

**Comments on
Addendum Subsequent Environmental Impact Report
CERRS Waste Management Facility
developed by County of Colusa Department of Planning and Building
January 1997**

Submitted by
G. Fred Lee PhD, DEE
G. Fred Lee & Associates

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The Colusa County Planning Commission (Commission) concluded that the Final Subsequent Environmental Impact Report (FSEIR) for the CERRS Waste Management Facility dated December, 1996 was deficient with respect to adequately describing the potential for this proposed landfill to pollute groundwaters. The Commission has required that an Addendum Subsequent Environmental Impact Report (ASEIR) that specifically addresses the potential for the proposed landfill liner system to protect groundwaters from pollution by landfill wastes be developed. The County of Colusa Department of Planning and Building released an ASEIR in January, 1997 that claims "*...to provide additional information on the permanence of the membrane liners proposed for use in the CERRS Waste Management Facility.*" I have been asked to conduct an in-depth review of the information provided by the County of Colusa Department of Planning and Building in its January, 1997 ASEIR. These comments specifically address the adequacy and reliability of the ASEIR in providing information on the ability of the CERRS proposed landfill liner system to protect groundwaters from pollution by landfill leachate for as long as the wastes in the landfill will be a threat to cause groundwater pollution.

Overall Findings

I find the County of Colusa Department of Planning and Building Addendum Subsequent Environmental Impact Report dated January, 1997 does not conform to CEQA requirements for full disclosure on the permanence of the proposed CERRS landfills liner system in protecting groundwaters from landfill leachate for as long as the wastes in the landfill will be a threat to cause groundwater pollution. The ASEIR is basically a pro-landfill development document that attempts to mislead the Commission into believing that the CERRS proposed landfill liner system will protect the groundwater resources potentially impacted by this landfill from pollution by wastes in the landfills for as long as they remain a threat. A critical review of the supporting documents contained within the ASEIR regarding what is known about the long term ability of landfill liner systems of the type that are proposed for use at the CERRS landfill shows that the liner system will ultimately fail to prevent groundwater pollution at the CERRS proposed landfill should it be constructed and operated as proposed. The supporting documents provided in the ASEIR contain materials that do not adequately consider long term liner permanence issues. As documented herein, they also contain materials developed by landfill consultants that are deliberately deceptive in discussing the information readily available on the expected performance of liner systems of the type proposed for the CERRS facility in protecting groundwaters.

It is recommended that the County of Colusa Planning Commission find that the Addendum Subsequent Environmental Impact Report dated January, 1997 does not comply with CEQA requirements for full disclosure of the potential of the proposed CERRS landfill to pollute groundwaters. This ASEIR should be rejected as failing to comply with CEQA requirements.

Qualification to Undertake Review

I have been involved in landfill groundwater quality issues since the mid-1960s. For a 30 year period, until 1989, I held university graduate level environmental engineering teaching and research positions at several major US universities. During that time he conducted over \$5 million in research and published over 500 professional papers and reports on this research. One of the topic areas of his research beginning in the 1970s was the performance of landfill liner systems. I have published extensively on this topic. Further, throughout my over 35 year professional career I have served as an advisor to numerous governmental agencies, industry, and others on various water supply water quality, water and wastewater treatment, water pollution control for surface and groundwaters, and the management of solid and hazardous wastes. This advisory work included serving as an advisor to the State of California Water Resources Control Board in the development of Chapter 15 governing the landfilling of wastes.

Since I retired from university teaching and research in 1989 and became a full time consultant, I have been active with many governmental agencies such as water utilities and municipalities and others in helping to evaluate the potential for an existing or proposed landfill to cause pollution of groundwaters. I have worked on a number of landfill situations in California, other states, and other countries. This work has included conducting reviews of environmental impact reports/statements. I am, therefore, familiar with CEQA requirements.

CEQA Requirements for Full Disclosure

CEQA Section 15151 states,

"An EIR should be prepared with a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of proposed projects need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure."

As part of my reviews of EIR's for clients who are concerned about a particular project, such as a landfill, I try to get the project proponent to provide a detailed discussion of a plausible worst-case scenario failure situation where the project proponent discusses:

- Whether project failures could occur at any time in the future that the project will exist - for landfills, for as long as the wastes in the landfill will be a threat - which would result in the release of hazardous or deleterious constituents to the environment. The failure of a landfill containment system would be the inability of the liner system to prevent leachate from passing through it which could lead to groundwater pollution.
- The reliability of the monitoring program to detect the failure before widespread harm is done to public health and/or the environment and the interests of those within the sphere

of influence of the project (landfill). The monitoring programs of concern are the groundwater monitoring programs using vertical monitoring wells spaced hundreds of feet apart where each monitoring well has a zone of capture of about one foot. This is the typical groundwater monitoring system used at today's Subtitle D landfills.

- The remediation approaches that will be taken when failure is detected. Further, information should be provided on how long remediation will be required. For a landfill, how would the groundwaters and the aquifer system be cleaned up so that the aquifer could be used again for domestic water supply?
- The magnitude of the funding under plausible worst-case failure conditions that will be needed to implement the remediation approaches and to compensate those who have been adversely impacted by the project failure.
- The source of the funding that could be needed at any time in the future when project failure could occur. How certain is it for public and private projects, such as landfills, that funds will, in fact, be available to remediate the environmental pollution that has occurred when the pollution is detected and how will the project proponent stop further pollution at the time of detection of the problem?
- How the proposed project conforms to the regulatory requirements for protection of public health, the environment and the interests of those within the sphere of influence of the project. For landfills, how well does the proposed landfill conform to the Water Resources Control Board's Chapter 15 requirements of protecting groundwaters from impaired use for as long as the wastes in the landfill will be a threat?

Any EIR or addendum to it that provides only the projects proponents views of issues that are designed to help gain approval of the project such as the development of a landfill that fails to provide decision makers such as a county planning commission, board of supervisors, and the public, etc. with a discussion of what is known in the literature and in science and engineering on the ability of plastic sheeting and compacted soil (clay) liners to prevent leachate and waste materials from passing through the liner and polluting groundwaters underlying the landfill does not conform to CEQA requirements for full disclosure. Planning commissions, boards of supervisors, and others are entitled to know the "whole truth" about expected landfill liner performance. They should not, as done in the ASEIR, only be given the information that the project proponents such as the CERRS landfill proponents wants them to receive in order to gain approval for the project.

Long Term Permanence of the Liner System

The ASEIR states on page 1,

"Included in this addendum are a description of the liner system proposed for the CERRS facility, a description of the method by which liner systems are installed and inspected, and a summary of technical studies that have been conducted by various researchers on the durability and long term integrity of liner systems."

As discussed herein, that statement is not reliable. Only a pro-project discussion of literature *"on the durability and long term integrity of liner systems"* conducted by various researchers has been provided in the ASEIR.

Further, the ASEIR states,

"Most of the information presented in this addendum is contained in the PSEIR, the ESEIR, or in the technical appendices and background reports incorporated by reference into the SEIR. These materials have already been reviewed by the County in accordance with CEQA."

This statement is also unreliable. I have reviewed the various drafts and final EIR and subsequent EIRs that have prepared for the CERRS facility proponents and find that at no place is full disclosure provided on landfill liner issues of importance to decision makers in determining whether to allow this landfill to be developed as proposed.

The ASEIR states,

"This information confirms the conclusion of the SEIR that the CERRS project can be constructed and operated as proposed and mitigated without any potential significant adverse impact to groundwater related to long term liner system integrity (DSEIR Section 5.1)."

This statement is in error. A proper full disclosure of the liner integrity issues will show that the technically valid assessment of the expected permanence of the liner system in protecting groundwaters from landfill leachate is that the proposed CERRS landfill will, if constructed as proposed, inevitably lead to significant groundwater pollution.

The ASEIR describes the proposed liner system as *"a composite liner consisting of 24" of low permeability clay overlain with a 60 mil HDPE geomembrane liner (DSEIR pages 4-5,4-8, and 4-9)."* As discussed herein, such liner systems are well known to eventually fail to prevent groundwater pollution by landfill leachate. The US EPA, as part of promulgating the RCRA Subtitle D landfilling regulations, stated in the Agency's Solid Waste Disposal Criteria (August 30, 1988),

"First, even the best liner and leachate collection system will ultimately fail due to natural deterioration, and recent improvements in MSWLF (municipal solid waste landfill) containment technologies suggest that releases may be delayed by many decades at some landfills."

The US EPA Criteria for Municipal Solid Waste Landfills (July 1988) state,

"Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit."

Why did the CERRS facility proponents, as part of developing their original draft and final EIRs as well as the ASEIR, not present to the Planning Commission the US EPA's findings on the long term permanence of Subtitle D landfill liner systems. This information is readily available in the literature. There are over a half dozen states in the US that will not allow landfills of the type that CERRS proposed to construct to be constructed in their states because of the lack of permanence of the landfill liner system. The CERRS facility proponents and/or their consultants should have known that eventually the CERRS proposed type of liner system will fail to prevent groundwater pollution. Rather than discuss this issue as required by CEQA, the staff have chosen to provide the Commission only with reports from landfill liner companies or consultants who work for landfill developers in assessing the "permanence" of the liner system proposed for the CERRS facility. The CERRS facility proponents' ASEIR has resulted in the Commission receiving a biased, unreliable, and inadequate assessment of the expected performance of the landfill liner system of the proposed CERRS facility.

While the CERRS facility proponents and their consultants may try to claim that the US EPA's 1988 assessment of the inevitable failure of the subtitle D liner system is not applicable to today's situation, such claims are not in accord with what is known today. The work that has been done over the past eight years has confirmed or provided strong support for the inevitable failure of a plastic sheeting liner as proposed for use in the CERRS facility proposed landfill liner system. As discussed herein and in the enclosed materials, the most recent work available on this topic shows that significant deterioration of the liner system is expected to start about 30 years after closure of the landfill i.e., at the time when the landfill owner could be relieved of further financial responsibility for protection of groundwater quality. At that time Colusa County residents would likely have to pay the cost for groundwater cleanup and proper waste management if further pollution of the groundwaters is to be prevented.

Reliability of Leachate Collection System

On the bottom of page 1, the ASEIR states, "*Leachate will be collected in the 12" drainage layer, above the liner system and routed through a series of pipes to a sump, and then pumped to a leachate collection pond (DSEJR page 4-9)*" That statement is only true as long as the plastic sheeting liner remains intact without significant holes or points of deterioration. Ultimately that liner will deteriorate. At that time, the wastes in the landfill will still be generating leachate which has a high potential to pollute groundwaters rendering them unusable for domestic water supply and other purposes.

Reliability of the Leak Detection System

The ASEIR states on page 2,

"The integrity of the liner system will be monitored through the use of lysimeters that will be placed at strategic points in the soil below the facility liner (DSEIR page 4-18). Sample tubes will extend from the lysimeters up to the surface to allow water samples to be extracted from the lysimeters and tested for the presence of leachate."

It also states,

"A series of new groundwater monitoring wells, in addition to the wells already in place, will also be installed in accordance with the direction of the Regional Water Quality Control Board, to monitor the quality of the groundwater up-gradient and down-gradient of the facility (DSEIR page 4-17)"

These statements are designed to try to cause the County's Planning Commission and Board of Supervisors, the public, and others to believe that even if the liners should for some reason fail to prevent leachate from passing through them a leak detection system that would detect any liner leaks before significant groundwater pollution has occurred. However, the "whole truth" is that the proponents of the CEERS facility are proposing to use the minimum leak detection system that will just get by the Central Valley Regional Water Quality Control Board's current approach for permitting landfills with respect to leak detection/groundwater monitoring. It has been known since 1990 with the publication of Dr. John Cherry's work (Cherry 1990) on the reliability of groundwater monitoring systems of the type that is proposed for use at the CERRS facility that these monitoring systems have a low probability of detecting landfill liner leaks before widespread groundwater pollution occurs. While the CERRS proponents and their consultants may claim they were unaware of the Cherry work on this topic, this situation is well documented

in the literature published by others. For example, Dr. Jones-Lee and I published a summary of this work (Lee and Jones-Lee, 1994) in one of the national environmental journals. Further, we have published reference to this situation in numerous solid waste magazines over the past several years. Copies of several of these publications are appended to these comments.

The fundamental problems with the groundwater monitoring that is proposed for use at the CERRS landfill facility is that the initial leakage through the liner system will occur through holes, rips, tears, or points of deterioration in the liner. As Cherry (1990) pointed out, such points of leakage will produce finger-like plumes of leachate. The CERRS facility is proposed to have monitoring wells spaced hundreds of feet apart. Each monitoring well has the ability to detect leachate about 1 foot on each side. Therefore, unless the monitoring wells are spaced about 10 feet apart, significant leakage of leachate through the liner system into the underlying groundwaters can occur and not be detected by the monitoring wells. This situation is shown diagrammatically in the attachments to these comments.

With respect to the use of lysimeters to monitor in the vadose zone underlying the landfill, the ability to detect leaks situation is even worse than with the monitoring wells. These types of monitoring devices have a very limited range in which they can detect leachate passing their location. Further, regulatory agencies such as the Central Valley Regional Water Quality Control Board require that a few of them are installed under each waste management cell. The net result is that it is likely that leachate can pass through the liner as it deteriorates and pass by the lysimeters and monitoring wells without being detected. Widespread groundwater pollution will likely occur which will be discovered in off-site production wells used for domestic water supply or agriculture.

In accord with CEQA requirements for full disclosure, county planning commissions, board of supervisors, the public and others should be informed, as part of the review of an EIR for a proposed landfill, of the reliability of detecting leaks through the landfill liner before pollution occurs beyond the point of compliance for groundwater monitoring. This is a location where the above discussed plausible worst case scenario failure evaluation can and should be used to provide decision makers with the needed information on the reliability (more appropriately unreliability) of the leak detection system proposed. Landfill applicants should be required to evaluate the reliability of the leak detection systems and report this information to the EIR reviewers. Without such information, an EIR, obviously, does not conform to CEQA requirements for full disclosure.

On the bottom of page 2 - top of page 3 the ASEIR discusses various aspects of liner material, characteristics, construction, etc. Someone reading this material who is not knowledgeable in the facts (whole truth) could gain the impression from the accompanying literature that these liner systems are reliable for protecting groundwater for as long as the wastes remain a threat. A number of the components of the solid waste of the type the CERRS facility proposes to accept will be a threat to groundwater quality **forever**. Since the liners have a limited time when they can be expected to function effectively, groundwater pollution is inevitable for landfills sited at location such as the CERRS facility where leakage through the liner will lead to groundwater pollution. While no one can estimate at this time when this pollution will occur, there is no question to the fact that it will occur.

An appropriate way to judge the reliability of the liner system to prevent groundwater pollution is to examine the warranty that landfill liner companies provide on their liners. While such information was not included in the materials provided to me, from my review of the situation, typically landfill liner companies only warrant the liner for a 20 year period. While some companies state that they believe their liner will last 100 or more years, they still only warrant the liner for 20 years. Further, this warranty is superficial in that it is prorated over the 20 year period and the landfill owner/operator has to find the location of the leak and remove all wastes above the liner at that point so that the liner company can make repairs. Obviously, such a warranty has no meaning except to indicate that landfill liner companies have limited faith that their liners will prevent groundwater pollution for as long as the wastes in the landfill will be a threat.

The ASEIR states on page 3,

"Attachment 2 is one of a series of technical notes prepared by the State Water Resources Control Board. This Technical Note (#6, dated October 13, 1992) addresses the often used statement 'all landfills leak' and indicates that a well designed, constructed and inspected liner system can protect ground water and that any impact from leaks will be negligible. Section 5.1.5.2 of the DSEIR (page 5-4) provides the results of simulations that were made to quantify the potential impact of leachate releases from the CERRS facility."

As presented, this is a highly misleading statement in that the State Water Resources Control Board Technical Note #6 only addresses when the landfill liners are new or shortly thereafter compared to the time that the liner must function perfectly if groundwater pollution is to be prevented for as long as the wastes in the landfill will be a threat. The State Board staff member responsible for Technical Note #6 has been found to only consider short term issues. He (B. Eagle) fails to address the long term considerations that have to be addressed in reliably reporting on the ability of the plastic sheeting liners of the type that are proposed for use in the CERRS landfill to prevent groundwater pollution for as long as the wastes represent a threat. The above quoted US EPA 1988 statement on this issue is a proper representation of what was known then and is known today. While it is possible to construct landfill liner systems that will leak at a slow rate for a period of time after the landfill is put in operation, eventually with liner deterioration, the rates of leakage would increase significantly; ultimately the liner will fail to prevent leakage through it which will lead to groundwater pollution.

Again, the CERRS proponents in the ASEIR have failed to provide the Commission and Board of Supervisors with full disclosure of issues. They have selectively provided information that only supports the position that would cause the Commission and Supervisors to approve this landfill.

Testing of Liner Material

The ASEIR states on page 3,

"Attachment 3 provides a discussion of the results of various chemical tests conducted on HDPE liner material. The tests were designed to expose the liner materials to the types of chemicals and conditions likely to be found in a landfill. The results of the tests did not indicate any discernible trend to indicate deterioration of the materials in a landfill environment."

There are several aspects of attachment 3 that need to be considered by the Commission. First is the nature of the publication (Geotechnical Fabrics Report). That publication is a trade publication that primarily supports the use of plastics in construction. I can document that this publication will not publish material that shows that plastics have significant problems in performing as described by the companies who manufacture/sell them.

The second factor to consider is the affiliation of the author (L.G. Tisinger). He is associated with GeoSyntec, Inc., a firm that is dependent primarily upon landfill liner company and landfill applicant support. As documented below, Mr. Tisinger has been found to provide unreliable information on the expected performance of geomembrane liners.

Dr. Jones-Lee and I (Lee and Jones, 1992) conducted a comprehensive review of the literature on landfill liner issues. Our review included a discussion of what was known about the ability to test landfill liners for long term performance. As we point out, Koerner *et al.* (1990) stated, *"While accelerated test methods are attractive to assess the various phenomena, these procedures may significantly misrepresent the actual long-term performance of geomembranes"*.

The facts (whole truth) is that the experts in the field understand and some will report on the fact that the testing procedures used for landfill liners will likely have limited reliability in predicting long term performance. The tests that are used to try to predict longer term performance of landfill liners do not address true long term performance of the type that will have to be achieved in a landfill such as the CERRS facility if groundwater protection is to be achieved for as long as the wastes in the landfill will be a threat. While it is understandable that Mr. Tisinger would not report this since he was affiliated with a testing laboratory at the time of this article and his reporting this would result in loss of business, the CERRS facility proponents and their consultants have an obligation under CEQA to make this information available to the Planning Commission and the Board of Supervisors in an EIR.

Scientific Studies of Liner Integrity

The ASEIR on page 3 presents several so-called scientific studies of liner integrity where they present another of the articles that have been published in Geotechnical Fabrics Report, this time by Tisinger and Giroud entitled: The Durability of HDPE Geomembranes. According to the ASEIR,

"This report discusses the nature and general chemical properties of HDPE, the chemical resistance of HDPE to various chemicals, and the consistency of the characteristics of HDPE over time. The report concludes that once buried in a landfill, HDPE liners are exposed to very little energy and oxygen, and therefore should perform satisfactorily for a long time after actual generation of leachate had stopped."

I am familiar with the Tisinger and Giroud 1993 article (attachment 4). In 1994, when I became aware of this article, I developed a critique of the unreliable information presented in it. A copy of this critique is attached to these comments.

Tisinger and Giroud stated in their discussion of "The Durability of HDPE Geomembranes" published in September 1993,

"One can conclude, then, that in properly designed and constructed facilities, HDPE geomembranes should be able to protect groundwater from leachate for hundreds of years, which is long after leachate generation has stopped

This is the same statement that was quoted in the ASEIR. Tisinger and Giroud cite as support for this position a section of a US EPA ad hoc Haxo and Haxo committee report on the durability of polymeric landfill lining materials and state,

"...has concluded that the polymeric landfilling materials should maintain their integrity in waste disposal facility environments in 'terms of hundreds of years ' (Haxo & Haxo,1988)"

One would be led to believe by this statement that the CERRS facility landfill liners could be expected to function for "100s of years" without leakage. This is certainly what the CERRS facility proponents wish to have the Commission believe. However, a more appropriate review of the Haxo and Haxo report shows that Tisinger and Giroud are quoting only the first paragraph out of a multi-paragraph discussion of the issue. As presented by Tisinger and Giroud, this is a highly misleading statement on the content of the Haxo & Haxo report.

Haxo & Haxo (1988) state as one of their conclusions,

"The polymers that were discussed and first-grade compounds based on these polymers should maintain their integrity in landfill environments for considerable lengths of time, probably in terms of 100's of years.

***Nevertheless, when these polymers or compounds are used in products such as FMLs, drainage nets, geotextiles, and pipe, they are subject to mechanical and combined mechanical and chemical stresses which may cause deterioration of some of the important properties of these polymeric products in shorter times.**"[emphasis added]*

It is therefore, highly misleading for Tisinger and Giroud to publish self-serving statements about the long term durability of plastic sheeting liners from the Haxo and Haxo report without presenting a discussion of the qualifiers that the Haxo and Haxo committee placed on the 100s of years' durability.

The issue is not the durability of pieces of HDPE when placed in a landfill as waste materials, but what is the expected effective **service life** as a liner where the HDPE plastic sheeting liner will prevent landfill leachate from passing through the liner into the groundwater system connected to the landfill. While no one knows how long HDPE liners of the type being used today will function as an effective liner to leachate migration through them. It is clear that the effective service life of such liners will be far less than the period of time that the municipal solid wastes (MSW) present in the landfills represent a threat to groundwater quality.

It may be concluded, with respect to attachment 4, that the Tisinger and Giroud article is a deliberate, biased presentation of information that significantly overstates the conclusions of the Haxo and Haxo report with respect to the expected performance of geomembrane liners in landfills.

With respect to the statement cited in the ASEIR on page 3, made by Tisinger and Giourd,

"The report concludes that once buried in a landfill, HDPE liners are exposed to very little energy and oxygen, and therefore should perform satisfactorily for a long time after actual generation of leachate had stopped."

First, it appears that the CERRS facility proponents are accepting, as factual, the Tisinger and Giourd statement that leachate generation in landfills stops at some time shortly after landfill closure, i.e. placing a cap on the landfill. This is another of the significant distortions contained within the Tisinger and Giourd statement. Those who know and will reliably report on the situation can unequivocally state that for a period of time after capping a landfill's waste management cell, leachate generation can be significantly reduced because of the reduced inflow of moisture into the landfill through the cover. However, as discussed in the enclosed paper by Lee and Jones-Lee (1995), "Overview of Landfill Post Closure Issues," the low rates of infiltration of moisture into the landfill which generate leachate occur for a short period of time. Ultimately the low permeability layer of the landfill cover deteriorates in its ability to prevent moisture from entering the landfill and generating leachate.

It is important to note that this low permeability layer in the landfill cover is buried below several feet of top soil and a drainage layer and is, therefore, not available for visual inspection. As discussed in the enclosed papers, over time leaks can and do develop in the landfill cover. It is misleading for the ASEIR to inform the Commission through citing a quote by Tisinger and Giourd that leachate generation in the proposed CERRS landfill will stop and therefore imply that the landfill only represents a short term threat to groundwater pollution.

The EIR cites as a reference the groundwater book by Freeze and Cherry (1979). It is unfortunate that those who developed the EIR did not read Freeze and Cherry. If they had, they would have found that Freeze and Cherry discuss Roman Empire landfills that are still producing leachate 2000 years after they were developed. Further, two Swiss scientists, Belevi and Baccini (1989), have modeled the behavior of municipal solid waste landfills where they find that the leachate produced in municipal solid waste landfills would likely contain lead at concentrations above drinking water standards for 2000 years. There is no doubt about the fact that if the CERRS facility proposed landfill is allowed to proceed, it can be considered to be a threat to groundwater quality forever; certainly many hundreds of thousands of years.

The ASEIR states,

"Attachment 4 also includes a paper that was presented by three researchers at the 10th Geosynthetic Research Institute Conference. This paper discusses the results of previous studies of the field performance of composite liners and presents the results of a new study that was conducted on the performance and integrity of liner systems at ten active landfills in the U.S."

On page 4, the ASEIR lists four conclusions. A review of these conclusions, however, shows that the authors have only considered short term leakage issues associated with modern day landfills. While short term (after the landfill was constructed and put into operation) leakage is of importance since it is an indication of the quality of construction of the liner system, it provides no reliable information on the longer term liner integrity issues. The short term issues are associated with whether the seams in the liner were properly welded, and whether the landfill

operator allowed the placement of wastes in the landfill in such a way as to puncture holes in the liner.

The ultimate deterioration of the plastic sheeting liner that will occur, while it can be influenced by quality of construction, is not the issue of primary concern. This deterioration will occur due to chemical breakdown of the liner material. This is not necessarily related to any chemicals in the wastes. There is a natural thermodynamic breakdown of plastics that occurs. This is a well known phenomenon that must be considered in the siting, design, operation, closure, and post-closure care of any landfill. At this time, the free radical breakdown of plastics in a liner is poorly understood. It is known, however, that it does occur. While it is usually associated with oxygen containing waters, there is evidence that it may occur under anoxic (oxygen free) conditions as well.

Basically, the CERRS landfill proponents and their consultants are asking the Planning Commission to believe that the relatively thin plastic sheeting that will be used as a landfill liner in the CERRS landfill will function perfectly as a landfill liner preventing leachate from passing through it for as long as the wastes in the landfill remain a threat. Certainly based on the principles of chemical thermodynamics and kinetics (chemistry) and common sense, it is highly unlikely that burying thin plastic sheeting under large amounts of garbage can be expected to prevent groundwater pollution for as long as the wastes in the landfill will be a threat, i.e. forever.

It is important to understand that I am not anti-landfill. I am anti-landfill where the proponents do not tell the whole truth about the potential problems of a proposed landfill such as has occurred in the various draft, subsequent, final and addendum EIRs. It is my understanding that the motivation behind the Department of Planning and Building staff for supporting this landfill but opposing the Cortina Rancheria proposed landfill which would be located in the same general area, is that the CERRS landfill represents a potential short term revenue source for the County. While I support host communities for properly developed landfills earning a substantial income associated with waste disposal in the landfill, I feel that it is important that the host community properly site, design, construct, operate, close and provide post-closure care to fully protect the groundwater resources, public health, the environment, and the interests of all individuals within the potential sphere of influence of the landfill. Municipal solid waste landfills are well known to have spheres of influence extending over several miles from there waste deposition areas.

I have written extensively on how to develop landfills that will be protective; they are more expensive than the minimum Subtitle D landfill of the type that the CERRS proponents propose to construct at the CERRS facility. The proposed location of the CERRS landfill is basically a geologically unsuitable site for such a landfill. The site provides little natural protection for the important groundwater resources in the vicinity of the landfill. While it would be possible to develop a municipal landfill at the proposed CERRS facility site, the cost of such development would be prohibitively expensive compared to landfill disposal fees that are available in other areas so as to make the CERRS facility landfill uneconomical to operate and compete with other landfills.

Unreliable Information

I have documented that the draft, final, subsequent and addendum EIRs for the CERRS facility have apparently deliberately tried to manipulate the information provided to the Commission on the expected performance of the proposed CERRS facility landfill liner system. It is not uncommon for consultants who work with landfill applicants to provide unreliable information to public entities and the public on the ability of landfill liner systems and groundwater monitoring systems for landfills to protect groundwaters from impaired use for as long as the wastes in the landfill represent a threat. It is well understood that if any consultant fully discusses these issues that they will not obtain future landfill development consulting jobs or EIR contracts.

This is such a significant problem that Dr. Jones-Lee and I have developed a paper on this topic which has been published in condensed form in the Forum section of Civil Engineering as "Environmental Ethics: The Whole Truth." That publication is a condensation of a more complete discussion of this issue "Practical Environmental Ethics: Is There an Obligation to Tell the Whole Truth?" A copy of these publications is appended to this report. They discuss the fact that often decision makers are provided unreliable information by landfill proponent and their consultants. It also discusses an approach that involves a full public peer review of technical issues so that decision makers such as planning commissions and boards of supervisors be reliably informed about the current information on a particular topic issue, such as in the long term integrity of landfill liners. I urge that the County Planning Commission consider using this approach for the CERRS facility should the CERRS facility proponents continue to claim that the draft, final, subsequent and addendum EIRs reliably describe the potential for this facility to inevitably cause groundwater pollution.

If the CERRS facility proponent and their consultants assert that my assessment of the inevitable groundwater pollution by this proposed landfill is incorrect, then I request that those who make such assertions provide their assertions in a written form with appropriate documentation to support their positions so that these positions can be properly, independently peer reviewed by experts in the topic area who do not have a financial interest in current or future landfill development or EIR work. I am confident that if such a peer review is conducted by the Commission, Board of Supervisors, etc. that the Commission and Board will conclude that my comments on the highly significant deficiencies in the ASEIR are technically valid and appropriate.

Overall Conclusion

It is concluded that the Addendum Subsequent Environmental Impact Report does not provide reliable and adequate information that the County Planning Commission requested on the permanence of the liner system that is proposed for the proposed CERRS landfill. This ASEIR does not conform to CEQA requirements for full disclosure for potential environmental impacts. Biased, unreliable, distorted and inadequate information is contained within the ASEIR relative to the potential for the proposed CERRS liner system to prevent groundwater pollution by landfill leachate for as long as the wastes in the landfill will be a threat.

If this landfill is constructed as proposed it will ultimately become a significant financial burden to the County of Colusa which will cost county residents far more money in groundwater

cleanup and proper waste management than will be gained through the funds that the County will derive from allowing this landfill to proceed as proposed.

While not a subject of this review of the ASEIR, it appears to me that there may already be significant groundwater pollution occurring at the CERRS facility due to past brine disposal practices at this location. It is clear from the information provided that the monitoring wells that have been used to detect groundwater pollution from past waste management activities at this location are unreliable for this purpose. The County and other regulatory agencies should require that the owners of the CERRS property conduct a proper groundwater quality investigation at this location to determine the extent of groundwater pollution that has occurred already and require that this pollution be cleaned up in accord with current requirements.

Further Information

I have enclosed as an appendix a number of papers and reports that provide additional information on the issues discussed. I will be happy to answer questions that the Commission, Board of Supervisors, or others raise on any issues pertinent to these comments.

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Cherry, John A., "Groundwater Monitoring: Some Deficiencies and Opportunities," IN: Hazardous Waste Site Investigations: Towards Better Decisions, B.A. Berven & R.B. Gammage, Eds., Proc. of 10th ORNL Life Sciences Symposium, Gatlinburg, TN, May 21-24, (1990).

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Lee, G.F. and Jones-Lee, A., "Overview of Landfill Post Closure Issues," Presented at American Society of Civil Engineers Convention session devoted to "Landfill Closures - Environmental Protection and Land Recovery," San Diego, CA, October (1995).

US EPA, "Solid Waste Disposal Facility Criteria; Proposed Rule," Federal Register 53(168):33314-33422, 40 CFR Parts 257 and 258, US EPA, Washington, D.C., August 30, (1988a).

US EPA, "Criteria for Municipal Solid Waste Landfills," US EPA Washington D.C., July (1988b).

List of Enclosures

- "Landfills Offer False Sense of Security"
- "Dry Tomb Landfills"
- "Landfill Leachate Management: Overview of Issues"
- "Groundwater Pollution by Municipal Landfills: Leachate Composition, Detection and Water Quality Significance"
- "A Groundwater Protection Strategy for Lined Landfills"
- "Detection of the Failure of Landfill Liner Systems"
- "Overview of Landfill Post Closure Issues"
- "Landfill Post-Closure Care: Can Owners Guarantee the Money Will Be There?"
- "Municipal Landfill Post-Closure Care Funding: The '30-year Post-Closure Care' Myth"
- "Landfilling of Solid & Hazardous Waste: Facing Long-Term Liability"
- "No Guarantee" for Post Closure Care Funding
- "Municipal Solid Waste Management in Lined, 'Dry Tomb' Landfills: A Technologically Flawed Approach for Protection of Groundwater Quality"
- "Geosynthetic Liner Systems for Municipal Solid Waste Landfills: An Inadequate Technology for Protection of Groundwater Quality?"
- "Comments on Tisinger and Giroud 'The Durability of HDPE Geomembranes'"
- "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview"
- "Review of Proposed Landfills: Questions that Should be Answered"
- "Evaluation of the Potential for a Proposed or Existing Landfill to Pollute Groundwaters"
- "Environmental Ethics: The Whole Truth"
- "Addressing Justifiable NIMBY: A Prescription for MSW Management"
- "Environmental Impacts of Alternative Approaches for Municipal Solid Waste Management: An Overview"
- "Disposal" of Municipal Solid Wastes
- Summary of G. Fred Lee's Qualifications to Undertake Review of a Proposed or Existing Municipal Solid Waste or Hazardous Waste Landfill Impacts



Comments on Addendum Subsequent EIR Landfill Liner Integrity Issue

Dr. G. Fred Lee, DEE
G. Fred Lee & Associates
El Macero, CA

The County of Colusa Department of Planning and Building released an ASEIR in January, 1997 that claims "*...to provide additional information on the permanence of the membrane liners proposed for use in the CERRS Waste Management Facility.*"

The ASEIR states,

"This information confirms the conclusion of the SEIR that the CERRS project can be constructed and operated as proposed and mitigated without any potential significant adverse impact to groundwater related to long term liner system integrity (DSEIR Section 5.1)."

Evaluate the Reliability of this Statement

Overall Findings

The County of Colusa Department of Planning and Building Addendum Subsequent Environmental Impact Report dated January, 1997 does not conform to CEQA requirements for full disclosure on the permanence of the proposed CERRS landfills liner system in protecting groundwaters from landfill leachate for as long as the wastes in the landfill will be a threat to cause groundwater pollution.

The ASEIR is basically a pro-landfill development document that attempts to mislead the Commission into believing that the CERRS proposed landfill liner system will protect the groundwater resources potentially impacted by this landfill from pollution by the landfill for as long as it remains a threat.

The supporting documents provided in the ASEIR contain materials that do not adequately consider long term liner permanence issues. As documented herein, they also contain materials developed by landfill consultants that are deliberately deceptive in discussing the information readily available on the expected performance of liner systems of the type proposed for the CERRS facility in protecting groundwaters.

Recommendation

It is recommended that the County of Colusa Planning Commission find that the Addendum Subsequent Environmental Impact Report dated January, 1997 does not comply with CEQA requirements for full disclosure of the potential of the proposed CERRS landfill to pollute groundwaters.

This ASEIR should be rejected as failing to comply with CEQA requirements.

Qualification to Undertake Review

- Involved in Landfill Groundwater Quality Issues Since the mid-1960s.
- 30 Years in University Graduate Level Environmental Engineering Teaching and Research Positions at Several Major US Universities.
- Conducted Over \$5 Million in Research and Published Over 500 Professional Papers and Reports on this Research.
- Researched Performance of Landfill Liner Systems Since the 1970s.
- Advisor to Numerous Governmental Agencies, Industry, and Others on Various Water Supply Water Quality, Water and Wastewater Treatment, Water Pollution for Surface and Groundwaters, and the Management of Solid and Hazardous Wastes.
- Advisor to the State of California Water Resources Control Board in the Development of Chapter 15 Governing the Landfilling of Wastes.
- Since 1989 Served as an Advisor to Governmental Agencies Such as Water Utilities and Municipalities and Others in Helping to Evaluate the Potential for an Existing or Proposed Landfill to Cause Pollution of Groundwaters in Situations in California, Other States, and Other Countries.
- This Work Has Included Conducting Reviews of Environmental Impact Reports/Statements and Becoming Familiar with CEQA Requirements.
-

CEQA Requirements for Full Disclosure

CEQA Section 15151 states,

"An EIR should be prepared with a sufficient degree of analysis to provide decision makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of proposed projects need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure."

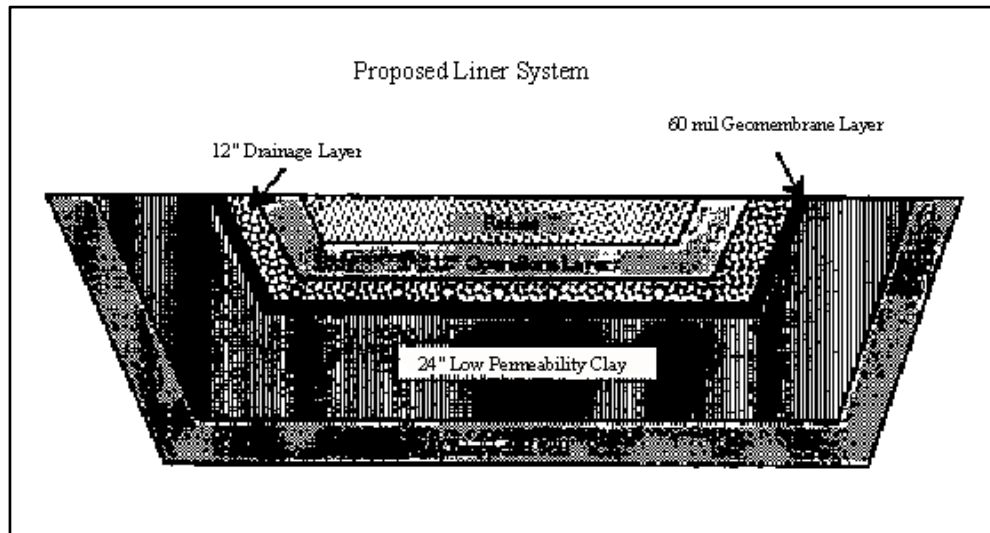
Review of the various drafts, final EIRs, subsequent EIRs and the Addendum EIR for the proposed CEERS facility shows that at no place is full disclosure provided on landfill liner issues of importance to decision makers in determining whether to allow this landfill to be developed as proposed.

CERRS Liner Characteristics

The ASEIR describes the proposed liner system as *"a composite liner consisting of 24" of low permeability clay overlain with a 60 mil HDPE geomembrane liner."*

As discussed herein, such liner systems are well known to eventually fail to prevent groundwater pollution by landfill leachate.

Proposed liner system for the proposed CERRS landfill



US EPA Assessment

The US EPA, as part of promulgating the RCRA Subtitle D landfilling regulations, stated in the Agency's Solid Waste Disposal Criteria (August 30, 1988),

"First, even the best liner and leachate collection system will ultimately fail due to natural deterioration, and recent improvements in MSWLF (municipal solid waste landfill) containment technologies suggest that releases may be delayed by many decades at some landfills."

The US EPA Criteria for Municipal Solid Waste Landfills (July 1988) state,

"Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit."

Basic Issues

- MSW Landfills Produce Leachate for Hundreds to Thousands of Years – Effectively, Forever.
- Small Amounts of MSW Leachate Can Pollute Large Amounts of Groundwater Making it Unusable for Water Supply.
- Plastic Sheeting Liners Will Over Time Eventually Fail to Collect Leachate
- Liner System Will Only Postpone Groundwater Pollution.
- CERRS Site Geologically Unsuitable for Landfill - Little Natural Protection of Groundwater

Reliability of the Leak Detection System

The ASEIR states on page 2,

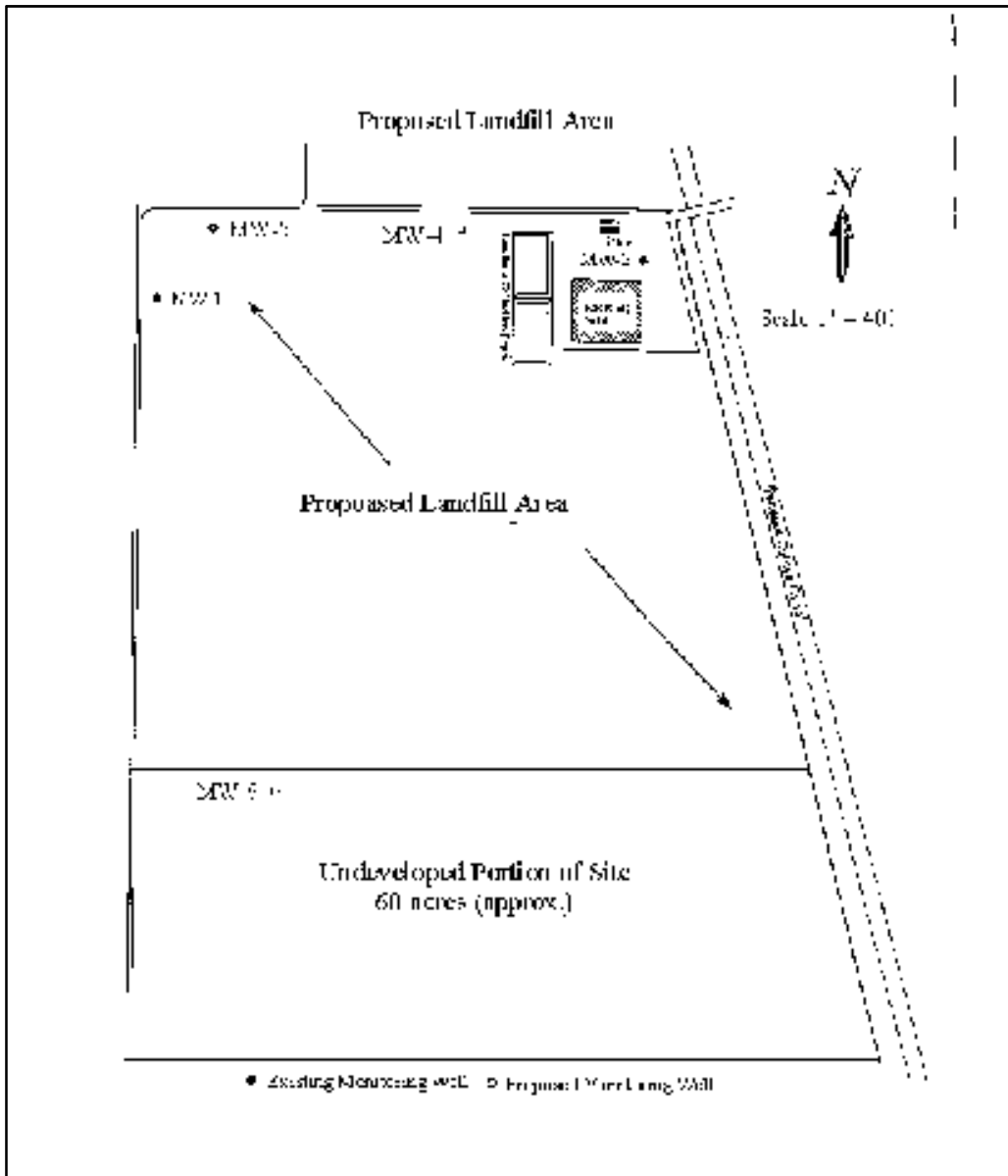
"The integrity of the liner system will be monitored through the use of lysimeters that will be placed at strategic points in the soil below the facility liner (DSEIR page 4-18). Sample tubes

will extend from the lysimeters up to the surface to allow water samples to be extracted from the lysimeters and tested for the presence of leachate."

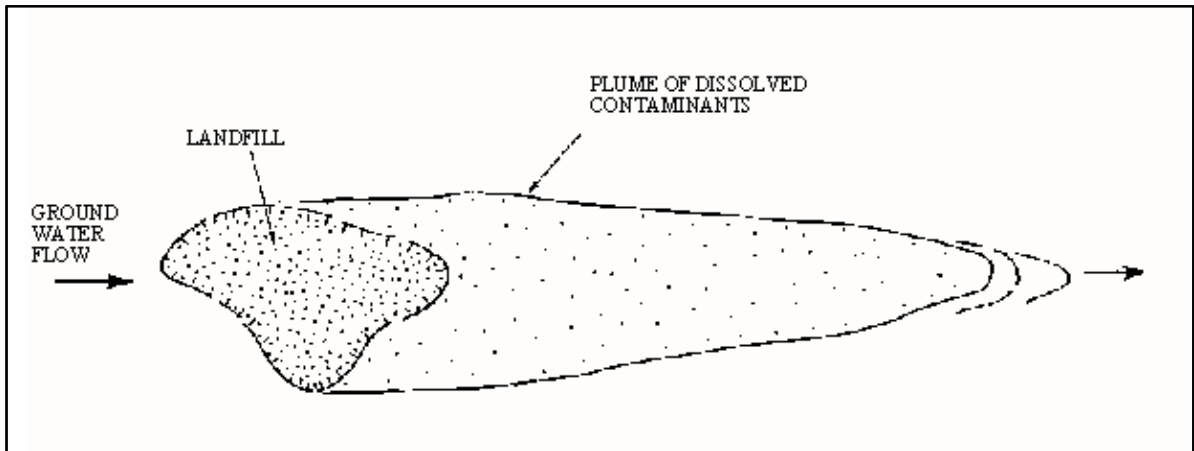
It also states,

"A series of new groundwater monitoring wells, in addition to the wells already in place, will also be installed in accordance with the direction of the Regional Water Quality Control Board, to monitor the quality of the groundwater up-gradient and down-gradient of the facility (DSEIR page 4-17)"

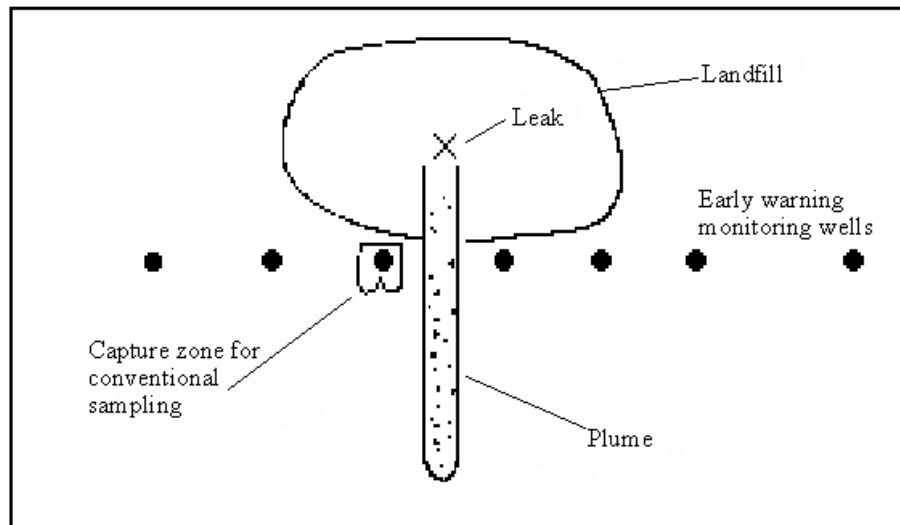
Map of proposed CERRS landfill area



*Pattern of Landfill Leakage - Groundwater Contamination from Unlined Landfills
(After Cherry, 1990)*

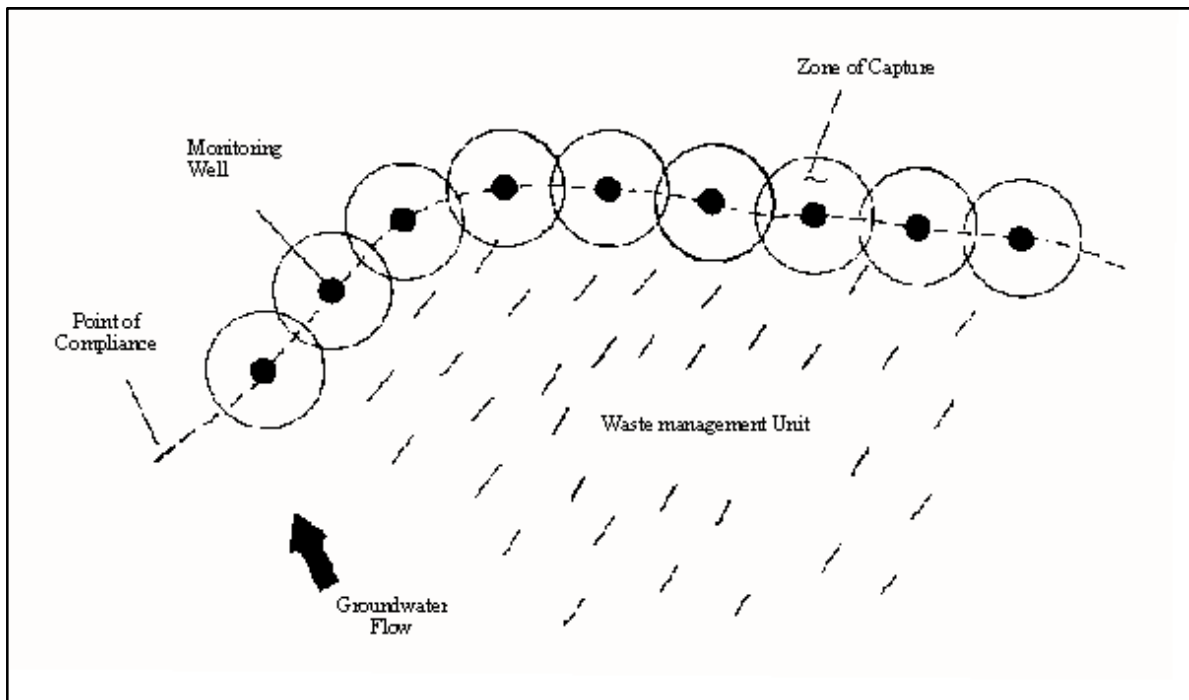


*Pattern of Landfill Leakage - Groundwater Contamination from Lined Landfills
(After Cherry, 1990)*



After Cherry 1990

Zones of Capture of Standard Monitoring Wells Must Overlap to Detect Leakage from Lined Landfills (After Parsons and Davis, 1992)



Landfill Liner Warranty

20 Years - Prorated

Owner Must Isolate the Point of Leachate Leakage Through the Liner and Remove Waste Above this Point so that the Liner Company Can Make Repair

While Landfill Liner Companies Claim that Landfill Liners Will Last Hundreds of Years or More, They Only Warrant the Liner for 20 Years

Prorated Means that Liner Companies Expect the Liner to Deteriorate

The ASEIR states on page 3 of the ASEIR,
"Attachment 2 is one of a series of technical notes prepared by the State Water Resources Control Board. This Technical Note (#6, dated October 13, 1992) addresses the often used statement 'all landfills leak' and indicates that a well designed, constructed and inspected liner system can protect ground water and that any impact from leaks will be negligible. Section 5.1.5.2 of the DSEIR (page 5-4) provides the results of simulations that were made to quantify the potential impact of leachate releases from the CERRS facility."

B. Eagle in Technical Note #6 Considers Only Short-Term - A Few Years to a Few Tens of Years --- Does Not Address Long-Term Issues

Testing of Liner Material

The ASEIR states on page 3,

"Attachment 3 provides a discussion of the results of various chemical tests conducted on HDPE liner material. The tests were designed to expose the liner materials to the types of chemicals and conditions likely to be found in a landfill. The results of the tests did not indicate any discernible trend to indicate deterioration of the materials in a landfill environment."

Koerner et al. (1990) stated,

"While accelerated test methods are attractive to assess the various phenomena, these procedures may significantly misrepresent the actual long-term performance of geomembranes".

Scientific Studies of Liner Integrity

The ASEIR on page 3 presents several so-called "scientific studies of liner integrity" where they present an articles published in Geotechnical Fabrics Report, by Tisinger and Giroud entitled: The Durability of HDPE Geomembranes. According to the ASEIR,

"This report discusses the nature and general chemical properties of HDPE, the chemical resistance of HDPE to various chemicals, and the consistency of the characteristics of HDPE over time. The report concludes that once buried in a landfill, HDPE liners are exposed to very little energy and oxygen, and therefore should perform satisfactorily for a long time after actual generation of leachate had stopped."

Facts are that Leachate Generation Will Not Stop for over a 1,000 of Years

The Report by Tisinger and Giroud Claims that Haxo and Haxo Stated that the Plastic Sheeting Liner will Last for 100's of Years

However, While Haxo & Haxo (1988) state as one of their conclusions that,

"The polymers that were discussed and first-grade compounds based on these polymers should maintain their integrity in landfill environments for considerable lengths of time, probably in terms of 100's of years."

They also Stated,

"Nevertheless, when these polymers or compounds are used in products such as FMLs, drainage nets, geotextiles, and pipe, they are subject to mechanical and combined mechanical and chemical stresses which may cause deterioration of some of the important properties of these polymeric products in shorter times."[emphasis added]

Unreliable Reporting of Information in the Haxo & Haxo Report

The ASEIR states,

"Attachment 4 also includes a paper that was presented by three researchers at the 10th Geosynthetic Research Institute Conference. This paper discusses the results of previous studies of the field performance of composite liners and presents the results of a new study that was conducted on the performance and integrity of liner systems at ten active landfills in the U.S."

On page 4, the ASEIR lists four conclusions. A review of these conclusions, however, shows that the authors, and now the ASEIR in citing them, have only considered short term leakage issues associated with modern day landfills.

Must Consider Expected Performance of the Liner for as Long as the Wastes Will Be A Threat Fails to Provide Full Disclosure Required by CEQA

Overall Conclusion

- The Addendum Subsequent Environmental Impact Report does not provide the reliable and adequate information that the County Planning Commission requested on the permanence of the liner system that is proposed for the proposed CERRS landfill.
- This ASEIR does not conform to CEQA requirements for full disclosure for potential environmental impacts. Biased, unreliable, distorted and inadequate information is contained within the ASEIR relative to the potential for the proposed CERRS liner system to prevent groundwater pollution.

Peer Review of Controversial Issues

Often Unreliable Information Presented to Decision Makers by Landfill Proponents on Potential Landfill Pollution Issues

Decision Makers Need to Require Full Public Peer Review of Liner Leakage and Groundwater Monitoring Issues for the Proposed CERRS Landfill

Overall Problems with "Dry Tomb" Landfills

Lee, G. F. and Jones-Lee, A, "'Dry Tomb' Landfills," MSW Management, 6:82-89 (1996).

Lee, G. F. and Jones-Lee, A., "Municipal and Industrial Non-Hazardous Waste Landfills Impact on Public Health and the Environment: An Overview," Report to State of California Environmental Protection Agency Comparative Risk Project, Berkeley, CA (1994).

Liner Failure Issues

Lee, G. F. and Jones, R. A., "Municipal Solid Waste Management in Lined, 'Dry Tomb' Landfills: A Technologically Flawed Approach for Protection of Groundwater Quality," Report of G. Fred Lee & Associates, El Macero, CA, 68pp (1992).

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Groundwater Pollution by Leachate

Jones-Lee, A. and Lee, G. F., "Groundwater Pollution by Municipal Landfills: Leachate Composition, Detection and Water Quality Significance," Proceedings of Sardinia '93 IV International Landfill Symposium, Sardinia, Italy, pp. 1093-1103 (1993).

Lee, G. F. and Jones-Lee, A., "Landfill Leachate Management: Overview of Issues," *MSW Management* 6:18-23 (1996).

Groundwater Monitoring

Lee, G. F. and Jones-Lee, A., "A Groundwater Protection Strategy for Lined Landfills," *Environmental Science & Technology*, 28:584-5 (1994).

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Post-Closure Care

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Lee, G. F. and Jones-Lee, A., "Landfilling of Solid & Hazardous Waste: Facing Long-Term Liability," Proceedings of the 1994 Federal Environmental Restoration III & Waste Minimization II Conference, Hazardous Materials Control Resources Institute, Rockville, MD, pp. 1610-1618 (1994).

Permitting of Landfills

Lee, G. F. and Jones, R. A., "Review of Proposed Landfills: Questions that Should Be Answered," Report of G. Fred Lee & Associates, El Macero, CA, 22pp (1991).

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Reference as: "Lee, G. F., 'Comments on Addendum Subsequent Environmental Impact Report CERRS Waste Management Facility developed by County of Colusa Department of Planning and Building January 1997,' Submitted to Colusa County Planning Commission, CA, February (1997)."