

G. Fred Lee & Associates

27298 E. El Macero Dr.
El Macero, California 95618-1005
Tel. (530) 753-9630 • Fax (530) 753-9956
e-mail: gfredlee@aol.com
web site: <http://www.gfredlee.com>

January 8, 2007

Via email: regs@dtsc.ca.gov

Ms. Nicole Sotak, Chief
Environmental Analysis and Regulations Section
Department of Toxic Substances Control

Re: **Comments on Alternative Management Standards for Treated Wood Waste**
Department Reference Number: R-2005-04
Office of Administrative Law Notice File Number: Z-06-1113-01

Dear Ms. Sotak:

In accordance with the Department of Toxic Substances Control's (DTSC's) request for comments on the Department's proposed Alternative Management Standards for Treated Wood Waste, I wish to submit the following comments.

The key issue of concern is the appropriateness of DTSC's proposing to allow treated wood waste to be placed in minimum design US EPA Subtitle D (State of California Title 27 Class III) municipal solid waste (MSW) landfills. There seems to be a lack of understanding on the part of the DTSC staff about the ability of this type of landfill to provide for protection of public health, groundwater resources and the environment for as long as the wastes in such a landfill will be a threat. There is no issue about the fact that, ultimately, minimum design Subtitle D (SWRCB Class III) landfills will fail to prevent groundwater pollution by landfill leachate during the time that MSW landfilled wastes, including any commingled treated wood wastes, will be a threat to pollute groundwaters. There is also no issue about the fact that treated wood wastes that have been treated with copper, chromium and/or arsenic will release these contaminants to MSW leachate. Therefore, placing treated wood wastes that have been treated with these chemicals in a MSW landfill represents a potential to increase the hazard to public health and the environment due to disposal of treated wood waste that contains arsenic and/or chromium.

Of particular concern is the proposed new section 67386.11 Disposal:

“§ 67386.11 Disposal

(a) When disposed to land, TWW shall be disposed in either a Class I hazardous waste landfill, or in a composite-lined portion of a solid waste landfill unit that meets all requirements applicable to disposal of municipal solid waste in California after October 9, 1993, and that is regulated by waste discharge requirements issued pursuant to

division 7 (commencing with § 13000) of the Water Code for discharges of designated waste, as defined in section 13173 of the Water Code, or TWW.

(b) A solid waste landfill that accepts TWW shall:

- (1) comply with the prohibitions in section 67386.3 for handling TWW;*
- (2) ensure that any management of the TWW at the solid waste landfill prior to disposal complies with the applicable requirements of this chapter;*
- (3) monitor the composite-lined portion of a landfill unit at which TWW has been disposed. When a release is verified, cease discharge of TWW to that landfill unit until corrective action results in cessation of the release. The landfill shall notify the department that TWW is no longer be discharged to that landfill unit and when corrective action results in cessation of the release; and ... ”*

These regulations allow treated wood wastes to be deposited in a minimum design (with a single composite liner) MSW landfill with the typical groundwater monitoring well array at the point of compliance with the wells frequently spaced hundreds of feet apart. As discussed herein and as is recognized, this approach is fundamentally flawed with respect to protecting groundwater resources, public health and the environment from pollution by landfilled wastes for as long as the wastes in a “dry tomb” type landfill will be a threat. Lee and Jones-Lee (2006a) have discussed the significant deficiencies that exist in allowing minimum design Subtitle D (Class III) landfills to be developed at sites where the geological strata underlying the landfill does not provide for a high degree of certainty of preventing groundwater pollution for as long as the wastes in the landfill will be a threat.

As discussed by Lee and Jones-Lee (2006a), the wastes in a dry tomb type landfill allowed under the current Title 27 regulations will be a threat, effectively forever, to cause groundwater pollution. However, the plastic sheeting and compacted clay liners (single composite liners) have a finite period of time that they can be effective in collecting leachate generated in the landfill. This situation is the basis for the flaw in the technology of minimum design Subtitle D landfilling regulations. It should be noted that there are over half a dozen US states that will not allow a minimum design Subtitle D landfill to be developed in their state because of the inability of the landfill liner systems and groundwater monitoring systems to prevent groundwater pollution and to detect the pollution once the leachate has passed through the liner into the underlying groundwaters before trespass onto adjacent properties.

While some of the California Regional Water Quality Control Boards are now beginning to require a double composite lined landfill for municipal solid wastes, such a design is not required under the current regulations, even though it is widely recognized that the current regulations are inadequate to protect public health and the environment for as long as the wastes in a single composite lined landfill will be a threat. These issues are discussed in detail, with appropriate references to the literature, in the Lee and Jones-Lee (2006a) “Flawed Technology” review, which is incorporated by reference as part of these comments. This review is readily available from the Internet:

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 March (2006).

<http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf>

Recently Drs. G. Fred Lee and Anne Jones-Lee (Lee and Jones-Lee, 2006b) have developed a discussion of Groundwater Quality Protection Issues, which is also incorporated by reference as part of these comments:

Lee, G. F. and Jones-Lee, A., "Groundwater Quality Protection Issues," Report of G. Fred Lee & Associates, El Macero, CA, December (2006b).
<http://www.members.aol.com/annejlee/GWProtectionIssues.pdf>

This discussion provides a chronicle of my experience with landfilling regulations in California. As discussed, beginning in the early 1980s, I was a consultant to the California State Water Resources Control Board in developing the original Subchapter 15, now Title 27, landfilling regulations. This review (Lee and Jones-Lee, 2006b) provides a discussion of the failure of the California Regional Water Quality Control Boards and the State Water Resources Control Board to follow well-established, technically valid approaches required by these regulations, of conducting a site-specific evaluation of the ability of a proposed landfill liner system to prevent groundwater pollution by landfill leachate for as long as the wastes in the landfill represent a threat.

Unfortunately, this situation still persists today, with the result that DTSC cannot rely on the current MSW landfilling regulations to prevent chemicals used to treat wood, such as chromium and arsenic, from being leached from any treated wood placed in a MSW landfill and thereby potentially increase the hazard that this leachate represents to groundwater and surface water resources potentially impacted by the landfill.

As discussed by Drs. Lee and Jones-Lee, one of the significant deficiencies in the current State of California landfilling regulations is the requirement that a landfill owner will provide postclosure monitoring, maintenance and groundwater remediation for as long as the wastes in the landfill will be a threat. While Title 27 specifies that this must be carried out, there are no provisions to assure that this funding requirement will be fulfilled. Of particular concern are privately developed landfills, since there are reasonable questions as to whether a private company that develops a landfill could reliably fulfill the postclosure funding requirements. While the public entity responsible for publicly owned landfills can be expected to fulfill the postclosure funding requirements, privately owned landfills may not be able to do so.

This issue is of sufficient importance to the California Integrated Waste Management Board (CIWMB) that the CIWMB staff are in the process of developing assured funding mechanisms that would develop the postclosure funding needed by both public and private landfill owners to fulfill the requirements of Title 27 for monitoring, maintenance and groundwater remediation for as long as the landfill represents a threat. Recently Drs. Lee and Jones-Lee (2007) have submitted a statement in support of the CIWMB efforts to address this issue:

Lee, G. F. and Jones-Lee, A., "Comments on the CIWMB Staff Efforts to Gain Assured Postclosure Funding for Landfills for as Long as the Wastes in the Landfill Are a Threat to Public Health and the Environment," Comments Submitted to California Integrated Waste Management Board by G. Fred Lee & Associates, El Macero, CA, January (2007).
<http://www.members.aol.com/annejlee/CIWMBPostCloseFund.pdf>

I request that this statement (Lee and Jones-Lee, 2007) also be incorporated into the record for the current DTSC review of Alternative Management Standards for Treated Wood Waste.

Overall, DTSC, as part of updating its management requirements for treated wood wastes, needs to revise these requirements so that those who propose to allow treated wood wastes to be deposited in a minimum design (with a single composite liner) Class III landfill must conduct the studies necessary to demonstrate that the disposal of treated wood wastes in a particular landfill will not have a significant potential to increase the hazard posed by that landfill's leachate to public health, groundwater resources and the environment for as long as the wastes in the landfill will represent a threat.

Basically the approach that should be used to make such an evaluation is based on Marshack's (of the Central Valley Regional Water Quality Control Board) Designated Level Methodology for Waste Classification and Cleanup Level Determination (Marshack, 1989), with the difference that, rather than focusing on whether the waste is "inert," the focus should be on whether the addition of treated wood waste for a particular landfill could ultimately lead to an increased hazard to the environment by constituents leached from the treated wood.

Background to these Comments

Appended to these comments is a summary of my expertise and experience pertinent to landfilling regulations. As discussed, this includes university research studies in the 1970s on behalf of the US EPA to investigate the ability of various landfill liner materials to contain leachate and liquid wastes. This information also provides a list of my recent papers and reports which serve as pertinent background to these comments, as well as references to various landfill impact evaluations that I have been involved in over the past several years.

Beginning in the 1960s and continuing today, I have been involved in reviewing over 80 landfilling situations with respect to the ability of a landfill to protect public health and the environment from pollution by landfilled wastes. This work has included evaluating landfills in various parts of the US, Canada and other countries, usually on behalf of a water utility, county, municipality or others who are concerned about the potential impacts of a proposed landfill or landfill expansion on the groundwater resources of a region. Example reports of my work on this issue are available on my website, <http://www.gfredlee.com>, in the Landfills-Groundwater section, Examples of Specific Landfill Studies subsection:

<http://www.gfredlee.com/plandfil2.htm#examples>

The issue of the potential of treated wood wastes to cause groundwater pollution has been an issue that I have devoted considerable time to during the past year as part of my working with citizens groups in Louisiana and Ohio, in evaluating the potential for construction and demolition wastes (C&D wastes) to pollute groundwaters and surface waters near a landfill. Several years ago I first became involved in reviewing the potential impacts of a C&D waste landfill on a domestic water supply located in Huber Heights, Ohio, where I concluded that C&D wastes represent a significant potential to cause groundwater pollution. About a year ago I was asked by the Louisiana Environmental Action Network (LEAN) to review the city of New Orleans' proposed approach for disposal of hurricane Katrina C&D wastes on top of the Gentilly Landfill, which was an old, unlined MSW landfill. One of the issues of particular concern was the

presence of treated wood wastes in the Katrina wastes. Reports on this situation are available from my website:

Lee, G. F., "Comments on the Louisiana Department of Environmental Quality's 'Decision for Utilization of Gentilly Landfill "Type III" for the Disposal of Hurricane Generated Debris,' Dated August 28, 2006," Comments Submitted to Louisiana Department of Environmental Quality by G. Fred Lee & Associates, El Macero, CA, October (2006). <http://www.members.aol.com/annejlee/LDEQ-Decision-comments.pdf>

Lee, G. F., "Summary of Findings on the Environmental Impacts of the Proposed C&D Landfill on Top of the Closed Gentilly Landfill," Submitted to Louisiana Department of Environmental Quality, Baton Rouge, LA, February (2006). <http://www.members.aol.com/annejlee/FindingsGentilly.pdf>

Also during the past year I worked with a group of concerned citizens in Morrow County, Ohio, helping them understand the potential impacts of C&D wastes, including treated wood wastes, on the groundwater resources potentially impacted by two proposed C&D landfills. A report covering this review is available on my website:

Lee, G. F., "Improving Public Health and Environmental Protection from the Proposed Morrow County C&DD Landfills," Report of G. Fred Lee & Associates, El Macero, CA, February 14 (2006). <http://www.members.aol.com/annejlee/CDD-LF-Improvement.pdf>

Overall

The current DTSC proposed approach for Alternative Management Standards for Treated Wood Waste is deficient in providing for adequate public health and environmental protection from the chemicals used to treat wood (chromium and arsenic), by allowing treated wood waste to be placed in a minimum design Title 27 Class III MSW landfill. DTSC needs to revise these regulations so that all disposal of treated wood wastes in such a landfill must be evaluated prior to disposal, to determine if the disposal of treated wood wastes in a landfill represents a significant additional threat to public health, groundwater resources and the environment. Failure to adopt this approach will perpetuate the existing situation of allowing the disposal of known hazardous chemicals in MSW landfills which, in time, will ultimately fail to prevent leachate generated in such landfills from polluting the groundwater and surface water resources near the landfill, as required by Title 27.

References

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 March (2006a). <http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf>

Lee, G. F. and Jones-Lee, A., "Groundwater Quality Protection Issues," Report of G. Fred Lee & Associates, El Macero, CA, December (2006b). <http://www.members.aol.com/annejlee/GWProtectionIssues.pdf>

Lee, G. F. and Jones-Lee, A., “Comments on the CIWMB Staff Efforts to Gain Assured Postclosure Funding for Landfills for as Long as the Wastes in the Landfill Are a Threat to Public Health and the Environment,” Comments Submitted to California Integrated Waste Management Board by G. Fred Lee & Associates, El Macero, CA, January (2007).
<http://www.members.aol.com/annejlee/CIWMBPostCloseFund.pdf>

Marshack, J., “The Designated Level Methodology for Waste Classification and Cleanup Level Determination,” Staff Report of the California Regional Water Quality Control Board, Central Valley Region, Rancho Cordova, CA, October 1986, Updated June (1989).
http://www.waterboards.ca.gov/centralvalley/available_documents/guidance/dlm.pdf

Appendix
Dr. G. Fred Lee, PE_(TX), DEE
AAEE Board Certified Environmental Engineer

**Expertise and Experience in Hazardous Chemical Site and
Municipal/Industrial Landfill Impact Assessment/Management**

Dr. G. Fred Lee's work on hazardous chemical site and municipal/industrial landfill impact assessment began in the mid-1950s while he was an undergraduate student in environmental health sciences at San Jose State College in San Jose, California. His course and field work involved review of municipal and industrial solid waste landfill impacts on public health and the environment.

He obtained a Master of Science in Public Health degree from the University of North Carolina, Chapel Hill, in 1957. The focus of his masters degree work was on water quality evaluation and management with respect to public health and environmental protection from chemical constituents and pathogenic organisms.

Dr. Lee obtained a PhD degree specializing in environmental engineering from Harvard University in 1960. As part of this degree work he obtained further formal education in the fate, effects and significance and the development of control programs for chemical constituents in surface and ground water systems. An area of specialization during his PhD work was aquatic chemistry, which focused on the transport, fate and transformations of chemical constituents in aquatic (surface and ground water) and terrestrial systems as well as in waste management facilities.

For a 30-year period, he held university graduate-level teaching and research positions in departments of civil and environmental engineering at several major United States universities, including the University of Wisconsin-Madison, University of Texas at Dallas, and Colorado State University. During this period he taught graduate-level environmental engineering courses in water and wastewater analysis, water and wastewater treatment plant design, surface and ground water quality evaluation and management, and solid and hazardous waste management. He has published over 1,100 professional papers and reports on his research results and professional experience. His research included, beginning in the 1970s, the first work done on the impacts of organics on clay liners for landfills and waste piles/lagoons.

His work on the impacts of hazardous chemical site and municipal/industrial solid waste landfills began in the 1960s when, while directing the Water Chemistry Program in the Department of Civil and Environmental Engineering at the University of Wisconsin-Madison, he became involved in the review of the impacts of municipal solid waste landfills on groundwater quality.

In the 1970s, while he was Director of the Center for Environmental Studies at the University of Texas at Dallas, he was involved in the review of a number of municipal solid and industrial (hazardous) waste landfill situations, focusing on the impacts of releases from the landfill on public health and the environment.

In the early 1980s while holding a professorship in Civil and Environmental Engineering at Colorado State University, he served as an advisor to the town of Brush, Colorado, on the potential impacts of a proposed hazardous waste landfill on the groundwater resources of interest to the community. Based on this work, he published a paper in the Journal of the American Water Works Association discussing the ultimate failure of the liner systems proposed for that landfill in preventing groundwater pollution by landfill leachate. In 1984 this paper was judged by the Water Resources Division of the American Water Works Association as the best paper published in the journal for that year.

In the 1980s, he conducted a comprehensive review of the properties of HDPE liners of the type being used today for lining municipal solid waste and hazardous waste landfills with respect to their compatibility with landfill leachate and their expected performance in containing waste-derived constituents for as long as the waste will be a threat.

In the 1980s while he held the positions of Director of the Site Assessment and Remediation Division of a multi-university consortium hazardous waste research center and Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology, he was involved in numerous situations concerning the impact of landfilling of municipal solid waste on public health and the environment. He has served as an advisor to the states of California, Michigan, New Jersey and Texas on solid waste regulations and management. He was involved in evaluating the potential threat of uranium waste solids from radium watch dial painting on groundwater quality when disposed of by burial in a gravel pit. The public in the area of this state of New Jersey proposed disposal site objected to the State's proposed approach. Dr. Lee provided testimony in litigation, which caused the judge reviewing this matter to prohibit the State from proceeding with the disposal of uranium/radium waste at the proposed location.

Dr. Lee's expertise includes surface and ground water quality evaluation and management. This expertise is based on academic course work, research conducted by Dr. Lee and others and consulting activities. He has served as an advisor to numerous governmental agencies in the US and other countries on water quality issues. Further, he has served on several editorial boards for professional journals, including *Ground Water*, *Environmental Science and Technology*, *Environmental Toxicology and Chemistry*, etc. Throughout his over-45-year professional career, he has been a member of several professional organization committees, including chairing the American Water Works Association national Quality Control in Reservoirs Committee and the US Public Health Service PCBs in Drinking Water Committee.

Beginning in the 1960s, while a full-time university professor, Dr. Lee was a part-time private consultant to governmental agencies, industry and environmental groups on water quality and solid and hazardous waste and mining management issues. His work included evaluating the impacts of a number of municipal and industrial solid waste landfills. Much of this work was done on behalf of water utilities, governmental agencies and public interest groups who were concerned about the impacts of a proposed landfill on their groundwater resources, public health and the environment.

In 1989, he retired after 30 years of graduate-level university teaching and research and expanded the part-time consulting that he had been doing with governmental agencies, industry and community and environmental groups into a full-time activity. A principal area of his work since then has been assisting water utilities, municipalities, industry, community and environmental groups, agricultural interests and others in evaluating the potential public health and environmental impacts of proposed or existing hazardous, as well as municipal solid waste landfills. He has been involved in the review of approximately 85 different landfills and waste piles (tailings) in various parts of the United States and in other countries, including 12 hazardous waste landfills, eight Superfund site landfills and five construction and demolition waste landfills. He has also served as an advisor to a hazardous waste landfill developer and to IBM corporate headquarters and other companies on managing hazardous wastes.

Dr. Anne Jones-Lee (his wife) and he have published extensively on the issues that should be considered in developing new or expanded municipal solid waste and hazardous waste landfills in order to protect the health, groundwater resources, environment and interests of those within the sphere of influence of the landfill. Their over 120 professional papers and reports on landfilling issues provide guidance not only on the problems of today's minimum US EPA Subtitle D landfills, but also on how landfilling of non-recyclable wastes can and should take place to protect public health, groundwater resources, the environment, and the interests of those within the sphere of influence of a landfill/waste management unit. They make many of their publications available as downloadable files from their web site, www.gfredlee.com.

Their work on landfill issues has particular relevance to Superfund site remediation, since regulatory agencies often propose to perform site remediation by developing an onsite landfill or capping waste materials that are present at the Superfund site. The proposed approach frequently falls short of providing true long-term health and environmental protection from the landfilled/capped waste.

In the early 1990s, Dr. Lee was appointed to a California Environmental Protection Agency's Comparative Risk Project Human Health Subcommittee that reviewed the public health hazards of chemicals in California's air and water. In connection with this activity, Dr. Jones-Lee and he developed a report, "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview," that served as a basis for the human health advisory committee to assess public health impacts of municipal landfills.

In 2004 Dr Lee was selected as one of two independent peer reviewers by the Pottstown (PA) Landfill Closure Committee to review the adequacy of the proposed closure of the Pottstown Landfill to protect public health, groundwater resources and the environment for as long as the wastes in the closed landfill will be a threat.

In addition to teaching and serving as a consultant in environmental engineering for over 40 years, Dr. Lee is a registered professional engineer in the state of Texas and a Diplomate in the American Academy of Environmental Engineers (AAEE). The latter recognizes his leadership roles in the environmental engineering field. He has served as the chief examiner for the AAEE in north-central California and New Jersey, where he has been responsible for

administering examinations for professional engineers with extensive experience and expertise in various aspects of environmental engineering, including solid and hazardous waste management.

His work on landfill impacts has included developing and presenting several two-day short-courses devoted to landfills and groundwater quality protection issues. These courses have been presented through the American Society of Civil Engineers, the American Water Resources Association, and the National Ground Water Association in several United States cities, including New York, Atlanta, Seattle and Chicago, and the University of California Extension Programs at several of the UC campuses, as well as through other groups. He has also participated in a mine waste management short-course organized by the University of Wisconsin-Madison and the University of Nevada. He has been an American Chemical Society tour speaker, where he is invited to lecture on landfills and groundwater quality protection issues, as well as domestic water supply water quality issues throughout the United States.

Throughout Dr. Lee's 30-year university graduate-level teaching and research career and his subsequent 16-year private consulting career, he has been active in developing professional papers and reports that are designed to help regulatory agencies and the public gain technical information on environmental quality management issues. Drs. Lee and Jones-Lee have provided a number of reviews on issues pertinent to the appropriate landfilling of solid wastes. Their most comprehensive review of municipal solid waste landfilling issues is what they call the "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," which was originally developed in 1992, and redeveloped and updated in the fall of 2004. Between the two versions they have published numerous invited and contributed papers that provide information on various aspects of municipal solid waste landfilling, with emphasis on protecting public health and the environment from waste components for as long as they will be a threat. The "Flawed Technology" review has been periodically updated, including the most recent update in March 2006, which can be found on their website at <http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf>.

This review provides a comprehensive, integrated discussion of the problems that can occur with minimum-design Subtitle D landfills and landfills developed in accord with state regulations that conform to minimum Subtitle D requirements. The "Flawed Technology" review contains a listing of the various reviews that Drs. Lee and Jones-Lee have developed, as well as peer-reviewed literature. Over 40 peer-reviewed papers are cited in "Flawed Technology" supporting issues discussed in this review.

SUMMARY BIOGRAPHICAL INFORMATION

NAME: G. Fred Lee

ADDRESS: 27298 E. El Macero Dr.
El Macero, CA 95618-1005

DATE & PLACE OF BIRTH: July 27, 1933
Delano, California, USA

TELEPHONE: 530/753-9630
(home/office)

E-MAIL: gfredlee@aol.com

WEBPAGE: <http://www.gfredlee.com>

EDUCATION

Ph.D. Environmental Engineering & Environmental Science, Harvard University,
Cambridge, Mass. 1960
M.S.P.H. Environmental Science-Environmental Chemistry, School of Public Health,
University of North Carolina, Chapel Hill, NC 1957
B.A. Environmental Health Science, San Jose State College, San Jose, CA 1955

ACADEMIC AND PROFESSIONAL EXPERIENCE

Current Position:

Consultant, President, G. Fred Lee and Associates

Previous Positions:

Distinguished Professor, Civil and Environmental Engineering, New Jersey Institute of
Technology, Newark, NJ, 1984-89
Senior Consulting Engineer, EBASCO-Envirosphere, Lyndhurst, NJ (part-time), 1988-89
Coordinator, Estuarine and Marine Water Quality Management Program, NJ Marine
Sciences Consortium Sea Grant Program, 1986
Director, Site Assessment and Remedial Action Division, Industry, Cooperative Center for
Research in Hazardous and Toxic Substances, New Jersey Institute of Technology et al.,
Newark, NJ, 1984-1987
Professor, Department of Civil and Environmental Engineering, Texas Tech University,
1982-1984
Professor, Environmental Engineering, Colorado State University, 1978-1982
Professor, Environmental Engineering & Sciences; Director, Center of Environmental
Studies, University of Texas at Dallas, 1973-1978
Professor of Water Chemistry, Department of Civil & Environmental Engineering,
University of Wisconsin-Madison, 1961-1973

Registered Professional Engineer, State of Texas, Registration No. 39906

Diplomate, American Academy of Environmental Engineers, Certificate No. 0701

PUBLICATIONS AND AREAS OF ACTIVITY

Published over 1,100 professional papers, chapters in books, professional reports, and similar materials. The topics covered include:

- Studies on sources, significance, fate and the development of control programs for chemicals in aquatic and terrestrial systems.
- Analytical methods for chemical contaminants in fresh and marine waters.
- Landfills and groundwater quality protection issues.
- Impact of landfills on public health and environment.
- Environmental impact and management of various types of wastewater discharges including municipal, mining, electric generating stations, domestic and industrial wastes, paper and steel mill, refinery wastewaters, etc.
Stormwater runoff water quality evaluation and BMP development for urban areas and highways.
- Eutrophication causes and control, groundwater quality impact of land disposal of municipal and industrial wastes, environmental impact of dredging and dredged material disposal, water quality modeling, hazard assessment for new and existing chemicals, water quality and sediment criteria and standards, water supply water quality, assessment of actual environmental impact of chemical contaminants on water quality.

LECTURES

Presented over 760 lectures at professional society meetings, universities, and to professional and public groups.

GRANTS AND AWARDS

Principal investigator for over six million dollars of contract and grant research in the water quality and solid and hazardous waste management field.

GRADUATE WORK CONDUCTED UNDER SUPERVISION OF G. FRED LEE

Over 90 M.S. theses and Ph.D. dissertations have been completed under the supervision of Dr. Lee.

ADVISORY ACTIVITIES

Consultant to numerous international, national and regional governmental agencies, community and environmental groups and industries.

Municipal Solid Waste Landfills and Groundwater Quality Protection Issues Publications

Drs. G. Fred Lee and Anne Jones-Lee have prepared several papers and reports on various aspects of municipal solid waste (MSW) management and hazardous waste management by landfilling, groundwater quality protection issues, as well as other issues of concern to those within a sphere of influence of a landfill. These materials provide an overview of the key problems associated with landfilling of MSW and hazardous waste utilizing lined "dry tomb" landfills and suggest alternative approaches for MSW management that will not lead to groundwater pollution by landfill leachate and protect the health and interests of those within the sphere of influence of a landfill. Copies of many of these papers and reports are available as downloadable files from Drs. G. Fred Lee's and Anne Jones-Lee's web page (<http://www.gfredlee.com>). Recent papers and reports on landfilling issues are listed below. Copies of the papers and reports listed below as well as a complete list of publications on this and related topics are available upon request.

Overall Problems with "Dry Tomb" Landfills

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 March (2006). <http://www.members.aol.com/apple27298/SubtitleDFlawedTechPap.pdf>

Lee, G. F., and Jones-Lee, A., "Municipal Solid Waste Landfills – Water Quality Issues," Water Encyclopedia: Water Quality and Resource Development, Wiley, Hoboken, NJ, pp 163-169 (2005). <http://www.members.aol.com/annejlee/WileyLandfills.pdf>

Lee, G. F. and Jones-Lee, A., "Overview of Subtitle D Landfill Design, Operation, Closure and Postclosure Care Relative to Providing Public Health and Environmental Protection for as Long as the Wastes in the Landfill will be a Threat," Report of G. Fred Lee & Associates, El Macero, CA (2004). <http://www.gfredlee.com/LFoverviewMSW.pdf>

Lee, G. F. and Jones, R.A., "Municipal Solid Waste Management: Long-Term Public Health and Environmental Protection," University of California, Davis, Landfills and Groundwater Quality Short Course Materials, April (1991). <http://www.members.aol.com/annejlee/MSWMANAGT.pdf>

Lee, G. F., "Comments on GeoSyntec Consultants' Draft Report 'Landfill Facility Compliance Study Task 8 Report-Summary of Findings and Comprehensive Recommendations,' Dated May 2004," Comments Submitted to CIWMB by G. Fred Lee & Associates, El Macero, CA, June (2004). <http://www.members.aol.com/duklee2307/GeoSyntecTask8-Comments.pdf>

Lee, G. F., "Comments on GeoSyntec Consultants' Draft Report 'Landfill Facility Compliance Study Task 8 Report-Summary of Findings and Comprehensive Recommendations,' Dated May 2004," Comments Submitted to CIWMB by G. Fred Lee & Associates, El Macero, CA, June (2004). <http://www.members.aol.com/duklee2307/GeoSyntecTask8-Comments.pdf>

Lee, G. F., "Comments on the California Integrated Waste Management Board Landfill Facility Compliance Study," Comments Submitted to CIWMB by G. Fred Lee & Associates, El Macero, CA, November (2003). <http://www.gfredlee.com/CIWMBcomments11-20-03.pdf>

Lee, G. F., "Comments on the California Integrated Waste Management Board Landfill Facility Compliance Study Phase I Report - Results of Screening of 224 California MSW Landfills, Developed by GeoSyntec Consultants, Inc., December 2003," Comments Submitted to CIWMB by G. Fred Lee & Associates, El Macero, CA, January (2004). <http://www.gfredlee.com/CIWMBCompliance Study comments.pdf>

Lee, G. F., "Solid Waste Management: USA Lined Landfilling Reliability," An invited submission for publication in *Natural Resources Forum*, a United Nations Journal, New York, NY, December (2002). <http://www.gfredlee.com/UNpaper-landfills.pdf>

Lee, G. F., "Deficiencies in the US EPA's Characterization of the Protection Provided by Subtitle D Landfilling of MSW," Report of G. Fred Lee & Associates, El Macero, CA, March (2003). <http://www.gfredlee.com/USEPApropaganda.pdf>

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<http://www.gfredlee.com/brownfield.html>

Landfills Evaluated by G. Fred Lee and Anne Jones-Lee

Arizona <i>(State Landfilling Regulations)</i>	Verde Valley - Copper Tailings Pile Closure Mobile – Southpoint Landfill
California <i>(State Landfilling Regulations)</i>	Colusa County - CERRS Landfill San Gabriel Valley - Azusa Landfill (Superfund Site) City of Industry - Puente Hills Landfill North San Diego County, 3 landfills San Diego County - Gregory Canyon Landfill El Dorado County Landfill Yolo County Landfill Half Moon Bay - Apanolio Landfill Pittsburg - Keller Canyon Landfill Chuckwalla Valley - Eagle Mountain Landfill Mountain View – Mountain View Landfill Barstow - Hidden Valley (Hazardous Waste) Mohave Desert - Broadwell Landfill (Hazardous Waste) Cadiz - Bolo Station-Rail Cycle Landfill University of California-Davis Landfills (4) (3 Superfund Site) San Marcos - San Marcos Landfill Placer County - Western Regional Sanitary Landfill Placer County – Turkey Carcass Disposal Pits Imperial County - Mesquite Landfill Los Angeles County - Calabasas Landfill and Palos Verdes Landfill Contra Costa County – Concord Naval Weapons Station Tidal LF (Superfund) Nevada County - Lava Cap Mine Area Landfill (Superfund Site) Sylmar - Sunshine Canyon Landfill Roseville - Roseville Landfill San Diego County – Campo Landfill
Colorado <i>(State Landfilling Regulations)</i>	Last Chance/Brush – (Hazardous Waste Landfill) Denver - Lowry (Hazardous Waste Landfill) Telluride/Idarado Mine Tailings
Delaware	Various MSW landfills – Evaluate past disposal of industrial wastes
Florida	Alachua County Landfill
Georgia	Meriwether County – Turkey Run Landfill Hancock County – Culverton Plantation Landfill
Illinois <i>(State Landfilling Regulations)</i>	Crystal Lake - McHenry County Landfill Wayne County Landfill Kankakee County – Kankakee Landfill Peoria County – Peoria Waste Disposal (Hazardous Waste)
Indiana <i>(State Landfilling Regulations)</i>	Posey County Landfill New Haven-Adams Center Landfill (Hazardous Waste)
Louisiana	New Orleans vicinity - Gentilly Landfill
Michigan <i>(State Landfilling Regulations)</i>	Menominee Township - Landfill Ypsilanti- Waste Disposal Inc. (Hazardous Waste - PCB's)
Minnesota	Reserve Mining Co., Silver Bay - taconite tailings Wright County - Superior FCR Landfill
Missouri	Jefferson County - Bob's Home Service (Hazardous Waste)

New Jersey	Fort Dix Landfill (Superfund Site) Cherry Hill – GEMS (Superfund Site) Lyndhurst - Meadowlands Landfill Scotch Plains Leaf Dump
New York	Staten Island - Fresh Kills Landfill, Niagara Falls Landfill – (Hazardous Waste), New York City – Ferry Point Landfill
North Dakota	Turtle River Township - Grand Forks Balefill Facility Landfill
Ohio	Clermont County - BFI/CECOS Landfill (Hazardous Waste) Huber Heights - Taylorville Road Hardfill Landfill (C&DD) Morrow County – Washington and Harmony Townships C&DD Landfills
Pennsylvania	Pottstown – Pottstown Landfill
Rhode Island	Richmond – Landfill (C&D)
South Carolina	Spartanburg - Palmetto Landfill
Texas	Dallas/Sachse – Landfill Fort Worth - Acme Brick Landfill (Hazardous Waste) City of Dallas - Jim Miller Road Landfill Pasadena – Mobil Mining and Minerals industrial waste pile
Vermont	Coventry, Vermont - Coventry Landfill
Washington	Tacoma - 304th and Meridian Landfill
Wisconsin	Madison and Wausau Landfills
INTERNATIONAL LANDFILLS	
Belize	Mile 27 Landfill
Ontario, Canada <i>(Prov. Landfilling Regulations)</i>	Greater Toronto Area - Landfill Siting Issues Kirkland Lake - Adams Mine Site Landfill Pembroke - Cott Solid Waste Disposal Areas
Manitoba, Canada	Winnipeg Area - Rosser Landfill
New Brunswick, Canada	St. John's - Crane Mountain Landfill
Nova Scotia, Canada	Sydney Tar Ponds and Coke Ovens Site
England	Mercyside Waste Disposal Bootle Landfill
Hong Kong	Three New MSW Landfills
Ireland	County Cork - Bottlehill Landfill County Clare - Central Waste Management Facility, Ballyduff
Korea	Yukong Gas Co. - Hazardous Waste Landfill
Mexico <i>(Haz. Waste Landfilling Reg.)</i>	San Luis Pontosi Landfill- (Hazardous Waste)
New Zealand	North Waikato Regional Landfill
Puerto Rico	Salinas - Campo Sur Landfill

**Surface and Groundwater Quality Evaluation and Management
and
Municipal Solid & Industrial Hazardous Waste Landfills**

<http://www.gfredlee.com>

Dr. G. Fred Lee and Dr. Anne Jones-Lee have prepared professional papers and reports on the various areas in which they are active in research and consulting including domestic water supply water quality, water and wastewater treatment, water pollution control, and the evaluation and management of the impacts of solid and hazardous wastes. Publications are available in the following areas:

Landfills and Groundwater Quality Protection

Water Quality Evaluation and Management for Wastewater Discharges

Stormwater Runoff, Ambient Waters and Pesticide Water Quality Management Issues,
TMDL Development, Water Quality Criteria/Standards Development and
Implementation

Impact of Hazardous Chemicals -- Superfund

LEHR Superfund Site Reports to DSCSOC

Lava Cap Mine Superfund Site reports to SYRCL
Smith Canal

Contaminated Sediment -- Aquafund, BPTCP, Sediment Quality Criteria

Domestic Water Supply Water Quality

Excessive Fertilization/Eutrophication, Nutrient Criteria

Reuse of Reclaimed Wastewaters

Watershed Based Water Quality Management Programs:

Sacramento River Watershed Program

Delta -- CALFED Program

Upper Newport Bay Watershed Program

San Joaquin River Watershed DO and OP Pesticide TMDL Programs

Stormwater Runoff Water Quality Newsletter

G. Fred Lee Advisory Services

G. Fred Lee & Associates was organized in the late 1960s to cover the part-time consulting activities that Dr. Lee undertook while a full-time university professor. In 1989, when Dr. Lee retired from 30 years of graduate-level teaching and research, he and Dr. Anne Jones-Lee, who was also a university professor, expanded G. Fred Lee & Associates into a full-time business activity. Examples of governmental agencies, consulting firms, citizens groups, industries and others for whom G. Fred Lee has served as an advisor include the following:

U.S. Environmental Protection Agency - Various Locations
Vison, Elkins, Searls, Connally & Smith, Attorneys - Houston, TX
International Joint Commission for the Great Lakes
U.S. Public Health Service - Washington, DC
Attorney General, State of Texas - Austin, TX
Madison Metropolitan Sewerage District - Madison, WI
Great Lakes Basin Commission - Windsor, Ontario
U.S. Army Environmental Hygiene Agency - Edgewood Arsenal, MD
City of Madison - Madison, WI
Council on Environmental Quality - Washington, DC
National Academies of Sciences and Engineering - Washington, DC
Water Quality Board State of Texas - Austin, TX
U.S. General Accounting Office - Washington, DC
U.S. Army Corps of Engineers - Vicksburg, MS
Tennessee Valley Authority - Various locations in Tennessee Valley
National Oceanic & Atmospheric Administration - Various locations
Organization for Economic Cooperation & Development - Paris
Attorney General, State of Illinois - Chicago, IL
State of Texas Hazardous Waste Legislative Committee - Austin
State of New Mexico Environmental Improvement Agency - Santa Fe
New York District Corps of Engineers - New York, NY
San Francisco District Corps of Engineers - San Francisco, CA
Wisconsin Electric Power Company - Milwaukee, WI
WAPORA - Washington, DC
Reserve Mining Company - Silver Bay, MN
United Engineers - Philadelphia, PA
Automated Environmental Systems - Long Island, NY
Procter & Gamble Company - Cincinnati, OH
Inland Steel Development Company - Chicago, IL
Kennecott Copper Corporation - Salt Lake City, UT
U.S. Steel Corporation - Pittsburgh, PA
Nekoosa Edwards, Inc. - WI
Zimpro, Inc. - Rothschild, WI
FMC Corporation - Philadelphia, PA
Acme Brick Company - Forth Worth, TX
Monsanto Chemical Company - St. Louis, MO
Gould, Inc. - Cleveland, OH
Illinois Petroleum Council - Chicago, IL
Inland Steel Corporation - Chicago, IL

Industrial Biotest Laboratories - Northbrook, IL
Wisconsin Pulp & Paper Industries - Upper Fox Valley, WI
Thilmany Pulp & Paper Company - Green Bay, WI
Chicago Park District - Chicago, IL
Nalco Chemical Company - Chicago, IL
Boise Cascade Development Company - Chicago, IL
Foley & Lardner, Attorneys - Milwaukee, WI
Timken & Lonsdorf, Attorneys - Wausau, WI
Strasburger, Price, Kelton, Martin & Unis, Attorneys - Dallas, TX
Rooks, Pitts, Fullagar & Poust, Attorneys - Chicago, IL
Jones, Day, Cockley & Reaves, Attorneys - Cleveland, OH
Sullivan, Hanft, Hastings, Fride & O'Brien, Attorneys - Duluth, MN
Hinshaw, Culbertson, Molemann, Hoban & Fuller, Attnys - Chicago, IL
Colorado Springs - Colorado Springs, CO
Mayer, Brown & Platt, Attorneys - Chicago, IL
Pueblo Area Council of Governments - Pueblo, CO
Platte River Power Authority - Fort Collins, CO
Linguist & Vennum, Attorneys - Minneapolis, MN
Norfolk District Corps of Engineers - Norfolk, VA
Spanish Ministry of Public Works - Madrid, Spain
The Netherlands - Rijkswaterstaat - Amsterdam, The Netherlands
U.S. Department of Energy - Various locations in US
King Industries - Norwalk, CT
Attorney General, State of Florida - Tallahassee, FL
State of Colorado Governor's Office - Denver, CO
Cities of Fort Collins, Longmont, and Loveland - CO
E.I. DuPont - Wilmington, DE
Allied Chemical Company - Morristown, NJ
Outboard Marine - Waukegan, IL
Amoco Oil Company - Denver, CO
Appalachian Timber Services - Charleston, WV
Mission Viejo Development - Denver, CO
Fisher, Brown, Huddleston & Gun, Attorneys - Fort Collins, CO
Tom Florczak, Attorney - Colorado Springs, CO
Wastewater Authority - Burlington, VT
Tad Foster, Attorney - Pueblo, CO
Holmes, Roberts & Owen, Attorneys - Denver, CO
Center for Energy and Environment Research - Puerto Rico
City of Brush - Brush, CO
Rock Island District Corps of Engineers - Rock Island, IL
Santo Domingo Water Authority - Dominican Republic
Ministry of Public Works and Environment - Buenos Aires, Argentina
Neville Chemical - Pittsburgh, PA
Fike Chemical Company - Huntington, WV
Stauffer Chemical Company - Richmond, CA
Adolph Coors Company - Golden, CO

Water Research Commission - South Africa
Grinnell Fire Protection Systems - Lubbock, TX
City of Lubbock Parks Department - Lubbock, TX
National Planning Council - Amman, Jordan
City of Olathe - Olathe, KS
City of Lubbock - Lubbock, TX
US AID - Amman, Jordan
Buffalo Springs Lake Improvement Association - Buffalo Springs, TX
Union Carbide Company - Charleston, WV
Canadian River Municipal Water Authority - Lake Meredith, TX
Mobil Chemical Company - Pasadena, TX
Unilever Ltd. - Rotterdam, The Netherlands
Brazos River Authority - Waco, TX
U.S. Army Construction Engineering Research Laboratory - Champaign, IL
James Yoho, Attorney - Danville, IL
Zukowsky, Rogers & Flood, Attorneys - Crystal Lake, IL
State of California Water Resources Control Board - Sacramento
Public Service Electric & Gas - Newark, NJ
Health Officer - Boonton Township, NJ
Scotland & Robeson Counties - Lumberton, NC
International Business Machines Corporation - White Plains, NY
Newark Watershed Conservation & Development Authority - NJ
State of Vermont Planning Agency - Montpelier, VT
CDM, Inc. - Edison, NJ
Attorney General, State of North Carolina - Raleigh, NC
City of Vernon - Vernon, NJ
Ebasco Services - Lyndhurst, NJ
Kraft, Inc. - Northbrook IL, with work in Canada, FL and MN
USSR Academy of Sciences - Moscow, USSR
Tillinghast, Collins & Graham, Attorneys - Providence, RI
City of Richmond, RI
Idarado Mining Company - Telluride, CO
Levy, Angstreich, Attorneys - Cherry Hill, NJ
Newport City Development - Jersey City, NJ
Orbe, Nugent & Collins, Attorneys - Ridgewood, NJ
Schmeltzer, Aptaker & Shepard, Attorneys - Washington, DC
CP Chemical - Sewaren, NJ
Dan Walsh, Attorney - Carson City, NJ
William Cody Kelly - Lake Tahoe, NV
NJ Department of Environmental Protection - Trenton, NJ
Hufstedler, Miller, Kaus & Beardsley, Attorneys - Los Angeles, CA
Main San Gabriel Basin Watermaster - CA
Metropolitan Water District of Southern California - Los Angeles, CA
San Diego Unified Port District - San Diego, CA
Delta Wetlands - CA
Simpson Paper Company - Humboldt County, CA

City of Sacramento - CA
Northern California Legal Services - Sacramento, CA
Rocketdyne - Canoga Park, CA
RR&C Development Co. - City of Industry, CA
American Dental Association - Chicago, IL
Emerald Environmental - Phoenix, AZ
Clayton Chemical Company - Sauget, IL
Stanford Ranch - Rocklin, CA
Public Liaison Committee - Kirkland Lake, Ontario
Miller Brewing Company, Los Angeles, CA
ASARCO Inc., Tacoma, WA
CALAMCO, Stockton, CA
Yunkong Gas Company, South Korea
Sutherlands, Pembroke, Ontario
Silverado Constructors, Irvine, CA
Agricultural Interests in Puerto Rico
City of Winnipeg, Manitoba
Strain Orchards, Colusa, CA
Davis South Campus Superfund Oversight Committee, Davis, CA
Monterrey County, California Housing Authority, Salinas, CA
CROWD, Tacoma, WA
Newport Beach, CA
SOLVE, Phoenix, AZ
Sports Fishing Alliance, San Francisco, CA
Caltrans (California Department of Transportation)
Citizens Group near St. John's, New Brunswick
Colonna Shipyards, Norfolk, VA
Clermont County, OH
Wright County, MN
Waikato River Protection Society, New Zealand
Drobac & Drobac, Attorneys, Santa Cruz, CA
Phelps Dunbar, L.L.P., Houston, TX
Walters Williams & Co, New Zealand
Environmental Protection Department, Hong Kong
NYPRIG New York City, NY
DeltaKeeper, Stockton
City of Stockton, CA
Central Valley Regional Water Quality Board, Sacramento, CA
Carson Harbor Village, Carson, CA
Sanitary District of Hammond, IN
South Bay CARES, Los Angeles, CA
Memphremagog Regional Council, Quebec, CANADA
Mobile, AZ
Pottstown Landfill Closure Committee, Pottstown, PA
Grand Forks County Citizens Coalition, Grand Forks, ND
Sunshine Canyon Landfill, Sylmar, CA
Meriwether County, GA
Hancock County, GA

Louisiana Environmental and Action Network, Baton Rouge, LA
OUTRAGE and POWER, Kankakee, IL
John Cobey et al., Morrow County, OH
Heart of Illinois Sierra Club and Peoria Families Against Toxic Waste, Peoria, IL
Sierra Club of Canada, Cape Breton Group, Nova Scotia
Backcountry Against Dumps, Boulevard, CA