Review of Potential Public Health & Groundwater Quality Impacts of the Proposed Jungo Landfill

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Nevada Land and Resource, Inc. of Carson City, NV (owner) and Recology of San Francisco, CA (operator) have proposed to construct and operate a Class I municipal solid waste (MSW) landfill facility, referred to as the Jungo Landfill, approximately 25 miles west of the city of Winnemucca, NV. The Nevada Division of Environmental Protection (NDEP) Bureau of Waste Management provides information concerning that proposed landfill and its permitting process for that landfill at various locations on the Internet including:

- NDEP "Proposed Jungo Landfill" Webpage, dated October 27, 2011 [http://ndep.nv.gov/bwm/jungo.htm]
- NDEP "Fact Sheet" http://ndep.nv.gov/docs_11/jungo_fact_sheet-2011.pdf
- Report of Design of Landfill http://ndep.nv.gov/bwm/docs/report_of_design.pdf
- Draft Permit http://ndep.nv.gov/docs_11/jungo_permit_draft-2011.pdf
- Plan of Operation http://ndep.nv.gov/bwm/docs/jungo_plan_operations.pdf

Presented below are excerpts from the above-named documents to highlight key characteristics and other aspects of the proposed landfill that are of concern relative to ensuring protection of public health and environmental quality for as long as the wastes are a threat; specific comments are offered on some of those issues. In these comments reference is made to more in-depth discussion of some of the issues in our "Flawed Technology" review of MSW landfilling practices and their ability to provide protection of public health and environmental quality for as long as the wastes represent a threat. That review is available as:

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

NDEP Fact Sheet

According to the Nevada Department of Environmental Protection (NDEP) "Fact Sheet" about the site [http://ndep.nv.gov/docs_11/jungo_fact_sheet-2011.pdf]:

"Description of Proposed Permit Issuance
Nevada Land and Resource Inc. has requested to construct and operate a Class I Landfill in Humboldt County Nevada. The Landfill will be constructed with a double liner with leachate collection and groundwater monitoring for the life of the landfill. Post closure care and monitoring will continue for 30 years upon final closure of the site. The Jungo Disposal Site serves as a regional disposal site for portions of Northern California generally including the nine counties which make up the San Francisco Bay Area, and tributary communities along the rail route. Refuse will be delivered to the site by rail at an estimated average annual rate of up to 4,000 tons/day. The Jungo Disposal Site is located approximately 25 miles west of Winnemucca,

Nevada. The landfill is located on a 634-acre parcel that consists of Section 7 of Township 35N, Range 33E. The landfill disposal footprint encompasses approximately 562-acres.

Proposed Action
The Nevada Division of Environmental Protection (NDEP) is proposing to approve and issue a Permit to Nevada Land and Resource Inc. for the Construction and Operation of a Class I Landfill in Humboldt County Nevada."

Sections of the October 2011 Nevada Department of Environmental Protection (NDEP) draft permit for the Jungo Landfill [http://ndep.nv.gov/docs_11/jungo_permit_draft-2011.pdf] are quoted and commented upon below:

"1 FACILITY SUMMARY
The Jungo Disposal Site serves as a regional disposal site for portions of Northern California generally including the nine counties which make up the San Francisco Bay Area, and tributary communities along the rail route. Refuse will be delivered to the site by rail at an estimated average annual rate of up to 4,000 tons/day. The Jungo Disposal Site is located approximately 25 miles west of Winnemucca, Nevada. The landfill is located on a 634-acre parcel that consists of Section 7 of Township 35N, Range 33E. The landfill disposal footprint encompasses approximately 562-acres.

1.1 GENERAL DESCRIPTION
The Landfill is on land designated as Agricultural use, approximately 25 miles to the west of the City of Winnemucca. The 562 acre Class I landfill unit is required to conduct Groundwater Monitoring, Methane Monitoring and will conduct Closure and Post Closure activities concurrent with landfill development. ***The Landfill will perform 30 years of Post-Closure care and monitoring.****"* [emphasis added]

"1.4 FACILITY DESIGN

Permitted Design Summary
Table 1

Class I	*Rev 00*
Disposal Area (acres)	*562*
Maximum Elevation (amsl)	*4375*
Minimum Elevation (amsl)	*4150*
Disposal Capacity (yds^3)	*$97(10^6)$*
Total Volume (yds^3)	*$111(10^6)$*

As discussed in these comments the proposed Jungo Landfill will be a very large MSW landfill that will if permitted be a significant threat to pollute groundwater in the area of the landfill.

"2.2 PERMIT ACTIONS (NAC 444.643)
This Permit is based upon the information submitted in the Permit application, and as approved by the Nevada Division of Environmental Protection (Division)."

NDEP's webpage devoted to the "Proposed Jungo Landfill," dated October 27, 2011, [http://ndep.nv.gov/bwm/jungo.htm] provides general information about surficial physical characteristics and climate of the proposed site, and links to resource documents and landfill application documents. It states:
"About This Webpage – This webpage provides information about the Division of Environmental Protection's (NDEP) permitting process to construct and operate a Class I municipal solid waste landfill facility at the Jungo disposal site located in Humboldt County, Nevada. The Jungo Disposal Site is located approximately 30 miles west of Winnemucca, Nevada along Jungo Road."

In the website's section on the "Climate and Hydrology" of the proposed landfill area, it is reported:
"Mean annual precipitation is estimated to be approximately 8 inches."
"Based on data from Rye Patch Reservoir located 14 miles to the south, evaporation from free water sources is approximately 48-inches per year (Cohen, 1965). The prevailing wind direction in Desert Valley is toward the west-southwest. The 25-year, 24-hour storm event is estimated to be 1.62 inches (NOAA, 2006)."

The NDEP stated in the "Topography and Drainage" section:
"*Precipitation or snow melt on the valley floor accumulates in localized depressions until it infiltrates or evaporates. At the Jungo Disposal Site, these shallow depressions are on the order of several inches deep. During normal precipitation events, water accumulates in the depressions until it evaporates or infiltrates into the subsurface soils.*

In the event of intense storms, it is possible that localized depressions may fill and then sheet flow to the next depressions located to the north or west. This is consistent with the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (2007), which estimates that ponding may occur locally to depths of 6 to 12 inches."

Jungo Draft Permit
The NDEP draft permit for the Jungo Landfill states in Section 2.4:
"*2.4 COMPLIANCE WITH STATUTES AND REGULATIONS*
The Permittee shall comply with NRS 444.440 through 444.620, and NAC 444.570 through 444.7499, as applicable."
A subsequent section of these comments discusses the NDEP regulations for this landfill relative to their providing protection of public health and groundwater quality, and from other potential impacts of this proposed landfill. As discussed in these comments the proposed landfill will fall far short of the regulatory requirement to provide protection of groundwater quality.

Approach to Jungo Landfill Impact Review
For the past five decades I (G. Fred Lee) have been involved in reviewing and researching the impacts of MSW landfills and the ability of various waste management systems to protect public

health and environmental quality from adverse impacts of the wastes. I have examined the nature, impacts, and reasonably expected impacts of more than 85 existing and proposed solid waste landfill systems in the US, Canada, and several other countries. Based on my university research on landfill liners and the investigation of landfill impacts I have developed more than 100 professional papers and reports on these issues. This experience has led to a systematic approach to evaluating potential impact of a proposed landfill focusing on the following issues:

- Suitability of the site for the proposed landfill
- Type of landfilling approach, e.g., "dry tomb" or "wet cell"
- Adequacy of the design of the landfill waste containment system, including the liner, leachate collection and removal system, landfill cover, groundwater monitoring system, landfill gas management and monitoring system, for protecting public health and environmental/groundwater quality
- Reliability and adequacy of closure plans
- Reliability and adequacy of the postclosure funding for landfill monitoring and maintenance for as long as the waste in the landfill will be a threat
- Adequacy of minimum regulatory requirements for providing for protection of public health, groundwater and surface water quality, and the interests of those within the sphere of influence of the landfill for as long as the wastes in the landfill will be a threat.

This review of the potential impacts of the proposed Jungo Landfill addresses each of these issues. It is based and focused on landfill siting and design information for the proposed landfill that is provided on the NDEP website for the Jungo Landfill [http://ndep.nv.gov/bwm/jungo.htm].

Out of our academic background and professional expertise and experience in researching and investigating impacts and potential impacts of individual landfills, we have developed our "Flawed Technology" review report. In that report, we synthesize and discuss the key elements of landfilling as it is practiced, and strengths and weaknesses of those practices for ensuring the protection of public health, groundwater and surface water quality, and the interests of those within the sphere of influence of the landfill for as long as the wastes in the landfill will be a threat. About 150 references to the professional literature on anticipated potential impacts of US EPA Subtitle D landfills are included in our approximately 100-page discussion of these issues. The "Flawed Technology" review is available as:

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

In our comments presented herein we make reference to sections of this "Flawed Technology" review for further technical information and references to the professional literature on the topics being discussed.

Qualifications to Provide Comments

Information on Drs. G. Fred Lee and Anne Jones-Lee's qualifications to provide these comments is summarized below. Dr. Lee earned his bachelor's degree in environmental health sciences from San Jose State College in San Jose, CA in 1955. His undergraduate education included work on public health aspects of landfilling of municipal solid wastes. He earned his Master of Science in Public Health degree from the University of North Carolina, Chapel Hill, NC in 1957,

and his PhD degree in Environmental Engineering from Harvard University in 1960 where he minored in public health protection and aquatic chemistry. Both his master's and PhD degree work included studies on water quality, public health protection, and waste management.

For 30 years Dr. Lee held teaching and research positions in graduate-level environmental engineering/environmental science programs at several major US universities. During that time he conducted more than $5 million in research and published more than 500 papers and reports on various aspects of water quality and impacts of chemical contaminants on public health and environmental quality. His work included investigating numerous municipal solid waste landfills and conducting research for the US EPA and others on landfill liner properties. In 1989 Dr. Lee retired from university teaching and research, and expanded his part-time, private consulting activities into a full-time business. He was joined in that work by his wife, Dr. Anne Jones-Lee, who at that time held an associate professorship in environmental engineering/ science.

In the 1970s while a university professor, Dr. G. Fred Lee was asked by the US EPA to undertake research on landfill liner integrity and the ability of such liners to prevent penetration of waste-derived chemicals. Over the past 40 years he has been active in investigating and reviewing the literature developed by others on the ability of plastic sheeting liners/covers to be effective in "dry tomb" type landfills to prevent the release of leachate through the liner over the time that the wastes in the landfill will be a threat. They have been active in investigating more than 85 municipal solid waste landfills located in various parts of the US and other countries. Drs. Lee and Jones-Lee have been active in developing publications on issues affecting the ability of "dry tomb" type landfills to protect public health, groundwater resources, environmental quality, and the interests of those in the sphere of influence of the landfill; they have developed more than 120 papers and reports on these issues. Many of those papers and reports are available on their website, www.gfredlee.com, in the Landfill Groundwater section at http://www.gfredlee.com/plandfil2.htm. An area of particular concern in my investigation of MSW landfills are the processes that occur in a landfill that impact the potential impact of the wastes to pollute the environment. Of particular concern are the processes that lead to landfill gas formation and the leaching of the wastes to be present in water (leachate) that penetrates through the wastes. Additional information on their qualification to provide these comments is provided in the appendix to these comments.

Dr, G. Fred Lee was provided a guided tour of the proposed landfill area by Mike MacDonald Humboldt District Attorney on the afternoon of December 1, 2011.

Ownership of the Jungo Landfill

The "Application for a Permit to Construct and Operate a Class I Landfill Facility Jungo Disposal Site, Humboldt County, Nevada" that is dated July 2011 states that the Jungo Landfill will be developed by Nevada Land and Resource LLC of Carson City, Nevada/Recology of San Francisco, California. However, the "Application for a Permit to Construct and Operate a Class I Landfill Facility, Jungo Disposal Site, Humboldt County, Nevada , Volume Ill, Plan Of Operations," Revision 4, Prepared for Jungo Land & Investments, Inc. by Golder Associates Inc. (July 2011) [http://ndep.nv.gov/bwm/docs/jungo_plan_operations.pdf] states:

"Jungo Land & Investments, Inc. (JLII), the landfill owner and operator, is submitting the following Plan of Operations for a Class I municipal solid waste disposal site as required by the general provisions for solid waste disposal defined in the Nevada Administrative Code (NAC 444.684)."
On page 1 of that document, Section 1.1 Site Description states:
"The facility will be operated by JLII in accordance with applicable State of Nevada solid waste regulations. The land is currently owned by Nevada Land and Resources, Inc. but will be acquired by JLII prior to development. JLII currently has a leasehold interest with an option to purchase the property, which JLII plans to exercise once the necessary State permits have been obtained."
It is unclear which organization (Nevada Land and Resource LLC of Carson City, Nevada/Recology and/or Jungo Land & Investments, Inc. (JLII)) will be responsible for care of the landfill to provide protection of public health and groundwater quality for as long as the landfill will be a threat to pollute groundwater or cause other adverse environmental impacts of the landfill.

Design of the Proposed Jungo Landfill
The design proposed for the Jungo Landfill is presented on the NDEP website as, "Application for a Permit to Construct and Operate a Class I Landfill Facility, Jungo Disposal Site, Humboldt County, Nevada, Report of Design Revision 5, Prepared for Jungo Land and Investments, Inc. Prepared by Golder Associates Inc. Roseville, CA dated April/July 2011." [http://ndep.nv.gov/bwm/docs/report_of_design.pdf]
Comments on that application are provided below.

The first phase of the review of the potential impact of a proposed landfill is an evaluation of the type of landfill containment system, i.e., "dry tomb" or "wet cell" design. A key difference between those two types of landfills is the length of time during which the landfill containment system, liner, cover, gas management system, monitoring, closure and postclosure systems and approaches must function as intended and prevent the release of hazardous and otherwise deleterious chemicals in the MSW to the environment. A "dry tomb" type landfill relies on the concept that as long as the MSW in the landfill are kept dry there will be no landfill gas or leachate generation. Both gas generation and leachate production processes require that liquid interact with the waste; water in contact with fermentable organics will result in the production of landfill gas, and liquid in contact with wastes will leach leachable components to generate leachate. While in principle such a "dry tomb" landfilling approach can offer protection of public health, groundwater resources and the environment from pollution by waste-derived chemicals, the approach relies on the ability of the containment systems to keep the wastes dry essentially forever. This is because without fermentation and leaching processes acting on the buried MSW, the hazardous and otherwise deleterious components simply remain entombed; those components do not become non-hazardous or non-deleterious just by the passage of time. Thus, as long as the buried wastes are kept dry, they are a threat to generate leachate and landfill gas effectively forever for hundreds to a thousand years or more.

In current practice the landfill liner and cover are composed of plastic sheeting and clay layers, which are relied upon to keep the wastes in the "dry tomb" dry. The plastic sheeting layer, typically LDPE in the landfill cover, deteriorates over time and allows water to penetrate through

the cover and enter the wastes where it generates leachate. The landfill liner typically consists of a layer of plastic sheeting (HDPE) and a compacted clay layer under the plastic sheeting. At best, those systems can be effective in keeping the wastes dry for a comparatively short period of time compared to the time that the wastes in a dry tomb type landfill will be a threat to generate landfill gas and leachate. Thus, even if those systems were well-designed and well-constructed, over time their ability to keep the wastes dry will deteriorate; they will not be amenable to ready and thorough inspection, maintenance, and repair as they will be buried beneath the wastes or cover layers.

Similarly, the systems designed to contain/collect leachate and manage landfill gas will function for a short period of time compared to the duration of time that the wastes in a "dry tomb" type landfill will be a threat to generate leachate and landfill gas. It has been well-established that plastic sheeting HDPE layers deteriorate over time and their "low permeability" properties diminish, decreasing the ability of the liner systems to collect all leachate that can be generated in the landfill when water enters the landfill through a landfill cover.

It was recognized by some in the technical community in the early 1980s when the regulations requiring "dry-tomb"-type landfills were promulgated by the US EPA, and is now widely recognized, that in practice the "dry tomb" landfilling approach is seriously flawed for the protection of groundwater quality; it only serves to postpone release of waste-derived constituents to the environment.

The proposed Jungo Landfill is a "dry tomb" type landfill, with plastic sheeting and compacted clay liner and cover; many of the deficiencies discussed on our "Flawed Technology" review characterize are applicable to the ability of this landfill to provide public health and groundwater resources protection in the vicinity of the proposed landfill for as long as the wastes in the landfill will be a threat.

The NDEP "Fact Sheet" on the proposed Jungo Landfill,
[http://ndep.nv.gov/docs_11/jungo_fact_sheet-2011.pdf] states:
"Proposed Action
The Nevada Division of Environmental Protection (NDEP) is proposing to approve and issue a Permit to Nevada Land and Resource Inc. for the Construction and Operation of a Class I Landfill in Humboldt County Nevada."

The Fact Sheet *"Description of Proposed Permit Issuance"* section states:
"Post closure care and monitoring will continue for 30 years upon final closure of the site."

Section 1.1 of NDEP's October 2011 draft permit for Jungo Landfill
[http://ndep.nv.gov/docs_11/jungo_permit_draft-2011.pdf] states in the "General Description":
"The Landfill will perform 30 years of Post-Closure care and monitoring." emphasis added

The postclosure care and monitoring period begins once the landfill or parts thereof is closed and no longer accepts wastes. Thus for the 30 years following closure of the Jungo Landfill, Recology-Nevada Land and Resource LLC, and/or Jungo Land & Investments, Inc. would be required to provide postclosure monitoring, maintenance and groundwater remediation when the

landfill liners fail to collect the leachate that is generated in the landfill when the landfill cover no longer prevents water from entering the wastes that generates leachate and landfill gas that has the potential to pollute the area of the landfill with hazardous and otherwise deleterious chemicals derived from the MSW. However, it could be reasonably anticipated that with careful design and construction, the generation of landfill leachate, or at least the evidence of leakage of leachate from the landfill, could be delayed for several decades. It could turn out that the leakage and pollution problems that will inevitably arise from the dry tomb Jungo Landfill are delayed until the after the 30-yr postclosure period has passed.

While this situation is allowed in the NDEP landfilling regulations it can be strongly adverse to the people in Humboldt County, NV where the Jungo Landfill is proposed to be located. The consequences of the development of the proposed Jungo Landfill, with the very limited period of responsibility for protection of public health of current and future residents, groundwater resources, and other issues of importance to Humboldt County and the state of Nevada, should be understood as part of permitting this landfill. As presently proposed with this draft permit, Recology-Nevada Land and Resource LLC, Jungo Land & Investments, Inc. will be able to dump large amounts of San Francisco, CA area garbage in Humboldt, NV, make a large amount of money in doing so, and leave the County and the State with a massive liability of impaired public health and destroyed water resources. Since Recology-Nevada Land and Resource LLC will not be required to provide the Superfund-like remediation of the proposed landfill area as this landfill pollutes the area, the County/State and its residents will be left to suffer the impacts and pay for remediation. The costs of those efforts can readily be several tens of millions of dollars. In permitting of this landfill as proposed NDEP will be enabling Recology-Nevada Land and Resource LLC, Jungo Land & Investments, Inc. to reap the benefits of the operation, and enabling the people in the San Francisco Bay area to enjoy garbage disposal for costs less than would be incurred if they were disposed of in CA with its stricter landfilling requirements, while burdening the current and future people of Humboldt County and the state of Nevada with the health, welfare, groundwater resource, and financial consequences.

A subsequent section of these comments discusses the significant deficiencies in the NDEP landfilling regulations that allow Nevada to become a dumping ground for other states' solid wastes. The Jungo Landfill, as proposed, could not be permitted in several other states. In the 1970s California adopted landfilling regulations that require that landfill developers bear the responsibility for developing landfills that will protect groundwater quality for as long as the wastes in the landfill will be a threat. California has recently defined the minimum post closure funding period as 100 years, a period that can be extended if needed.

Following are comments on inadequacies in the proposed landfill location, design, operation, closure, and especially the postclosure funding for monitoring and maintenance for as long as the wastes in this proposed landfill will be a threat.

Comments on "Application for a Permit to Construct and Operate a Class I Landfill Facility, Jungo Disposal Site, Humboldt County, Nevada, Report of Design Revision 5, Volume I" Prepared for Jungo Land and Investments, Inc. by Golder Associates April 2011 [http://ndep.nv.gov/bwm/docs/report_of_design.pdf] (Referred to as "Report of Design")

Pages 2 and 3 of the Report of Design lists how the Jungo Disposal site satisfies a number of NV restrictions for location of Class I landfills, including the following:

- *"NAC 444.678 (2) and (3) The landfill design includes containment systems, controls, and monitoring systems that will prevent uncontrolled migration of landfill gas, control leachate, and prevent degradation of groundwater."*

That statement concerning the alleged protective nature of the proposed Jungo Landfill design is misleading at best. It gives the erroneous impression that the landfill as proposed will be able to contain the MSW waste components within the landfill for as long as the wastes, when contacted by water, will be a threat. This issue was discussed above and is reviewed at length in the "Flawed Technology" review.

- *"NAC 444.678 (9) The nearest surface water body is more than 14 miles from the site. The landfill is located within 100 feet of the uppermost groundwater aquifer. However, to prevent degradation of the groundwater aquifer, the landfill design incorporates extensive protective measures consisting of low-permeability containment systems, conservatively designed leachate control system, and landfill gas control systems. These protective measures are described in Section 2.3."*

That statement regarding the ability of the proposed landfill to prevent degradation of groundwater quality is an unreliable representation of the true protective nature of the proposed Jungo Landfill to prevent groundwater pollution for as long as the wastes in the landfill will be able to generate leachate that will penetrate through the liner and migrate through the unsaturated zone to the groundwater table rendering it unusable for domestic and some other purposes. The technical aspects of this issue were discussed above and is reviewed at length in the "Flawed Technology" review. Details of this assessment are also presented in the discussion of the unreliable information provided by Golder in Section 2.3.

- "*NAC 444.6785- Floodplain: The site is not located within a floodplain. The site is located within a desert basin where precipitation temporarily collects in shallow depressions until it evaporates or infiltrates into the underlying soils."*

That statement is an inadequate and unreliable assessment of the characteristics of the proposed landfill site. As discussed in section 2.1.3 (p. 4) of the Report of Design and in the NDEP discussion of "Topography and Drainage," in times of intense rainfall the area of the landfill can have accumulations of water to a depth of a foot or more. This characteristic causes the site to be similar to one within a floodplain.

A discussion of the site geology begins on page 5 of the Report of Design. The geology in the area of the proposed landfill is complex with multi-layered strata of clays, silts, and sands. The geology of a proposed landfill site is key to providing natural protection of the groundwater quality from pollution by landfill leachate. Based on the information provided by Golder, the geology of this site does not provide natural protection of groundwater quality from pollution of groundwater by landfill leachate when the liner system ultimately fails to prevent leachate penetration.

Page 10 of the Report of Design states in the Ground Water Velocity section:

"*Rising head slug tests were conducted in each well on February 2, 2007 to determine the hydraulic conductivity of the middle sand and silty sand. With these data, hydraulic conductivities were calculated for each well. To determine a hydraulic conductivity for the site, the geometric mean of the four individual well conductivities was calculated. As such, the hydraulic conductivity at the site is estimated to be 1.2 x 10^{-4} cm/s. The slug test data is presented in Appendix D.*

Using the calculated gradient (i), the hydraulic conductivity (K), and the estimated effective porosity of the water-bearing zone (n_e), the approximate groundwater seepage velocity can be calculated using Darcy's Law ($v = Ki/n_e$). An effective porosity value of 0.15 for the sandy zones is assumed, based on information from Cohen (1963). Groundwater seepage velocity beneath the site is estimated to be 2.4 x 10^{-7} cm/s (0.25 feet per year [ft/yr])."

The information on the groundwater horizontal velocity shows that the geology of the area does not provide for protection of offsite groundwater from pollution by leachate-polluted groundwater that will occur under the landfill as the landfill liner systems fail. The information provided is misleading because the hydraulic conductivity was reported as the geometric mean. It is not the mean velocity that defines how fast offsite groundwater stands to be polluted by landfill leachate; it is the fastest velocity that will define the incipient, or first, pollution of offsite groundwater once the groundwater under the landfill is polluted by leachate. The farmer who has a well near the landfill wants to know the earliest estimated time at which his well could be polluted.

Pages 10 and 11 of the Report of Design present information on the vertical gradient of groundwater at the proposed site. This characteristic is important for understanding the ability of geology of the area under the landfill to prevent the transport of leachate to the underlying groundwater at the landfill site. From the information presented in the Report of Design, it is clear that leachate that will eventually penetrate the liner will eventually reach the saturated groundwater under the landfill, i.e., there is effectively no natural protection of the groundwater from pollution by landfill leachate. Under those conditions, the protection of groundwater quality is completely dependent on the integrity of the landfill liner system. As noted previously, and discussed further below, the liner proposed for the Jungo Landfill will not prevent leachate penetration for as long as the wastes in the landfill will be a threat to generate leachate when contacted by water. Further, if this landfill were to be permitted as proposed, postclosure funding would only be assured for 30 years of the hundreds or more years that the wastes in this landfill would be threat to cause groundwater pollution.

Lopes, T. J., "Hydrologic Evaluation of the Jungo Area, Southern Desert Valley, Nevada" Open-File Report 2010–1009 U.S. Department of the Interior U.S. Geological Survey (2010) http://pubs.usgs.gov/of/2010/1009/pdf/ofr20101009.pdf.

The abstract of that USGS (Lopes) report states:
"*On September 22, 2009, the Interior Appropriation (S.A. 2494) was amended to require the U.S. Geological Survey to evaluate the proposed Jungo landfill site for:*
(1) potential water-quality impacts on nearby surface-water resources, including Rye Patch Reservoir and the Humboldt River;

(2) potential impacts on municipal water resources of Winnemucca, Nevada;
*(3) locations and altitudes of aquifers; *
(4) how long it will take waste seepage from the site to contaminate local aquifers; and
(5) the direction and distance that contaminated groundwater would travel at 95 and 190 years.
This evaluation was based on review of existing data and information.
Estimates indicate that contaminants would travel about 0.02 mile and a maximum of 2.5 miles in 95 years and about 0.04 mile and a maximum of 5.0 miles in 190 years. The closest supply wells that could be impacted by contaminants are 5 to 6 miles downgradient and are used for industry, irrigation, and stock watering."

That USGS (Lopez) report states on page 7:
"*Slug tests done on four monitoring wells at the proposed Jungo landfill site had K values that ranged from 0.26 to 0.45 ft/d and averaged 0.34 ft/d (Golder Associates, Inc., 2008, appendix D). Near the proposed Jungo landfill site, the maximum hydraulic conductivity is 50 ft/d (Berger, 1995)."* That statement illustrates the substantial difference between the "average" and the "maximum" hydraulic conductivity at this site; the maximum rate of movement is nearly 150 times faster than the average.

Further, the large range in hydraulic conductivities indicates that only four slug tests for an area with complex geology of the Jungo Landfill site are not adequate to define the hydrological characteristics of the groundwater under the proposed landfill, especially given that the landfill would, if permitted as proposed, be one of the largest landfills in Nevada, and for that matter elsewhere. It has been our experience that a much more comprehensive geotechnical/ hydrological investigation needs to be conducted to adequately characterize the geology/ hydrogeology under and near the landfill.

The 2010 USGS (Lopez) report was not included in the List of References on page 26 of the Report of Design that is dated April 2011.

Another important issue that needs to be considered is that the future generations (forever) that will own land near the proposed landfill will want to be able to use their groundwater resources without adverse impacts of the landfill. No landfill should be allowed to be developed without protecting to a very high degree the future uses of properties near the landfill.

An important issue that needs to be understood is the current distance to the nearest water supply well may not exist in the future. A land owner of adjacent and nearby properties should be able to use his/her land for agricultural and other purposes including developing a water supply well on their property near the property line with the landfill without adverse impacts of the landfill. However the proposed landfill will only have a few hundred feet of buffer land this owned by the landfill developer. This means that wells developed on private property near the landfill can be polluted in a much shorter time than that projected for the existing well. As landfill developer should not be able to control how a adjacent/nearby property uses their land as a result of the landfill developer failing to develop a landfill that will protect the groundwater quality from pollution by landfill leachate for as long as the wastes in the landfill can generate leachate when contacted by water.

While Lopez mentions that some pollutants in MSW leachate can be adsorbed on the aquifer particles and not travel at the same rate as the water, there are some constituents in MSW landfill leachate that are attenuated very little if at all and will move at the rate of water movement.

The conclusion that must be drawn from the limited groundwater flow data available is that when the landfill liners system eventually fails to prevent leachate from entering the underlying aquifer system the groundwater under the landfill will be polluted by hazardous and otherwise deleterious chemicals derived from the MSW. The lateral movement of groundwater under and near the proposed landfill will transport pollutant from the landfill offsite and pollute the groundwaters near the landfill. As discussed in the review of Nevada landfilling regulations presented below, that pollution will violate Nevada landfilling regulations.

In describing "Refuse Quantities and Landfill Capacity" on Page 12, the Report of Design states: "*The site will accept only municipal solid waste (MSW). Typically, MSW from Northern California is processed to remove recyclable or compostable materials including selected metals, plastics, and greenwaste. In addition, a screening program exists to remove hazardous waste before it is loaded into waste containers. The screening program is described in the Operating Plan (Volume Ill).*

The waste will be comprised of residential, commercial and selected special wastes, which will include construction and demolition (C&D) wastes, and waste tires. Wastes will be containerized for rail delivery to the disposal site. At the point of loading, most wastes will be commingled. Exceptions to commingling can include tires and inerts. No hazardous wastes will be accepted."

That manner of describing the wastes that would be disposed of at the Jungo Landfill is highly misleading. It misrepresents the MSW as benign, devoid of "hazardous" components, and not posing a significant threat to pollute the groundwaters with hazardous and otherwise deleterious chemicals or being capable of adversely affecting the health and welfare of people and animals that use that water as a water supply. The fact is that wastes of the types described as being acceptable for disposal at the proposed landfill do contain hazardous and otherwise deleterious chemicals – even if they are not categorized by regulations as "hazardous wastes" – that will produce leachates that can render leachate-containing groundwaters unusable for water supply purposes. Those components include chemicals that are known to cause adverse health effects, chemicals that cause adverse impacts at levels below drinking water MCLs, chemicals for which there are not presently regulatory standards, chemicals whose hazards are not yet recognized, as well as salts and other chemicals that impart tastes, odors, or other qualities to the water that, whether or not they pose a hazard to public health, destroy its utility for water supply.

A detailed discussion of these issues is provided in the "Flawed Technology" review. For example, in the section, "Hazardous versus Non Hazardous Waste Classification," the following passage (page 53) describes "non-conventional" contaminants expected in MSW:
"Non-conventional contaminants are largely organic chemicals that have not been defined, and whose potential hazards to public health and groundwater quality are not known. Typically the organic Priority Pollutants – those organics that are identified and quantified – represent a very small fraction of the total organic matter present in leachate as measured by chemical oxygen demand and total organic carbon. It is estimated that from 90 to 95 percent of the organic

materials in municipal landfill leachate are of unknown composition. Those chemicals have not been identified, and obviously their potential impacts on public health and groundwater quality are unknown."

The following passage on page 55of the "Flawed Technology" review describes the findings of C. Daughton, a US EPA senior scientist, with regard to classifying and describing pollutants:
"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 over 22 million organic and inorganic substances, with nearly 6 million commercially available. The current water quality regulatory approach addresses less than 200 of these chemicals, where in general PPCPs and many other chemicals are not regulated. 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.'"

Despite the Jungo Report of Design's reassuring description of the acceptable waste stream, the MSW that will be accepted at the proposed Jungo Landfill will contain hazardous and otherwise deleterious chemicals that will be a significant threat to human health and the usability of the area groundwater for water supply.

With respect to the acceptance of C&D (construction and demolition) wastes at the proposed Jungo Landfill, it has been well-established that C&D wastes contain hazards chemicals that are a threat to public health and groundwater quality. Issues associated with C&D wastes in landfills are discussed in the "Flawed Technology" review section, "Construction and Demolition Waste Landfilling," on pages 58-63. That discussion includes the passage (page 60):
"Additional information on the potential presence of PCBs in C & D wastes is presented by Lee, and Jones-Lee (2010 d,e). Studies in the San Francisco Bay area have been found that urban stormwater runoff contains sufficient PCBs to contribute to excessive PCBs concentrations in receiving water fish. One of the sources of the PCBs in urban stormwater runoff has been found to be runoff from residential/commercial/industrial demolition areas where there is release of PCBs from caulking compounds used as sealant at wood and concrete joints."

Section 4.2 of the Draft Permit for the proposed Jungo Landfill [http://ndep.nv.gov/docs_11/jungo_permit_draft-2011.pdf] lists the following as "Prohibited Solid Wastes":
"The Permittee is prohibited from placing in the Class I landfill the following wastes:
1. *Liquid waste as defined by NAC 444.692(4)*
2. *Hazardous waste, as defined NAC 444.580 (NRS 459.430)*
3. *PCB waste, as defined by NAC 444.6665*
4. *BioSolids*
5. *Asbestos*

6. Reserved"

That provision is also misleading with regard to materials that will be allowed, or could be placed, in the Jungo Landfill if approved. For example, even though NDEP "prohibits" the disposal of "PCB waste," the acceptance of C&D wastes in the proposed Jungo Landfill will result in the deposition of PCBs in the landfill since, as discussed earlier, PCBs are known to be present in some C&D wastes. As discussed elsewhere in these comments as well as in the "Flawed Technology" review, the fact that materials classified as "hazardous waste" are prohibited does not mean that no chemicals or materials that are hazardous or otherwise deleterious to public health/welfare or groundwater quality will be allowed in the landfill, or that all materials that are accepted cannot adversely affect public health/welfare or groundwater quality.

Page 12 of the Report of Design states:
"The maximum refuse thickness is 200 feet at the center of the landfill. The maximum refuse height extends approximately 200 feet above the surrounding grades at the center of the landfill.

The disposal volume is approximately 104 million cubic yards. Based on an estimated in place effective density of 1,100 pounds/cubic yard (pcy), the landfill has a refuse capacity of approximately 57.1 million tons. Effective density is defined as the weight of disposed refuse divided by the total volume occupied by refuse and soil cover. For initial planning, it assumed that approximately 600,000 tons of refuse will be disposed annually. Accordingly, this disposal rate would result in a projected life of 95 years. The projected life will decrease as the disposal tonnages increase."

The disposal of 600,000 tons/year of San Francisco area garbage for 95 years will result in a massive landfill that, as discussed herein, will be a significant source of pollutants for the area groundwater.

The Report of Design also states on Page 12:
"*The base grades have been designed to maximize the separation between the bottom of the liner system and groundwater. The minimum separation distance is approximately 24 to 26 feet at the sumps after settlement of the base grades due to the weight of the overlying refuse. The average separation distance will be approximately 37 to 38 feet following base settlement induced by refuse loading (Section 2.3 .4.1). Section 2.3 describes the containment systems and controls used to protect the underlying groundwater from potential impacts of leachate and landfill gas."*

The statement in the last sentence "*Section 2.3 describes the containment systems and controls used to protect the underlying groundwater from potential impacts of leachate and landfill gas."* is significantly misleading with respect to what is known to be the ability of the proposed Jungo Landfill liner system to prevent groundwater pollution. As discussed in these comments, at best – with high-quality design and construction – the proposed landfill liner will only delay groundwater pollution; evidence of groundwater pollution from this landfill could potentially be delayed to a time beyond the 30-year period during which Nevada Land and Resource LLC/Recology-Jungo Land & Investments, Inc. are required to provide postclosure monitoring, maintenance, and remediation for groundwater polluted by landfill leachate. There is no question that over the very long time that the wastes in the proposed landfill will be a threat to

generate leachate when contacted by water, the liner system will fail to prevent leachate from penetrating the liner system and polluting the underlying groundwater.

The first paragraph of Page 13 in the Report of Design states:
"*2.2.2 Site Development*
The site development is illustrated in the landfill design drawings provided in Volume II. The landfill disposal boundary is located 100 feet from the west, south, and east property boundaries. The disposal boundary is located 200 to 300 feet from the north property boundary to allow the development of a rail yard for unloading waste containers."

Providing only 100 to 300 feet buffer between the disposal boundary and adjacent properties is grossly inadequate for dissipation of nuisance and hazardous airborne releases from the landfill before they trespass onto adjacent/nearby properties during the nearly 100-year active life of the landfill. Typically a mile or more buffer lands is required to allow on-site dissipation of odors and volatile hazardous chemicals that will be released from a MSW landfill. As discussed below, the presence of MSW landfill odors indicates the presence of volatile organic compounds (VOCs) that are a threat to human and animal health. It is clear that the operation of the proposed landfill would cause trespass of hazardous and otherwise deleterious chemicals onto adjacent/nearby properties. Nevada Land and Resource LLC/Recology-Jungo Land & Investments, Inc. should not be allowed to use adjacent properties to augment the landfill property needed to dissipate odors and other chemical releases.

Page 14 of the Report of Design, Section 2.3.1, lists the components of the liner design as follows:

- *"1-foot-thick operations soil layer;*
- *1-foot thick gravel blanket for the primary LCRS with a permeability of 1 cm/s or greater;*
- *central leachate collection piping within each module to provide redundant leachate capacity;*
- *16-oz geotextile cushion;*
- *60-mil high-density polyethylene (HDPE) primary geomembrane;*
- *2-foot thick compacted low-permeability soil liner with a permeability (k) less than or equal to $1x10^{-7}$cm/s;*
- *A secondary geocomposite drainage layer for the secondary LCRS; and*
- *A 60-mil high-density polyethylene (HDPE) secondary geomembrane*

On the side-slopes, the base liner system is comprised of the following components from top to bottom:

- *2-foot-thick operations soil layer;*
- *Geocomposite drainage layer (geonet with geotextile heat-bonded to both sides) for the LCRS;*
- *60-mil HDPE primary geomembrane;*
- *2-foot thick compacted low-permeability soil liner (k $1x10^{-}7$ cm/s).*
- *A secondary geocomposite drainage layer for the secondary LCRS; and*
- *A 60-mil high-density polyethylene (HDPE) secondary geomembrane"*

The bottom liner and the side slopes liner proposed for the landfill would consist of a single composite liner (plastic sheet and compacted clay) underlain by a drainage layer that is underlain by a plastic sheeting layer. This proposed design is a step toward a double-composite liner but will not provide the additional protection afforded by a true double-composite liner. The difference is that the lower plastic sheeting layer (secondary geomembrane) of the proposed system is not backed, and necessarily in intimate contact, with a compacted clay layer of the type specified in US EPA Subtitle D requirements for a composite liner.

Dr. David Daniel, a speaker in the US EPA seminar series on "Design and Construction of RCRA/CERCLA Final Covers," (conducted by the US EPA Office of Research and Development CERI 90-50 Washington DC, 1990), discussed the relative rates of leakage of various types of landfill liner designs. As discussed in our "Flawed Technology" review, he pointed that an HDPE liner without a low permeability clay layer in intimate contact with it, can leak at a very high rate compared to a true composite liner or even just a compacted soil layer. As also discussed in greater detail in our "Flawed Technology" review, a single-composite liner will eventually lose its ability to prevent passage of leachate through it; leachate will pass through the areas of deterioration that will inevitably and unpreventably develop over time, while the wastes in the "dry tomb"-type landfill continue to be a threat. The inability of a composite liner to contain leachate that will be generated as the integrity of the cover also inevitably deteriorates, will result in the entrance of leachate into the drainage layer just below the composite liner. Leachate can be collected and removed from the landfill drainage system as long as the lower plastic sheeting layer maintains its intended integrity. However, that plastic sheeting layer will also deteriorate over time, increasingly lose its low permeability properties; one would not expect that that liner would resist deterioration significantly longer than the low permeability cover or the composite liner. Furthermore, like the composite liner, the bottom plastic sheeting liner would not be available for regular and thorough inspection, maintenance, and repair as it will be located beneath the landfilled wastes and containment systems. The result will be that the leachate that will inevitably develop within the landfill will be able to pass through the holes in the plastic sheeting into the groundwater system underlying the landfill.

A fundamental issue that was not addressed by Golder in its design report in the Report of Design is who will remove leachate from the leachate collection system and the secondary geocomposite drainage layer once Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc. is no longer responsible for the postclosure monitoring, maintenance, and other care issues, i.e., in year 31 and for the subsequent hundreds of years or more after closure when the buried wastes will still be a threat to generate leachate that can pollute groundwater. Current Nevada landfilling regulations and as outlined in the plan of the landfill developer, Nevada Land and Resource LLC/Recology Jungo Land & Investments, Inc. will be able to walk away from the site 30 years after closure and leave a massive pile of San Francisco Bay area garbage. The state of Nevada and Humboldt County will be left to deal with the abandoned site, which will ultimately and predictably need a "superfund"-like cleanup to address the polluted groundwater that this landfill will cause.

A key to reducing the rate of leachate penetration through holes and areas of deterioration in the plastic sheeting and compacted clay layers is minimizing the head (depth) of leachate on the plastic sheeting liner. During the active life and 30-yr monitored postclosure care period the

landfill owner/operator will be required to remove leachate from the leachate collection system and secondary leak detection layer. As cover inspection, maintenance, and repair becomes less rigorous as could be expected to occur after the 30-yr postclosure period, leachate generation will be accelerated. If leachate removal is not adequately attended to, leachate will build up on the liner and penetrate the liners more rapidly. However as discussed further below, the issue of who will be responsible for maintaining the landfill cover in year 31 and beyond after closure, has not been addressed by the applicant or regulators. It is essential that rigorous inspection, maintenance, and repair be continued after the 30-yr postclosure period to maintain the system's ability to retard the infiltration of water into the landfill that will generate leachate that will build up in the landfill and cause the landfill liner system to leak at a much higher rate than if the leachate were collected in the leachate collection system and secondary leak detection layers. The proposed design for the Jungo Landfill will virtually ensure that the County will inherit a significant environmental, public health, and financial liability when Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc. walks away after the 30-yr postclosure period.

Page 16 of the Report of Design describes the proposed leachate collection and removal system as follows:
"2.3.2 Leachate Collection and Removal System (LCRS)
The landfill liner system design includes a blanket LCRS (Drawing 4, Volume II) that has a high hydraulic capacity that is designed to collect leachate while minimizing leachate head build-up on the liner. The maximum leachate head on the liner is estimated to be only a fraction of one-inch, which is considerably less than the 12-inch (30 centimeter) maximum depth allowed by NAC 444.681. The leakage potential of a liner system is reduced by decreasing the potential head build-up on the liner system."

The statement regarding the expected depth (head) of leachate on the liner only applies as long as the leachate is actively and effectively removed from the sump. While Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc. would be responsible for removing leachate from the leachate collection system during the active life and for 30 years after landfill closure, neither the Report of Design, nor other documents we have reviewed concerning this proposed landfill defines ho will conduct diligent leachate removal beginning in year 31 of postclosure, or before year 31 if these companies are no longer in business.

Page 16 of the Report of Design states
"*Extracted leachate will be used for dust control over constructed, lined modules. In the event that the collected leachate exceeds the dust control needs, the excess leachate will be re-circulated within the landfill. However, such recirculation volumes are expected to be very small with a negligent impact on the moisture content of the waste or depth of leachate head on the liner."*

The use of leachate for dust control is not allowed in several other states because it contributes pollutants to the stormwater runoff from the landfill area. That practice should not be allowed at the Jungo Landfill should it be permitted.

Section 2.3.3 on Page 16 of the Report of Design addresses "Landfill Gas Control." That section, however, provides little information on the approach that will be used to control landfill

gas releases. It also fails to discuss the fact that even with highly effective control of landfill gas releases there will still be releases of landfill gas to the landfill area. With only a few hundred feet of buffer land between waste deposition areas and adjacent property lines, trespass of landfill gas and the associated hazardous and obnoxious chemicals can be reasonably anticipated onto adjacent properties. As noted above, the landfill gas will contain VOCs that pose a cancer risk to humans, domestic animals and wildlife that are exposed to the odors released from the MSW landfill. Issues and problems of landfill gas and airborne emissions from landfills are also discussed in our "Flawed Technology" review beginning on page 39.

As discussed in our "Flawed Technology" review it is important to understand that the proposed Jungo Landfill will likely generate landfill gas for a very long time much beyond the 30 year postclosure period. An issue that should be defined is who will operate and maintain the gas collection and treatment system for as long as the Jungo Landfill will generate landfill gas?

Page 19 of the Report of Design begins a description of report leachate generation at the proposed landfill and the hydraulic capacity of the proposed leachate collection and removal system (LCRS):
"2.3.4.3 Leachate Generation and LCRS Capacity
A very conservative leachate generation model was developed to conservatively size the hydraulic capacity of the LCRS. A conservative approach was used to provide an additional level of environmental protection relative to leachate management.

The model was developed using the computer program Hydrologic Evaluation of Landfill Performance (HELP). Appendix G includes details on the HELP modeling for the Jungo Disposal Site. The conservatively developed HELP model estimates a peak leachate generation rate of75 gallons/acre/day (gpad) for the Jungo Disposal Site. This estimated leachate generation rate is very high for an arid site with only 8-inches of average annual precipitation."

The repeated characterization of the leachate generation model and its output is misleading at best. The HELP model upon which the report indicated the assessments were made is not reliable for predicting the rate at which water can enter a landfill through the landfill cover over the period during which the wastes in the landfill will be a threat to generate leachate when contacted by water. While the nature, rate, pattern, and other details of the deterioration that will occur in the plastic sheeting layer in the cover cannot be predicted and depend to large extent on the nature, rigor, and effectiveness of cover inspection, maintenance, and repair, it is clear that deterioration will occur over time; that deterioration, and the inability to reliably model it, render the HELP model unreliable for long-term prediction of leachate generation.

Page 21 of the Report of Design addresses drainage control:
"2.3.4.5 Drainage Controls During Operations
Drainage controls will be implemented during site development to control surface water run-on and runoff. Surface water run-on will be prevented by the following measures:

- *A 4-foot high perimeter berm will be constructed to prevent run-on from shallow (6-inch to 12-inch) ponding that may occur locally following intense thunderstorms."*

The effectiveness of this approach for preventing run-on onto the landfill surface area will depend in large part on the adequacy of design and construction, and most importantly on the rigor and reliability of dike inspection, maintenance, and repair for as long as the wastes in the landfill will be a threat to generate leachate, likely hundreds or more years after closure. Another important consideration is whether the soils of the area are adequate for construction of a dike capable of preventing flood water in the area outside the dike from penetrating the dike and flooding the area of the landfill during the period over which the wastes in the landfill will be a threat to generate leachate when contacted by water. The dike will need to be properly designed, constructed, and maintained to prevent seepage of water through it during the times that the area around the landfill property is flooded with a foot or more of water. Even with such design and construction, dikes of that type that are subject to a variety of failure mechanisms including settlement cracking, wind erosion, burrowing animals, and plant roots. Again, no mention was made as to who will maintain the dike for the hundreds of years that will be necessary after the postclosure period; that issue should be addressed before the landfill is permitted.

Section 2.3.5 "Closure Design" on Page 21 of the Report of Design describes the design of the landfill closure, and states:
"*A final cover system will be constructed over the waste at the Jungo Disposal Site as part of the closure activities. The final cover system is a prescriptive cover, in accordance with NAC 444.6891) consisting of the following components (Drawing 8, Volume II):*

- *A minimum 2-foot thick vegetative soil layer;*
- *A geocomposite drainage layer;*
- *A 60-mil HDPE geomembrane layer (textured on both sides); and*
- *A one-foot thick foundation layer."*

That design for the landfill cover is the design that is specified in US EPA Subtitle D and NDEP regulations.

That section also states:
"The above cover system provides a low-permeability barrier that has permeability less than or equal to the base liner system. HELP modeling of the cover system indicates that a negligible amount of water will infiltrate through the cover."

Beginning on page 20, our "Flawed Technology" review discusses long-term problems and deficiencies with a landfill cover design of the type proposed for the Jungo Landfill for keeping the buried wastes dry. Those deficiencies include the eventual deterioration of the plastic sheeting layer (geomembrane) in the cover, a component that is the key to preventing entrance of water into the wastes through the cover. Since the plastic sheeting layer is buried under a 2-ft vegetative soil layer, it is not possible to maintain a pro-active, preventive approach to maintaining cover integrity; it is not possible to thoroughly inspect the plastic sheeting layer for areas of weakness and make needed repairs before the reliable functioning of the cover to prevent water from penetrating the cover and entering the wastes is compromised. Instead, cover failure is typically not known until the cover has been sufficiently breached that leachate has been generated and has migrated to the leachate collection system sump. By the time leachate is detected, substantial breach of the cover is likely to have already occurred.

The presence of leachate in the leachate collection system of a closed cell is typically the first indication that there is need to repair the landfill cover. Repair of the plastic sheeting layer in the cover necessitates searching the landfill cover's plastic sheeting layer that is buried under the top soil layer to find the areas of the buried plastic sheeting layer that have deteriorated and repair them. This requires that funds remain available for such searches and repairs whenever needed over the 100s of years or more during which the cover must function to keep the wastes dry. Once again it was not specified who would provide the needed inspection, maintenance, and repair of the cover when Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc.'s 30 years of postclosure funding expires. What is clear is that a large amount of funds will be needed to maintain the landfill cover on the Jungo Landfill for as long as a reliable low-permeability cover is needed to control leachate generation in the landfill.

The description of the closure design in the Report of Design also states (page 22):
"The Jungo Disposal Site will pursue an alternative Evapotranspirative (ET) final cover design once the landfill is in operation."
Issues of importance in incorporating an evapotranspirative cover into the design of a landfill cover are discussed in our "Flawed Technology" review beginning on page 24. The potential for saturated and unsaturated flow of water through such a cover during periods of extended precipitation must be considered in evaluating whether this type of cover will keep the wastes dry. In making such an assessment, it is important that maximum precipitation values, rather than commonly used average values, be used in the estimation of the penetration of water through the alternative cover.

"Application for Permit to Construct and Operate a Class I Landfill Facility, Jungo Disposal Site, Humboldt County, Nevada, Volume III, Plan of Operations," Revision 4, Prepared for Jungo Land & Investments, Inc. by: Golder Associates Inc., dated April (2011) [http://ndep.nv.gov/bwm/docs/jungo_plan_operations.pdf]
The "Plan of Operations" document discusses characteristics of the proposed Jungo Landfill. Presented below is our review of a number of the issues raised by that Plan of Operations that can have an adverse impact on public health and welfare, and groundwater quality. Many of these issues have been discussed in other sections of these comments as well as in our "Flawed Technology" review.

Section 1.0 – Introduction in the Plan of Operations states:
"Jungo Land & Investments, Inc. (JLII), the landfill owner and operator, is submitting the following Plan of Operations for a Class I municipal solid waste disposal site as required by the general provisions for solid waste disposal defined in the Nevada Administrative Code (NAC 444.684)."

Page 1, Section 1.1 Site Description states:
"The facility will be operated by JLII in accordance with applicable State of Nevada solid waste regulations. The land is currently owned by Nevada Land and Resources, Inc. but will be acquired by JLII prior to development. JLII currently has a leasehold interest with an option to purchase the property, which JLII plans to exercise once the necessary State permits have been obtained. Property ownership documents will be maintained in the landfill operating record."

This transfer of ownership raises questions about which firm or firms will be responsible for providing postclosure care (monitoring, maintenance, and eventual groundwater remediation when the landfill liners fail to prevent leachate generated in the landfill from polluting groundwater under and downgradient of the landfill) when the landfill is no longer generating revenue. What will be the role of Recology a principal developer of the landfill and the firm that apparently will gain significant financial benefit from the operation of the landfill? It will be important that this transfer of ownership is transparent and not a shell game to relieve the developers of the landfill from the significant long-term responsibility and liability for controlling the adverse impacts of the landfill on public health and the groundwater resources of the area of the landfill.

The site description section continues on Page 2 of the Plan of Operations and states: "*The Jungo Disposal Site will be capable of operating 7 days per week, 24 hours per day. However, peak hours of activity will be associated with the arrival of a unit waste train. Generally a full train can be unloaded and the waste placed in the landfill within a 10-hour period. At other times, personnel may be onsite for maintenance, monitoring and construction purposes."*

It has been our experience that permitting agencies for landfills typically restrict the hours of operation of a landfill so that certain adverse impacts of the landfill, such as noise, are limited to daylight hours. While at this time such adverse impacts will apparently not impact nearby human populations, in the future the owners of adjacent and nearby lands should not have the development and use of their lands limited by the operations of the landfill at night. This is especially important at the proposed Jungo Landfill because those operations would, as proposed, involve the deposition to wastes almost to the edge of the property.

Section 5.0 beginning on page 10 of the Plan of Operations presents a characterization of the nature and types of wastes that would, and would not be accepted at the proposed landfill. As was found in, and discussed in these comments concerning the Report of Design, the manner in which the Plan describes the wastes that would and would not be disposed of at the Jungo Landfill is highly misleading. As discussed above, and in our "Flawed Technology" review, wastes of the types described as being acceptable for disposal at the proposed landfill do contain hazardous and otherwise deleterious chemicals – even if they are not categorized by regulations as "hazardous wastes" – that will produce leachates that can render leachate-containing groundwaters unusable for water supply purposes.

Page 11 of the Plan of Operations discusses the characteristics of the rail haul of the garbage. An issue that was not mentioned, but needs to be specifically addressed, is that the garbage transport containers should be water-tight to prevent the discharge of garbage juice" along the rail route. The regulatory program should include periodic inspection of the containers to ensure that they maintain their water-tight characteristics for as long as they are used. The liquid ("garbage juice") that will be formed in the railcars during transit will be a threat to the health of wildlife along the rail line. Those waste residues that leak onto the ground along the rail line would also be expected to contaminate stormwater runoff from the rail line area; the polluted runoff would

pose a threat to human health, water quality and wildlife and in waters receiving stormwater runoff from the rail track areas.

Page 11 Section 5.2, Page 13 section 5.8, and Page 14 section 5.8.5 of the Plan of Operations address C&D waste. As discussed previously with regard to the Report of Design document, No mention was made about the fact that C&D wastes often contain PCBs that were used as caulking in older buildings.

Page 14 Section 5.8.5 Handling Procedures for Hazardous or PCB Wastes, states:
"The General Manager and/or operators at the landfill will be responsible for the management of any hazardous and PCB wastes, which may be discovered in the waste stream."
That statement implies that no "hazardous waste" will be allowed to be deposited in this landfill and that the site manager is to take action to control the deposition of such wastes if they are discovered. The US EPA and the NDEP allow household hazardous wastes to be legally deposited in a MSW landfill. Further, it is common practice for some small industries to comingle hazardous wastes and the industrial solid wastes that are allowed in MSW landfills. It is also inconsistent with the allowance of C&D wastes, some of which, as discussed previously, are known to contain PCBs, in the landfill.

Page 16 of the Plan of Operations presents a description of landfill gas control and states:
"6.0 Control of Explosive Gas (NAC 444.667)
Operators of solid waste disposal facilities must ensure that the concentration of methane gas generated by the landfill does not exceed 25 percent of the lower explosive limit (LEL) for methane in landfill structures (excluding gas control or recovery system components), and 100 percent of the LEL for methane at the landfill property boundary."

Since the VOC components of MSW landfill gas can penetrate an intact (without holes) landfill liner by diffusion there is a great likelihood that landfill gas from the Jungo Landfill would trespass onto adjacent properties in violation of this regulation. The Preliminary Landfill Gas Collection Plan (Jungo Drawing 06) shows that the landfill soil gas probes are to be spaced at about 1000 feet apart. The penetration of landfill gas through the liner will be in specific areas which could follow preferential pathways in the heterogeneous soils of the area. The proposed landfill gas probe monitoring locations are spaced too far apart to reliably detect landfill gas released through the liner into subsurface soils before the gas trespasses onto adjacent property.

Page 18 of the Plan of Operation, Section 8.0 Operation & Maintenance (NAC 444.686) states:
"The Jungo Disposal Site will be operated in a manner, which does not create odors, unsightliness, or other nuisances. The working face will be kept as narrow as possible while maintaining safe and efficient equipment operation. Bulky waste material which may provide for the harborage of rodents will not be used for the final surface of side slopes. Waste will be spread into layers not exceeding two feet in thickness prior to compaction, and compacted using dozers and/or compactors. The equipment will make a minimum of two passes over each waste layer. The perimeter boundary of the extent of waste placement will be at least 100 feet from the property boundary of the site.

Odors from landfill operations will be controlled through the placement of daily, intermediate and final cover. In addition, the narrow working face will act to minimize any odors. In the event that a highly odorous load is received, the odorous material may receive cover more frequently."

Such claims that the site "*will be operated in a manner, which does not create odors, unsightliness, or other nuisances"* and *"odors from landfill operations will be controlled"* are hollow. In the past 50 years that he has been reviewing existing impacts of MSW landfills, Dr. Lee routinely hears landfill developers making assurance that it will "control" offsite releases from the wastes that cause adverse impacts, including odors, fugitive papers, etc., to adjacent and nearby property owners. Such assurances notwithstanding, Lee has yet to observe an MSW landfill that did not create nuisance conditions within 100 feet or so of where the wastes are deposited.

Page 24 of the Plan of Operations states in Section 12.7 Leachate Release:
"The Ground Water Monitoring Plan provides the means for determining the presence of leachate below the liner system and to initiate corrective action in the event that leachate reaches ground water. The presence of leachate in the collection structures is a design function of a leachate collection and removal system (LCRS) and a lined waste management unit. The presence of leachate in a containment structure is expected and is the result of a system that is functioning as originally planned and designed."

Contrary to the claims articulated in that section, the groundwater monitoring plan does not provide "*the means for determining the presence of leachate below the liner system and to initiate corrective action in the event that leachate reaches ground water."* There is no doubt that over the hundreds of years or longer that the wastes in that landfill would be a threat to generate leachate when contacted by water there likely will be leachate in the leachate collection system that will not be removed and that will penetrate the liner system and enter the underlying groundwater system. The proposed monitoring program has little chance of detecting incipient leakage of leachate from the landfill before widespread pollution of the groundwater occurs. These issues are discussed in the other sections of these comment, and in detail in the "Flawed Technology" review.

Page 27 of the Plan of Operations, Section 14.0 Closure and Postclosure and Financial Assurance (NAC 444.6891 through NAC 444.6897 and NAC 444.685 through NAC 444.6859) states, "*Closure and postclosure plans have been prepared for the Jungo Disposal Site and specify activities required for compliance with NAC 444.6891 through NAC 444.6897. These plans are included in Appendix C as required by NAC 444.6897.*"

"*The Jungo Disposal Site will utilize a trust fund to demonstrate financial assurance for the Class I operation. NDEP will be notified upon placement and funding of the standby trust fund. Financial assurance estimates for closure and postclosure monitoring and maintenance are included in Appendix C."*

The NDEP website [http://ndep.nv.gov/bwm/jungo.htm] that presents characteristics of the proposed Jungo Landfill provides a link to Jungo Landfill Application Volume I "Table –

Closure Cost Post Closure Estimates." That link leads to "Table 5. Post-Closure Monitoring and Maintenance Cost Estimates" which shows a total annual cost for 30 year of post closure care of $12,502,500. That cost estimate includes "*vegetation maintenance, leachate sampling and testing, landfill gas monitoring/maintenance, groundwater monitoring, maintenance, surface water monitoring/maintenance, drainage/cover maintenance, security maintenance and inspection.*" No cost estimates are included for replacement of the landfill cover when it will no longer adequately prevents entrance of water into the landfill, or for the superfund-like remediation that will eventually have to be conducted at the site. The agency (County and State) will have to fund these costs ($416,750 year plus cover replacement and groundwater remediation) from year 31 and beyond.

As discussed in these comments, the Jungo Landfill developer/owner Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc. has repeatedly state that it will provide postclosure care (landfill monitoring, maintenance of the landfill cover and other components of the monitoring and containment system including leachate removal) for 30 years. Since the landfill will be a significant threat to public health and groundwater quality well-beyond that 30-year period, and since the NDEP landfilling regulations state that the postclosure period can be extended, the NDEP permit for this landfill should specify that the postclosure period for this landfill will extend as long as the wastes in the landfill can generate leachate and/or landfill gas. It should be understood that that period can be expected to last for over hundreds of years. Nevada Land and Resource LLC /Recology-Jungo Land & Investments, Inc. would thus be required to fund postclosure monitoring, maintenance, and remediation, including replacement of the deteriorated landfill cover as needed to stop leachate generation and the remediation of the pollution of groundwater that will occur at this landfill at any time in the future.

One of the items mentioned on the NDEP Jungo Landfill webpage is an "Agreement of Trust" in which funds payable to NDEP are to be kept by the Union Bank of California to provide assurance for "closure and/or post-closure care of the facility." It appears, however, that the trust funds will not be available to address postclosure funding needs for year 31 and beyond. Also, apparently none of the trust funds can be used by Humboldt County should it become responsible for providing postclosure care. A dedicated trust fund of sufficient magnitude should be established from disposal fees to address all plausible worst-case failure scenarios for the landfill containment system for as long as the wastes in the landfill will be a threat to generate leachate when contacted by water. The payment should be to the NDEP and Humboldt County as appropriate to meet true costs of long-term postclosure care and remediation.

End of Post-Closure Care

Neither the NDEP nor US EPA provides guidance on when postclosure care can be terminated without risk to public health/welfare or environmental quality. Landfills will continue to pose a threat to public health/welfare and environmental quality until such time that the wastes in the landfill can no longer generate leachate that could cause groundwater pollution and/or release landfill gas. We suggested in our "Flawed Technology" review that post-closure care may be able to be reasonably discontinued once representative samples of wastes taken from the landfill, when properly contacted with water, do not produce leachate that could impair the use of groundwater or surface water for domestic or other purposes, including animal water supply. Since there is no protocol for conducting this type of evaluation, the NDEP/US EPA needs to

develop a protocol to make a reliable, objective evaluation of when postclosure care can be terminated without compromising long-term protection of public health/welfare and environmental quality.

Page 28 of the Plan of Operations, Section 15.0 Monitoring Plan (NAC 444.683) states: *"Environmental monitoring will be completed during landfill development and following closure and will include groundwater monitoring, leachate monitoring, and landfill gas monitoring. Surface water monitoring will not be completed because there is no nearby surface water body. However, storm water monitoring will be completed in accordance with NPDES requirements. Appendix D includes a monitoring plan that address groundwater, leachate, and landfill gas monitoring."*

The NDEP website [http://ndep.nv.gov/bwm/jungo.htm] that presents characteristics of the proposed Jungo Landfill provides a link to Jungo Landfill Application Volume III Appendix D: Monitoring Plan, "Figure 2 – groundwater monitoring map." According to that figure, the proposed landfill will have a set of groundwater monitoring wells at the downgradient edge of the landfill that are spaced about 900 feet apart. As discussed in our "Flawed Technology" review beginning on page 27, that approach to groundwater monitoring for landfill-derived pollution has a very low ability of detecting the initial failure of the landfill liner that leads to groundwater pollution by landfill leachate. The placement of the monitoring wells immediately adjacent to the edge of the landfill is even more problematic at the Jungo Landfill because waste deposition areas are so near the edge of the landfill property. The zone of capture about the conventional monitoring well is about a 1 ft radius about the well. Leachate-polluted groundwater will emanate from the Jungo site as a narrow plume from areas of breach. With monitoring wells space about 900 feet apart, narrow leachate plumes can readily pass the line of groundwater monitoring wells at the edge of landfill around the around the perimeter of the landfill without being detected. There is no doubt that offsite groundwaters will eventually be polluted by landfill leachate without its being detected by the proposed monitoring approach for the Jungo Landfill.

The discussion of monitoring in the Plan of Operations focuses on detecting potential releases from the landfill. However, the Plan states that there are no nearby offsite groundwater wells that would be impacted by a release from the site. Also it is stated that there are no municipal water wells within 10 miles of the site. The nearest groundwater well is used for agricultural purposes and is located more than one mile northeast of, and upgradient from, the landfill site. The Plan of Operations' discussion about the nearest existing well that could be polluted when the landfill liner system fails has no relevance to the NDEP regulations governing the protection of groundwater from pollution by landfill leachate. As discussed in another section of these comments, NDEP regulations for protection of groundwater quality are explicit in requiring that the landfill shall not pollute groundwater at any location. There is no provision that allows for offsite pollution of groundwater as long as there are no existing wells in the adjacent and nearby areas that could be polluted.

The proposed Jungo Landfill is planned to rise about 200 ft above the ground surface. Such above-gradient landfills are prone to developing seeps of leachate through their above-ground sides that will pollute stormwater runoff. Therefore, it will be important to continue the

stormwater runoff monitoring for as long as the wastes in the landfill can generate leachate when contacted by water.

The NDEP website [http://ndep.nv.gov/bwm/jungo.htm] that presents characteristics of the proposed Jungo Landfill provides a link to Jungo Landfill Application Volume III Appendix D: Monitoring Plan, which contains "Table 2–Monitoring Parameters and Methods" that lists the chemicals that will be monitored at the proposed Jungo Landfill. Our "Flawed Technology" review beginning on page 35 discusses inadequacies of the approaches typically used in monitoring pollution sources including landfills. One of the inadequacies is that they only monitor for the presence of a very small number of the chemicals in MSW that can be a threat to human and animal health and groundwater quality. This issue is discussed in another section of these comments.

Compliance with Nevada Landfilling Regulations
A review of the State of Nevada solid waste regulations is presented on the Internet as:
NDEP Solid Waste Disposal Regulations
[http://www.leg.state.nv.us/NAC/NAC-444.html#NAC444Sec570]
Sections of those regulations that are pertinent to the evaluation of the compliance with the Nevada landfilling regulations are presented below.

NAC 444.605 "Pollutant" defined. (NRS 444.560**)** "Pollutant" has the meaning ascribed to it in NRS 445A.400.

NRS 445A.405 "Pollution" defined. "Pollution" means the human-caused or human-induced alteration of the chemical, physical, biological and radiological integrity of water.
(Added to NRS by 1973, 1709)—(Substituted in revision for NRS 445.181)

NAC 444.644 Systems for solid waste. (*NRS 444.560****)***
1. All solid wastes must be:
(a) Stored, collected, utilized, treated, processed and disposed of by means that do not create a health hazard, public nuisance or impairment of the environment.
(b) Handled in such a manner which does not contribute to breeding of insects and rodents or to support any disease vector.
2. All solid waste systems must be operated in a manner that will not cause or contribute to pollution of:
(a) The atmosphere; or
(b) Surface or groundwaters of the State.

NAC 444.678 Location restrictions: Generally. (*NRS 444.560****)*** *The location of a Class I site must:*
1. Be easily accessible in all kinds of weather to all vehicles expected to use it.
2. Prevent pollutants and contaminants from the municipal solid waste landfill units at the site from degrading the waters of the State.
3. Prevent uncontrolled migration of gas at the site.

The above regulations are explicit in requiring that landfills must be developed so as to prevent the pollution of the state's groundwaters. There is no time limitation on that requirement.

NAC 444.683 Plan for monitoring water; suspension of monitoring requirements. (NRS 444.560)

1. The plan for monitoring water for a Class I site must provide a complete description of a system capable of monitoring the performance of the design of the site, including monitoring of the groundwater to detect the release of pollutants or contaminants from the municipal solid waste landfill unit into the waters of the State."

"3. The solid waste management authority may suspend monitoring requirements if the owner or operator of a Class I site demonstrates that there is no potential for migration of pollutants or contaminants from the site to waters of the State during the active life of the site, including the period for closure and postclosure. The demonstration must be:

(b) Based on:

(2) Predictions of the fate and transportation of the pollutants or contaminants that consider the maximum rate of the migration of contaminants and the impact of the pollutants or contaminants on public health and safety and the environment.

The information on movement of groundwater in the vicinity of the landfill is such that the pollution the groundwater under the landfill will lead to offsite groundwater pollution that will be a violation of this regulation. There will likely also be fugitive papers from the landfill that will trespass onto adjacent properties.

NAC 444.686 Operation and maintenance. (NRS 444.560)

1. The operation and maintenance of a Class I site must be in a manner which will not create odors, unsightliness or other nuisances.

Because of the extremely limited amount of buffer land owned by the landfill between the deposition footprint and adjacent property line, offsite emanation of odors from this landfill will, without question, result in violations of this regulation.

NAC 444.6894 Program for postclosure for each municipal solid waste landfill unit within Class I site. (NRS 444.560)

1. After the closure of each municipal solid waste landfill unit of a Class I site, the owner or operator of the site shall conduct a program for postclosure for that unit. Except as otherwise provided in subsection 2, the program must be conducted for 30 years and consist of at least the following:

(a) The integrity and effectiveness of any final cover must be maintained, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion or other events, and preventing runon and runoff from eroding or otherwise damaging the final cover.

(b) The system to collect leachate must be maintained and operated in accordance with the requirements in NAC 444.681, if applicable. The solid waste management authority may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to public health and safety and the environment.

(c) The groundwater must be monitored in accordance with NAC 444.7481 to 444.7499, inclusive, and the system for monitoring the groundwater must be maintained, if applicable.
(d) The system for monitoring gas must be maintained and operated in accordance with NAC 444.667.
2. The length of the program for postclosure may be:
(a) Decreased by the solid waste management authority if the owner or operator demonstrates that the reduced period is sufficient to protect public health and safety and the environment and this demonstration is approved by the solid waste management authority; or
(b) Increased by the solid waste management authority if it determines that the lengthened period is necessary to protect public health and safety and the environment.

The postclosure period for the proposed Jungo Landfill should be extended until the wastes in the landfill are no longer a threat to generate leachate and landfill gas when contacted by water. If the proposed landfill is permitted NDEP should make this requirement a part of the permit that is issued to Nevada Land and Resource /Recology-Jungo Land & Investments, Inc.

Overall

A San Francisco based firm proposes to develop a large landfill near Winnemucca, Nevada that will receive 4000 tons/day of San Francisco, CA area municipal solid wastes. The proposed landfill location is subject to period flooding during periods of intense rainfall. There are important groundwaters underlying the landfill that can be polluted by the ultimate failure of the landfill liner. The proposed landfill liner and waste containment system is essentially the minimum allowed under the US EPA Subtitle D and Nevada DEP landfills development regulations. These regulations in some instances are deficient in providing the protection of public health, water resources quality and several other impacts of MSW. Some states will not allow this design of an MSW landfill to be developed in the state. In no event should the citizens of the state of Nevada and Humboldt County be required in any way to bear any costs for postclosure care.

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Comments on
NDEP December 1, 2011Jungo Landfill Hearing Presentation by
J. Taylor, NDEP Staff Member Responsible for Jungo Landfill Technical Review

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At the December 1, 2011 NDEP hearing for the Jungo Landfill, Jon Taylor, PE, CEM–NDEP Permitting, made a technical-review presentation on the characteristics of the proposed Jungo Landfill that NDEP has recommended for permitting. Dr. G. Fred Lee made a tape-recording of his presentation. Presented below are quotations and paraphrases of some of the statements that
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J. Taylor made concerning the so-called protective nature of the proposed Jungo Landfill along with our comments on their technical accuracy. In these comments we have only provided summary overview discussion of issues that we covered in detail in our comments on the Golder Design and Operations reports, and for which the technical basis is covered in our "Flawed Technology" review. Those reports should be consulted for more detailed discussion of the issues discussed herein.

Mr. Taylor indicated that he was the NDEP staff member responsible for technical review of the proposed Jungo Landfill. He also indicated that he had incorporated into the current design of this proposed landfill several features that *"provided for greater protection from the landfill impacts."*

The times indicated at the beginning of the comments are approximate times into the hearing. The reference to time will be replaced with specific citations to the location of the comment issues from the transcription of the hearing that NDEP made when it becomes available.

7:14 Taylor discussed the sizes of current large landfills in Nevada, and indicated that Apex, Rawhide, Crestline are the three largest landfills in the state. If Jungo is permitted, it will be the fourth largest landfill. In his response to comments Taylor should provide information on the current and anticipated future daily MSW loads to each and the percentage of the wastes currently received by each landfill from sources outside of the state of Nevada. Such information will provide a much better comparison between those landfills and the proposed Jungo Landfill.

9:26 Taylor said that because of the proximity of the landfill bottom to groundwater, the landfill would require *"more protective design and monitoring"* to mitigate for there being less than 100 ft. between the bottom of the landfill and underlying groundwater table as required by NDEP regulations. He indicated that that condition could be mitigated by requiring an improved landfill liner design beyond the minimum allowed (single-composite liner). The mitigation improvements would include an additional HDPE liner and secondary leachate collection under the composite liner and improved monitoring. Taylor's approach for so-called mitigation for the lack of at least 100 feet of separation between the bottom of the landfill and groundwater table is fundamentally flawed for providing protection from groundwater pollution by leachate that will eventually penetrate the "improved" landfill liner design without detection by the proposed monitoring approach before it passes onto adjacent property. Additional discussion of those so-called improvements is presented below.

15:37 Taylor indicated that the minimum design for landfill cover is 6 in of soil and that the design for the proposed Jungo Landfill cover would be 3 ft of soil and an HDPE liner. As discussed in our comments on the Golder Report of Design, the design of the Jungo Landfill cover will not prevent the entrance of water into the closed landfill cells over the time that the wastes in the landfill will be a threat to generate leachate when contacted by water.

15:39 Taylor indicated that there would be improved gas control for the Jungo Landfill; improvements include gas collection pipes in the leachate collection system. As discussed in our comments on the Golder Report of Design, the gas probes for monitoring landfill gas releases to

the soils adjacent to the perimeter of the landfill are spaced too far apart to reliably detect initial landfill gas releases through the liner below the ground surface. Taylor did not mention that the gas collection pipes in the leachate collection system will need vigilant maintenance to prevent them from becoming plugged with deposits. He also did not mention who will operate the gas collection system in the postclosure period beyond year 31 when Recology et al. will walk away from the landfill and leave the financial burden for the landfill to the State and County. This issue is discussed further below.

16:41 Taylor stated that one of the additional criteria for the Jungo Landfill is a 24-hour detection evaluation program that focuses on groundwater monitoring at 10 and 25 years to evaluate the performance of the liner at 10 and 25 years of operation. The 25-year review will be for about 25% of the projected active life of the landfill. As discussed in another section of these comments, that approach is not reliable for evaluating liner performance over the period during which the wastes at the landfill will be a threat.

18:42 In response to a comment made by a member of the public, Taylor stated that *"the playa standing water is not sheet flow."* The fact is that the proposed landfill area periodically is flooded is similar to the siting of a landfill in a floodplain, a practice that is prohibited by US EPA and Nevada landfilling regulations. As discussed in our comments on the Golder Report, using a dike to try to keep the flood water out of the landfill area, as is being planned for the Jungo Landfill, is subject to significant problems and is unreliable for keeping standing water away from the landfill.

20:40 A member of the public questioned the suitability of the soils of the area for use in the landfill. Taylor stated in response, *"Settlement monitoring part of the performance review is to address soil settlement properties."* The suitability of the soils (lack thereof) of the area of the landfill is discussed in a separate section of these comments.

22:09 Taylor stated, *"the prescriptive design of the liner is a single-composite liner with a primary geomembrane and a compacted soil liner."* and that the Jungo Landfill will contain another geomembrane beneath the single composite liner.

22:36 Taylor stated, *"gas collection includes a pipe in the leachate collection system to collect gas."* As discussed in another section of these comments, that system requires postclosure operation of the gas collection system for as long as the wastes in the landfill can produce landfill gas when contacted by water. That period can extend well-beyond the monitored 30-year postclosure period provided by Recology et al.

26:20 Taylor stated that two angle borings under the sump and two vertical wells at the boundary on each side of the 25 year waste footprint would be used for the interim groundwater monitoring for 25% of the landfill projected active life. He stated that the proposed landfill will have *"a lot of groundwater monitoring."* That characterization notwithstanding, as discussed in our comments on the Golder Design report the perimeter groundwater monitoring wells are spaced too-far apart to detect the failure of the landfill leachate collection system before polluted leachate-polluted groundwater trespasses onto adjacent property. Leachate that initially penetrates the liner system near the down-groundwater-gradient part of the landfill will produce

narrow, finger-like plumes of leachate that can pass between the perimeter monitoring wells and not be detected by them.

Taylor's so-called "performance monitoring" that he designed and proposed for about 25% of the proposed landfill active life of about 100 years, cannot be expected to properly assess the long-term ability of the proposed landfill liner system to collect all leachate generated in the landfill over the hundreds of years that the proposed dry tomb landfill will be a threat to generate leachate when contacted by water. The basic problem is that Taylor has failed to properly assess the rate of leachate passage through the compacted clay layer underlying holes that will inevitably be present in the HDPE plastic sheeting layer in the composite liner at the time of construction, that can develop upon waste deposition, and that develop as the plastic sheeting layer deteriorates. A far more reliable approach for detecting inadequacies in landfill liner construction that results in early landfill liner failure is the detection of leachate in the secondary leachate detection layer under the composite liner. If, at 25 years, leachate is found in that leak detection layer then it is clear that the composite liner was not properly constructed or protected. Trying to detect early liner failure by monitoring four perimeter monitoring wells, two on each side of the first 25-year cells, and by two horizontal monitoring wells under the sumps is expensive and highly unreliable.

29:28 Asked by a member of audience what he was looking for in the groundwater monitoring. Taylor responded, *"Once the landfill starts generating leachate, we're going to be testing leachate for everything under the sun"* and then see if any of those leachate parameters are in the monitoring wells tested at 25 years. Contrary to Taylor's figurative claim of *"testing for everything under the sun,"* it is well-known that MSW leachate contains innumerable chemicals that are not included in typical monitoring regimens, as well as unregulated chemicals, that can be a threat to public health and the environment. Those issues are discussed in our comments on the monitoring section of the Golder report.

38:32 A member of the audience stated that 21 out of 27 issues reviewed in the USDA NRCS Soils report were of poor to very poor quality for use in developing a landfill. A discussion of the USDA NRCA report is presented later in these comments.

Taylor again stated that he *"try to take requirements and push them as far as I can."* As discussed in these comments, Taylor in response to comments should provide the specific Nevada landfilling regulations that are the basis for his so-called constraints in imposing requirements on the proposed landfill to provide long-term protection of public health and the environment from that landfill.

43:21 Taylor stated that there will be *"ongoing closure certification by NDEP personnel* as parts of the landfill reach capacity and close. This could mean that parts of the landfill will begin the 30-year postclosure period while other parts of the landfill are still receiving wastes.

40:36 Members of the audience pointed out that NDEP's statements about the prevailing wind direction in the area of the proposed landfill is wrong.

44:30 Taylor stated that the 30-yr postclosure care can be extended – *"something going on can extend that timeframe."* He did not define what he meant by *"something going on."* Taylor should discuss in his response to comments what he meant by extending the postclosure period and what may trigger that, for the period of time during which the wastes in the landfill, when contacted by water, can generate leachate that can pollute groundwater if the liner system fails to collect all leachate generated in the landfill. He should also discuss specific failure scenarios and what would be done by him/NDEP and his successors to reliably shepherd the operations/monitoring and maintenance of the Jungo Landfill over the hundreds of years that this landfill will require close inspection by NDEP.

45:26 A member of audience asked, *"Why is it only 30-yrs of postclosure; why can't it be 100 years?"* Taylor's response was, *"30 years is in regulations." "I am constrained by the regulations."* His claim of being constrained by the NDEP regulations from improving the design of this landfill to match that used by some other states, including California (from which the wastes for Jungo Landfill would originate) is questioned. California adopted landfilling regulations in the 1980s that require that an MSW landfill be located, designed, monitored, and maintained in a manner so as to prevent groundwater impairment by landfill leachate. There is no time limitation on that requirement. More recently, the CA Integrated Waste Management Board (now called CalRecycle) adopted regulations that require that the assured postclosure funding for a landfill be provided for at least 100 years, not the 30 years minimum specified in the US EPA Subtitle D regulations. NDEP should cite specific NDEP regulations that prevent Nevada from adopting the California approach for postclosure funding for monitoring, maintenance, and, as needed, remediation of groundwater pollution.

47:29 A member of audience asked, *"Where do you get the soil for the cover?"* Taylor's response was, *"It will come out of the excavation as the cells are being installed."* A member of the audience retorted, *"It's going to be covered with bug dust."* The 153-page US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) report, "Custom Soil Resource, Report for Humboldt County, Nevada, East Part" US Department of Agriculture October 13, (2009), discusses the characteristics and suitability of the soils in the area of the proposed Jungo Landfill for use in various components of the proposed landfill as well as for other uses. Neither the Golder Design Report for the Jungo Landfill nor the NDEP report that provided information on the proposed Jungo Landfill make reference to that USDA NRCS report or its conclusions regarding the suitability of area soils for use in the landfill development and maintenance. While both the Golder Design Report and the NDEP report make reference to other, earlier USDA NRCS reports on other issues such as flooding of the area, neither Golder nor NDEP was evidently aware of the USDA NRCS 2009 report that specifically discusses the use of area soils in the development of the proposed landfill. This is a serious deficiency in the review of the literature pertinent to the evaluation of the landfill area for its suitability for siting the proposed Jungo Landfill.

Table 1 was prepared by us to summarize USDA NRCS (2009) findings concerning the unsuitability of the soils of the area for use in landfill development. The US Department of Agriculture and Natural Resources Conservation Service develop "soil survey interpretations," that integrate measured characteristics of soils into assessments and rankings of a soil's predicted

behavior and suitability for specified soil uses (Source: Natural Resources Conservation Service [http://soils.usda.gov/technical/handbook/contents/part617.html]).

According to USDA NRCS (2009):
"Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use.
"Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.
"Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected."

Table 1 provides a summary of information (extracted from the USDA NRCS 2009 report) concerning soil interpretations for those uses of soils in the eastern portion of Humboldt County, NV that could be pertinent to the development and maintenance of the Jungo Landfill. Those uses include: Local Roads & Streets, Shallow Excavations, Gravel Source / Sand Source, Roadfill Source, Source of Reclamation Material, Topsoil Source, Catastrophic Mortality, Large Animal Disposal, Pit/Trench, Clay Liner Material Source, Composting Facility - Subsurface, Composting Medium & Final Cover, Rubble & Debris Disposal, Large-Scale Event, Sanitary Facilities (e.g., sanitary landfills) Daily Cover, Sanitary Landfill (Area), Sanitary Landfill (Trench), Waste Management (Disposal of Wastewater by Irrigation), Water Management (Embankments, Dikes, and Levees) , Pond Reservoir Areas. Also provided in Table 1 is a brief, quoted description of the basis for the interpretation ranking assigned by the USDA/NRCS, the ranking itself, as well as reasons given for the ranking. (The "Humboldt County, Nevada, East Part" region covered by the report was defined by two "map unit" areas, "Boton-Playas Association" and "Playas." Information on only the "Boton-Playas Association" area was included in Table 1 as that was the area in which the landfill would be sited. The "rankings" of quality of the Playas area was basically the same as those for the "Boton-Playas Association.")

Overall, as can be seen in Table 1, for essentially all 19 purposes for which area soils could be used in some way in the development and maintenance of the Jungo Landfill, the area soils have been characterized by the USDA as being "poor," "severely limited," or "very limited." The best ranking area soils received for 3 of the 19 uses that may be associated in some way with landfill development was "somewhat limited."

Table 1. Summary of Key USDA/NRCS Soil Survey Interpretations and Ratings of Suitabilities & Limitations for Use
Humboldt County, NV East Part Boton-Playas Association Soils*

Uses	Description	Rating	Reason	page*
Local Roads & Streets	The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity	very limited	low strength, shrink-swell, depth to sat. zone, ponding	17
Shallow Excavations	The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing.	some-what limited	cutbanks cave	19
Gravel Source / Sand Source	Gravel Source / Sand Source	poor	bottom layer; thickest layer	24, 28
Roadfill Source	The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place.	poor	low strength, shrink-swell, wetness depth	26
Source of Reclamation Material	The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place.	poor	salinity, sodium, alk, low org. matter, water erosion, croughty, too clayey	30
Topsoil Source	The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area.	poor	sodium, salinity, wetness depth, too clayey	32
Catastrophic Mortality, Large Animal Disposal, Pit/Trench	Catastrophic Mortality, Large Animal Disposal, Pit/Trench	very limited	salt, water gathering, cutbanks cave, wetness, ponding, sodium, too clayey	35, 38
Clay Liner Material Source	This interpretation shows the degree and kinds of properties that make soil material suitable for use as a clay liner. The ratings are based on the soil properties that affect ease of excavation, compactability of the material, the thickness of the soil layer, reclamation of the area, and erosion from the site.	poor	area reclaim difficult; hard to pack	40
Composting Facility - Subsurface	The ratings are based on the soil properties that affect attenuation of suspended, soil solution, and gaseous decomposition products and microorganisms, construction and maintenance of the site, and public health. Improper site selection, design, or installation may cause contamination of ground water, seepage, and contamination of stream systems from surface drainage or floodwater.	some-what limited	low precip, water gathering, cutbanks cave	44

Composting Medium & Final Cover	This interpretation shows the degree and kinds of properties that make soil material suitable for use as composting medium and final cover material. The ratings are based on the soil properties that affect ease of excavation, workability of the material, the thickness of the soil layer, reclamation of the area, and erosion from the site.	poor	sodium	47
Rubble & Debris Disposal, Large-Scale Event	Such a landfill involves excavating a large pit or trench, placing the rubble and debris in the trench, and covering each layer with a blanket of soil material. A final blanket of cover material is placed over the whole facility when completed. The ratings are based on the soil properties that affect attenuation of suspended, soil solution, and gaseous decomposition products and microorganisms; construction and maintenance of the site; and public health. Improper site selection, design, or installation may cause contamination of ground water, seepage, and contamination of stream systems from surface drainage or floodwater.	severely limited	salt, water gathering, cutbanks cave, wetness, poinding, sodium, too clayey	51
Sanitary Facilities (e.g., sanitary landfills) Daily Cover	The ratings also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.	very limited	depth to sat. zone, sodium, hard to compact, salinity, ponding	54
Sanitary Landfill (Area)	In an "area sanitary landfill," solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. A landfill must be able to bear heavy vehicular traffic. It can result in the pollution of ground water. Ease of excavation and revegetation should be considered. The ratings are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.	very limited	depth to sat zone; ponding	56
Sanitary Landfill (Trench)	The ratings are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include saturated hydraulic conductivity (Ksat), depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium.	very limited	salt, depth to sat zone, sodium, ponding, too clayey	60

Waste Management (Disposal of Wastewater by Irrigation)	The ratings are based on the soil properties that affect the design, construction, management, and performance of the irrigation system.	very limited	sodium, slow water movement, droughty, depth to sat zone, salinity	63
Water Management (Embankments, Dikes, and Levees)	The soils are rated as a source of material for embankment fill.Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.	very limited	salinity, piping, depth to sat zone, hard to pack, ponding	81
Pond Reservoir Areas	Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the saturated hydraulic conductivity (Ksat) of the soil and the depth to fractured bedrock or other permeable material	some-what limited	seepage	87

*Source: USDA and NRCS, "Custom Soil Resource Report for Humboldt County, Nevada, East Part," US Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS), October 13 (2009). Page numbers given in Table refer to page numbers in USDA/NRCS report on which tables of rankings for the given use appear.

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The information in the USDA NRCS soils report raises serious questions about the reliability of the statements made in the Golder Design Report and by Taylor at the hearing concerning the use of local excavation soils for landfill development. It also contributes to the significant questions of the technical credibility of evaluation of the proposed Jungo Landfill.

48:08 Taylor stated, *"At the end of the day, this land becomes deed restricted. There must be a restriction on the deed to be sure this property…"* A deed restriction that limits the use of the closed landfill area, even if thorough and well-crafted, is in the end only as reliable as the agency and its personnel are in implementing the deed restriction over the hundreds of years that the wastes in the landfill will be a threat to pollute the environment to prevent future land-use activities from damaging or diminishing the integrity of the landfill containment and monitoring systems. NDEP should address who will be responsible for reliable implementation of the deed restriction over the hundreds of years that they will be needed to be enforced.

49:09 Taylor stated the financial assurance, trust fund was *"for NDEP to hire a third-party contractor to perform activities in the application and required by the permit"* for 30 yrs. and described it as being *"cash in the bank."* This statement fails to address the true long-term need for financial assurance that will extend well-beyond the 30-year period covered by the implement he described in order to protect the groundwater and the health/welfare of the people of the County.
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59:48 Taylor stated, *"What I have on my desk is a well-engineered, well-designed landfill."* As discussed in these comments, the proposed landfill will, at best, only delay groundwater pollution by landfill leachate and will cause the state of Nevada and Humboldt County to inherit a massive liability of San Francisco Bay area garbage to the detriment of the current and future County residents. While the proposed Jungo Landfill may be a well-design and well-engineered landfill by Nevada standards, a landfill of that design and provision could not be permitted in several other states because of inadequacies in its siting and design, as well as foreseeable problems in its ability to control releases from the landfill, and the lack of assured postclosure funding for care for as long as the wastes in the landfill will be a threat.

60:00 Taylor commented on the Nevada Department of Wildlife's (NDOW) concern about standing water in industrial area ponds that would be threat to wildlife that could drink from the ponds. Taylor indicated that there would be no wildlife mortality due to a fence to keep wildlife out of the landfill property. While Recology would be responsible for maintaining the fence and ensuring its adequacy during the active life and monitored postclosure period, Taylor did not indicate who would be responsible for such monitoring and maintenance after Recology walks away from responsibility for postclosure maintenance of the landfill area. This should be defined.

61:40 Taylor stated, *"For us, designed this landfill out about as far as I think I can while still being within my regulatory constraints. In other words, I'm trying hard not to exceed my regulatory requirements."* If the degree of protection afforded by landfills is, in fact, restricted by Nevada regulations, NDEP should cite the statutory limitations and make those limitations very clear to the people who stand to be adversely affected by this landfill, now and in the future. However, we have reviewed the NDEP landfilling regulations and do not find any statement of constraints that prohibit NDEP from requiring landfill developers to provide design proposals that will be fully protective of public health and the environment for as long as the wastes are a threat. In fact the NDEP landfilling regulations at several locations specify that an MSW landfill shall not be adverse to groundwater quality, cause offsite nuisance, or result in other adverse impacts to adjacent and nearby property owners/users. NDEP should provide specific citations to the so-called constraints that prevent NDEP from making this landfill fully protective.

Taylor mentioned that leachate could be used for dust control at the landfill. As discussed in our report, that practice can lead to pollution of stormwater runoff by hazardous and otherwise deleterious chemicals in the leachate.

64:48 Taylor: *"I will evaluate and respond to **all** comments."* (emphasis his). It will be important that NDEP address the specific literature that we have provided that discusses the technical basis upon which we have challenged the reliability of the information in the Golder Jungo Landfill design report concerning the long-term protection afforded by the proposed landfill.

65:26 Taylor stated, *"If there are off-site complaints about nuisance, NDEP would inspect and change operation practices to control the nuisance conditions."* Given that landfill buffer lands are virtually nonexistent, there being only few hundred feet between the proposed edge of waste

deposition and adjacent property lines, there is no doubt that nuisance offsite odor conditions will exist at this landfill and that they would, at times, extend for several miles from the landfill property.

Biographical Information for G. Fred Lee and Anne Jones-Lee

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, J. Stormwater, J. Remediation etc. Throughout his over-50-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 waste 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 is vice president of G. Fred Lee & Associates. She earned her BS degree in biology from Southern Methodist University in 1973 and her PhD degree in environmental science from the University of Texas Dallas in 1978. For 11 years she held teaching and research positions in graduate degree programs of several US universities, where she specialized in evaluating the impact of chemicals and pathogens on public health and water quality. Dr. Jones-Lee is editor of Drs. Lee and Jones-Lee's "Stormwater Runoff Water Quality Newsletter." She has worked with Dr. G. Fred Lee since 1975 in research and consulting, and has co-authored many papers and reports.

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 150 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" and hazardous waste 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 50 years, Dr. Lee is a registered professional engineer in the state of Texas and an American Academy of Environmental Engineers (AAEE) board certified Environmental Engineer. The latter recognizes his leadership roles in the environmental engineering field. He served as the chief examiner for the AAEE in north-central California during 1990-2010 and in the 1980s in 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.

In November 2009 elected Dr. Lee as a fellow of the American Society of Civil Engineers. This election recognizes Dr. Lee five decade career as a national/international leader university graduate level educator and environmental consultant recognizing his leadership role in the environmental quality management field. In September 2010 the Sacramento Section of the American Society of Civil Engineers awarded Dr. Lee as the Outstanding ASCE Life Member.

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 22-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 June 2010, which can be found on their website at
http://www.gfredlee.com/Landfills/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.

Drs. Lee and Jones-Lee have developed guidance on the evaluation of the potential impacts of landfills. This guidance is available as,

Lee, G. F., and Jones-Lee, A., "Guidance on the Evaluation of the Potential Impacts of a Proposed Landfill," Report of G. Fred Lee & Associates, El Macero, CA January (2007). http://www.gfredlee.com/Landfills/EvaluationImpactLF.pdf.

SUMMARY BIOGRAPHICAL INFORMATION

NAME: G. Fred Lee

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

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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

American Academy of Environmental Engineers Board Certified Environmental Engineer, Certificate No. 0701 Chief Examiner Northern California for AAEE Board Certification including in the solid and hazardous waste management

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.
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.
Publications are available in the following topics at http://www.gfredlee.com/plandfil2.htm

- Overall Problems with “Dry Tomb” Landfills
- Liner Failure Issues
- Groundwater Pollution by Leachate
- Groundwater Monitoring
- Post-Closure Care
- Permitting of Landfills
- Fermentation/Leaching “Wet Cell” Landfills
- Landfill Mining
- Landfills and the 3R’s
- NIMBY Issues
- Review of Specific Landfills
- Hazardous Waste Landfills
- Groundwater Protection Issues

Landfills that have been examined by G, Fred Lee

Arizona *(State Landfilling Regulations)*	Verde Valley - Copper Tailings Pile Closure Mobile – Southpoint Landfill
California *(State Landfilling Regulations)*	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) Mojave 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 Colusa County – Cortina Landfill Imperial – Allied Imperial Landfill Brisbane – Brisbane Landfill
Colorado (*State Landfilling Regulations)*	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 (*State Landfilling Regulations*)	Crystal Lake – McHenry County Landfill Wayne County Landfill Kankakee County – Kankakee Landfill Peoria County – Peoria Waste Disposal (Hazardous Waste) DeWitt County – Chemical Waste Unit at Clinton Landfill
Indiana (*State Landfilling Regulations*)	Posey County Landfill New Haven-Adams Center Landfill (Hazardous Waste)
Louisiana	New Orleans vicinity - Gentilly Landfill and Chef Menteur Debris Waste Disposal Area
Michigan (*State Landfilling Regulations*)	Menominee Township – Landfill Ypsilanti- Waste Disposal Inc. (Hazardous Waste - PCB's)
Minnesota	Reserve Mining Co., Silver Bay - taconite tailings Wright County - Superior FCR Landfill Four landfills in Sherburne County
Missouri	Jefferson County - Bob's Home Service (Hazardous Waste)

Nevada	Jungo Disposal Site Humboldt County,
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
Alberta, Canada	Waste Management proposed Thorhild Landfill
Ontario, Canada (*Prov. Landfilling Regulations*)	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 (*Haz. Waste Landfilling Reg.*)	San Luis Pontosi Landfill- (Hazardous Waste)
New Zealand	Hampton Downs Landfill 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
Linquist & 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
Tulane Environmental Law Center, New Orleans, LA
Backcountry Against Dumps, Boulevard, CA
The Roth Law Firm, Marshall, TX
Citizens group Meriwether, County, GA
North Sacramento Land Company, Sacramento, California
Macuga, Liddle & Durbin Detroit, Michigan
Lozeau & Drury, Alameda, CA
DeWitt County, IL
Concerned Citizens of Thorhild County Alberta, Canada
Wisconsin Fox River Consortium
Minnesota Agricultural Water Resources Coalition
Brisbane Baylands Community Advisory Group

Announcement of American Society of Civil Engineers (ASCE) Election of Dr. G. Fred Lee as ASCE Fellow

In December 2009 Dr. G. Fred Lee was elected as an ASCE Fellow. This election recognizes Dr. Lee five decade career as a national/international leader university graduate level educator and environmental consultant. The ASCE announcement of this election is presented below.

G. FRED LEE, Ph.D., P.E., BCEE, F.ASCE, earned his Master of Science in Public Health from the University of North Carolina in 1957 and his PhD degree in environmental engineering from Harvard University in 1960. For 30 years he served on the graduate civil and environmental engineering/science faculty of several major US universities where he taught, conducted research, mentored the Masters and PhD work of 90 students, published extensively in professional journals, and actively undertook public service for the regulatory, professional, and lay communities.

In 1989 Dr. Lee retired from his academic career to focus on private consulting and public service; he is president of G. Fred Lee & Associates. Areas of emphasis include domestic water supply water quality focusing on how land use in a water supply watershed impacts water supply water quality; investigation and management of surface and groundwater quality, stormwater runoff, contaminated sediments, land surface activities that impact groundwater quality, and use of reclaimed wastewater; and investigation and management of impacts of solid and hazardous chemicals including MSW and hazardous waste landfills, Superfund, and other hazardous chemical sites.

Dr. Lee has served on the editorial boards for several professional publications, and currently serves on the editorial board for the Journals *Stormwater* and *Remediation*. Dr. Lee has long served on the American Academy of Environmental Engineers' (AAEE) examination board for AAEE professional

engineer certification; until 2009 he served as Chief Examiner for Northern California in Water Supply and Wastewater and in the Hazardous Waste areas for 20 years.

Dr. Lee has published more than 1100 professional papers and reports many of which are posted on his website [www.gfredlee.com]. In addition, out of the need for greater influence of science and engineering in water quality regulation and management, he created and authors an email-based Stormwater Runoff Water Quality Newsletter which he has distributed about monthly for the past 12 years, at no-cost, to about 8,000 subscribers.

Outstanding ASCE Life Member

Dr. G. Fred Lee — G. Fred Lee & Associates

Dr. Lee has been a full-time consultant through the firm of G. Fred Lee & Associates since 1989 when he moved to El Macero, CA (near Sacramento). This firm specializes in evaluating and managing the impacts of chemicals on water quality, advanced level water supply water quality, water and waste water treatment, water pollution control, and solid and hazardous waste investigation and management. Dr. Lee has established a website, www.gfredlee.com, where he has make available over 600 papers and reports developed from his research and consulting activities. In December 2009, Dr. G. Fred Lee was elected as an ASCE Fellow. This election recognizes Dr. Lee's five-decade career as a national/international leader, university graduate-level educator, and environmental consultant.

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SUMMARY RESUME

Anne Jones-Lee, PhD

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El Macero, CA 95618-1005
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annejlee23@sbcglobal.net

EDUCATION

Ph.D. Environmental Sciences, University of Texas at Dallas, Richardson, TX, 1978. Areas of Specialization: Aquatic Toxicology/Chemistry, Aquatic Biology, Water Quality Evaluation and Management

M.S. Environmental Sciences, University of Texas at Dallas, Richardson, TX, 1975

B.S. Biology, Southern Methodist University, Dallas, TX, 1973

ACADEMIC AND PROFESSIONAL EXPERIENCE

1989 – Present Vice President, G. Fred Lee & Associates
[A list of major project areas in which Dr. Jones-Lee (R. A. Jones) had a leading role is provided at the close of this resume]

2000-2004 Adjunct Research Scientist, California State University, Fresno, CA

1984 - 1989 Associate Professor of Civil and Environmental Engineering (tenured), New Jersey Institute of Technology, Newark, NJ

1988 - 1989 Consulting Engineer, Ebasco-Envirosphere, Lyndhurst, NJ (part-time)

1984 - 1988 Director of Environmental Engineering Laboratories, Department of Civil and Environmental Engineering, NJIT, Newark, NJ

1982 - 1984 Research Associate and Lecturer, Department of Civil Engineering, Texas Tech University, Lubbock, TX

1982 Coordinator for Aquatic Biology, Fluor Engineers Advanced Technology Division, Irvine, CA

1978 - 1981 Research Assistant Professor, Department of Civil Engineering, Colorado State University, Fort Collins, CO

1973 - 1974 Research Technician, Frito-Lay Research and Development Laboratory, Irving, TX

SUMMARY OF PROFESSIONAL REPORTS AND PUBLICATIONS

Published more than 250 professional papers, and co-authored more than 450 reports and occasional papers. Topic areas addressed include:

- Sources, significance, fate, and control of chemical contaminants in fresh water, marine, and estuarine systems
- Environmental impact of various types of wastewater discharges including mining, electric generating station, domestic, and industrial
- Causes and control of eutrophication; groundwater quality; impact of land disposal of municipal and industrial wastes; environmental impact of dredging and dredged sediment disposal; water quality modeling; hazard assessment of new and existing chemicals; water quality criteria and standards; water supply water quality; assessment of actual environmental impact of chemical contaminants on water quality; toxicity of sediments; impact of landfills on environmental quality.

Served as collaborator in essentially all research and consulting projects and publications of Dr. G. Fred Lee since the mid-1970s; many of their publications are available on their website at www.gfredlee.com. A bibliographic listing of papers and reports on which Dr. Jones-Lee (R. A. Jones) was senior author is provided at the close of this resume.

SUMMARY OF PROFESSIONAL PRESENTATIONS

Presented 55 lectures and professional papers at professional society meetings, short courses, universities, public service groups, and national and international conferences.

1983–With Dr. G. F. Lee, presented workshop to South African Water Research Commission on application of OECD eutrophication modeling approach to South African impoundments

1987–With Dr. G. F. Lee, presented one-week workshop for the USSR Academy of Sciences on water quality management programs for Volga River system

AWARDS

Charles B. Dudley Award - American Society for Testing and Materials award for contribution to Hazardous Solid Waste Testing, "Application of Site-Specific Hazard Assessment Testing to Solid Wastes," published (1984).

1986 Best Paper of the Year - American Water Works Association Resources Division award for paper published in the Journal, "Is Hazardous Waste Disposal in Clay Vaults Safe?" (1986)

TEACHING EXPERTISE AND EXPERIENCE

Taught Graduate Courses in

- Microbiological Aspects of Environmental Engineering
- Introductory Chemical Aspects of Environmental Engineering
- Aquatic Toxicology
- Water and Wastewater Analysis
- Introduction to Water and Wastewater Treatment
- Introduction to Environmental Engineering

Faculty Director of Women in Science and Engineering Program (1988)

OTHER PROFESSIONAL ACTIVITIES

Editor of the “Stormwater Runoff Water Quality Newsletter.” Past issues available at http://www.gfredlee.com/newsindex.htm

Webmaster for G. Fred Lee and Anne Jones-Lee’s website, www.gfredlee.com