the "Best Paper" presented at that conference.

The leaching of a pollutant from a solid is highly dependent on the characteristics of the leaching test; the results obtained are governed largely by the design and conduct of the test. During the 1970s, G. Fred Lee conducted about 1 million dollars in research on behalf of the Corps of Engineers on the release/leaching of about 30 pollutants, including various heavy metals, from dredged sediments taken from US waterways. As part of those studies Lee and his associates evaluated the reliability of the elutriate test for assessing and quantifying the potential for the various pollutants to be released from dredged sediments. A significant focus was the evaluation of the influence of the conditions of the test on the release of pollutants from the sediments. It was found that the elutriate test was a good measure of the potential release of pollutants from dredged sediments upon open water disposal of the sediments. The results of these studies were published in several reports and papers including a summary paper,

> *Lee, G. F. and Jones-Lee, A., "Water Quality Aspects of Dredging and Dredged Sediment Disposal," IN: Handbook of Dredging Engineering, Second Edition, McGraw Hill, pp. 14-1 to 14-42 (2000). http://www.gfredlee.com/Sediment/dredging.html*

In developing the EP Tox leaching test (which subsequently became the TCLP test) for use in the classification of solid wastes as "hazardous" vs "non hazardous," the US EPA chose to incorporate many of the test conditions established for the elutriate test for assessing release of pollutants from dredged sediments. While the conditions used in the elutriate test are appropriate for testing dredged sediments, they are totally inappropriate for evaluation of the leaching of pollutants in solid wastes. The conditions that exist in an MSW landfill that influence leaching are completely different from the conditions of open water disposal of dredged sediment for which the test conditions were established.

By far the greatest error made by the US EPA in developing and applying the TCLP test is the approach used to characterize excessive leaching. Notwithstanding the aforementioned technical deficiencies, the purpose of the TCLP was to classify wastes as either "hazardous" or "nonhazardous." The regulatory limits established for interpretation of TCLP results are arbitrary, and not based on a proper evaluation of the concentrations of leached pollutants that can pollute groundwater to impair the use of MSW-leachate-polluted groundwater for domestic water supply. For example, the characteristics of the hydrogeology of a site are not properly *taken into account in interpreting the results of the test to determine whether a waste can be placed in a nonhazardous waste landfill. The allowed attenuation factor (5-to-1 dilution is assumed) will be overly protective for some hydrogeological groundwater systems, but be insufficiently protective in others. Thus, what are deemed, by virtue of TCLP results, to be "nonhazardous" waste components can still generate leachate that is a significant threat to public health and the environment. The unreliability of this approach is discussed further in Lee and Jones-Lee (2004).*

The support provided in the US EPA/Petteway email for the US EPA's position that electronic wastes in landfills are not a threat to groundwater quality was the failure of electronic wastes to release heavy metals above the TCLP regulatory limits. However, the TCLP assessment and regulatory limit is fundamentally flawed for making such an evaluation."

"*The Lee and Jones (1982) paper, "A Risk Assessment Approach for Evaluating the Environmental Significance of Chemical Contaminants in Solid Wastes," (referenced above) discusses technically reliable approaches for evaluating excessive leaching from a solid waste. Necessary for such evaluation is site-specific evaluation of the conditions in the landfill and the hydrogeology of the groundwater system underlying the landfill to determine the amount of leaching that can occur and not pollute groundwater to a sufficient extent to cause it to impair the use of the groundwater for domestic purposes. As part of a US congress-ordered revision of the TCLP test, the US EPA initially proposed a site-specific approach to the evaluation of excessive leaching. However, the Agency failed to follow through with finalizing such an approach and continues the arbitrarily developed TCLP regulatory limit. As discussed by Lee (2004, 2006) that makes the TCLP test unreliable for evaluating excessive leaching of lead and several other pollutants in electronic and other wastes.*

Overall, the US EPA has used a technically invalid approach to conclude that the heavy metals in electronic wastes do not represent a threat to pollute groundwaters to a sufficient extent to represent a threat to the health of those who use the groundwater as a domestic water supply source. At this time, however, the technical community has not defined or isolated the significance of allowing the deposition of electronic wastes in MSW landfills to the pollution of groundwaters by landfill leachate that will inevitably occur as the liners fail to prevent leachate-leakage through the liners. In light of this situation, for now it would be prudent public health and environmental protection policy for state and local jurisdictions to restrict deposition of electronic wastes in MSW landfills. This could also be said of deposition of other wastes that contain hazardous chemicals.

Lee and Jones-Lee (2009) stated, At this time it is unclear whether or not the disposal of electronic wastes in MSW landfills will significantly increase the heavy metal-pollution of groundwaters once the liners systems fail to collect and remove all leachate generated in the landfill. It is clear, however, that the US EPA's assessment, in response to the NY Times article on the potential of electronic wastes to cause groundwater pollution, is not in accord with technical information available on this issue. Until such time as it is demonstrated that electronics-derived heavy metals make inconsequential contributions to MSW landfill leachate heavy metal concentrations, prudent public health and groundwater protection policy and *practice would indicate that disposal of electronic wastes in MSW landfills should be prohibited."*

Sydney Tar Ponds Leaching of Hazardous Chemicals

Lee and Jones-Lee (2006) conducted a review of the approach that the Sydney Tar Ponds Agency (STPA) used to evaluate the ability of adding Portland Cement into the Sydney Nova Scotia Tar Pond sediments to immobilize PCBs, PAHs and other hazardous chemicals in estuarine sediments that were derived from about 100 years of operation of a large steel mill including a coking operation without waste treatment. Lee and Jones-Lee issued several reports on this issue including,

> Lee, G. F., "Assessment of the Adequacy & Reliability of the STPA Proposed Approach for Remediation of the Sydney Tar Ponds' Sediments," Presentation to the Sydney Tar Ponds and Coke Ovens Sites Remediation Project Joint Review Panel, Sydney, Nova Scotia, CANADA, PowerPoint Slides; G. Fred Lee & Associates, El Macero, CA, May 15 (2006). http://www.gfredlee.com/Landfills/SydneyTarPondsPowerPt.pdf
>
> Lee, G. F., "Unreliable/Inadequate Information on the Efficacy of Solidification/ Stabilization of Sydney Tar Pond Sediments," Report of G. Fred Lee & Associates, El Macero, CA, February (2007).
> http://www.gfredlee.com/Landfills/SydneyTPSedSolidif.pdf

The STPA relied on the TCLP to test the cement treated samples of the Tar Pond sediments.

In,

> Lee, G. F., "Comments on, 'Remediation of Sydney Tar Ponds and Coke Ovens Sites Environmental Impact Statement, Sydney, Nova Scotia,' dated December 2005," Report of G. Fred Lee & Associates, El Macero, CA, USA, May 15 (2006).
> http://www.gfredlee.com/Landfills/SydneyTarPondsReport.pdf

Lee stated,

"*Another important deficiency in the STPA EIS Volume 7 is the failure to evaluate the potential for persistent organic chemicals such as PCBs that are present in a sediment to bioaccumulate through the food web to excessive concentrations in edible organisms of the area. The critical concentrations in sediments for this situation are typically lower than the concentrations that are adverse to aquatic life living in the sediments. The co-occurrence-based approach for developing sediment quality guidelines does not incorporate food web accumulation issues.*

With respect to the remediation of the Sydney Tar Pond sediments, the continued accumulation of PCBs in edible organisms of the Estuary/Harbour has to be one of the most important issues that needs to be addressed in terms of evaluating the success of the S/S treatment of the Tar Pond sediments. As discussed elsewhere in these comments, according to the US EPA (2002), concentrations of PCBs in the water column above 0.000064 µg/L can bioaccumulate to excessive levels in edible aquatic life. The US EPA does not have critical concentrations for PCBs in sediments that, through food web accumulation, would lead to excessive concentrations in edible fish and shellfish. In order to evaluate this situation, it is necessary to perform site-

specific studies of whether PCBs and other pollutants in sediments can bioaccumulate to excessive levels in higher trophic level organisms that are a threat to public health and/or fish-eating birds and animals. These are the issues that must be carefully evaluated as part of developing remediation objectives for S/S treatment of the Tar Pond sediments."

Also in this review,

"*The summary of the Wiles and Barth paper states,*
This paper discussed some approaches for determining whether or not organic contaminated soils should be treated by S/S technologies. The approaches are conservative and give little recognition to the physical characteristics of the solidified waste forms in the immobilization process. These approaches are also based upon technical rather than regulatory considerations after reviewing available information on the S/S of organic wastes. Several instances have been reported where processors have claimed treatment of organics by S/S. In most but not all of these, the experimental approach was too limited. Measuring organic content before treatment and after treatment without controls to collect and analyze air emissions is not acceptable. Many, if not all, of the volatile and semivolatile organics will "disappear" during the process because they volatilize. Much more sound scientific evidence is required before S/S of organic contaminated waste can become routine practice."

Wiles and Barth, at the time they developed this paper, were with the US EPA Risk Reduction Engineering Laboratory in Cincinnati, Ohio. It was their responsibility to evaluate the effectiveness of S/S treatment of various types of wastes as part of the US EPA SITE (Superfund Innovative Technology Evaluation) program. In connection with conducting this review, I contacted Ed Barth regarding the current understanding of the effectiveness of using cement-based S/S to treat high-organic wastes such as those that are present in the Tar Ponds. He confirmed (Barth, pers. comm., 2006) that the situation today is no different than it was in 1992 when he and Wiles developed their paper on this issue. Basically, there are significant questions about whether cement-based S/S is an effective immobilization approach for high-organic wastes such as the Tar Pond sediments. Therefore, the STPA promotion for S/S for treating the Tar Pond sediments based on the so-called widespread use of this approach is, at best, superficial and does not properly evaluate the effectiveness of such practice. This is an issue that the Agency should have discussed in a credible EIS, in order to inform regulatory decision-makers and the public about the potential problems associated with S/S of the Tar Pond polluted sediments.

Mattus and Gilliam (1994) of the Oak Ridge National Laboratory, Oak Ridge, TN, conducted a comprehensive review of the literature regarding cement-based waste-form development to identify waste species that pose problems for the use of the technology, and at what concentrations those species render the process unfeasible. They concluded, "The literature search has confirmed that the knowledge of cement-based waste-form chemistry has not progressed to the point where this is possible."

In the course of their review of organic species that may interfere with various waste-form properties, they made the following statements, observations, and conclusions:

"In the context of the FFCA [Federal Facility Compliance A – cement] project, waste streams loaded with organics are supposed to be thermally treated to destroy the organic species before the waste is solidified in the cement-based matrix;"

"Many researchers, when reporting results of studies using S/S to immobilize organic wastes, arrive at a common conclusion: that is, S/S technologies are generally not appropriate to treat organic-bearing wastes (Wiles and Barth, 1992; Brown et al., 1992)."

"Many authors discuss the inability of the available tests such as the TCLP to evaluate the retention of organics in cement-based waste forms, due to the fact that many organics are not miscible in water or acetic acid solution."

"Interpretation of results [from US EPA SITE program tests on the treatability of real contaminated wastes containing organics] is usually inconclusive regarding the presence of organic species, according to de Piercin (1990) and Brown et al. (1992). They reported results obtained from three EPA Superfund sites that illustrate this problem. They state that very little scientific literature claims that S/S is effective for treating organic wastes."

"Some studies investigated the mechanism of retention of organic species in cement products. Wiles and Barth (1992), for example, reported that organics are unlikely to form insoluble precipitates; neither do organics enter into the structure of cement hydrates. Therefore, physical encapsulation will be the principal way to contain organics in cement-based waste forms. They conclude that S/S processes, 'should follow some earlier stage of treatment for removal and/or destruction of the volatile and semivolatile constituents.'"

Since phenols are major components of coal tar, Mattus and Gilliam's accounts of studies by Vipulanandan and Krishnan (1990) and Shukla et al. (1992) are of interest. Mattus and Gilliam (1994) stated,

"Vipulanandan and Krishnan (1990) incorporated 0.5 and 2% by weight pure phenol in Type I Portland cement. The addition of 2% phenol increased the set time by a factor of 3. TCLP leaching tests recovered up to 100% of the organics in the leachate, proof that phenol is not chemically bound to the cement structure."

"Shukla et al. (1992) showed that the leaching performance of PCP and phenol is better when the cure time is increased."

The literature review concluded:

"What is clear from the literature search is that cement-based waste forms, sometimes referred to as a 'low-tech option,' are anything but simple from the standpoint of waste-form chemistry. Indeed, cement waste-form chemistry is extremely complex and is poorly understood even for some simple systems of a single waste constituent in a cement-water paste."

"The literature search has clearly established that no definitive waste characterization requirements exist. … Consequently, the approach to waste characterization needs presented is to request 'screening type' characterization."

Brown, R. E.; Jindal, B. S. and Bulzan, J. D., "A Critical Review of the Effectiveness of Stabilization and Solidification of Hazardous Organic Wastes," pp. 43-60 in Stabilization and Solidification of Hazardous, Radioactive, and Mixed Wastes, Vol. 2, ASTM STP 1123, ed. T.M. Gilliam and C.C. Wiles, American Society for Testing and Materials, Philadelphia (1992).

de Percin, P. R., "Results from the Stabilization Technologies Evaluated by the SITE Program," pp. 648-660 in Proceedings of the New England Environmental Expo, Hynes Convention Center, April 10-12, 1990, EPA/600/D-90/232, US. Environmental Protection Agency, Cincinnati (1990).

Shukla, S. S.; Shukla, A. S.; Lee, I. G. C.; Aminabhair, T. M. and Balundgi, R.H., "Solidification/Stabilization Study for the Disposal of Pentachlorophenol," Journal of Hazardous Materials 30(3):17-33 (1992).

Vipulanandan, C. and Krishnan, S., "Solidification/Stabilization of Phenolic Waste with Cementitious and Polymeric Materials," Journal of Hazardous Materials 24:123-136 (1990).

Wiles, C. C. and Barth, E., "Solidification/Stabilization: Is It Always Appropriate?" Stabilization and Solidification of Hazardous, Radioactive, and Mixed Wastes, 2nd Volume, ASTM STP 1123, T. M. Gilliam and C. C. Wiles, Eds. American Society for Testing and Materials, Philadelphia, PA, pp. 18-32 (1992).

As we commented in,

> Lee, G. F. and Jones-Lee, A., "Progress toward Remediation of the Sydney Tar Ponds: A Major Canadian PCB/PAH 'Superfund' Site," Journal Remediation 17(1):111-119 (2006). http://www.gfredlee.com/Landfills/STP-Remediation-pap.pdf

"Further, and most important, in the agency's studies of S/S treatment of Sydney Tar Ponds sediments, the Agency used an analytical method detection limit for measurement of PCBs released from the treated sediments that was well above the concentrations that are known to bioaccumulate to excessive levels in edible organisms. The STPA erroneously assumed that because they could not measure a release in the TCLP test, there was no release, and, therefore, S/S treatment of these sediments was effective."

In follow up discussion of the unreliable information provided by STPA and its consultants on the potential efficacy of cement based stabilization of hazardous chemicals a solid waste we developed,

> Lee, G. F., "Unreliable/Inadequate Information on the Efficacy of Solidification/ Stabilization of Sydney Tar Pond Sediments," Report of G. Fred Lee & Associates, El Macero, CA, February (2007).
> http://www.gfredlee.com/Landfills/SydneyTPSedSolidif.pdf

in which Lee quoted from the literature on significant questions on the ability of cement based solidification stabilization to immobilize PCBs and other chemicals. For example,

"*Thornburg et al. (2006), in a recent study entitled "Effectiveness of In Situ Cement Stabilization for Remediation of Sediment Containing Coal Tar Derived Hydrocarbons," found that S/S treatment of these organic sediments was not effective in preventing release of pollutants from them. They reported,*

Sediments adjacent to a former coal tar processing facility are associated with intermittent releases of hydrocarbon droplets and sheen to the overlying marine water column, particularly during low tide. In situ sediment stabilization with Portland cement was one of the alternatives considered for a response action to control sheen in accordance with Surface Water Quality Standards. The remedial design concept consisted of driving large-diameter caissons through the sediment and into the underlying clay aquitard, mixing Portland cement inside the caissons (approximately 15 percent by weight) using an auger or similar piece of equipment, and removing minor amounts of surficial sediment that had bulked up above the original mudline. The caissons would then be pulled, offset in a systematic overlapping pattern, and the process repeated until the sheen-producing area had been stabilized.

Bench-scale laboratory testing was conducted on composite samples of both untreated and stabilized sediments from the area to better characterize the effectiveness of cement stabilization for controlling sheen. The bench-scale tests included the Sequential Batch Leaching Test (SBLT), a U. S. Army Corps of Engineers protocol (Myers et al., 1992) that simulates the effects of contaminated sediment on pore-water chemistry, and a more qualitative Static Sheen Test, per USEPA (40 CFR Chapter 1, Part 435). Tests were conducted on sediments treated with 10, 15, and 20 percent dry cement, 15 percent cement slurry, and, for comparison, 10 percent organoclay, a hydrocarbon adsorbent. Sediment mixtures were allowed to cure for seven days before testing.

The bench-scale test results indicate in situ stabilization as a stand-alone technology would not be effective at controlling sheen; the response action would require additional components, such as the addition of a thick cap or placement of sediments in a confined disposal facility, to achieve this objective. Even the most effective stabilization mixtures leached polycyclic aromatic hydrocarbons (PAHs) and mid-range aromatic and aliphatic hydrocarbons at concentrations well above their effective solubilities, indicating a strong tendency for continued sheen production. Performing the appropriate bench-scale tests cost-effectively demonstrated the need for a different approach to designing and implementing an effective remedial solution for this site.
Presented at 22 Annual Conference on Soils, Sediments and Water, University of Massachusetts Amherst, MA October 2006.
http://www.umasssoils.com/abstracts2005/Thursday/evolving%20strategies.htm#Effectiveness%20of%20in%20situ%20Cement%20Stabil"

"Perera et al. (2005) (from the Department of Engineering, University of Cambridge, Cambridge, UK; Viridis, Berkshire, UK; and S/S Remediation Consultancy, Nottingham, UK), in a report, "State of practice report UK stabilisation/solidification treatment and remediation, Part V: Long-term performance and environmental impact," have stated,

"The application of S/S, for the immobilisation of contaminants by the addition of cement-based additives has been widely practised for many years, and has been generally used successfully, although some contaminants are known to pose problems in treatment (Conner, 1990). However, most of this success is based on results of treatability studies, which are normally conducted over short time periods, typically up to 28 days after treatment. As a result, concerns regarding the long-term effectiveness of the technique have regularly been raised in recent years (Conner, 1990; Borns, 1997; Glasser, 1997; Loxham et al., 1997). These concerns are due to (i) the uncertainties in test methods, (ii) observed deficiencies in the process application, (iii) observed lack of chemical binding in crushed samples of treated waste, suggesting that contaminants could leach out under certain conditions and (iv) uncertainties of performance arising from anticipated behavioural degradation of the material over time.

Degradation, however, ranges between two extremes: complete release of the contaminant in a relatively short time period and a gradual release over a long period of time. It is highly likely that degradation of S/S materials is possible as nothing lasts forever. Degradation with complete release of the contaminant in a relatively short time period is clearly not acceptable and such catastrophic failure is unlikely. However, a gradual release of some contaminants over a long period of time is more likely, and where the level of contaminant release at any time does not represent a significant risk it will satisfy remediation objectives.

These uncertainties can best be quantified by obtaining real-time long-term data. However, despite the widespread use of S/S techniques, evidence of validation in the long-term is still very limited and there is still no direct evidence of time-related material performance in the field (Kirk, 1996). Validation of the long-term effectiveness of any contaminated ground and waste treatment methodology is essential for its success and in the assessment of its sustainability."

The Perera et al. (2005) statements quoted above on this issue are similar to those that I quoted in my report to the Joint Review Panel (Lee 2006a). They demonstrate that, even today, there is still considerable uncertainty about the long-term effectiveness of S/S treatment of wastes, especially high-organic wastes such as the Sydney Tar Ponds sediments.

Borns, D.J. (1997). Predictive tools and data needs for long-term performance of in-situ stabilisation and containment systems: DOE/OST stabilisation workshop, June 26-27, Park City, Utah. Proceeding of the International Containment Technology Conference, Florida State University, pp. 1022-1028.

Conner, J. R. (1990.) Chemical fixation and solidification of hazardous wastes, Van Nostrand Reinhold.

Glasser, F. P. (1997). Fundamental aspects of cement solidification and stabilisation. Journal of Hazardous Materials, Vol. 52, pp. 151-170.

Loxham, M., Orr, T. and Jefferis, S. A. (1997). Contaminated land reclamation (design, construction and management). In Report of the ISSMFE Technical Committee TC5 on Environmental Geotechnics, pp. 113-132.

Perera, A. S. R., Al-Tabbaa, A, Reid, J. M. and Johnson, D. (2005). State of practice report UK stabilisation/solidification treatment and remediation, Part V: Long-term performance and environmental impact. Proceedings of the International Conference on Stabilisation/Solidification Treatment and Remediation, April, Cambridge, UK, Balkema, 437-457. http://www-starnet.eng.cam.ac.uk/SoP%20Reports/SoP%205.pdf

Thornburg, T., Leuteritz, C., Templeton, D., Metcalf, T., Bell, T., & Paschl, K. October (2006). Effectiveness of in situ cement stabilization for remediation of sediment containing coal tar derived hydrocarbons. Presented at the 22nd Annual Conference on Soils, Sediments and Water, University of Massachusetts, Amherst, MA.
http://www.umasssoils.com/abstracts2005/Thursday/evolving%20strategies.htm#Effectiveness%20of%20in%20situ%20Cement%20Stabil

Wiles, C. C., & Barth, E. (1992). Solidification/stabilization: Is it always appropriate? In T. M. Gilliam & C. C. Wiles (Eds.), Stabilization and solidification of hazardous, radioactive, and mixed wastes (Vol. 2, pp. 18-32). ASTM STP 1123. West Conshohocken, PA: American Society for Testing and Materials."

Drs. Anne Jones-Lee and G. Fred Lee have been involved in reviewing the critical concentrations of PCBs in soils and wastes that can be considered safe in accord with some regulatory limits. In connection with the review of the US Gypsum/Port of Stockton, California draft environmental impact statement we submitted,

> Lee, G. F., and Jones-Lee, A., "Comments on 'US Gypsum Draft Environmental Impact Statement for the Development of the US Gypsum Proposed Wallboard Plant to be Located on Port of Stockton West Complex,'" Comments submitted to Lozeau/Drury, Alameda, CA by G. Fred Lee & Associates, El Macero, CA, December 15 (2008).
> http://www.gfredlee.com/HazChemSites/USGypsumDEIR.pdf

as comments on the inappropriate approach for evaluating the potential hazards of PCBs in soils and wastes. We commented,

"*Page 3-85 states,*
"The West Complex EIR found the exposure of individuals to Polychlorinated biphenyls (PCB) (West Complex EIR MM 4.11.7) would be less than significant because the Navy removed all PCB equipment or contaminated equipment containing PCB levels of 50 ppm or greater in 1990. No mitigation was required."

I (Dr. G. F. Lee) have been involved in investigating the occurrence and impacts of PCBs since the late 1960s. A summary of this experience is provided in the attached summary of our experience. This involvement has included reviewing and developing criteria for assessing the impacts of PCBs on public health and the environment. It is known that the 50 ppm allowed soil *residual concentration is not necessarily protective of public health and the environment. This issue should have been discussed in this DEIR to inform decision makers and the public about the current deficiencies in the current regulatory approach for PCBs. Without this information in the reviewers of the DEIR are unreliable informed about the threat that the PCBs in the soils at the USG project area represent.*

I (Dr. G. F. Lee) have been involved in investigating the occurrence and impacts of PCBs since the late 1960s. A summary of this experience is provided in the attached summary of our experience. This involvement has included reviewing and developing criteria for assessing the impacts of PCBs on public health and the environment. It is known that the 50 ppm allowed soil residual concentration is not necessarily protective of public health and the environment. ITRC (2005) conducted a review of PCB concentrations used by states in evaluating excessive PCBs in soils. It reported , "For residential soil, the states reported screening values ranging from 0.089 ppm to 0.43 ppm, varying around the Region 9 PRGs. The health-based screening values for PCBs in industrial soils ranged from 0.0028 to 2.1 mg/kg." (mg/kg = ppm). These values are far less than the 50 ppm cited by the Port and USG as acceptable PCBs in soil for the USG wallboard plant soils.

With respect to protecting aquatic life and human health from excessive bioaccumulation of PCBs in fish the USEPA (2005) has adopted Polychlorinated Biphenyls PCBs water quality criteria to protect aquatic life from PCB toxicity of 0.014 µg/L and 0.000064 µg/L to prevent excessive bioaccumulation of PCBs in fish that would cause the fish to be to hazardous to consume for food. This value is about 10 million times smaller than the 50 mg/L value that USG and Port propose to allow to be discharged to the SJR. As discussed by Lee and Jones-Lee (2002, 2004) the SJR and Delta some fish already have excessive concentrations of PCBs and are hazardous to be used as food. Further there could readily be concentrations of PCBs in the stormwater discharges that USG and the Port propose to discharge to the SJR DWSC that contribute to excessive bioaccumulation of PCBS in SJR fish."

As discussed in the above sections of reports on PCB management issues, the TCLP is not a valid test to evaluate whether PCBs in soils, wastes and cement "stabilized" wastes can be leached from the wastes in sufficient concentrations to cause pollution of the environment by PCBs. This same conclusion applies to many other types of hazardous chemicals such as PAHs, heavy metals etc.

A search of the Internet for information on the reliability of the TCLP to evaluate environmental hazards of chemicals in a solid shows a number of others have developed similar conclusions. For example,

> Karuppiah, M. and Gupta, G., "Toxicity of metals in coal combustion ash leachate." Journal of Hazardous Materials 56: 53-58 (1997).
> http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TGF-3SH49TM-4&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=f05a1701c68972913bfd3bcb56c4c37e

D.C. Susan, M. Sharma, A.D. Wait, The misuse of TCLP methods, Environ. Lab. 8 22-25. (1996)

SUMMARY: The Truth about TCLP-Passing Fluorescent Lamps TAG lamps mercury TCLP test fluorescent lamps Hg passing elemental mercury additives metals iron shields waste Mercury Content Electric lamps Toxicity Characteristic Leaching Procedure test lamp components liquid mercury Truth landfill reactions If a waste fails the TCLP test, it is considered hazardous and is subject to regulation under Subtitle C of RCRA due to its potential to leach significant concentrations of .. Some states may continue to require the TCLP test under their state RCRA program.

Texaco's Misuse of the TCLP Test in Ecuador
The TCLP test was designed by the U.S. Environmental Protection Agency (EPA) to determine whether soil (or waste ... than 5 mg/L TPH by the TCLP test (5 mg/L was the detection limit in the tests. they conducted), and therefore passed their cleanup standard by at least a factor of ...

State of Wisconsin challenged the applicability of the TCLP test to manufactured gas plant waste. MGP waste, that waste is not exempt from the TCLP test and the generator will have to determine if it exhibits any of the hazardous waste characteristics. TAG characteristic exhibits rule EPA Regions NR leaching manufactured gas plant Battery remediation State of Wisconsin applicability plant waste RCRA.

Questions on these issues can be directed to Dr. G. Fred Lee at gfredlee@aol.com.