Response to Declaration of Charles A. Dowdell
Case no. BS 022186 Superior Court of the State of California
for the County of Los Angeles, Signature Date April 12, 1993

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Page 3, lines 10-11. Mr. Dowdell stated,
"I have a Master of Science degree in Environmental Engineering from the University of Texas at Dallas."
According to the Registrar at the University of Texas at Dallas, in 1978 Mr. Dowdell received a Master of Science degree in Environmental Science - NOT Environmental Engineering. That program did not offer at that time, nor has it ever offered, the degree of Master of Science in Environmental Engineering that Mr. Dowdell declared, under penalty of perjury under the laws of the State of California, to hold.

I have personal knowledge of the graduate degree environmental programs at the University of Texas at Dallas (UTD) at the time that Mr. Dowdell matriculated and graduated. In 1973, I worked with the UTD administration to establish the degree programs in environmental sciences at that institution. From 1973 to 1978, I was Director of the Center for Environmental Studies at the University of Texas at Dallas. While there were some environmental engineering courses taught in that program, that program would not be considered to provide an education equivalent to that of an environmental engineering degree program in an engineering school. As noted above, the environmental degrees awarded at the University of Texas at Dallas have never been "engineering" degrees.

Page 8, lines 23-24. Mr. Dowdell stated,
"It is my expert opinion that NO leachate migration has occurred or will occur in connection with the Puente Hills Landfill site." (emphasis his)
He made similar statements on page 9, lines 20-21, and on page 11, lines 11-12 and 22-23.

While Mr. Dowdell repeatedly stated his opinion in this regard, he has not addressed the significant technical information presented that demonstrates that his opinion in that matter is not accurate. These issues have been discussed in detail in the comments on the significant deficiencies in the EIR submitted by Dr. Dennis Williams and Dr. Jones-Lee and me. While Mr. Dowdell asserted that no leachate migration has occurred at the Puente Hill Landfill, he has ignored the fact that in its Solid Waste Assessment Test (SWAT) Program Report to the Legislature 1989-1990 dated January 1991, "Table III: Sites Determined to Be Leaking Waste Constituents below Department of Health Services' Action Levels," the Water Resources Control Board listed "L.A. Co. SD-Puente Hills Landfill" as one of the landfills that was polluting groundwater at that time (WRCB, 1991).

There is no legitimate question about the fact that the existing Puente Hills Landfill has and will continue to pollute groundwater with landfill leachate. Further, the expanded landfill, with its liner system, will only postpone groundwater pollution from the expansion; it will not prevent it. It

should be noted that the SWAT report listed 12 other landfills in Los Angeles County that are also polluting groundwater. This is exactly what is to be expected in that area.

Page 8, lines 24-26 continuing on page 9 lines 1-3. Mr. Dowdell stated,

"In addition, detailed lithology, geologic structure, and groundwater up to three miles around the landfill site have already been fully characterized as part of the 'Report of Geologic and Hydrogeologic Investigation, Puente Hills Landfill Site, Volumes I, II, and III', by LeRoy Crandall and Associates, dated October 9, 1981. That report was only one of many used as reference material to write the Draft and Final EIR."

He also made statements claiming the sufficiency of existing information on the groundwater and/or geological characteristics on page 9 (lines 8-13; lines 21-24), and page 11 (lines 10-11). Mr. Dowdell has chosen to ignore the fact well-recognized among professionals that landfills sited over a fractured rock geology, such as the Puente Hills Landfill, are essentially impossible to reliably monitor with regard to landfill leachate-pollution of groundwater. Haitjema (1991) a professor at the University of Indiana who is known to have high degrees of expertise in monitoring of groundwaters in fractured rock geology, stated in an article devoted to "Ground Water Hydraulics Considerations Regarding Landfills,"

"An extreme example of Equation (1) (aquifer heterogeneity) is flow through fractured rock. The design of monitoring well systems in such an environment is a nightmare and usually not more than a blind gamble."

* * *

"Monitoring wells in the regional aquifer are unreliable detectors of local leaks in a landfill."

Professionals knowledgeable in the topic know that Haitjema's characterization of trying to monitor landfill leachate pollution of groundwater in a fractured rock geology of the Puente Hills type is appropriate. It is also evident that the kinds of studies done at the Puente Hills Landfill to characterize the geology and hydrogeology are significantly deficient compared to what is needed to properly characterize that system so that the pollution of groundwater that is occurring by landfill leachate can be reliably intercepted before it pollutes the major groundwater aquifer system in the San Gabriel Basin.

Mr. Dowdell's claim on page 9 (lines 7-8), that further modeling is not needed for current landfill operations and the proposed landfill operations, would not be accepted as a reliable assessment of the situation by a proper, qualified peer review of this issue.

Page 9, lines 20-21. Mr. Dowdell again asserted that the existing landfill is not polluting groundwater. If that were the case, there would be no need for the Regional Water Quality Control Board to order the Districts to construct groundwater barriers near the edge of the property. The facts are that the existing landfill would be expected to be polluting groundwater, and it has been found to be polluting groundwater. Further, at this time the Districts are spending over $1 million trying to construct another groundwater barrier (Barrier 3) for the purpose of trying to prevent leachate-polluted groundwater from migrating from the landfill area to the off-site groundwater of the

region. It is important to note that the reconstruction of Barrier 3 was ordered by the Regional Water Quality Control Board. Mr. Dowdell's statement about the existing landfill's not polluting groundwater is simply not factual.

Page 9, lines 25-27. Mr. Dowdell asserted that since the Regional Water Quality Control Board will have to approve the groundwater monitoring system, that the system will be reliable. It is well-known that the LA Regional Water Quality Control Board as well as a number of other Water Quality Control Boards in the State have approved, and are continuing to approve, groundwater monitoring systems for landfills that have a low probability of detecting significant groundwater pollution by landfill leachate before widespread pollution occurs. A specific example of this situation in the Puente Hills region is the approval of the groundwater monitoring system by the LA Regional Water Quality Control Board for the proposed expansion of the Azusa Landfill. The groundwater monitoring system for the expanded part of that landfill, approved by this Board, was so deficient so as to provide a very low probability of detecting groundwater pollution by landfill leachate before widespread pollution occurs. In the review of the Regional Board's approval of that landfill expansion, the State Water Resources Control Board staff recommended against that expansion for a number of reasons, including the inadequacy of the groundwater monitoring program.

Those familiar with the permitting of landfills over the years know that regulatory agencies have been approving the construction and operation of landfills which have subsequently been found to pollute groundwaters. Based on the SWAT results (WRCB, 1991), more than 80% of the landfills that have been constructed in California are polluting groundwaters with landfill leachate. With few exceptions, those landfills would have been permitted and constructed in accord with the regulations applicable at that time. Simply meeting regulatory agency requirements does not insure that public health, groundwater quality, or the environment will be protected.

If Mr. Dowdell's assessment of the situation with respect to the reliability of regulations governing the landfilling of waste and their implementation at the Regional Board level were accurate, there would be no need for the State Water Resources Control Board to initiate significant upgrading of Chapter 15 in an effort to try to improve groundwater quality protection from landfill leachate pollution. On June 1, 1993 the State Water Quality Resources Control Board will hold the first of a series of workshops and hearings to be held over the next year or more devoted to improving Chapter 15 and most importantly, its implementation at the Regional Board level. Mr. Dowdell's statement about Regional Board approval of the Puente Hills Landfill expansion should not be interpreted to mean that the Puente Hills Landfill expansion will conform to Chapter 15's requirements of protecting groundwater quality from impaired use for as long as the wastes represent a threat. The wastes in that landfill will be a significant threat to groundwater quality for as long as they remain buried there, i.e. forever. The landfill containment system (plastic sheeting and a compacted soil layer) will not function perfectly forever to prevent leachate from migrating from the landfill to the underlying groundwaters. Once in those groundwaters, it is only a matter of time until the leachate-polluted groundwater reaches the Main San Gabriel Basin aquifer system. While the Districts and the Regional Board are trying to construct groundwater barriers to intercept the leachate-polluted groundwater, such barriers are well-known to be ineffective in preventing

groundwater pollution downgradient of the barrier.

Page 10, beginning on line 26, continuing to page 11, line 2. Mr. Dowdell again provided misleading information on the ability of the proposed groundwater monitoring system to perform in accord with Article 5 of Chapter 15, i.e., to detect leachate-pollution of groundwater at the earliest possible time. Because of the fractured rock geology this is essentially impossible to do with a monitoring system of the type that the Districts have used for the existing landfill.

Page 11, lines 25-27. Mr. Dowdell attempted to minimize the significance of pollution of Puente Hills Landfill area groundwater by landfill leachate by stating,

"The local groundwater only accounts for less than 1.4% of the total water delivered to local communities and this water is required to be treated prior to delivery to meet all applicable drinking water standards."

Mr. Dowdell's portrayal of this situation is highly inaccurate and misleading. First, it is somewhat distressing that an individual who identifies himself as a graduate environmental engineer would claim that leachate-polluted groundwater, after receiving treatment to meet the existing drinking water standards, would be safe to consume. This is well-known not to be the case. As discussed in our testimony, there are on the order of 60,000 chemicals used every day in this country. Many thousands of these can be present in municipal solid waste from homes, and commercial and industrial establishments. As discussed elsewhere (Lee and Jones, 1991; Jones-Lee and Lee, 1993), municipal landfill leachate contains large amounts of organic chemicals whose chemical composition is unknown, whose hazard to public health and the environment is unknown, and for which there are no drinking water standards. There are drinking water standards for fewer than 100 chemicals. To assert, as Mr. Dowdell did, that a water that has been contaminated by municipal landfill leachate would be safe to drink if all of the constituents for which there are drinking water standards are below the current standards, reflects a lack of understanding on his part of elementary principles of public health protection. Groundwaters contaminated by municipal landfill leachate, even after treatment by conventional treatment means to meet all drinking water standards, cannot be considered to be safe to consume, and should not be consumed.

The fact is that the leachate-pollution of San Gabriel Basin groundwater that will occur from the Puente Hills Landfill, if it has not already occurred, can be very significant to the water resources within that basin as well as to the downgradient basins. The region near the Puente Hills basin is particularly vulnerable to groundwater pollution. The groundwaters in the region have to pass through the Whittier Narrows part of the Basin. Pollution of these groundwaters can affect the water supply for very large numbers of people in the LA Basin area. Mr. Dowdell has provided highly unreliable information on the significance of Puente Hills Landfill leachate-pollution of groundwater in the San Gabriel Basin.

Page 12, lines 4-13. Mr. Dowdell stated,

"...there is NO direct connection between the refuse fill and groundwater bearing zones..."

On line 6 of page 12 Dowdell quoted, according to him from the EIR prepared by the Districts, *"These deposits...provide limited pathways for offsite migration of shallow canyon waters."* (ellipsis Dowdell's). That statement reportedly quoted from the EIR in fact contradicts Mr. Dowdell's

statement in his declaration that there is no direct connection between the landfill and the area groundwater. The EIR statement clearly indicates that there are pathways by which leachate-polluted groundwaters can migrate off-site. That migration can then lead to pollution of the San Gabriel Basin aquifer system, rendering the contaminated part unusable for domestic water supply purposes.

Beginning on lines 10 and continuing through line 12 of page 12, Mr. Dowdell quoted from a consultant's report that the

"...strata which impede direct continuity with the adjoining San Gabriel Groundwater Basin."

The word, "impede," does not mean "prohibit." Again, a Districts' consultant has indicated that there is potential for off-site migration of leachate-polluted groundwater to the San Gabriel Basin. Those Districts' consultants did not say there was no hydraulic connection; to the contrary, they have clearly indicated that there is, in fact, a hydraulic connection (pathway) between the groundwaters of the Puente Hills Landfill and the San Gabriel Basin.

Beginning on line 7 of page 12, Mr. Dowdell stated with regard to those pathways for leachate migration, reportedly quoting from the EIR,

"These pathways, however, can be hydraulically separated from the San Gabriel Valley alluvium by subsurface barriers at the canyon mouths, as discussed in Section 4.4 Hydrogeology."

It is important to note that the fact that a statement was made in the District's EIR does not mean that the statement is accurate. It is totally inappropriate for Mr. Dowdell to cite EIR statements, which were prepared by the Sanitation Districts staff, as a reliable source of information on the potential ability of barrier walls of the type constructed by the Districts to prevent off-site migration of leachate-polluted groundwater. Those familiar with the ability of barrier walls of the type that have been and are being constructed by the Districts know that such barriers are not effective in preventing all groundwaters upgradient of the barrier from passing through or around the barrier, through fractures in the rocks, to pollute groundwaters downgradient of the barrier. Such migration will, without question, occur at the Puente Hills Landfill. Barrier walls have an inherent, significant permeability that will allow passage of leachate-contaminated groundwater through the barrier. Further, barrier walls develop significant problems over time which lead to high-permeability zones for leachate transport through the barrier. Because of the fractured rock geology in which the barriers are situated, there can be no question that some fractures will exist that can transport leachate-contaminated groundwater under the barrier. Mr. Dowdell's assertion that the groundwater barriers will prevent groundwater pollution downgradient of the barriers by Puente Hills Landfill leachate is not factual. Such pollution will occur.

Page 12, lines 14-20 (item 13). Mr. Dowdell referenced as his Exhibit B, a memorandum from H. Schueller, Chief Division of Clean Water Programs, State Water Resources Control Board, dated

April 23, 1992, which he stated was provided to him by B. Ponek-Bacharowski of the Los Angeles Regional Board - staff. Mr. Dowdell stated,

"Attached hereto as Exhibit 'B' is a true and correct copy of a letter from the State Water Resources Control Board to all the Regional Water Quality Control Boards correcting Dr. G. Fred Lee's misstatements that he was an advisor to the State Board in the development of Chapter 15 Regulations."

Contrary to Mr. Dowdell's statement quoted, I have made no misstatement regarding my advisory role to the State Board in the development of Chapter 15 regulations, nor did the memorandum from H. Schueller, Exhibit B, make any claim that I had misrepresented my role in those activities. That memorandum stated in toto,

"You have received a letter from Dr. G. Fred Lee, dated March 14, 1992. In both the letter and in one of the enclosed publications, Dr. Lee states that he was involved in the review and development of the 1984 version of Chapter 15. Dr. Lee's involvement was limited in that he was among a group of 19 or 20 individuals <u>who were asked to comment upon the proposed regulations</u>. None of these individuals worked as a team member with State Water Board staff in writing the regulations, although some of their input was used as additional substantiation, regarding a given requirement in the Statement of Reasons.

If you have any questions, please telephone Charlene Herbst at (916)739-4196 (CALNET 497-4196)." (emphasis added)

Thus the memorandum simply provided additional detail that substantiated that I was, in fact, among a group of professionals who were asked to comment to the State Board on the development of Chapter 15 regulations. I have never claimed to have been the primary advisor, the sole advisor, or a "team member" with the State Board staff. However, since at the time that this occurred in the early 1980's I was teaching in the University of Texas system and had had no previous contact with the State Board or its staff on these matters and had not lived in California since 1955, the fact that I was asked to be a reviewer of Chapter 15 by the State Board staff demonstrates that my expertise was in fact sought-out in the development of these regulations. Further, while not mentioned by Mr. Schueller, I was, at the request of the State Board staff, present at the final hearing when Chapter 15 was adopted and was prepared to testify on behalf of the Staff's position in support of these regulations should that have been necessary. Also, at the same time, and at the request of the State Board staff, I presented a workshop on groundwater monitoring associated with landfills to State Board and Regional Board staff.

Page 12, lines 21-27 continuing on page 13 to line 8 (numbered item 14). Mr. Dowdell quoted a statement we made regarding the published findings of Bonaparte and Gross (1990) and proceeded to make the following statement.

"Attached hereto as Exhibit 'C' is a true and correct copy of a letter from Dr. Bonaparte,

dated November 20, 1992, which unequivocally states that Dr. Lee has misinterpreted the information in Dr. Bonaparte's paper. Dr. Bonaparte states 'there is no data or information in the Bonaparte and Gross paper suggesting that there was leakage through any of the double-liner systems included in the study'. Also attached to Dr. Bonaparte's letter is a discussion of the correct interpretation of the data and information in Dr. Bonaparte's paper."

Contrary to the implications of Mr. Dowdell's and Bonaparte's comments quoted, we have never indicated that data were presented by Bonaparte and Gross regarding leakage through a double-liner system included in their study. We have quoted Bonaparte and Gross (1990) directly from their paper. Bonaparte and Gross (1990) stated,

"All of the double-lined landfill cells reviewed in this study that were constructed with geomembrane top liners appear to have exhibited top liner leakage. Based on the available data, the flow rates attributable to top liner leakage at active cells that had geomembrane top liners and CQA programs were frequently less than 200 lphd; the maximum measured flow rates, which were often associated with increased flow from the leachate collection layers shortly after storm events, were typically several times the average flow rates."

* * *

"The double-lined landfills and surface impoundments in this study having a layer of compacted clay as the soil component of a composite top liner almost always exhibited flows due to consolidation water. Measured flow rates attributable to consolidation water were in the range of 20 to 840 lphd."

* * *

"Based on the data in this study, an action leakage rate of 50 lphd is too restrictive and presents a performance standard that, if promulgated by USEPA, frequently will not be met by facilities that were constructed to present standards with rigorous third-part CQA programs. An action leakage rate of 200 lphd appears to be reasonable for landfills that have been constructed using rigorous third-party CQA programs. Even at this level, the action leakage rate may be temporarily exceeded at the start of operation of a facility, due to drainage of construction water, and, for facilities with composite top liners, during the active life of the facility, due to drainage of consolidation water."

In Dowdell's Exhibit C (November 20, 1992 letter from Bonaparte) the focus of Bonaparte's objection to our "interpretation" of his paper co-authored with Gross was that their *"paper addresses flow rate <u>within</u> double-liner systems, which is not the same as the potential for leakage <u>through</u> double-liner systems."* (emphasis his). It is obvious that the point of determination of leachate flow was the leachate detection system, as he pointed out in his comments on our statements. There would be no way to measure the leakage that occurs through the bottom liner; it could be many years before that would be found through the groundwater pollution monitoring systems used.

Dowdell and Bonaparte are trying to mislead the reviewers of this statement to believe that if

leakage of leachate occurs through the top liner system so that it is detected in a leak detection system, that the bottom liner will prevent all leakage of leachate through it for as long as the wastes represent a threat. This is obviously not the case. Some of the landfills that Bonaparte and Gross reported leakage data on likely had leakage through the bottom liner as well. However, since there was no leak detection system below the bottom liner, there was no way of knowing that this leakage was occurring.

Bonaparte tries to convey the impression, in his attempt to discuss these issues, that the leakage that was occurring was through an FML and not a composite liner (which is an FML backed by a low-permeability layer of soil). The way that composite liners leak leachate is through holes in the FML. While a composite liner with few holes in it will leak less than an FML alone, it still will leak. On page 4 of Bonaparte's letter, in the second paragraph in Bonaparte's discussion of composite top liner leakage he stated,

"Only a small fraction of the reported flow was categorized as possibly being due to top liner leakage."

Therefore Bonaparte admitted, as he should, that composite liners will also leak leachate through them. On page 6, paragraph two of his letter, Bonaparte commented on our comments on the difficulty of reliably constructing a composite liner. It is well-known in the liner technology field that it is essentially impossible to achieve true composite liner characteristics in a landfill liner. While Bonaparte claimed that he has the ability to develop composite liners which "minimize wrinkles," he did not state that he can achieve true composite liner properties in a landfill liner. It will still have wrinkles. At every wrinkle the FML and the soil layer will act as independent liners which can leak at very high rates, rather than as a composite liner. Further, over time, the FML will deteriorate with ever an increasing number of holes developing in it leading to increasing rates of leakage. In addition, there is a wide variety of mechanisms, such as desiccation cracking, ion exchange cracking, etc., that can cause the soil backing layer of a composite liner to transmit leachate through it at much greater rates than those predicted based on the design permeability.

It is important to note that this situation is well-recognized in the field. For example, as part of promulgating the RCRA Subtitle D regulations governing municipal landfills in 1988, the US EPA stated (US EPA, 1988a),

"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 stated (US EPA, 1988b),

"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."

There is another very important aspect of liner leakage that Dowdell and Bonaparte have failed to acknowledge, even though Bonaparte is well-aware of it. This is the permeation of an intact plastic sheeting liner, i.e., no holes, by organic solvents. These issues were discussed in the materials submitted to the Sanitation Districts on the deficiencies in the Districts' EIR. The solvents of concern can be purchased at hardware stores and other firms by the public, used to some extent, and the remainder of the can of solvent discarded in the trash. These materials are, and will continue to be, present in municipal landfills. A fraction of a gallon of these solvents can pollute millions of gallons of groundwater rendering it hazardous to consume because of increased cancer risk. Studies by University of Wisconsin researchers (Sakti *et al*., 1991) reported that the plastic sheeting in landfill liners would have to be three inches thick to prevent these solvents from passing through the liner in 25 years. With the normal-thickness plastic sheeting liner used, passage through this liner material by the solvents occurs within a few days. It is important to emphasize that this phenomenon occurs without any holes in the plastic sheeting.

Bonaparte's letter went on to provide six additional pages of "interpretation" of the paper he published with Gross. In all his additional "interpretation" Bonaparte did not address the issues we raised. Bonaparte and Gross stated their finding that the upper liners leak, as quoted above. In his letter, Bonaparte also pointed out that upper liners leak. That finding is consistent with the nature of liner systems as we have pointed out. His figures A and B show top liner leakage as one of the three *"... most likely potential sources of liquids within leakage detection layers of double-liner systems located above the ground-water table ..."* While recognizing top liner leakage, he claims that there would not be similar leakage of the lower liner. He is careful, however, not to claim that the lower liner will not leak. He stated,

> *"It is important to recognize that this liquid* [in the leakage detection layer within the double-composite liner] *is contained within the double-liner system, above the bottom liner, and that the liquid collection efficiency of a typical leakage detection layer is very high. The leakage detection layer for a modern double-liner system is designed to allow rapid drainage of liquid to a sump, thereby minimizing the potential for hydraulic head buildup on the bottom liner. With this design, there is little potential for liquid migration into the bottom liner."*

It is significant that Bonaparte failed to point out that leachate collection and removal systems, which are above the top liner are also *"designed to allow rapid drainage of liquid to a sump."* That design, however, does not preclude leakage through the top liner, as shown by the Bonaparte and Gross data, and it will not preclude leakage of leachate out of the leak detection system before it reaches a sump, through the bottom liner.

Therefore while design considerations for a flawless system may indicate "little potential for liquid migration into the bottom liner," the facts are that the systems are subject to clogs and deterioration, and depend on the integrity of the lower FML. Further, those systems, which are relied upon to collect leachate in perpetuity, are located beneath hundreds of feet of garbage and are not available for inspection and repair without waste exhumation. It is therefore obvious that it is only a matter of time until at least some of the leachate that appears in the detection system between

two liners will pass through the bottom liner as well. Small amounts of municipal solid waste landfill leachate can pollute large amounts of groundwater, rendering it unusable for domestic water supply. We have discussed in previous testimony and publications the technical basis well-described in the technical literature, for the indisputable conclusion that the lower liner of a double-lined landfill will not be impermeable in perpetuity.

With respect to the proposed Puente Hills Landfill expansion, it is important to note that that would not be a double-lined facility, but rather a single composite lined system. Therefore leaks will occur through the composite liner which will lead to groundwater pollution under the landfill.

It is also important to note that what Bonaparte and Gross have said about leakage rates of liners is not different from what others have independently reported on this topic. The US EPA (1989) stated,

"EPA realizes that even with a good construction quality assurance plan, flexible membrane liners (FMLs) will allow some liquid transmission either through water vapor permeation of an intact FML, or through small pinholes or tears in a slightly flawed FML.

Leakage rates resulting from these mechanisms can range from less than 1 to 300 gallons per acre per day (gal/acre/day)."

It is clear to me that Bonaparte and Gross did not understand the significance of their statements about liner leakage rates when they were trying to convince the regulatory agencies and others that the agencies should allow a higher liner leakage rate than what the agency was proposing on the basis that even with good quality construction, such liners will leak at rates above the proposed regulatory values. By asserting that greater leakage rates should be allowed before the liner is considered to have failed, Bonaparte is trying to protect an obviously flawed technology where thin plastic sheeting and a compacted soil layer a couple feet thick are expected to prevent leachate migration through them in perpetuity, i.e., for as long as the wastes represent a threat. Obviously, even if a landfill liner system could be constructed that would not leak at the time the landfill was put in operation, it is only a matter of time until the quality of the liner system deteriorates so that significant leakage through the liner system will occur.

On the bottom of page 5 and the top of page 6 of his letter, Bonaparte objected to our use of the words "liner failure" in describing leakage that he and Gross reported as occurring in a liner system. This is more of the inappropriate approaches used by Bonaparte and some of his colleagues in trying to perpetuate the use of an obviously flawed technology for managing municipal solid waste in "dry tomb" landfills. Ian Peggs, who is recognized as a pioneer in work on landfill liner integrity, stated in a December 14, 1992 memorandum "re: Proposed ASTM Symposium on Geosynthetic Failures: Forensic Analysis Methods and Remediation,"

"It has become apparent that the word 'failure' should not have been used in the title of the Symposium. It limited the number of abstracts submitted."

It has become very clear that those, like Bonaparte, who are proponents of plastic sheeting and compacted soil layers as liners for landfills are trying to dodge the fact that these systems have significant failures within short periods of time after construction. There is no question about the fact that all of these systems will fail to protect groundwater quality for as long as the wastes are a threat (forever).

It is important to understand also that Bonaparte has frequently testified before regulatory boards on behalf of landfill companies. We have found on several occasions that in his quoting from the literature that he claims supports his technical position on matters, Bonaparte has selectively presented those parts of passages or materials that give the appearance of supporting his client's position. Examination of the complete passage or document on those matters, however, has revealed that it does not support his client's position and, in fact, raises serious questions about the ability of the liner systems of the type that Bonaparte asserts will "protect" groundwater quality to provide groundwater quality protection for as long as the wastes represent a threat as required by Chapter 15.

In our testimony on the technical reliability of Bonaparte's statements on behalf of Browning Ferris Industries' (BFI) proposal to construct the Keller Landfill near Pittsburg, PA, before the San Francisco Bay Regional Water Quality Control Board, and in his testimony before the LA Regional Water Quality Control Board, he has provided highly unreliable, incomplete and inaccurate information to the Boards on the views of others in the literature, on the expected performance of the liners of the type being used today (plastic sheeting and compacted soil layers) to prevent pollution of groundwater which impairs its use, by landfill leachate, for as long as the wastes represent a threat, i.e., forever, as required in Chapter 15. In Bonaparte's testimony before various boards he has often cited parts of the writings of Haxo and Haxo (1988) and Mitchell and Jaber (1990). For example he appended to his November 18, 1991 letter to LA Regional Water Quality Control Board, a copy of his declaration to the State Water Resources Control Board dated July 21, 1991 (Bonaparte, 1991b). In that declaration Bonaparte cited and selectively quoted from conclusions of an "Ad Hoc Meeting of the Service in Landfills of Flexible Membrane Liners and Other Synthetic Polymeric Materials of Construction" convened by the US EPA at the US EPA Hazardous Waste Engineering Research Laboratory, reported by Haxo and Haxo (1988). Three major conclusions of the "Ad Hoc Meeting" were presented by Haxo and Haxo (1988). On page 14 of Bonaparte's declaration addendum to his November 18 letter, he quoted two-and-a-half of those conclusions, omitting the major qualifying component of the conclusions. Specifically, he cited the first statement from the third conclusion of Haxo and Haxo (1988),

"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."

He omitted the subsequent and final statement of that conclusion which reads,

"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."

The part of the Haxo and Haxo conclusion that Bonaparte left out of his quotation of conclusions to the State Board and to the LA Regional Board indicates that the ad hoc committee concluded that the long-term stability/integrity of membrane liner materials to function reliably as a liner cannot be demonstrated and therefore is in question.

In addition, Bonaparte did not cite the *"areas of concern that may affect the service life of components of liner systems and the functioning of the liner system as originally designed"* that were expressed by Haxo and Haxo (1988). Those "areas of concern" included:

"The combined mechanical and chemical stresses under which the liner system functions may cause cracking and breaking of the components due to environmental stress-cracking or possibly to mechanical fatigue under long service." and

"Seams of FMLs continue to be an area of concern, as none of the test methods truly assess the effects of long-term exposure in landfills." and

"Clogging of drainage and detection systems continues to present a problem. The clogging can be by biological clogging due to growth or sedimentation or through precipitation of dissolved constituents."

Thus it is clear that while Bonaparte quoted words from the Haxo and Haxo report of the ad hoc meeting held by the US EPA, by his selective citation from the report Bonaparte provided a distorted representation of the content and conclusions of that work.

Another example of Bonaparte's inadequate and unreliable reporting of the literature on the stability of landfill liners occurred in his 1991 statement,

"In addition, I presented an excerpt from a publication by Professor J. K. Mitchell of the University of California, Berkeley [Mitchell and Jaber, 1990] indicating that a clay liner in a stable chemical/physical environment (such as the one at the Keller Canyon Landfill) 'would be expected to function well as a seepage barrier indefinitely'." (Bonaparte, 1991a).

A review of the document cited by Bonaparte (a document published in a conference proceeding that Bonaparte edited) shows that Bonaparte distorted what was presented in the literature. In truth, the statement made by Mitchell and Jaber (1990) in the passage that Bonaparte only partially quoted, clearly and explicitly contradicted Bonaparte's reporting of it. The complete passage from Mitchell and Jaber (1990) is presented below (the portion underlined is that portion cited by Bonaparte; other emphasis was added):

"By their very nature most clay soils are quite stable materials in their natural state, because they are towards the end point of the degradation phase of the weathering and

rock-forming cycle. Thus, if a naturally occurring clay soil is compacted to high density, thereby producing a material with very low hydraulic conductivity, and ***if it is maintained within the same ranges of temperature, pressure, and chemical and biological environment****, it would be expected to function well as a seepage barrier indefinitely.* ***In waste containment applications, however, conditions do not remain the same. The permeation of a compacted clay liner by chemicals of many types is inevitable, since no compacted clay or any other type of liner material is either totally impervious or immune to chemical interactions of various types.*** *In addition, most clay liner systems are subjected to distortional stresses that may cause differential movement. If these movements lead to formation of open cracks, then the liquid retention ability of the system will be lost."*

Therefore, contrary to the distorted citation presented by Bonaparte, Mitchell and Jaber (1990) question the reliability of clay liners to function as effective landfill containment systems over long periods of time.

Bonaparte's letter and claims do not reflect an understanding that very small amounts of leakage of municipal landfill leachate through a liner system can pollute very large amounts of groundwater, rendering it unusable for domestic water supply purposes. The US EPA has repeatedly stated what is well-known, that once a domestic water supply well is polluted by municipal landfill leachate, the well has to be abandoned. This point was discussed in both its 1988 and 1991 proposed and finalized RCRA Subtitle D regulations (US EPA 1988a, 1991). It is also well-known that once a groundwater is polluted by municipal landfill leachate, there is no possibility of cleaning up the groundwater or affected portions of the aquifer so that it can ever be used safely again for domestic water supply purposes (see Rowe, 1991). Lee and Jones (1992) have presented a review of this issue from the literature. The rates of leakage that Bonaparte proposed as acceptable are sufficient in some landfill settings to pollute very large amounts of groundwater, rendering it unusable for domestic water supply purposes.

Those who understand the properties of liner materials of the type being used today in solid waste landfills, which are the same materials that the Sanitation Districts propose to use in the Puente Hills Landfill expansion (plastic sheeting and a compacted soil layer) and who reliably report on their knowledge on this topic, know that the US EPA's 1988 assessment (quoted above) of the ultimate deterioration of the liner material and the failure of these liners to function perfectly forever is correct. It is only a matter of time until liners of this type will allow sufficient leachate passage through them to lead to groundwater pollution below the landfill. In landfill settings such as the Puente Hills Landfill where there are pathways for off-site migration of the leachate-polluted groundwater, it is only a matter of time until the groundwaters of the San Gabriel Basin will be polluted by leachate from the existing landfill, as well as the expanded landfill (if constructed). It is important not to allow the expansion of the Puente Hills Landfill as proposed by the Districts since this will establish new pathways to transport much larger amounts of leachate polluted groundwaters to the basin.

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