Comments on
Wayne Disposal Incorporated's Proposal
to Renew the License/Permit for Continued Operation
of its Hazardous Waste Landfill, Wayne Disposal Landfill Site #2,
and the Expansion of this License/Permit to Include
the Acceptance of PCB Wastes

Submitted by

G. Fred Lee, Ph.D, P.E., D.E.E.

G. Fred Lee & Associates
El Macero, CA 95618
Ph: (916) 753-9630
Fx: (916) 753-9956
e-mail: gfredlee@aol.com

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Executive Summary

Wayne Disposal, Inc. (WDI) has filed an application to the Michigan Department of Environmental Quality (MDEQ) and the US Environmental Protection Agency (US EPA) for continued operation of WDI site #2 hazardous waste landfill located in Belleville, Michigan. WDI has also filed an application to these agencies to expand the types of waste that can be accepted by this landfill to include PCB wastes. MDEQ has issued a draft license and the US EPA has issued a draft permit for continued operation of the WDI site #2 hazardous waste landfill with the provision to allow the disposal of PCB wastes in this landfill. A public hearing devoted to review of the draft license and permit was held on April 23, 1996 and July 16, 1996. The author (Dr. G. Fred Lee) has conducted a comprehensive review of:

· WDI's application for continued operation of the landfill site #2 hazardous waste landfill and to expand the types of waste accepted to include PCB wastes;

· draft license and permit issued by MDEQ and US EPA, respectively;

· US EPA RCRA, TSCA and MDEQ regulations governing the disposal of hazardous wastes and PCB wastes by landfilling;

· transcript of the April 23, 1996 public hearing conducted by MDEQ and the US EPA; and

· the literature on the expected performance of landfill liner systems and groundwater monitoring systems of the type that WDI has proposed for continued operation of its site #2 landfill, as well as other documents pertinent to review of this matter.

Based on the review of this matter, the following conclusions and recommendations have been developed.

Suitability of WDI Landfill Site #2 for Continued Operation

· The geological and geographic/demographic setting of WDI landfill site #2 is unsuitable for continued operation of this landfill as a hazardous waste landfill or as a landfill that would accept PCB wastes.

Adequacy of MDEQ and US EPA Permit Conditions

· The draft license and permit conditions set forth by MDEQ and the US EPA do not conform to the respective agencies' regulatory requirements for operation of a hazardous waste landfill and a landfill that would accept PCB wastes at the Belleville site.

Denial of License and Permit Applications

· The Michigan Department of Environmental Quality and the US EPA should not issue a license or a permit to allow Wayne Disposal, Inc. to continue to operate its WDI landfill site #2 since this site already represents a significant threat to public health, groundwater resources and the environment. Continued operation of this landfill will increase the magnitude of this threat.

Deficiencies in Regulatory Agency Review of the Application For WDI Landfill Site #2 Continued Operation

· The MDEQ and US EPA reviews of the WDI proposed landfill containment system and groundwater monitoring systems did not adequately consider the US EPA RCRA, TSCA and MDEQ Act 64 requirements. The agencies have considered the potential for groundwater pollution by this expanded landfill for only a short period of time compared to the period of time that wastes in the landfill would be a threat to groundwater quality.

· MDEQ and the US EPA have failed to adequately consider the information available on the properties of the proposed WDI landfill site #2 waste containment system components (landfill cover, leachate collection and removal system, liner systems and leak detection system) to function as an effective, reliable barrier to moisture entry into the landfill that will produce leachate and to transport of leachate out of the landfill that can pollute groundwaters for as long as the wastes in the landfill will be a threat.

· MDEQ and the US EPA have failed to adequately evaluate the reliability of the landfill liner containment system, leachate leak detection system, and groundwater monitoring systems to detect leachate leakage from the landfill at the point of compliance before widespread groundwater pollution occurs by waste-derived constituents.

· Many components of the waste that will be placed in the cells during the proposed continued operation of the WDI landfill site #2 will represent a significant threat to

groundwater quality and could be expected to impair the uses of the groundwaters for domestic and many other purposes effectively forever.

- The proposed treatment of the hazardous wastes proposed to be deposited in this landfill will not be adequate to prevent groundwater pollution by hazardous and otherwise deleterious components of the wastes that can cause groundwaters to be unusable for domestic and many other purposes. Further, MDEQ and the US EPA have failed to adequately consider the potential for the large amount of unregulated waste components that will be deposited in this landfill to adversely affect groundwater quality.

- The period of time during which the landfill cover and base liners (composed of plastic sheeting and compacted clay layers) can potentially be effective in preventing moisture from entering the landfill which generates leachate, and in collecting the leachate that is generated in the landfill, is extremely limited compared to the period of time that the wastes in this landfill will be a threat to groundwater quality.

- The key component of the leachate collection and detection systems is the plastic sheeting layer (flexible membrane liner) in the two composite liner systems. It has been well-known since the late 1980s that such a plastic sheeting layer will deteriorate over time and will eventually fail to function as an effective barrier for leachate transport through it. The contaminating lifespan of the landfilled wastes with respect to causing groundwater pollution by hazardous and otherwise deleterious chemicals far exceeds the expected service life of the landfill liner system. Therefore ultimately, if licensed and permitted as proposed by MDEQ and the US EPA, the landfill can be expected to lead to groundwater pollution, rendering the groundwaters unusable for domestic and many other purposes. Such pollution would be in violation of current US EPA and MDEQ regulations.

- The current WDI proposed and US EPA and MDEQ accepted groundwater monitoring system for Master Cell VI for the proposed continued operation of this landfill have a low probability of detecting leachate migration at the point of compliance. The spacing of groundwater monitoring wells allowed (about 400 feet apart along the downgradient edge of the landfill), coupled with each monitoring well's zone of capture with a radius of about one foot, means that there are about 398 feet between monitoring wells where leachate-polluted groundwater could pass en route to off-site groundwater pollution and without be detected by the monitoring wells.

- The retrofitted suction lysimeters installed under Master Cells V and VII have limited ability to detect leachate migration at their location. MDEQ staff's attempts at the public hearing and in the draft license to support the appropriateness of this site for continued operation of this landfill based on a failure to detect groundwater pollution by the existing landfill is inappropriate and technically invalid. The failure to detect pollution of groundwaters by the existing landfill's cells reflects the short period of time that these landfill cells have existed and the unreliable nature of the groundwater monitoring and

leachate migration detection programs that WDI has been allowed to install associated with the existing landfill cells.

- The high groundwater table in the surficial sands that surround the landfill cells represent significant threats to generation of leachate through groundwater migration into the landfill through the cutoff dike and drain that WDI has constructed to try to isolate the landfill cells from this groundwater. Inadequate attention has been given by WDI to the *ad infinitum* monitoring and maintenance of the waste cell isolation barrier system to ensure that it will function reliably and effectively forever to prevent groundwater from migrating laterally into the waste cells when the liner systems are no longer effective in preventing migration of groundwater through them.

  The high groundwaters in the surficial sands surrounding the landfill cells also represents a landfill leachate transport pathway to surface waters of the region should at any time in the future WDI fail to remove leachate from the landfill during the time that the waste in the landfill will be a threat.

- WDI stated in the application that it will provide for 30 years of post-closure care for this landfill. That statement has been incorporated into the draft license issued by MDEQ. Such an approach is not in accord with regulatory requirements of US EPA RCRA or MDEQ Act 64. The 30-year period specified in those regulations is a **minimum** 30-year period for post-closure care. Those regulations do not limit the period of post-closure care but rather require that public health, groundwater resources, the environment, and the interests of those potentially impacted by the landfill be protected. Obviously, if protection is, in fact, to be achieved, the post-closure care period planned for in the license/permit for this landfill's continued operation must be for the period of time during which any of the waste components, either hazardous or otherwise deleterious, represents a threat to groundwater quality for the use of the groundwaters for domestic and other purposes.

- The MDEQ and US EPA draft license/permit propose to allow WDI to provide financial assurance of $3,791,382 for closure of the landfill and $5,466,670 for 30 years of post-closure care. These amounts are significantly deficient compared to the true costs of properly closing this landfill and for the 30-year post-closure care period, much less the infinite period of time that post-closure care will have to be provided if this landfill is to be maintained in accord with current regulatory requirements.

- MDEQ regulations allow the director to revoke an operating license of an existing landfill if it is found that new information or standards indicate that a threat to human health or the environment exists which was unknown at the time of license issuance. From the time that the license was originally issued for the WDI landfill in the early 1980s, considerable amounts of new information have been developed on the significant deficiencies in plastic sheeting and compacted clay-lined landfill liners of the type that conform to minimum landfill containment system component design set forth in RCRA Subtitle C requirements and which have been incorporated into MDEQ's Act 64 in

protecting public health, groundwater resources and the interests of those within the sphere of influence of the landfill.

Also since the original license was issued in the early 1980s, new information has become available on the significant deficiencies in the ability of the minimum groundwater monitoring systems such as those proposed to be allowed by MDEQ and the US EPA to detect leachate-polluted groundwaters at the point of compliance in accord with regulatory requirements. These requirements mandate that the environmental monitoring system be capable of detecting a release of hazardous waste or hazardous waste constituents from the facility. Further, the groundwater monitoring system must reliably monitor the groundwaters to provide an early warning of failure from the hazardous waste management unit. The MDEQ/US EPA draft license/permit covering groundwater monitoring fail to recognize the unreliable monitoring of groundwater pollution that will occur with the monitoring approach proposed or allowed in the draft license/permit.

While the operating license for the WDI hazardous waste landfill site #2 was renewed in 1990, MDEQ and the US EPA did not adequately and reliably consider the information that was available at that time on the deficiencies of the landfill liner systems and groundwater monitoring system to perform in accord with regulatory requirements for as long as the waste in the landfill will be a threat. Since 1990, considerable additional new information has been developed and published in the literature on the deficiencies in the landfill liner systems and groundwater monitoring system of the type that WDI proposes to use for waste containment and monitoring for Master Cell VI in being able to perform in accord with regulatory requirements for as long as the waste in the landfill will be a threat. This information must be adequately and reliably considered in the pending renewal of the license/permit for this landfill.

The MDEQ director can also, according to Act 64, revoke construction permits and operating licenses if WDI fails in its application to disclose fully all relevant facts or at any time misrepresents any relevant facts. The WDI application for continued operation of this landfill fails to provide adequate and reliable information on the period of time during which the wastes in this landfill will be a threat and on long-term properties of and reliability of the landfill liner containment system to prevent leachate from passing through the liner for as long as the wastes in the landfill will be a threat. WDI has also failed to provide adequate and reliable information on the reliability of the groundwater monitoring system that is proposed for continued operation of this landfill in conforming to regulatory requirements.

With this new information and its implications for deficiencies in the WDI landfill site #2 in protecting public health, groundwater quality, the environment, and the interests of those who are potentially impacted by the landfill and given the deficiencies in the WDI application for continued operation of this landfill, MDEQ can and must deny the approval of the license for continued operation of the landfill and take the necessary steps

to more adequately and reliably protect public health and groundwater resources from pollution by past landfilling operations.

- The geographic and demographic setting of this landfill and its proximity to adjacent properties and populated areas are such that there are insufficient bufferlands owned by WDI to allow dissipation of airborne releases from the landfill that represent significant threats to the health and welfare of people in the region. Through its past failures to prevent off-site adverse impacts to the use of adjacent and nearby properties, WDI has demonstrated itself to be a poor neighbor. This failure alone should preclude the continued operation of this landfill.

Implementation of Effective Programs for Control of Eventual Groundwater Pollution from the Existing Landfill

- The existing WDI landfill should be closed immediately and the regulatory agencies should take the necessary steps to require that WDI establish a reliable landfill leachate leakage detection program under the existing landfill cells that will reliably, and with a high probability detect when leachate containing hazardous and deleterious constituents derived from the wastes already deposited in this landfill begin to pollute the aquifer system underlying the landfill.

- The regulatory agencies should immediately require that WDI establish a dedicated trust fund of sufficient magnitude to install, operate and maintain a reliable leachate leakage detection system under the existing landfill cells for as long as the wastes in these cells represent a threat. For planning purposes, the wastes in these cells should be considered to be a threat effectively forever. The magnitude of these funds should be sufficient so that if WDI fails to take appropriate action when leachate migration is detected under the landfill that is a potential threat to the quality of the groundwater resources underlying the landfill, WDI must use the funds available to exhume the wastes and properly manage them at an appropriate location for the management approaches adopted.

A detailed discussion of the technical base for the findings presented in this executive summary is provided in the accompanying report.

Introduction

Ypsilanti Township has requested that the author (Dr. G. Fred Lee) conduct a critical review of Wayne Disposal, Incorporated's (WDI) proposed continued operation of its WDI landfill site #2 located in Belleville, Michigan to provide for public health, groundwater resource and environmental protection from the hazardous or otherwise deleterious chemicals that will be present in the hazardous waste deposited in this landfill should it be allowed to continue to operate. In connection with the development of this report the author reviewed the following reports prepared by WDI and its consultants, US EPA and MDEQ.

- Wayne Disposal Site #2 Landfill P.A. 64 Permit Application

- Initial Report for Approval of a Chemical Waste Landfill for the Disposal of PCBs Under the Toxic Substances Control Act (Ref: 40 CFR 761.75[c]), Prepared for Wayne Disposal Site #2 Landfill, Wayne Disposal, Inc., Ypsilanti, Michigan, Prepared by RMT, Inc., July 1995.

- Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act, Wayne Disposal Landfill Site #2, Wayne Disposal, Inc., Ypsilanti, Michigan, Prepared by RMT, Inc., July 1995.

- Volumes 2, 3, 4, 5, and 6 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for the Disposal of PCBs Under the Toxic Substances Control Act, Wayne Disposal Landfill Site #2, Wayne Disposal, Inc., Ypsilanti, Michigan, Prepared by RMT, Inc., July 1995.

- RCRA Corrective Action Plan RFI Phase I Environmental Monitoring Report for Wayne Disposal Site #1 Landfill and Wayne Disposal Site #2 Landfill (Mid 048 090 633) NTH July 1990.

- Draft Report on RCRA Facility Investigation Phase II Release Assessment for Wayne Disposal Site No. 1 Landfill October 1992.

- Michigan Department of Environmental Quality "FACT SHEET" Proposed Relicensing of Wayne Disposal, Inc. Hazardous Waste Landfill Facility, Belleville, Michigan, MID 048 090 633, February, 1996.

- Michigan Department of Environmental Quality DRAFT Hazardous Waste Management Facility Operating License, Wayne Disposal, Inc., MID 048 090 633, undated.

- US EPA Region 5, Hazardous Waste Management Draft Permit for Wayne Disposal, Inc., and Ford Motor Company for Wayne Disposal Site #2 Landfill, MID 048 090 633, undated.

- Draft for Public Comment, US EPA Region 5, in the Matter of: Wayne Disposal, Inc., and Ford Motor Co., WDI Landfill [Master Cell VI], Ypsilanti, Michigan on "Approval to Dispose of Polychlorinated Biphenyls (PCBs)," undated.

- US EPA/MDEQ Public Hearing Transcript on the Proposed Continued Operation of the WDI Hazardous Waste Landfill and the Expansion of this Landfill to Accept PCB Wastes, Belleville, Michigan, April 23, 1996.

Further, the author has reviewed:

- Michigan Department of Natural Resources, Administrative Rules Promulgated Pursuant to Michigan's Hazardous Waste Management Act 1979 PA 64, as Amended (Act 64), Effective June 18, 1994.

- Code of Federal Regulations 40 Part 261--Identification and Listing of Hazardous Waste and Part 264--Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, July 1, 1995.

- Code of Federal Regulations 40 Part 761--Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibition, July 1, 1995.

- The Solid Waste Disposal Act as Amended by The Hazardous and Solid Waste Amendments of 1984 (Public Law 98-616), US EPA/530-SW-85-022, 1987.

- Environmental Protection Agency 40 CFR parts 148, 260, 261, *et al.* Land Disposal Restrictions for Newly Listed Wastes and Contaminated Debris; Proposed Rule, Federal Register, OSWFR92001, January 9, 1992.

- Environmental Protection Agency Hazardous Waste Management System; Permitting Requirements for Land Disposal Facilities, Federal Register, July 26, 1982.

- State of Michigan, Chapter 3: Waste Management, Part 111 Hazardous Waste Management, Cumulative Supplement §§13A.11101 through 13A.11118a.

In review of these documents and others pertinent to this issue, the author has commented on some of the inaccurate, and/or unreliable information provided by WDI and its consultants, as well as the US EPA and MDEQ, on the ability of the Master Cell VI containment systems, leak detection system, and groundwater monitoring system to perform in accord with regulatory requirements of protecting public health, groundwater quality and the environment from pollution by landfill leachate for as long as the waste in the landfill will be a threat. It has been found that, in document after document, WDI and/or the US EPA/MDEQ have repeated the same unreliable information on the suitability of landfill site #2 Master Cell VI for disposal of hazardous waste and PCB waste to protect public health, groundwater resources and the environment. Specific citations to much of the unreliable information are provided in these comments.

The author has considerable experience devoted to the review of landfill regulations and landfilling issues in Michigan and in a number of other US states, Canada and Mexico. Further, he has been involved in evaluating the impact of hazardous waste and municipal solid waste landfills on public health, groundwater resources and the environment since the mid-1960s and has done extensive university-based research on various types of landfill liners with reference to their ability to prevent leachate passage through them for as long as the wastes in the landfill will be a threat. Further information on the author's qualifications to undertake this review are presented below and in the appended materials.

Overall Conclusions and Recommendations

It has been found that the WDI landfill site #2 location is unsuitable for the proposed landfill design to protect groundwaters from pollution by landfill leachate-derived constituents for as long as the wastes in this landfill will be a threat to groundwater quality. The natural geological strata, the characteristics of the proposed landfill containment system, and the properties of the proposed groundwater monitoring system are such that the continued operation of this landfill as proposed will not conform to current regulatory requirements of protecting public health, groundwater resources, the environment, and welfare of those potentially impacted by the landfill.

MDEQ and the US EPA have not adequately and reliably represented the potential for this landfill to pollute groundwaters by landfill waste-derived constituents for as long as the wastes in the landfill will be a threat. The agencies have also failed to properly evaluate the conformance of the proposed landfill's continued operation to conform to current regulatory requirements. The agencies' staff at the public hearing provided unreliable and inadequate information on the potential for this landfill to protect public health, groundwater resources, the environment, and the public's interests.

The WDI proposed continued operation of this landfill should not be approved. The operations of this landfill should be immediately terminated and all existing waste management cells should be closed.

MDEQ and the US EPA should immediately require that WDI develop a much more effective and reliable approach for monitoring of leachate migration from the existing waste management cells. Further, WDI should be required to develop a dedicated trust fund of sufficient magnitude to address plausible worst-case failure scenarios that could lead to pollution of the aquifer system underlying the landfill and the surficial groundwaters-surface waters by waste-derived constituents for as long as the waste will be a threat. This dedicated trust fund should be of sufficient magnitude to provide adequate funds for *ad infinitum,* (i.e., as long as the wastes in the existing landfill are a threat), monitoring and maintenance of the landfill as well as waste exhumation and proper management if WDI cannot prevent migration of waste-derived constituents out of the landfill containment system.

Qualifications to Undertake Review

Dr. G. Fred Lee is president of G. Fred Lee & Associates, an environmental consulting firm located in El Macero, California. For 30 years Dr. Lee held university faculty graduate-level teaching and research positions at the Universities of Wisconsin and Texas, and at Colorado State University. In 1989 he retired from university graduate level teaching and research as a Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology. While holding university professorial teaching and research positions, Dr. Lee taught university graduate level environmental engineering courses devoted to landfill design and evaluation of the impact of landfills on public health and the environment. Since retiring from university teaching he has been active in presenting one- and two-day short-courses to professional engineers and scientists on landfills and groundwater quality protection issues. He has made these presentations through the University of California Extension Programs for the University of California Berkeley, Los Angeles, Riverside, Santa Barbara and Davis. Also, he has presented these short-courses under the sponsorship of the American Society of Civil Engineers, the American Water Resources Association and the National Ground Water Association in New York City, NY; Atlanta, GA; Chicago, IL; Reno and Las Vegas, NV; Tucson, AZ; and Seattle, WA. Dr. Lee is frequently an invited lecturer on landfill issues and has been an American Chemical Society tour speaker on these and other issues over the past 20 years. He has discussed landfill and groundwater quality protection issues at about 50 ACS local section meetings throughout the US.

Dr. Lee holds a PhD degree from Harvard University in environmental engineering and environmental sciences and a Master of Science in Public Health degree from the University of North Carolina. He obtained a bachelor's degree from San Jose State University.

Dr. Lee has conducted over $5 million in university graduate- level research on various aspects of water quality and solid and hazardous waste management. This research has included pioneering work on the ability of landfill liners to prevent leachate from passing through them for as long as the wastes in the landfill represent a threat. He has published more than 650 papers and reports on his work. A listing of his papers and reports pertinent to landfills and groundwater quality protection issues is appended to this report.

He has served as an advisor to numerous governmental agencies and industries in the US and other countries on water quality and solid and hazardous waste management issues. A list of landfill projects that he has been involved with is appended to these comments. These projects in general involve work on behalf of municipalities, water utilities and others in evaluating the potential impact of a proposed or existing landfill on public health, groundwater resources and the environment as well as the interests of those who own or use properties within the sphere of influence of a landfill.

Dr. Lee is a registered Professional Engineer in Texas and a Diplomate in the American Academy of Environmental Engineers.

Dr. Lee has over 25 years experience in addressing the impact of municipal solid waste and industrial hazardous waste landfills on public health and the environment, pollution of

groundwater by landfills, evaluation of the ability of landfill liners and liner systems to prevent groundwater pollution, and monitoring of groundwater quality near landfills. His work includes evaluation and management of the adverse impacts of municipal solid waste (MSW) and industrial hazardous and non-hazardous waste landfills and the development of approaches to eliminate adverse impacts on those who own or use properties near a landfill. He has extensive academic and professional background, understanding and expertise in the chemical characteristics of wastes and their potential to pollute air and groundwater; landfill processes; impact of chemicals on beneficial uses of surface and groundwater; and the nature, transport, and transformation of chemical contaminants in surface and groundwater systems.

Dr. Lee's work on landfill pollution of groundwaters began in the 1970s while he was Professor of Water Chemistry at the University of Wisconsin, Madison in the Department of Civil and Environmental Engineering. From that time he has been involved in the review of approximately 50 existing or proposed landfills, helping an entity or group evaluate the potential for groundwater pollution and other adverse impacts of a landfill. A list of his work in this area is appended to these comments.

His work on hazardous waste management started in the early 1970s when he held a Professorship of Engineering at the University of Texas at Dallas. In the early 1980s, he helped develop and then directed the Center for Environmental Studies at the University of Texas, Dallas. One of his major research areas in this position was devoted to groundwater quality protection from hazardous chemicals, such as those used by industry. Under sponsorship of the US EPA National Groundwater Research Center, Dr. Lee undertook the first research ever initiated on the ability of compacted clay liners to prevent organics from being transported through the liner. This led to the discovery of the impact of organics on clay liners. It was the work of Dr. William Green, who was a post-doctorate fellow working in Dr. Lee's program, that showed that organic solvents of the type that then were being disposed of in various types of lagoons and in landfills could interact with clay liners, causing them to shrink and crack, allowing rapid transport of the organics through the liner. This work initiated a series of investigations supported by the US EPA and others on the appropriateness of using clay liners for waste lagoons and landfills.

In about 1980, Dr. Lee began to work on behalf of Brush, Colorado, helping this community review the potential of a then-proposed hazardous waste landfill that would be constructed in their groundwater well field area to pollute the groundwaters of the region by landfill leachate. At that time, the landfills were being designed with only compacted clay liners. He pointed out that the proposed liner system for this landfill would not prevent groundwater pollution. His work on this landfill situation led to the development of a professional paper entitled, "Is Hazardous Waste Disposal in Clay Vaults Safe?" This paper was co-authored by R.A. Jones and was published in the *Journal of the American Waterworks Association.* In 1984 it was judged by the Water Resources Division of that Association as the best paper published in the journal during 1982. This paper discussed the fact that hazardous waste landfills of the type being developed at that time would not protect groundwaters from pollution by landfill leachate.

By the mid-1980s, plastic sheeting liners were beginning to be used for landfills and waste management lagoons. At that time, Dr. Lee held a Distinguished Professorship in Civil and Environmental Engineering at the New Jersey Institute of Technology. One of his research areas was devoted to assessing the ability of plastic sheeting liners to prevent leachate from passing through them. This work led to the conclusion that HDPE liners, which are similar to liners being used today, would for a period of time prevent leachate from passing through them in liner systems that are properly constructed. Ultimately, however, these liners would fail, and leachate would pass through the liner, polluting groundwaters associated with the landfill. Further, then, as now, because of the limited experience with the use of these liners and the fact that problems were beginning to be found with their integrity over much shorter periods of time than would be expected based on normal deterioration of plastics, there was considerable concern about how well these liners would perform over the long-term. It was about that time that stress cracks were beginning to be observed in HDPE liners.

It is well-known now that over time HDPE and other plastic sheeting liners deteriorate and eventually become ineffective as a liner material. Dr. Lee has published extensively on this topic in which he has prepared comprehensive literature reviews on it. A list of his references on this topic is appended to this report. Further, his papers provide extensive reference to the literature covering the work of others on this topic. Several of Dr. Lee's papers are appended to these comments and provide backup information to the statements made in this report on the ability of plastic sheeting liners to prevent leachate passing through them for as along as the waste in the landfill will be a threat.

As discussed herein, while HDPE and other types of plastics can provide for short-term containment of wastes in a properly designed and constructed landfill, these liner systems will deteriorate and ultimately fail to prevent leachate from passage through them. It began to be recognized in the mid-1980s that the "dry tomb" landfilling approach that was originally adopted in the early 1980s, which is the same type of landfilling approach that WDI, MDEQ and the US EPA propose to follow for the continued operation of the WDI landfill site #2 Master Cell VI was a fundamentally flawed technology that would not protect groundwater from pollution by landfill leachate for those landfills sited, like the WDI landfill site #2, where there are high-quality groundwaters hydraulically connected to the landfill. This situation has led Dr. Lee to work toward developing alternative landfilling approaches that make use of the expected effective service life of these liner materials for temporary containment of wastes.

Dr. Lee has published extensively on a fermentation-leaching "wet cell" landfilling approach that will enable the management of solid wastes in landfills and protect groundwater resources from eventual pollution by landfill leachate. A list of his papers and reports on this and other related topics is appended to this report.

In the early 1980s, Dr. Lee worked as an advisor to several governmental agencies in developing landfilling regulations. This work included advising the state of California Water Resources Control Board on the development of Chapter 15 governing the landfilling of wastes within the state. Dr. Lee also served as an advisor to a state of Texas legislative committee on managing hazardous wastes. Dr. Lee served as an advisor to Governor Lamm of the state of

Colorado on the Lowry Hazardous Waste Landfill issues. In 1984, Dr. Lee was awarded a contract by the state of Michigan Toxic Substances Control Commission devoted to review of the state's landfilling regulations.

Dr. Lee has extensive experience in work with PCBs in the environment. While teaching at the University of Wisconsin, Madison, his graduate students worked under his supervision on determining the sources, fate and potential water quality significance of PCBs. He is also familiar with the public health and water quality significance of PCBs. He served as chairman of a US Public Health Service committee reviewing the need for developing PCB drinking water standards.

Dr. Lee is qualified to undertake a critical review of the WDI proposed continued operation of landfill site #2 to provide public health, groundwater resource and environmental protection from hazardous waste-associated constituents, including PCB wastes, for as long as the wastes in the landfill represent a threat.

Review of the Potential for WDI's Landfill Site #2 to Protect Groundwaters from Pollution by Landfill Leachate for as Long as the Wastes in the Landfill Will Be a Threat

The first step in evaluating the ability of a proposed landfill or landfill expansion to comply with groundwater quality protection regulations of the type in effect in Michigan is to determine whether the landfill site is hydraulically connected to groundwaters that are or could at any time in the future be used for domestic or other water supply purposes. If there are potable and palatable groundwaters hydraulically connected to the landfill, then it is necessary to evaluate whether natural barriers, such as thick, low permeability layers that do not have fractures, cracks, sandy lenses, etc., that could provide avenues for leachate transport exist between the landfill base and the groundwaters that could potentially be polluted by landfill leachate at any time in the future while the wastes in the landfill represent a threat.

Suitability of WDI Landfill Site #2 Location for the Existing Landfill and Proposed Landfill Continued Operations

The WDI landfill site #2 location for continued operation (Master Cell VI) is hydraulically connected to potable groundwaters that are being used now and will certainly be used in the future as a domestic water supply source. Further, examination of the geological characteristics of the groundwater system underlying the existing landfill and proposed location for the landfill's continued operation and the groundwater resources of the region that could be polluted by landfill leachate, shows that there is an inadequate natural barrier between the landfill and the groundwaters of concern. While there is low permeability clay between the base of the landfill and the uppermost aquifer, this clay will only slow down the transport of waste-derived constituents that penetrate the liner system into the underlying aquifer system.

There has been insufficient investigation of the characteristics of the geological formations underlying the landfill cells to justify that there are no higher permeability pathways

through the clay layer that would more rapidly transport leachate-associated constituents from the base of the landfill to the underlying aquifer system. As discussed below, WDI and the regulatory agencies are relying on groundwater investigations that were conducted in the late 1970s to mid-1980s to characterize the hydrogeology of the region. These studies, however, did not adequately characterize the hydrogeology of the area when conducted to support the siting of a landfill at this location. Further, these studies certainly do not serve as an adequate base of reliable information for characterization of the hydrogeology underlying Master Cell VI for continued operations of this landfill. A discussion of the deficiencies in the hydrogeology information provided by WDI in its application for continued operation of landfill site #2, as well as for support of a landfill that would accept PCB wastes, is provided in another section of this report.

It has been the author's experience that while landfill applicants and their consultants often claim, based on a somewhat cursory examination of the characteristics of a low-permeability clay layer that underlies an existing or proposed landfill cell, that the layer is a barrier to leachate transport, frequently a more comprehensive study of the potential for transport of leachate through the layer shows that it could be much more rapid than originally predicted. This is likely to be the case for the WDI landfill site #2 where properly conducted additional studies could show that this site does not conform to the minimum siting requirements for maximum permeability for a PCB landfill.

While the underlying aquifer is somewhat confined with the result that there is a reported upward groundwater gradient (piezometric surface) which would retard the movement of leachate-containing waste constituents through the clay layer, such a situation, if it is a real barrier to leachate migration, cannot be relied on to prevent the downward migration of leachate into the waterbearing strata. The location of the piezometric surface for the confined uppermost aquifer cannot be assured to remain in its current position for as long as the wastes in the landfill represent a threat. That position is determined by a variety of factors, such as climate-precipitation, groundwater use, etc.

To assert that the situation that exists today governing the position of the uppermost aquifer's piezometric surface will always be the situation during the infinite period of time that the wastes in the existing landfill or proposed landfill continued operation will be a threat is inappropriate. Climate change and/or altered groundwater pumping situations could readily significantly change the hydraulic gradient between the base of the landfill and the waterbearing strata underlying the landfill that is considered to be the uppermost aquifer.

Another factor to consider in evaluating the so-called isolation of the uppermost aquifer from the base of the landfill is that in low-permeability clay systems the major transport mechanism may be diffusion control rather than advective control. Diffusion, while slow, will transport leachate-derived constituents through the clay layer, eventually polluting the underlying aquifer system. It appears that WDI, its consultants, and the regulatory agency personnel have ignored the fact that for low permeability clays diffusion is a more important mechanism for pollutant transport than advection.

There is potential for the sandy lenses that apparently occur in the geological strata underlying Master Cell VI to serve as a conduit for more rapid transport of leachate than is now predicted. In addition, there could readily be cracks, fissures or other high permeability pathways through the low permeability layer underlying Master Cell VI which would enable leachate to reach the underlying aquifer system more rapidly than currently predicted by WDI. Further, because of the limited permeability testing and the way the permeability tests were conducted, it is likely that the permeability of the underlying strata is at some locations somewhat higher than those reported by WDI.

There is also a potentially significant problem with the high groundwater table present in the surficial sands located around the landfill cells. This groundwater will likely be a source of moisture entering the waste management cells at sometime in the future which could lead to increased leachate generation. Further, the surficial sand aquifer system provides a possible pathway for leachate to leave the waste management cell and into surface waters of the region. This issue is discussed further in another section of this report.

Basically, the WDI landfill site #2 proposed continued operation would if licensed/permitted be conducted in a hydrogeologically unsuitable site for this landfill since leachate that escapes from this landfill will lead to groundwater pollution, impairing its use and thereby violating US EPA's and state of Michigan's landfilling regulations.

Deficiencies in Proposed WDI Landfill Site #2 Landfill Design

WDI has proposed to use a double composite liner for the continued operation of landfill site #2 Master Cell VI. This proposed approach conforms to essentially the minimum design requirements set forth in the US EPA's and state of Michigan's hazardous waste landfill liner design requirements. However, as discussed herein and in the enclosed supporting documents appended to this report, double composite liners of the type that WDI has proposed and MDEQ and the US EPA have apparently accepted, based on their draft license/permit, are well-known to leak leachate at the time of construction, and ultimately the liner will deteriorate to the point where it will be an ineffective barrier for transport of leachate through it on its way toward the groundwater resources hydraulically connected to the landfill that could be used for domestic water supply purposes at any time in the future.

The US EPA (1988a) as part of promulgating RCRA Subtitle D regulations in which the Agency propose to adopt a single composite liner of the type that WDI has proposed for the continued operation of the WDI landfill site #2 Master Cell VI which would continue to accept hazardous waste and would begin to accept PCB wastes stated,

> *"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's "Criteria for Municipal Solid Waste Landfills" (US EPA, 1988b) stated,

"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."

The US EPA 1988 assessment of the ability of a minimum Subtitle D single composite liner to prevent groundwater pollution by landfill leachate is still applicable today. If anything, today there is more widespread general recognition that a single or double composite lined landfilling will not protect groundwaters from pollution by landfill leachate for as long as the wastes in the landfill will be a threat.

Lee and Jones (1992) have conducted a review of the literature on what is known about the properties of flexible membrane liners and clay liners to prevent landfill leachate from passing through them for as long as the waste in the landfill will be a threat. Lee and Jones-Lee (1996a) have recently brought the 1992 review up to date discussing some of the more recent work on this topic in the context of predicting whether an existing or proposed landfill will pollute groundwater by landfill leachate for as long as the waste in the landfill represent a threat. They conclude that these types of liner systems, while possibly providing short-term protection of groundwater quality, are not reliable for long-term protection, and will ultimately fail to prevent leachate from passing through them.

Hsuan and Koerner (1995) have reported on the initial phase of long-term (10-year) studies that are underway on examining the rates of deterioration of flexible membrane liners. The focus of the Hsuan and Koerner's work is on the breakdown of the polymers in the plastic sheeting liners. They predict that this breakdown will occur due to free radical polymer chain scission in 40 to 120 years. These estimates are indicated by Koerner to consider only some of the mechanisms that could cause breakdown. It is possible that breakdown could begin much earlier. Even if the breakdown of the plastic sheeting polymers took 100 years or so, there is still no question that ultimately the plastic sheeting in the flexible membrane liners will break down, leading to an inability to prevent leachate from passing through it causing groundwater pollution in the area.

An area of growing concern with respect to plastic sheeting-lined landfills is that dilute aqueous solvents can permeate through an intact, without holes, HDPE liner. This is a chemical transport process in which the low molecular weight organics dissolve into the liner and exit on the downgradient side. Sakti, *et al*., (1991) have reviewed the available information on this topic and have conducted excessive research on it. They found that an HDPE liner would have to be over an inch thick to prevent permeation of certain organics through it within a period of 25 years. Buss, *et al.* (1995) has recently reviewed the information on the mechanisms of leakage through synthetic landfill liner materials. They discuss the importance of permeation of organics through plastic sheeting liners as a landfill liner leakage mechanism that does not require deterioration of the liner properties. This is an issue that has not been addressed by WDI in its application and by the regulatory agencies in review of the application for a continued operating license/permit as well as a permit for PCB waste.

<u>Reliable Reporting on FML Properties.</u> One of the problems with addressing the ultimate breakdown of the liner system is the failure of landfill applicants and their consultants to reliably

report on the long-term stability problems with flexible membrane liners. There are several examples in the literature such as Fluet *et al.* (1992), Tisinger and Giroud (1993) and Flood (1994) where individuals who work for landfill applicants inadequately and/or unreliably report on the ultimate breakdown of flexible membrane liners. As discussed by Lee and Jones-Lee (1993a), a common approach used by landfill consultants is to claim that the liner system will be "protective." However, they fail to discuss their definition of the duration of time in which they will be protective and fail to mention the fact that, ultimately, this protective definition that they use will result in groundwater pollution beyond the time that they are considering to be of significance. Often this time is considered to be only 30 years beyond the closure of the landfill.

The WDI landfill site #2 liner system is basically two single composite liners stacked upon each other. This design does not eliminate the fundamentally flawed nature of a composite liner-lined landfill. Each of the two composite liners in the WDI landfill site #2 Master Cell VI will experience the same ultimate failure to prevent leachate from passing through the liners and ultimately polluting groundwaters.

Enclosed are discussions that have been prepared by the author which summarize the literature on the ability of composite liners of the type that WDI proposes to utilize in the continued operation of WDI landfill site #2 to prevent groundwater pollution by landfill leachate for as long as the wastes in the landfill will be a threat. These papers/reports, as well as the literature cited in the references, should be consulted for additional information on this topic.

As part of evaluating WDI's proposed approach for the containment system associated with the WDI landfill site #2, it is important to understand that the treated hazardous waste residues and PCB wastes that are proposed to be disposed of by burial in this landfill will represent a threat to groundwater quality effectively forever. While those who do not understand the processes that take place in a landfill or do not reliably report on them, assert that a landfill will only be a threat for a few years after its closure, it is now well understood that landfill cells of the type that WDI proposes to continue to operate at the Belleville site will be a threat to groundwater pollution for a long period of time, effectively forever.

WDI proposes to place a cover over the WDI landfill site #2 Master Cell VI which will restrict the amount of precipitation that enters the waste. Since the period of time that the landfill waste will be a threat is directly dependent on the amount of moisture entering the landfill which, in turn, ferments and leaches the waste leading to landfill gas and leachate formation, it can be expected that the WDI landfill site #2 Master Cell VI will be a threat to groundwater quality for hundreds if not a thousand or more years.

Freeze and Cherry (1979) of the University of British Columbia and the University of Waterloo, respectively, in their book, Groundwater, discuss that landfills developed in the Roman Empire about 2,000 years ago are still producing leachate. Belevi and Baccini (1989), two Swiss scientists who have examined the expected contaminating lifespan of Swiss landfills, have estimated that Swiss landfills will leach lead from the waste at concentrations above drinking water standards for over 2,000 years. As discussed in the appended materials which summarize the literature on this topic, a landfill of the type that WDI proposes to continue to use for the Belleville site will be a threat to groundwater resources for long periods of time,

effectively forever. These issues are discussed further in the appended papers and reports by the author. Of particular concern are the papers entitled, "Landfilling of Solid & Hazardous Waste: Facing Long-Term Liability" (Lee and Jones-Lee, 1994a) and "Groundwater Pollution by Municipal Landfills: Leachate Composition, Detection and Water Quality Significance" (Jones-Lee and Lee, 1993).

While the latter paper focuses on municipal solid waste landfills, similar issues arise and situations occur for hazardous waste landfills of the type that WDI proposes to continue to use at the Belleville site. Whether lead or some other hazardous/deleterious chemical is in a "dry tomb" type municipal solid waste landfill or "dry tomb" type hazardous waste landfill does not, for many constituents, affect the overall period of time that the constituent will be hazardous in that type of landfill.

The plastic sheeting and compacted clay cover and liners that WDI proposes to use as the containment system for the continued operation of the WDI landfill site #2 Master Cell VI will not function to prevent leachate generation and to effectively collect all leachate that is generated within the landfill for as long as the wastes in the landfill represent a threat. Further, the ultimate failure of this line of system will allow releases of hazardous and deleterious constituents to occur from Master Cell VI that ultimately will pollute groundwaters underlying this cell.

Deficiencies in WDI's Proposed Groundwater Monitoring System

While WDI and its consultants assert that the groundwater monitoring system that is proposed for continued operation of the WDI landfill site #2 Master Cell VI will detect groundwater pollution by landfill leachate before widespread pollution occurs, in fact, when critically examined, it can be readily ascertained that the proposed groundwater monitoring system will not be effective in detecting pollution of groundwater by landfill leachate before widespread pollution occurs. Dr. Cherry (1990) of the University of Waterloo was the first to point out that the groundwater monitoring system of the type that WDI has proposed for the WDI landfill site #2 Master Cell VI involving vertical monitoring wells spaced at hundreds of feet apart around a landfill have a low probability of detecting leachate leakage from the landfill that can pollute groundwater before widespread pollution occurs.

Dr. Jones-Lee and the author published a review article on this topic in which they have utilized Cherry's findings to point out that minimum Subtitle C (hazardous waste) and D (municipal solid waste) landfills that utilize vertical monitoring wells of the type that WDI has proposed for the WDI landfill site #2 (Master Cell VI) will not be reliable for monitoring landfill pollution of groundwaters by the landfill before widespread pollution occurs (Lee and Jones-Lee, "A Groundwater Protection Strategy for Lined Landfills," 1994b). This situation is easily understood by the fact that the initial leakage through the flexible membrane liner of the composite liner for a minimum design Subtitle C landfill or the equivalent, such as the WDI landfill site #2 Master Cell VI, will initially leak through holes, rips, tears or points of deterioration within the flexible membrane liner. Such leaks will produce finger plumes of limited dimensions compared to the spacing of groundwater monitoring wells. Groundwater

monitoring wells of the type that WDI proposes for the WDI landfill site #2 Master Cell VI will have zones of capture of about 1 foot on each side of the well.

According to the WDI application for continued operation of the landfill site #2 Master Cell VI, WDI proposes to space the primary monitoring wells at about 400 feet apart at the down groundwater gradient edge of the waste management unit. This means that the finger-like leachate plumes produced from the initial leakage through the flexible membrane liner of WDI's proposed liner system could readily fail to be detected by the monitoring wells. There is a space of about 398 feet between the monitoring wells through which the finger plumes of leachate, which could be on the order of a few feet wide at the location of the monitoring wells, could pass and never be detected.

As discussed in the author's review of this issue, (Lee and Jones-Lee, 1994b) the groundwater monitoring approach of the type that WDI has proposed for the WDI landfill site #2 Master Cell VI is a fundamentally flawed technological approach for protecting groundwaters from pollution by landfill leachate. This means that WDI's proposed approach for monitoring groundwater pollution by leachate that passed through the liner system could readily fail to be detected by the monitoring wells that WDI proposes to use to detect leachate leakage through the liner. This leachate would eventually likely be detected in off-site production wells. By then there would be widespread pollution of groundwaters by the leachate.

Overall Conclusions on the Suitability of Siting and Design of the WDI's Proposed Continued Operation of the WDI Landfill Site #2

From an overall perspective, it can therefore be appropriately concluded that the WDI landfill site #2 is located at a geologically unsuitable site where high quality groundwaters will eventually be polluted by landfill leachate that will pass through the liner system and fail to be detected by the groundwater monitoring system that WDI proposes for this landfill. Further, and most importantly, this landfill should not be licensed/permitted, since it cannot conform to the state of Michigan and the US EPA landfilling requirements of protecting groundwaters from pollution by landfill leachate for as long as the wastes in the landfill will be a threat.

Burden of Proof for Groundwater Quality Protection Should Be on the Landfill Applicant

A review of WDI's application covering the proposed continued operation of its landfill site #2 Master Cell VI and the MDEQ and the US EPA draft license/permit, shows that WDI and the regulatory agencies have adopted the approach of placing the burden for critical review of the deficiencies in the landfill location, design, operation, closure and post-closure care on the public, who would be potentially adversely impacted by the landfill. WDI should have provided a critical, in-depth review of the reliability of the landfill containment system and groundwater monitoring systems to protect public health, groundwater resources and the environment from pollution by landfill leachate for as long as the waste in the landfill will be a threat. Instead, as documented herein, WDI has essentially adopted minimum regulatory requirements for the continued operation of its landfill site #2 Master Cell VI.

It is disappointing to find that the MDEQ and US EPA review of the WDI application has been conducted in such a superficial manner as to basically accept WDI's statements that the minimum regulatory requirements will be protective. A critical review of the approach that WDI proposes to follow in continuing to operate Master Cell VI and that MDEQ and the US EPA propose to allow WDI to follow, as part of reissuing the license/permit for WDI landfill site #2 operations, will show that this landfill has not and will not continue to meet the minimum regulatory requirements for protection of public health, groundwater quality, the environment, and the interests of those within the sphere of influence of the landfill.

It is important that as part of developing a landfill or the relicensing of a landfill for continued operations, the landfill applicant should be required to convincingly demonstrate that the landfill will be sited, designed, constructed, operated, closed and provided with post-closure care such that it will protect the groundwater resources, public health, environment and the interests of those within the sphere of influence of the landfill, for as long as the wastes in the landfill represent a threat. As discussed herein, for planning purposes, the wastes that are proposed for deposition in WDI landfill #2 Master Cell VI should be considered a threat to public health, the environment and groundwater resources forever.

If there are questions about any particular landfill being appropriately sited, designed, constructed, operated and closed and whether there will be adequate post-closure care funding and implementation for as long as the wastes represent a threat, i.e., forever, then the landfill should not be developed, allowed to continue to operate or be expanded. Those who own or use properties near landfills should be protected from adverse impacts of the landfill. This will require that those who generate wastes that are placed in a landfill pay the true cost associated with landfilling the wastes and not pass these costs, health and environmental threats and groundwater resource losses on to the public within the sphere of influence of the landfill.

In those situations where there is inadequate information to evaluate whether a landfill will be protective, it is appropriate to err on the side of protection of public health, the environment and the interests of those who live or utilize properties near landfills rather than on the side of cheaper-than-real-cost waste disposal. As discussed in the enclosed report, "Evaluation of the Potential for a Proposed or Existing Landfill to Pollute Groundwaters," a properly conducted risk/hazard assessment should be developed for each landfill to determine the potential for the landfill to pollute groundwaters with waste-derived constituents for as long as the waste in the landfill will be a threat.

There is need to recognize the technical invalidity of the approach of claiming that meeting the minimum containment system component design requirements and groundwater monitoring requirements is adequate to enable the landfill owner to continue to operate the landfill. Rather than the superficial review involving a mechanical comparison between the minimum regulatory requirement for a particular component of the landfill system, such as the installation of a minimum of three monitoring wells along the downgradient edge of the waste management unit, as has been followed by WDI, MDEQ and the US EPA, the applicant, as well as the regulatory agencies, should critically examine the reliability of only utilizing three

monitoring wells along the downgradient edge of the landfill as a basis for detecting leachate pollution of the groundwaters in accord with current regulatory requirements covering public health, groundwater resource and environmental protection. In most cases the critical in-depth review of the reliability of the groundwater monitoring system would show that the system has a poor reliability and obviously cannot conform to regulatory requirements. The same situation applies to the liner systems, leachate collection and removal system, leak detection system, etc.

Basically, MDEQ and the US EPA need to start over in conducting a review of the WDI application for the continued operation of this landfill. This time the agency should involve individuals who are knowledgeable in the long-term properties of the landfill liner materials and the reliability of sampling groundwaters using vertical monitoring wells at the point of compliance for the landfill groundwater monitoring system in conducting this review.

Extrapolating Current Experience of Leachate Leakage/Groundwater Pollution from the Existing Landfill Cells to Master Cell VI

WDI and representatives of the MDEQ and US EPA have attempted to justify the continued operation of WDI landfill site #2 Master Cell VI based on the observation that the groundwater monitoring and leachate leakage detection systems that have been used for the existing landfill cells (Master Cells V and VII) have thus far not detected leachate leakage or groundwater pollution from these cells. The basic reasoning (no pollution of groundwaters by landfill leachate has yet been detected) that is being used to support continued operation of WDI's landfill site #2 is fundamentally flawed for several reasons. These issues are discussed below.

Travel Time of Leachate. In low-permeability strata such as at the WDI landfill site #2, a finite period of time is needed for leachate to move from the edge of the landfill containment system, if there is any, to the point of detection. It is appropriate to inquire whether there has been sufficient time for leachate migration from the waste deposition areas to the leak detection areas to enable a reliable conclusion to be developed that there is no migration of leachate from the landfill cells. It is likely that there has not been sufficient time at the existing WDI landfill cells for leachate to have moved the required distance so that it has been detected by the detection systems used.

The burden of proof for investigating this situation should be on the applicant and the regulatory agencies, not on the public. Such an investigation should be conducted before it is claimed, as has been done by the regulatory agencies' staff, that the landfill's continued operation application should be approved, since no pollution has been found from the existing waste management cells.

Unreliable Groundwater Monitoring. One of the primary reasons why the pollution of groundwaters by the WDI existing landfill cells has not been detected is that the method of detection of groundwater pollution involves vertical monitoring wells spaced hundreds of feet apart near the downgradient edge of the landfill. These monitoring wells have zones of capture into the aquifer of about one foot based on a three borehole volume purge of the well before sampling. This same situation applies to the suction cup lysimeters that have been placed under

Master Cells V and VII. These devices have limited zones of capture compared to the area through which leakage could occur. Basically, unless there is widespread general leakage throughout the bottom of the landfill liner system, the plumes that are generated from initial leakage would not likely be detected by the groundwater monitoring wells or the suction cup lysimeters.

Parsons and Davis (1992) have discussed the approach that should be used to develop reliable groundwater monitoring systems for lined landfills. Basically, the zone of capture of the monitoring wells at the point of compliance for groundwater monitoring must be of such dimensions (lateral extent) so as to intersect the leachate plumes that arise from leaks through the liner system. This would require that monitoring wells that could detect leaks through the liner system that arise near the down groundwater gradient edge of the landfill waste management unit be no more than a few feet apart.

There may be an attempt to argue that leaks through the upper composite liner would be detected by the leak detection system between the two composite liners and therefore the unreliability of the groundwater monitoring system to detect leaks through the liners is of no consequence in protecting groundwater quality. However, such an argument is not technically valid for the period of time that the waste in the landfill will be a threat. As discussed above, the key component of the leak detection system between the two composite liners is the plastic sheeting flexible membrane liner which serves as the upper component of the lower composite liner. It is this component that conveys leachate that passes through the upper component liner to a sump where the presence of leachate in the leak detection system can be assessed.

Ultimately, however, the flexible membrane liner base of the leak detection system will deteriorate to the point where it is no longer an effective barrier to leachate passing through it. Under these conditions, the leaks that occur through the upper composite liner will enter the leak detection system and pass through it into the lower composite liner without being detected in the leak detection system. It is for this reason that the leak detection system that WDI proposes to use in Master Cell VI as part of continued operation of this cell is not a reliable basis for detecting the failure of the double composite liner system to contain waste components for as long as the waste in the landfill will be a threat.

From an overall perspective, the leachate leakage detection system and the groundwater pollution monitoring system that are being used at the WDI landfill site #2 Master Cells V, VI and VII (the existing waste management cells) are unreliable in detecting leachate leakage from these cells at this time. Leakage of leachate is almost certainly been occurring that has not yet been detected. As discussed below, it is therefore inappropriate for the MDEQ and US EPA staff to claim that since no waste cell leakage has been detected thus far from the existing waste cells the proposed continued operation of this landfill should be licensed/permitted.

Regulatory Requirements

The first step in reviewing an existing or proposed landfill is to examine the regulatory requirements for the landfill. This section of the report summarizes state of Michigan and

federal requirements covering the continued operation and expanded operation of the WDI hazardous waste landfill site #2 Master Cell VI.

The state of Michigan's Administrative Rules Promulgated Pursuant to Michigan's Hazardous Waste Management Act 1979 PA 64, as Amended (Act 64) which became effective June 18, 1994 provide the regulatory basis governing the continued operation of WDI's landfill site #2. Excerpts from these regulations that are pertinent to examining the appropriateness of the MDEQ proposed license for the continued operation of WDI landfill site #2 Master Cell VI are presented below. The pertinent parts of the regulation are followed by discussion of its implications for issuing a license renewal for continued operation of Master Cell VI.

*"**R 299.9504 Construction permit application; content.***

Rule 504. (1) In addition to the information that may be required by subrule (16) of this rule, all applications for a construction permit shall include all of the following items:"

"(e) An environmental assessment, including a failure mode assessment that provides an analysis of the potential major methods by which safe handling of hazardous wastes may fail at a treatment, storage, or disposal facility. The owner or operator of a facility that stores, treats, or disposes of hazardous waste in a surface impoundment or a landfill shall include, in the environmental assessment, information that is reasonably ascertainable by the owner or operator on the potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the unit. At a minimum, the information shall address all of the following subjects:

(i) Reasonably foreseeable potential releases from both normal operations and accidents at the unit, including releases associated with transportation to or from the unit.

(ii) The potential pathways of human exposure to hazardous waste or constituents resulting from the releases described in paragraph (i) of this subdivision.

(iii) The potential magnitude and nature of the human exposure resulting from the releases described in paragraph (i) of this subdivision."

The Environmental Assessment for the application has been included in Appendix A of the "Supplemental Information Report" dated July 1995. Detailed comments on the significant deficiencies in WDI's Environmental Assessment are provided in another section of this report devoted to the review of the application for acceptance of PCB wastes in Master Cell VI. As discussed therein, environmental assessment developed by WDI is deficient compared to the regulatory requirements set forth above.

"R 299.9518 Operating license denial

Rule 518. (1) The director shall deny an application for an operating license if the operation of the treatment, storage, or disposal facility for which the license is sought will violate the act of these rules.

(2) The applicant is on notice that, in addition to any other of these rules, the director shall deny an operating license application if any of the following occur:"

"(b) The existing construction or operation of an existing facility of facility newly subjected to the licensing requirements of the act and these rules presents a hazard to the public health or the environment.

(c) The applicant has not submitted sufficiently detailed or accurate information to enable the director to make reasonable judgments as to whether the license should be granted."

Based on this regulatory requirement, the MDEQ director can and should deny the WDI application for continued operation of Master Cell VI based on the fact that waste placed in this cell will be a significant hazard to public health and the environment. Further, the MDEQ director can readily justify denying WDI's application for renewed operation of WDI landfill site #2 based on WDI failing to provide sufficiently detailed and accurate information to enable the director to make a reasonable judgment on the potential threat that this landfill cell represents to public health and the environment.

"R 299.9519 Modification, revocation, and suspension of construction permits and operating licenses during their terms.
Rule 519"

"(4) Suitability of the facility location shall not be considered at the time of construction permit or operating license modification, suspension, or revocation unless new information or standards indicate that a threat to human health or the environment exists which was unknown at the time of license issuance. In addition, the director shall not modify a construction permit beyond what is authorized in the construction permit by the site review board."

"(11) A construction permit or operating license may be revoked for any of the following reasons:"

"(b) A determination that the licensed activity endangers human health or the environment.

(c) The owner or operator fails in the application or during the construction permit or operating license issuance process to disclose fully all relevant facts or at any time misrepresents any relevant facts."

This section provides the authority for the MDEQ director to revoke an operating license based on new information on the ultimate failure of liners to prevent groundwater pollution and the inadequacies of the groundwater monitoring system that exists now that was not well understood at the time of the original licensing.

"R 299.9602 Environmental and human health standards generally.

Rule 602. (1) All treatment, storage, and disposal facilities shall be located, designed, constructed, and operated in a manner that will prevent all of the following:"

"(d) Exposure of humans or the environment to harmful quantities of hazardous waste or hazardous waste constituents.

(e) Pollution, impairment, or destruction of the natural resources of the state."

This section establishes the overall standard for continued operation of WDI landfill site #2. The proposed landfill continued operation cannot conform to the requirements of protecting people and the environment from harmful quantities of hazardous waste and waste constituents. Further, the continued operation of Master Cell VI will cause pollution, impairment and destruction of state of Michigan natural resources.

"R 299.9603 Location standards.

Rule 603. (1) Active portions of new treatment, storage, or disposal facilities or expansions, enlargements, or alterations of existing facilities shall not be located in any of the following areas:"

"(5) Landfills, surface impoundments, and waste piles shall only be located in areas where there is not less than 6 meters of soil with a maximum permeability of 1.0 x 10^{-6} cm/sec at all points below and lateral to the liner or bottom of the landfill, surface impoundment, or waste pile, unless the owner or operator substitutes an engineered backup liner of equivalent design and demonstrates to the director that it provides equivalent environmental protection."

Failing to conform to this section's requirements represents one of the significant deficiencies in the current landfilling regulations in that it allows individuals who want to site a landfill at an inappropriate location such as the WDI landfill site #2 to do so by claiming that they meet the minimum location requirements of Act 64. It is important to note, however, that the location standards set forth above do not state that these minimum requirements are necessarily protective. As discussed, the purpose of the regulations is to protect public health, groundwater resources and the environment from pollution from landfill leachate for as long as the waste in the landfill represent a threat. Since the waste in the WDI site #2 landfill will be a threat effectively forever, providing for a minimum of 40 years of transport time through a geological strata that has a maximum permeability of 1.0 x 10^{-6} cm/sec is obviously not protective. The 40 year value is derived from the fact that under 1 foot of head, 10^{-6} cm/sec represents about 1 foot per year of leachate transport through 18 meters strata.

A regulatory agency staff member that reviews a particular landfill should (must) evaluate whether the location provides for true protection of public health, groundwater resources, the environment or simply postpones when pollution occurs. WDI site #2 does not provide for true protection but at best, postpones for a few tens of years when pollution occurs. Because of this situation, this site does not conform to the overall groundwater protection standards set forth within Act 64 of preventing pollution by waste derived constituents.

"R 299.9604 Facility design and operating standards.

Rule 604. (1) The owner or operator of a treatment, storage, or disposal facility shall design, construct, operate, and maintain all of the following:"

"(c) Systems to prevent hazardous waste or hazardous waste constituents from escaping into the soil, directly or indirectly into surface water or groundwaters, or uncontrolled into drains or sewers."

This section explicitly indicates that the WDI landfill site #2 shall be designed and operated to prevent the escape of hazardous waste constituents from the landfill unit. The WDI proposed design as well as the MDEQ proposed license for this landfill's continued operations cannot conform to this section's requirements. At best, the proposed design only postpones for a period of time when escape of constituents in the waste from the landfill will occur.

"R 299.9611 Environmental monitoring.

Rule 611. (1) An owner or operator of a hazardous waste treatment, storage, or disposal facility shall develop an environmental monitoring program that is capable of detecting a release of hazardous waste or hazardous waste constituents from the facility."

This section provides the regulatory basis for concluding that WDI's proposed groundwater monitoring system and the MDEQ approval of this system is inappropriate. A groundwater monitoring system that has a low probability of detecting when releases of waste occur at the point of compliance such as the WDI landfill site #2 groundwater monitoring system cannot conform to the requirements set forth in this section.

"R 299.9613 Closure and post-closure.

Rule 613. (1) The owner or operator of a hazardous waste treatment, storage, or disposal facility shall comply with the closure and post-closure provisions of 40 C.F.R. part 264, subpart G, except 40 C.F.R. §§264.112 (d) (1), 264.115, and 264.120."

This section establishes the regulatory basis for requiring that the WDI landfill site #2 Master Cell VI, as well as all other Master Cells which have received waste, be properly closed and that proper post-closure care be required for as long as the waste in the landfill will be a threat.

"R 299.9619 Landfills.

Rule 619. (1) Owners or operators of facilities that use landfills to dispose of hazardous waste shall comply with the design and operating requirements of 40 C.F.R. part 264, subpart N.

(2) In addition to the liner system requirements of 40 C.F.R. §264.301, the owner or operator of a landfill shall design the liner system to meet the requirements of R 299.9620.

(3) All landfills shall contain a leak detection, collection, and removal system beneath the liner system that is designed, constructed, operated, and maintained in accordance with the provisions of R 299.9622, unless the landfill is exempted pursuant to the provisions of R 299.9622."

"(5) In addition to the closure and post-closure care requirements of 40 C.F.R. §264.310, the owner or operator of a landfill shall do all of the following with respect to closure and post-closure care:

(a) Close the facility so that the final cover includes both of the following:

(i) Compacted clay which is in compliance with the requirements of R 299.9620 (3) and which is not less than 90 centimeters thick.

(ii) Not less than 60 centimeters of additional material, such as topsoil, subsurface drainage media, or cobbles to prevent animal burrowing. The additional material shall be applied in a manner that protects the clay and any synthetic component from the effects of temperature, erosion, and rooted vegetation. For temperature protection, the additional material thickness shall equal not less than 60 centimeters or the maximum depth of frost penetration, whichever is greater."

This section establishes several minimum design requirements for the landfill containment system. At no place does it indicate that these minimum design requirements will be protective. Any landfill applicant who develops a landfill must develop a landfill that is protective of public

health, groundwater resources, the environment and those within the sphere of influence of the landfill for as long as the wastes in the landfill will be a threat. WDI's landfill site #2 Master Cell VI design, while meeting minimum design requirements, will not be protective as long as the waste in the cell will be a threat. Therefore, the design of Master Cell VI does not conform to the groundwater protection standard set forth in Act 64 and should not be relicensed.

"R 299.9622 Leak detection systems.

Rule 622. (1) Each new unit and lateral expansion or replacement of an existing unit at a landfill, surface impoundment, waste pile, or land treatment facility shall include a leak detection system capable of detecting leaks of hazardous constituents at the earliest practicable time.

(2) If contamination is detected in the leak detection system required by this rule, the owner or operator shall do all of the following:"

"(c) If failures have occurred, do either of the following on a schedule which insures the protection of human health and the environment:

(i) Repair the failures in the liner system and obtain the certification of a registered professional engineer that, to the best of his or her knowledge and opinion, the failure has been corrected.

(ii) Cease placing waste in the failed unit and take action to prevent the migration of hazardous waste and hazardous waste constituents from the facility."

This section requires the operation and maintenance of the leak detection system for as long as the wastes in the landfill are a threat. WDI only proposes to provide post-closure care for 30 years. MDEQ and the US EPA have not established in the draft license/permit an assured funding mechanism that provides a high degree of reliability that the leak detection system requirements set forth above will be carried out for as long as the waste in the landfill will be a threat.

The requirements set forth in this section will likely require waste exhumation in order to replace the flexible membrane liner when it deteriorates to the point where it is no longer an effective base of the leak detection system. This could occur during the post-closure period, year 31 after closure, year 50, 100, 200, etc. The waste in this landfill will still be a threat at that time. It is therefore essential that sufficient funds be made available in the dedicated trust fund to carry out the requirements set forth in this section for the leak detection system. This landfill should not be licensed/permitted unless there is a high degree of reliability that the leak detection system can in fact be maintained in accord with the requirements set forth above for as long as the waste in the landfill will be a threat.

"***R 299.9629 Corrective action.***

Rule 629. (1) Owners or operators of facilities that treat, store, or dispose of hazardous waste shall conduct corrective action as necessary to protect the public health, safety, welfare, and the environment in accordance with a corrective action program approved by the director. The corrective action program shall be conducted as follows:

(a) Owners or operators of facilities that apply for, or have been issued, an operating license pursuant to the provisions of the act shall institute corrective action for all releases of a

contaminant from any waste management units at the facility, regardless of when the contaminant may have been placed in or released from the waste management unit."

The corrective action requirements cited above are clear in requiring that WDI be able to effectively implement corrective action for all releases of waste-derived constituents at any time in the future. There is no 30-year limit on corrective action.

In order to implement the requirements of this corrective action regulation with a high degree of reliability, WDI should be required to develop a dedicated trust fund of sufficient magnitude that could address all plausible worst-case scenario failures of the landfill containment system for as long as the waste in the landfill will be a threat. The current draft license/permit issued by MDEQ and the US EPA does not provide for this level of protection. It is therefore significantly deficient and should not be approved.

"R 299.9703 Financial assurance for closure and post-closure care.

Rule 703. (1) The owner or operator of each facility shall establish financial assurance for closure of the facility by utilizing the options specified in R 299.9704 to R 299.9709. The owner or operator of each disposal facility shall establish financial assurance for post-closure care of the facility utilizing the options specified in R 299.9704 to R 299.9709."

It is important that the interpretation of this regulation require that WDI establish financial assurance that it has a high probability of being implemented at any time in the future while the wastes in this landfill are a threat in order to be able to address all plausible worst-case scenario failures of the landfill containment system for as long as the waste in the landfill will be a threat. Hickman (1992, 1995) has discussed the importance of using a dedicated trust fund as the financial assurance instrument for landfills. As he points out, all other financial instruments have uncertainties as to whether or not they will be available when needed during the post-closure care period.

The typical 30-year post-closure fund associated with both hazardous and non-hazardous waste landfills is deficient compared to the funds that will likely be required during the 30-year period, much less the infinite period of time that funds will be needed to address contingencies that will ultimately have to be addressed at the landfill. An important aspect of this situation is whether private landfilling companies will, in fact, be economically viable in the future when the funds will be needed--20, 50, 100 or so years from now. As discussed by Lee and Jones-Lee (1993b, 1994a), private landfilling companies are accruing massive liabilities that ultimately will cause these firms' stockholders to sell their stock from the firms, making the firms financially unstable, ultimately leading to their bankruptcy. This past year, at the annual meeting of the Waste Management of North America Stockholders, the WMX CEO, D. Buntrock, noted that WMX was losing money on its hazardous waste management business. D. Buntrock is quoted in the Chicago Tribune as stating at this meeting, *"Most of us in the company wish today we never heard of the business."*

Situations such as this give little confidence that landfill companies will, in fact, meet their long-term obligations associated with post-closure care of landfills. Some states, such as

South Carolina, are beginning to address this issue by requiring that waste management companies post cash bonds to address long-term landfill contingencies. It is important that the financial instrument used to provide post-closure care not be dependent on the solvency of the company. It is for this reason that dedicated trust, established at the time of landfill operation, be available to address routine maintenance and monitoring, as well as all plausible worst-case scenario failures associated with the landfill's operation, closure and post-closure care.

While generally today, regulatory agencies are not adequately addressing the long-term issues associated with municipal and hazardous waste landfills ultimately failing to protect public health, groundwater resources and the environment from waste derived constituents, there is growing recognition of the deficiencies of current regulatory approaches where the minimum landfill design for Subtitle C and D landfills is recognized as being badly out of date and not protective of public health and the environment for as long as the wastes in the landfill will be a threat. An encouraging situation recently developed in the state of Indiana where the Hazardous Waste Facility Siting Authority reviewed a Chemical Waste Management of Indiana proposal to expand a hazardous waste landfill where it became clear that ultimately that landfill would pollute groundwaters of interest to the city of New Haven, which is located immediately adjacent to this landfill. The Siting Authority concluded in an eight-to-one vote that the landfill should not be expanded, even though it met minimum design requirements, because of its potential to ultimately pollute groundwaters of interest to New Haven, Indiana.

*"**R 299.9712 Cost estimate for corrective action.***

Rule 712. (1) The owner or operator of a facility who is required to perform corrective action pursuant to the provisions of the act or these rules shall have a detailed written estimate, in current dollars, of the cost of performing corrective action at the facility in accordance with the provisions of R 299.9629.

(2) The cost estimate shall be based on the cost of hiring a third-party to complete the corrective action measures required pursuant to the provisions of R 299.9629."

It is concluded that WDI has not properly complied with this requirement, since it has not reliably estimated the cost of performing possible corrective action at any time in the future while the waste in the landfill will be a threat. Further, the draft license and permit issued by MDEQ and US EPA, respectively, do not adequately and reliably address this issue. Since this issue is an extremely important part of providing public health, groundwater resource and environmental protection for those in the sphere of influence of the landfill, the draft license/permit cannot be approved and comply with this requirement.

Comments on
Code of Federal Regulations
Part 40, July 1, 1995

Subpart C - Characteristics of Hazardous Waste

"§261.24 Toxicity characteristic.

(a) A solid waste exhibits the characteristic of toxicity if, using the Toxicity Characteristic Leaching Procedure..."

Table 1, "Maximum Concentration of Contaminants for the Toxicity Characteristic" in this section lists 30 chemicals that are regulated under this provision out of the many tens of thousands of chemicals that could be hazardous to public health groundwater quality that will be present in the waste that will be deposited in the WDI landfill should it be relicensed/permitted. Further, these wastes which leach the listed constituents many times drinking water standards, are considered non-hazardous wastes.

This approach was based on an administrative decision by the US EPA in the implementation of RCRA to limit the size of the hazardous waste stream that had to be managed by the agency. It does not reflect a finding that the unregulated chemicals, as well as the regulated chemicals, that are classified as non-hazardous wastes do not represent a significant hazard to public health or groundwater quality. It is therefore important to understand that just because a waste passes the current toxicity characteristic leaching procedure-TCLP test that it is not a significant hazard to public health, groundwater quality and the interests of those within the sphere of influence of the landfill.

Subpart F - Releases From Solid Waste Management Units

"§264.93 Hazardous constituents.

(a) The Regional Administrator will specify in the facility permit the hazardous constituents to which the ground-water protection standard of §264.92 applies. Hazardous constituents are constituents identified in appendix VII of part 261 of this chapter that have been detected in ground water in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless the Regional Administrator has excluded them under paragraph (b) of this section."

A review of Appendix VII of Part 261 shows that there is a wide variety of constituents that will be present in the waste that will be accepted by WDI that represent threats to groundwater quality that are not classified by the US EPA as hazardous constituents. It is therefore important to understand that even if a leachate developed in the landfill does not contain any so-called hazardous constituents based on the US EPA's classification approach, this leachate can be hazardous to public health and significantly detrimental to groundwater quality. The contamination of a well by WDI landfill leachate would likely cause it to have to be abandoned as a domestic water supply source.

"§264.97 General ground-water monitoring requirements.

The owner or operator must comply with the following requirements for any ground-water monitoring program developed to satisfy §264.98, §264.99, or §264.100:

(a) The ground-water monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths to yield ground-water samples from the uppermost aquifer that:"

"(B) Sampling at other wells will provide an indication of background ground-water quality that is representative or more representative than that provided by the upgradient wells; and"

"(3) Allow for the detection of contamination when hazardous waste or hazardous constituents have migrated from the waste management area to the uppermost aquifer."

"(d) The ground-water monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide a reliable indication of ground-water quality below the waste management area. At a minimum the program must include procedures and techniques for:"

The minimum requirements set forth for the groundwater monitoring program are not met by WDI's proposed groundwater monitoring approach. Further, the draft license/permit does not require that WDI develop a credible groundwater monitoring program that would satisfy the above requirements. As discussed herein, the groundwater monitoring program proposed to be allowed by MDEQ and the US EPA, as set forth in the draft license/permit, is largely cosmetic. It has a low probability of detecting releases from the landfill before widespread pollution occurs. There is an insufficient number of wells to comply with the above-listed requirement. The license/permit cannot be issued as proposed by MDEQ and the US EPA and comply with the groundwater monitoring requirements set forth in RCRA.

"§264.117 Post-closure care and use of property.

(a)(1) Post-closure care for each hazardous waste management unit subject to the requirements of §§264.117 through 264.120 must begin after completion of closure of the unit and continue for 30 years after that date and must consist of at least the following:"

This section does not limit the post-closure period to 30 years; it only specifies that 30 years is the minimum period for which post-closure care must be provided. Post-closure care must be provided for as long as the wastes in the landfill will be a threat, not just for 30 years as WDI proposes and as MDEQ and the US EPA propose to allow since they have incorporated WDI's proposal into their license/permit. Lee and Jones-Lee (1992) have discussed the error that was made by Congress in the 1970s in establishing the RCRA 30-year minimum post-closure care period. Those responsible for this value did not understand the difference between landfill gas generation in a classical sanitary landfill and leachate generation in such landfills as well as in "dry-tomb" landfills of the type being developed today.

Subpart N - Landfills

"§264.301 Design and operating requirements.

(1) A liner that is designed, constructed, and installed to prevent any migration of wastes out of the landfill to the adjacent subsurface soil or ground water or surface water at anytime during the active life (including the closure period) of the landfill." "(2) A leachate collection and removal system immediately above the liner that is designed, constructed, maintained, and operated to collect and remove leachate from the landfill. The Regional Administrator will specify design and operating conditions in the permit to ensure that the leachate depth over the liner does not exceed 30 cm (one foot). The leachate collection and removal system must be:"

"(1)(i) The liner system *must include:*

(A) A top liner designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into such liner during the active life and post-closure care period; and

(B) A composite bottom liner, consisting of at least two components. The upper component must be designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into this component during the active life and post-closure care period. The lower component must be designed and constructed of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur. The lower component must be constructed of at least 3 feet (91 cm) of compacted soil material with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec."

Specifications for the design and operations of the liner system require containment of waste-derived constituents for as long as the wastes in the landfill represent a threat. WDI's proposed landfill liner design and proposed approach for closure and providing post-closure care which have apparently been approved by MDEQ and the US EPA will not comply with the requirements set forth in this section during the time that the wastes in the landfill will be a threat. The liner system will eventually deteriorate to the point where it will no longer be effective in preventing waste-derived constituents from leaving the landfill en route to high-quality groundwaters underlying the landfill.

"§264.310 Closure and post-closure care

(a) At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to:"

"(1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;

(2) Continue to operate the leachate collection and removal system until leachate is no longer detected;

(3) Maintain and monitor the leak detection system in accordance with §§264.301(c)(3)(iv) and (4) and 264.303(c), and comply with all other applicable leak detection system requirements of this part;

(4) Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of subpart F of this part;"

As discussed herein in connection with review of other requirements, the proposed WDI landfill closure and post-closure care approach as well as the approach approved by the US EPA and MDEQ as set forth in the draft permit/license do not comply with the requirements for closure

and post-closure care set forth in this section. This landfill cannot be permitted/licensed without significantly changing the post-closure care requirements and assurance of funding for as long as the wastes in the landfill will be a threat.

Lee and Jones-Lee (1995a) have discussed how properly sited hazardous waste landfills can be closed with appropriate post-closure care to protect public health, groundwater quality and the environment for as long as the waste in the landfill will be a threat. Information on their recommendations is presented in various sections of this report.

Subpart F - Ground-Water Monitoring

"§265.91 Ground-water monitoring system.

(a) A ground-water monitoring system must be capable of yielding ground-water samples for analysis and must consist of:

(1) Monitoring wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths must be sufficient to yield ground-water samples that are:"

"(2) Monitoring wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths must ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer."

This section explicitly sets forth in (2) above the requirements for developing the groundwater monitoring program at the edge of the waste management unit. It is important to note that this section does not state that the minimum of three downgradient wells is sufficient to detect any statistically significant amounts of hazardous waste or hazardous waste constituents at the point of compliance. WDI's proposed approach which is proposed for approval by MDEQ and the US EPA of only installing the minimum number of required wells obviously does not comply with the requirements set forth in this section. The groundwater monitoring approach set forth in the draft license/permit is fundamentally flawed and cannot be allowed to be approved and comply with these requirements.

Subpart G - Closure and Post-Closure

"§265.111 Closure performance standard

The owner or operator must close the facility in a manner that:

(a) Minimizes the need for further maintenance, and

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere,"

This section sets forth the overall requirements for closure and post-closure care. As discussed herein, WDI and the MDEQ/US EPA proposed approach for addressing closure and post-closure care falls far short of meeting the requirements set forth in this section.

US EPA Code of Federal Regulations 40, 761 Polychlorinated Biphenyls, Subpart D, "Storage and Disposal."

The regulations governing the landfilling of PCB waste are set forth in part 761.75. Part 761.3 provides a definition of a chemical waste landfill that can be used to dispose of PCBs. Such a landfill is defined as:

> "*a landfill at which protection against risk of injury to health or the environment from migration of PCBs to land, water, or the atmosphere is provided from PCBs and PCB Items deposited therein by locating, engineering, and operation of the landfill as specified in § 761.75*"

In general, it is widely recognized that the specific landfilling requirements for PCBs set forth in these regulations are badly out of date and are not necessarily protective. These regulations were originally developed in the late 1970s and have not been significantly updated in some key areas of groundwater quality protection since that time. Even with this situation, the above landfill definition makes it clear that the performance standard for the landfill is protection against risk of injury to health and the environment from PCB wastes.

Regulatory Authority

One of the issues that frequently arises in the review of hazardous waste, and for that matter municipal solid waste landfills, is that the regulatory agencies staff claim that they do not have the authority to require the landfill owner to go beyond the minimum design requirements. Such statements are inappropriate in that with few exceptions most regulations contain a statement of the overall objectives of the regulations as being protection of public health, groundwater resources and the environment. These regulations do not necessarily state that these requirements are only for a limited period of time. The purpose of landfilling regulations such as those discussed above is to protect public health and groundwater resources from pollution by landfill leachate for as long as the waste remains a threat. While the minimum landfill containment component design requirements set forth in the regulations may be applicable to some sites, they are not universally applicable to all sites.

It is important that under conditions where the minimum design requirements are not adequate to protect public health, groundwater resources, the environment, and interest and welfare of those within the sphere of influence of the landfill, that the landfill be sited, designed, operated, closed and receive post-closure care to provide true protection for as long as the wastes in the landfill represent a threat. It is the obligation of the regulatory agency personnel to make known to the public any deficiencies in current minimum regulatory requirements so that the public can work through their elected representatives and the courts to change the regulations so that protection is in fact achieved.

WDI Landfill Site #2 Application for TSCA Permit Covering Disposal of PCB Waste in Master Cell VI

WDI filed a TSCA application in support of disposal of PCBs in WDI landfill site #2 Master Cell VI. WDI also filed an application for continued operation of WDI landfill site #2 Master Cell VI as a hazardous waste landfill with MDEQ and the US EPA. The comments presented in this section focus on discussing the deficiencies in WDI's application for the TSCA permit. WDI, in submitting its TSCA application, incorporated sections from its previously submitted RCRA/state of Michigan hazardous waste landfill application. This application is currently governed by Act 64 requirements. The comments presented in this section have, with few exceptions, direct applicability to WDI's application for continued operation of its hazardous waste landfill site #2 Master Cell VI at the Belleville site.

WDI submitted a series of volumes prepared by RMT, Inc., that were dated July 1995. These volumes support the application to gain acceptance for adding a PCB waste stream to the types of hazardous wastes that can be managed in this landfill. Information is provided in this application on the characteristics of the RCRA landfill. Comments on some of the deficiencies in the RCRA relicensing application and the proposed addition of PCB wastes to the waste stream accepted by WDI at this landfill are presented in this section of this report.

"Initial Report for Approval of a Chemical Waste Landfill For the Disposal of PCBs Under the Toxic Substances Control Act," Dated July 1995

The "Initial Report" is an overview summary of the WDI landfill site #2 characteristics and proposed operations that are relevant to the relicensing of the RCRA landfill and the acceptance of PCB wastes at landfill site #2 Master Cell VI.

This report states on page 1,

> "*Wayne Disposal, Inc. (WDI), operates a hazardous waste landfill, known as the Wayne Disposal Site #2 Landfill (Site #2), in Van Buren Township, Wayne County, Michigan. WDI is requesting approval from the United States Environmental Protection Agency (USEPA) to allow the disposal of waste containing polychlorinated biphenyls (PCBs) in concentrations equal to or in excess of 50 ppm that are approved for landfill disposal as specified in 40 CFR 761.60 pursuant to the Toxic Substances Control Act (TSCA). This waste will be disposed in Master Cell VI of Site #2*."

Wayne Disposal states, in the second paragraph of page 1, that it has an RCRA permit for site #2, which has been issued by the MDEQ and the US EPA under RCRA and Michigan Act 64. This permit was issued on March 30, 1990, and allows WDI to dispose of regulated hazardous waste at the site. WDI states that the operating license for this application is under review by MDEQ.

WDI states on page 4, paragraph 2 of section 2.1.1, that site #2 occupies 435 acres of land with the hazardous waste landfill area comprising 120 acres. Master Cell VI occupies approximately 32 acres, which is divided into five cells ranging from 5 to 7 acres each.

On page 8, WDI provides a discussion of the siting requirements for a PCB landfill compared to the characteristics of the WDI landfill site #2 containment system. As discussed herein, neither the minimum design requirements nor Master Cell VI design characteristics will, at the Master Cell VI location, conform to the TSCA requirements of preventing the migration of leachate which contains hazardous waste and PCB waste components for as long as the wastes represent a threat.

On page 10, WDI states in the first paragraph, "*TSCA regulations require a liner system to prevent the migration of leachate from the landfill.*" WDI states,

> "*Given the hydrogeologic setting of the landfill and the quality of the material used in the construction of the recompacted clay liner, the liner system at the site complies with, and exceeds, applicable regulations in the following manner:*"

WDI lists as the first bulleted item, "*...natural clay deposits have permeabilities ranging from 4.6 x 10^{-9} to 7.9 x 10^{-8} cm/s...*".

In the second bulleted item, WDI claims that this landfill conforms to TSCA requirements since MDNR approved the certificate of construction for Master Cell VI.

The third bulleted item provides yet another so-called reason that the proposed landfill complies with TSCA regulations of requiring a clay liner permeability of 1 x 10^{-7} cm/sec or less.

It appears from WDI's comments that WDI has difficulty understanding the regulations and the properties of the natural strata and compacted clay liner to "*...prevent the migration of leachate from the landfill,*" and thereby conform to these regulations for as long as the PCB and other hazardous wastes in the landfill will be a threat. Those familiar with the properties of wastes and waste residues of the type that WDI proposes to manage in this landfill and the characteristics of the landfill containment system, know that the wastes of the type WDI proposes to dispose of in Master Cell VI will be a threat to groundwater quality effectively forever.

WDI seems to be operating under the misconception that it only has to be concerned about the minimum 30-year post-closure care period. The facts are that the TSCA regulations, as WDI states, require that the landfill have a "*...liner system to prevent the migration of leachate from the landfill.*" There is no time limitation on conformance to this requirement. The only issue that should be considered in performance of the containment system relative to the regulations is therefore the ability of the liner system to prevent leachate from passing through it for as long as the wastes represent a threat. The PCB wastes and other wastes placed in this landfill will be a threat to ground water pollution far longer than the liner system will have sufficient integrity to prevent leachate from migrating through it. As a result, this landfill cannot

be permitted for continued operation where it would accept PCB waste. The same problems occur with respect to continuing operation of this landfill as an RCRA hazardous waste landfill.

With respect to the attempts by WDI to use the natural strata which is part of the underlying aquifer system as a supplemental barrier to the migration of PCB and other wastes, such an approach is not in accord with regulatory requirements. Even if this were allowed by the regulations, WDI has provided unreliable information on the properties of the natural strata in preventing leachate migration through the strata. As discussed herein, the permeabilities that are cited here are based on laboratory measurements, which often underestimate the permeability of the strata.

Even if the laboratory-measured permeabilities were, in fact, reliable estimates of the actual permeability, the liners and the natural strata will not prevent leachate-containing PCB waste components from passing through it for as long as the wastes will be a threat.

Overall, WDI's conformance to TSCA regulations is fundamentally flawed. The WDI landfill site #2 Master Cell VI cannot conform to TSCA regulations of preventing "*...the migration of leachate from the landfill.*"

On the bottom of page 11, WDI presents a discussion of synthetic membrane liners where it is stated that,

> "*According to TSCA regulations, synthetic membrane liners (geomembranes) or composite liners are not mandatory for facilities accepting PCB waste and are required only if necessary because of hydrologic or geologic conditions, to achieve the permeability requirements discussed above in regard to clay soil. Since the clay soil used in the construction of Master Cell VI of the landfill is less permeable than required under 40 CFR 761.75(b)(1), a geomembrane component would not typically be required as part of the liner design for a TSCA landfill at this site.*"

Such an analysis of the regulations represents a superficial approach toward their review. Typically, landfilling regulations establish an overall performance standard such as preventing waste migration through the liner cited above and some minimum containment system design requirements such as the permeability and thickness of clay layers, the need for plastic sheeting liners, etc. WDI is attempting to convince the regulatory agencies and the public that meeting the minimum design requirements for containment system components meets the overall public health and groundwater protection standards set forth in the regulations. The regulations do not state that meeting the minimum design requirements will be protective. It is up to the applicant and the regulatory agencies to ensure that public health, groundwater quality and the environment are protected from the waste-derived constituents for as long as the wastes are a threat.

It is the responsibility of WDI and the regulatory agencies to reliably evaluate whether the minimum design requirements or some other design for the containment system components will provide protection. In light of what is known today about the properties of compacted clay

and plastic sheeting liners and the ability of natural strata of the type underlying Master Cell VI, the liner system and the natural strata will not protect groundwater quality and public health from waste-derived constituents for as long as the wastes represent a threat. Therefore, WDI's statements about the need for a synthetic liner membrane, etc. are inappropriate since neither the compacted clay, natural strata or synthetic liners will be protective.

On page 12, WDI states,

> "*According to USEPA guidance documents, the clay and the geomembrane in the primary liner work to provide a barrier to any potential migration of leachate that is more effective than a liner system constructed solely of clay or a geomembrane acting alone.*"

Once again, WDI has provided unreliable information on key issues pertinent to whether this landfill, as proposed, conforms to TSCA regulations. The issue is not whether a composite liner is a more effective barrier than a liner system constructed solely of clay or a geomembrane. The issue is whether the liner system that WDI proposes to use to manage PCB wastes conforms to the regulatory requirements of preventing releases of waste components from the landfill for as long as the waste represent a threat. As quoted herein, the US EPA acknowledged in 1988 that composite liners only delay when groundwater pollution occurs; they do not prevent it. Therefore, a single or double composite liner cannot prevent leachate from passing through it for as long as the wastes represent a threat.

On page 13, WDI provides a discussion of the hydrologic setting for Master Cell VI. In the first paragraph WDI states,

> *"The first useable aquifer is a medium to coarse sand and gravel layer, which overlies shale bedrock beneath the site. The thick silty clay glacial till in which the landfill is constructed provides natural protection of this aquifer. The hydrogeologic setting described in this section and the engineered liner features described in Subsections 2.2 and 2.3 will provide protection equivalent to or greater than that required for TSCA landfills in 40 CFR 761.75 (b)(1)."*

In this statement WDI admits that there is a useable aquifer underlying the site. WDI's statement, however, about how the glacial till presents natural protection for this aquifer is inaccurate. The glacial till, at best, postpones when the aquifer will become polluted by waste-derived constituents. It will not prevent it. Further, the engineered liner also only postpones when waste-derived constituents enter the aquifer system. These issues are discussed in detail in other parts of this report. Again, WDI has provided unreliable information to the regulatory agencies and the public on the ability of the proposed landfill to manage PCB wastes in accord with regulatory requirements.

On page 14, WDI mentioned that the water table is encountered in the "*deltaic surface sand*." The high water table alone should make the site unsuitable for a landfill of any type. In an effort to try to circumvent this situation, WDI has constructed a cutoff dike and a subsurface

drain around each Master Cell to *"...intercepts the groundwater entering the site from the north and transfers it off-site such that the flow eventually passes south to Belleville Lake."* No discussion, however, is presented about the need to ensure that this system functions effectively for as long as the waste in the landfill will be a threat, i.e., forever. Who in post-closure year 31, 100, 200, etc., will inspect the cutoff dike and drain system and make the necessary repairs to ensure that the surficial groundwaters do not penetrate the wastes and thereby serve as an additional source of moisture that generates leachate that will pollute the groundwaters underlying the landfill? WDI has already apparently had a problem with surficial groundwater entering the leak detection system between the two composite liners in Master Cell VI.

It is important to note that the landfill liner system cannot be relied on in perpetuity to prevent the surficial groundwaters from entering the waste cells. Eventually the liner system will be ineffective in preventing the surficial groundwaters from entering the waste and generating leachate.

On page 16 WDI states,

> *"TSCA regulations (40 CFR 761.75[b][3]) require that a 50-foot separation distance of unspecified geologic composition be maintained between the historically high water table and the bottom of the landfill liner system. While Site #2 cannot strictly meet this requirement, its natural hydrogeologic setting and engineered liner system exhibit important features that make the landfill equivalent to or more protective of a site designed to minimum TSCA requirements. These features are described below and form the justification of a request that the 50-foot separation distance be waived under the provision in 40 CFR 761.75(c)(4)."*

WDI admits that the site is an unsuitable site for PCB wastes since it does not conform to the basic minimum TSCA landfill siting criteria. Contrary to the statements made, the natural hydrogeologic setting and the engineered liner system do not make this landfill site more protective. They only slow down when groundwater pollution occurs.

On page 19 WDI discusses the approach that is being followed to conform to TSCA groundwater monitoring requirements. This approach involves the placement of three monitoring wells at the downgradient (southern) edge of Master Cell VI. Examination of Figure 6 shows that these three wells are located about 400 feet apart. With each of these wells having a zone of capture with a radius of about one foot, there is on the order of 398 feet between the wells through which leachate-polluted groundwaters can pass without being detected by them. WDI must be required to conduct an in-depth comprehensive assessment of the ability of the proposed groundwater monitoring system to detect leachate-polluted groundwater at the point of compliance for as long as the wastes in the landfill will be a threat.

While in this section WDI claims that it is going to provide "ongoing" monitoring, in fact, it only proposes to utilize a 30- year post-closure period. Who is going to monitor the wells

in year 31, 50, 100, 500? The waste will still be there and still be a threat. These are issues that must be addressed in any credible landfill permit application.

On page 22, WDI presents information on the leachate collection and removal system. The key issue that must be addressed in considering the reliability of this leachate collection system is how effective will it be when the flexible membrane liner, which serves as the base of the system, has deteriorated to the point that significant amounts of leachate pass through the liner en route to the groundwaters underlying the landfill. This is an issue that WDI must address as part of not only applying for acceptance of PCB waste, but also for continuing to operate Master Cell VI for RCRA wastes.

Overall, this "Initial Report" in support of the application to accept PCB wastes in WDI landfill site #2 Master Cell VI falls far short of providing an adequate, accurate discussion of regulatory requirements and the conformance of these requirements by the proposed continued operation of Master Cell VI. The acceptance of PCB waste at this landfill cannot be approved and conform to the TSCA and the RCRA requirements governing the landfilling of hazardous waste and PCB waste.

"Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act Wayne Disposal Landfill Site #2"

This volume provides information on the geology and groundwater in the landfill area. Basically, this site is an unsuitable site for a landfill. There is a surficial sand layer in which the landfill cells are located. As discussed on page 19,

> *"Cutoff dikes, composed of silty clay that is keyed into the native clay deposit, have been constructed around each Master Cell within the landfill."*

These cutoff dikes are supposed to be designed to try to limit the lateral movement of groundwater into the cells and leachate out of the cells for as long as the wastes in the landfill would be a threat. Cutoff dikes of this type can function to limit water from moving into the cells for a period of time, provided they are constructed properly. Ultimately the high groundwater table in the surficial sand layer in the vicinity of the landfill could enter the cells through the cutoff dikes and the deteriorated liner system adding additional moisture to the waste management cells which generates leachate. Therefore, even if an impermeable cover were installed and maintained in perpetuity on this landfill through the use of a leak detection system in the cover, there is still the potential for leachate generation due to the high groundwaters surrounding the landfill cells. It appears that this issue has been ignored by WDI, its consultants and MDEQ in developing this landfill. The landfill application should have discussed these issues. Failure to do so is yet another example of the inadequacy of the application.

This volume states that underlying the surficial sands is a glacial till layer which has a mean vertical permeability of about 3×10^{-8} cm/sec. The glacial till contains varying amounts of sand and gravel. Basically, the geology of the area in which the landfill cells are constructed is such that it does not provide for natural protection of the aquifer system underlying the landfill.

As reported on page 25, some samples of the silt and sandy silt underlying the landfill area have been found to have permeabilities of 10^{-5} cm/sec.

There are several aspects in this discussion of the hydrogeology of the region that need to be considered. First, as pointed out in the subsequent discussion of the "supplemental volumes," the permeability measurements which serve as a basis for the "mean" vertical permeability of 1 x 10^{-8} cm/sec listed above were generated using laboratory-based permeability measurements. Such permeability measurements are not necessarily reliable. They tend to underestimate the actual permeability that would govern the transport of waste-derived constituents through the geological strata underlying the landfill.

It is inappropriate to use the mean permeability in an assessment of this type. The public whose well could be polluted by landfill leachate is not interested in the mean value of how long it takes leachate to move from the base of the landfill to their well. They want to know and should know what is the fastest rate, i.e., the highest permeability, that waste-derived constituents could move from the base of the landfill to their well.

This report states on page 20 that groundwater recharge of an underlying aquifer occurs through the transition silts. Does this statement indicate that the geological strata of the region have sufficient permeability to recharge the aquifer at a sufficient rate to maintain the aquifer? It has been the author's experience that at geological settings of this type the dating of the waters in the aquifer using radioisotopes often shows that atmospheric moisture (precipitation) has moved from the surface of the soil through the low permeability layers to the underlying aquifer at a rate much higher than that predicted based on the mean permeability rates measured by laboratory-based measurement techniques. Clearly WDI must conduct a much more comprehensive, up-to-date assessment of the hydrogeology in the vicinity of and underlying WDI landfill site #2 and Master Cell VI.

Beginning on page 40 is a discussion of the groundwater monitoring that is used for this landfill. A set of vertical monitoring wells is used in an attempt to try to monitor for liner leakage before widespread groundwater pollution occurs. From the information provided in Figure 16, it appears that the monitoring wells are spaced about 400-500 feet apart along the downgradient edge of the landfill. Each of these monitoring wells has a zone of capture of about one foot. Therefore, there are hundreds of feet between the monitoring wells where leachate-polluted groundwaters could pass and not be detected by them.

In addition, WDI indicates that five pairs of vacuum pressure lysimeters are installed in the silty clay beneath cells V and VII. While not discussed, lysimeters of this type have a small zone of capture and are largely ineffective in detecting leakage from landfill cells under the conditions being used by WDI for their location.

Overall, the groundwater quality monitoring conducted at this landfill site and that specifically associated with Master Cell VI will be deficient compared to that needed to detect leachate-polluted groundwater before it passes the point of compliance for groundwater monitoring. As discussed herein, the area of sampling by the monitoring wells and the

lysimeters represents a small part of the area through which leachate containing waste constituents derived from the landfill could pass the point of compliance for groundwater monitoring and not be detected by the monitoring system.

Page 48 describes the landfill cover that will be used. It will consist of a clay layer with a maximum permeability at the time of construction of 10^{-7} cm/sec. A geomembrane will be placed over the clay layer. On top of the geomembrane will be placed a protective layer of soil and a layer of topsoil. The entire area is to be fertilized, seeded and mulched. The detailed expected performance characteristics of the cover are not provided in this discussion. This is yet another significant deficiency in this application that should cause it to be rejected as a credible application for acceptance of PCB wastes as well as the continued acceptance of RCRA hazardous wastes.

Environmental Assessment

Act 64 requires that an environmental assessment be developed. According to R 299.9504 Construction permit application; content. Rule 504, (1) In addition to the information that may be required by subrule (16) of this rule, all applications for a construction permit shall include all of the following items:

> *"(e) An environmental assessment, including a failure mode assessment that provides an analysis of the potential major methods by which safe handling of hazardous wastes may fail at a treatment, storage, or disposal facility. The owner or operator of a facility that stores, treats, or disposes of hazardous waste in a surface impoundment or a landfill shall include, in the environmental assessment, information that is reasonably ascertainable by the owner or operator on the potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the unit. At a minimum, the information shall address all of the following subjects:*
> *(i) Reasonably foreseeable potential releases from both normal operations and accidents at the unit, including releases associated with transportation to or from the unit.*
> *(ii) The potential pathways of human exposure to hazardous waste or constituents resulting from the releases described in paragraph (i) of this subdivision.*
> *(iii) The potential magnitude and nature of the human exposure resulting from the releases described in paragraph (i) of this subdivision."*

Appendix A in this report contains an "Environmental Assessment" that was prepared by Applied Science and Technology in May 1987. On page 2, it is stated, *"The EA is a <u>focused</u> discussion of the environmental issues associated with WDI's operations in Master Cells V, VI and VII."*

On page 12, mention is made that there are about 120 to 125 registered drinking water wells within 3 miles of the site. It is further stated, *"It is estimated that approximately 235 to 240 additional wells exist for which records were unavailable."*

Page 15 mentions the Ypsilanti Township well field. This well field is potentially threatened by this landfill.

It is therefore clear that the groundwaters in this region are extensively used for water supply purposes and that pollution of these groundwaters could be a significant public health, groundwater resource and environmental threat.

Page 46 mentions that

> *"The 120-acre area used for hazardous waste operations is divided into three `master cells' (V, VI and VII) of approximately 40 acres each. Master Cells* (sic) *V is now complete and closed; Master Cell VI is in operation. Master Cell VII is filled, but has not been closed."*

The Master Cells are divided into smaller cells of 5 to 15 acres each.

It states on the bottom of page 46 that

> *"Each disposal cell is equipped with its own independent leachate collection and removal system... All of Master Cell V and cells A and B of Master Cell VII have recompacted clay liners. Cell C of Master Cell VII has a double synthetic liner system. All of Master Cell VI will have a double synthetic liner system."*

From information contained in this Environmental Assessment and in other parts of the application, it is clear that conventional landfill liner technology is being used in an attempt to try to contain the waste constituents within the landfill for as long as the wastes represent a threat. The PCB wastes and the hazardous wastes that will be deposited in Master Cell VI will in this type of landfill be a threat to cause groundwater pollution-impaired use, effectively forever. Further, it is well-known that the liner systems for Master Cells V, VI and VII have finite periods of time during which they can be expected to function effectively to prevent leachate from migrating out of the cells into the underlying aquifer system. Such migration is in violation of MDEQ Act 64 and RCRA/TSCA regulations. Once the migration through the liner system has occurred, it is only a matter of time until the aquifer system underlying the landfill is polluted by waste-derived constituents.

On page 56 of the Environmental Assessment begins a discussion of possible failure of the landfill liner systems. This Environmental Assessment was prepared in 1987. The authors on page 56 discuss what was known then about flexible membrane liners' ability to prevent leachate passing through them for as long as the wastes represent a threat. The report states, *"Thus FML's installed at WDI may fail at some future time, but the chances of such failure are virtually unknown."*

On page 57, the Environmental Assessment states, *"To date WDI has not detected any hazardous constituents in the leak detection systems installed beneath any of the disposal cells."*

The fact that WDI has not detected leakage which has been found in the groundwater monitoring well system does not mean that significant leakage is not occurring; it reflects the fact that the number of monitoring wells used is inadequate to provide an early warning of leachate leakage. While in 1987 when the Environmental Assessment was prepared the work of Dr. John Cherry (Cherry 1990) which pointed out the unreliability of the groundwater monitoring systems of the type that WDI is using in detecting leaks from lined landfills had not yet been published, today this and other work on this topic is well-known and therefore the issue of the reliability of groundwater monitoring wells of the type being used by WDI to determine leakage from the Master Cells and the suitability of the site has to be considered in any credible environmental assessment.

On the bottom part of page 57, it is stated, *"Thus the probability of such leaks being a `major method' of failure is extremely low."* The Environmental Assessment analysis of the ability of the liners to prevent groundwater pollution is superficial and must be considered inadequate in light of what is known today about the ability of plastic sheeting and compacted clay liners of the type used in Master Cell VI to prevent waste-derived constituents from passing through the liner into the underlying strata that is part of the aquifer system of importance to many individuals in the region.

If this Environmental Assessment had been brought up-to-date as it should have been, there could be unequivocal statements made that major failure of the landfill containment system (liners) is inevitable. It is only a matter of time until the liner systems fail and allow leachate to penetrate into the aquifer system underlying the landfill. There is no question about the fact that the landfill liner system will fail to prevent leachate from passing through it and that the groundwater monitoring system used will have a high probability of failing to detect these leachate-polluted groundwaters before widespread pollution occurs.

On page 60 there is a discussion of the potential for plugging of the leachate collection system. It is stated that the leachate collection system has a high (10^{-3} cm/sec) permeability. A 10^{-3} cm/sec leachate collection system is quite low compared to the recommended design that is typically used today.

Page 72, first paragraph, states,

> *"However, some cells were constructed with a double synthetic liner; these are all of master cell VI and cell C of master cell VII. For these units, the liner systems greatly reduce the probability of a release and subsequent downward/horizontal migration."*

This analysis is fundamentally flawed. The liner systems will prevent movement of leachate downward through the geological strata for a period of time dependent on the quality of construction and a number of other factors; they will not prevent the movement of the hazardous and deleterious components of the waste down through the aquifer system for as long as the wastes in the landfill will be a threat.

The analysis on page 72, mid-paragraph, about rates of migration is flawed in that it does not properly consider the highest rates of travel that could occur. Further, these permeability measurements are based on laboratory procedures which can significantly under-estimate the real permeability of the strata underlying the landfill and over-estimate the travel times needed to reach wells that exist or could be constructed on adjacent properties.

Overall, WDI's Environmental Assessment does not conform to regulatory requirements and has provided unreliable information on the potential for groundwater pollution to occur by Master Cell VI as well as the other cells at WDI's landfill site #2. The Environmental Assessment is basically unreliable and must be rejected as reflecting a lack of the current state of knowledge of the issues that should have been considered in making this evaluation.

Page 79 mentions the problems that WDI has had in maintaining odor control at the facility. A review of the public's comments on the odor problem associated with WDI's waste treatment and disposal operations shows that WDI has been a poor neighbor and has significantly impaired the health, interests and welfare of those within the sphere of influence of its waste management activities. As discussed in this report, odors of the type that the public has experienced are now recognized as a significant threat to their health.

Beginning on page 94 is a discussion, "Mitigating Measures." However, no mention is made of any mitigation measures for the inevitable groundwater pollution that will occur associated with the operations of Master Cell VI as well as Master Cells V and VII. This Environmental Assessment is deficient from the perspective of failing to address the groundwater pollution issues and how these would be mitigated. It has to be rejected as an inappropriate assessment of issues for the continued operation of this landfill as an RCRA hazardous waste landfill as well as a TSCA PCB landfill.

Over the years the author has reviewed many "environmental assessments" for existing and proposed landfills. He finds that the Environmental Assessment for WDI's landfill is one of the most superficial-inadequate discussion of issues that he has reviewed. It does not conform to Act 64 Rule 504

"Volume 2 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act," Wayne Disposal Landfill Site #2, Prepared by RMT, Inc., Dated July 1995

Volume 2 presents the Supplemental Information Report in support of the application for the acceptance of a PCB waste stream Appendix B, "Report on Preliminary Hydrogeologic Investigation, Wayne Disposal Site #2 Landfill, NTH, November 1980, Volumes I and II." WDI has had RMT put a new cover page on a 1980 report covering the "Preliminary Hydrogeologic Investigation" issued by Neyer, Tiseo & Hindo, Ltd. Comments on the deficiencies in this report are combined with the comments on Volumes 3, 4 and 5 discussed below.

"Volume 3 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act," Wayne Disposal Landfill Site #2, Prepared by RMT, Inc., Dated July 1995

Volume 3 presents the Supplemental Information Report in support of the application for the acceptance of a PCB waste stream Appendix B, "Report on Final Hydrogeologic Investigation, Wayne Disposal Site #2 Landfill, NTH July 8, 1981." WDI has had RMT put a new cover on a 1981 report, "Report on Final Hydrogeologic Investigation," issued by Neyer, Tiseo & Hindo, Ltd. Comments on the deficiencies in this report are combined with the comments on Volumes 2, 4 and 5 discussed below.

"Volume 4 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act," Wayne Disposal Landfill Site #2, Prepared by RMT, Inc., Dated July 1995

Volume 4 presents the Supplemental Information Report in support of the application for the acceptance of a PCB waste stream Appendix B, "Item IV - Groundwater Protection (Subpart F) - Hazardous Waste Management Area 40 CFR 270.14 and 40 CFR 264.90 Through 100, Wayne Disposal Site #2 Landfill, NTH, September 7, 1983" as well as "Report on Monitoring Well Installation, Wayne Disposal Site #2 Landfill, NTH, October 1984." WDI has had RMT put new cover pages on a 1983 report covering "Groundwater Protection (Subpart F) - Hazardous Waste Management Area," issued by Neyer, Tiseo & Hindo, Ltd. and a 1984 report covering, "Monitoring Well Installation," issued by Neyer, Tiseo & Hindo, Ltd. Comments on the deficiencies in these reports are combined with the comments on Volumes 2, 3 and 5 discussed below.

"Volume 5 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act," Wayne Disposal Landfill Site #2, Prepared by RMT, Inc., dated July 1995

Volume 5 presents the Supplemental Information Report in support of the application for the acceptance of a PCB waste stream Appendix B, "Report on Hydrogeologic Investigation for Master Cell VI, Site No. 2, Wayne Disposal Site #2 Landfill, NTH, March 1986, Volumes I and II;" "Report on Groundwater Monitoring Well Installation, Wayne Disposal Site #2 Landfill, NTH, December 1987;" and "Report on Abandonment and Replacement of Monitoring Wells Nos. OB-31A, OB-34 and OB-40 at Wayne Disposal Site #2, NTH, June 1993." WDI has had RMT put new cover pages on a 1986 report covering the "Preliminary Hydrogeologic Investigation of Master Cell VI, Site No. 2" issued by Neyer, Tiseo & Hindo, Ltd; a 1987 report covering "Groundwater Monitoring Well Installation" issued by Neyer, Tiseo & Hindo, Ltd; and a 1993 report covering "Abandonment and Replacement of Monitoring Wells Nos. OB-31A, OB-34 and OB-40" issued by Neyer, Tiseo & Hindo, Ltd.

A review of Volumes 2, 3, 4 and 5 shows that the original application for establishment of the RCRA landfill did not include sufficient or reliable hydrogeologic investigation to adequately characterize the hydrogeology of WDI landfill site #2. This deficiency has not been

addressed by the subsequent investigations of the hydrogeology of the area underlying the waste disposal site.

Further and most importantly, the approach that was used in the 1980s for assessing the permeability of the low-permeability layer underlying the landfill involved laboratory measurements of permeability. It has been well-known for many years that laboratory measurements of permeability typically significantly under-estimate the real permeability of the geological strata being investigated. There are many places where laboratory measurements of permeability are not allowed because of this problem.

While in the early 1980's the level of hydrogeologic investigation that WDI has submitted in its 1995 application could possibly have been considered adequate in light of what was known then about the long-term threat that hazardous wastes represent to public health and groundwater quality, today this level of hydrogeologic investigation is not acceptable. There could readily be pathways through the low permeability layer underlying the landfill that would allow much more rapid transport of hazardous waste constituents and PCB waste constituents to the groundwaters than has been estimated by WDI and its consultants. It can be concluded that at this time there has been insufficient hydrogeologic characterization of WDI landfill site #2 and especially Master Cell VI to continue to issue an operating license for this landfill.

"Volume 6 Supplemental Information Report to the Initial Report for Approval of a Chemical Waste Landfill for Disposal of PCBs Under the Toxic Substances Control Act," Wayne Disposal Landfill Site #2, Prepared by RMT, Inc., Dated July 1995

Volume 6 presents the Supplemental Information Report in support of the application for the acceptance of a PCB waste stream Appendix C, "Waste Analysis Plan;" Appendix D, "As-Built Plans;" Appendix E, "Correspondence - MDNR Letter Approving Construction Certification Report for Cell D of Master Cell VI;" and Appendix F, "Environmental Monitoring Plan." While RMT dated the report July 1995, the material in Appendix C is dated September 1990. WDI has had RMT put a new cover page on a 1990 report covering the material in Appendix C, "Waste Analysis Plan."

The material in Appendix D is dated 1991. WDI has had RMT put a new cover page on a 1991 report covering the material in Appendix D, "As-Built Plans," issued by Midwestern Consultants.

The material in Appendix E consists of several letters dated from 1986 through 1991 covering the construction of Master Cell VI. WDI has had RMT put a new cover page on this material in Appendix E, "Correspondence - MDNR Letter Approving Construction Certification Report for Cell D of Master Cell VI."

The material in Appendix F is dated 1992. WDI has had RMT put a new cover page on a 1992 report covering the material in Appendix F, "Environmental Monitoring Plan."

It is somewhat surprising in light of what is known today about the transport of hazardous waste constituents through landfill liner systems and natural strata that WDI would simply put new cover pages on reports that were developed many years ago as part of an application to expand the operations of a hazardous waste landfill to include PCB wastes. The materials covered in these volumes are inadequate and out-of-date in providing the information needed to adequately and reliably characterize the threat that hazardous wastes and PCB wastes represent to the groundwater resources underlying WDI landfill #2 Master Cell VI.

MDEQ Fact Sheet for Proposed Relicensing of WDI Landfill Site #2

This "FACT SHEET" covers the MDEQ's relicensing of the Wayne Disposal, Inc., continued operation of WDI landfill site #2 as well as the expansion of its license to include the acceptance of PCB wastes.

In the middle of the first page, it is stated that MDEQ is required

> *"...to issue a license to a hazardous waste treatment, storage or disposal facility unless: the facility has not been constructed in accordance with approved plans, applicable rules or the conditions of the approved construction permit; the construction or operation of the facility presents a hazard to public health or the environment; or the applicant has not submitted sufficiently detailed or accurate information to enable the Chief of Waste Management Division to make a reasonable judgement as to whether the license should be issued."*

As discussed herein and contrary to the statements made by MDEQ, WDI has not provided sufficiently detailed and accurate information to enable a reliable estimate to be made by the Chief of the Waste Management Division on the public health and environmental threat that this facility presents. Further, this facility has in the past and if relicensed will continue to represent a significant hazard to public health and the environment.

The statement is made in item 2 on this page, *"The facility does not at this time present a hazard to human health or the environment."* MDEQ has taken significant liberties with its required mandate in making this evaluation. The issue is not whether it represents a threat **"at this time;"** the issue, according to the State of Michigan regulations cited in another section of this report, is whether the facility represents a threat to public health or the environment. There is no question that this facility is a significant threat to public health through contamination of groundwaters by landfill leachate. To take a narrow view, as the MDEQ has, of only considering whether pollution has already occurred that has been detected by the inadequate monitoring program that exists is not in accord with Michigan regulations governing the landfilling of hazardous waste.

The third item states, *"The application submitted by WDI is sufficiently detailed to demonstrate that the facility's design and operation complies with the applicable technical standards."* That finding is not reliable. As documented herein, there are many issues that need to be addressed in more detail in order to fully evaluate the reliability of the landfill containment

and monitoring systems to be able to determine the significant threat that this facility represents to public health and groundwater resources.

Mr. Quackenbush is listed as the contact for further information on this facility. As discussed in the comments on his presentation at the April 23, 1996 hearing, he has not provided adequate and reliable information on the threat that this facility represents to public health and groundwater resources.

The last page, "III. B. Groundwater Monitoring," states,

> *"WDI conducts a groundwater monitoring program to evaluate whether hazardous constituents from the landfill cells have entered the groundwater under the waste management areas. The results of the monitoring to date, have shown that the operation of the landfill has not impacted the groundwater."*

It goes on to state,

> *"The draft operating license includes a groundwater monitoring program to detect contamination and to effectively evaluate and remediate the groundwater, if necessary."*

That statement is unreliable. The groundwater monitoring program that has been proposed to be allowed at this site is unreliable in detecting groundwater pollution by landfill leachate. It would be unusual that this groundwater monitoring system would detect leachate-polluted groundwaters at the point of compliance for groundwater monitoring when leachate-polluted groundwaters first reach that point. As discussed in this report, the number and spacing of the groundwater monitoring wells and their zones of capture of groundwaters associated with their sampling are such that the groundwater monitoring system proposed by WDI and proposed for licensing by MDEQ are unreliable.

The reliability of the groundwater monitoring system is one of the areas in which WDI has failed to provide adequate and reliable information. An appropriately developed groundwater monitoring program would have included a critical analysis of the probability of detecting leaks through the landfill liner system into the underlying groundwaters with the groundwater monitoring program proposed. An elementary evaluation of this topic area shows that the monitoring wells proposed have a zone of capture of about one foot. They are spaced about 400 feet apart at the point of compliance. Therefore, there are 398 feet between each well where leachate-polluted groundwaters could pass and not be detected by the groundwater monitoring system. This issue should have been discussed by MDEQ in their so-called fact sheet supporting the relicensing of this landfill.

Another reason that would justify termination of the WDI landfill operations is the failure of WDI to provide adequate information on the long-term properties of the landfill liner system and cover to prevent moisture from entering the landfill and generating leachate and to prevent leachate from passing through the liner for as long as the wastes in the landfill will be a threat. These are two areas (ultimate failure of the liner system and inadequate groundwater monitoring

system) that have not been adequately and/or reliably described in the original application and in the reapplication. At the time of the original application in the early 1980s, these issues were not well understood. Today, they are well understood. There is no question that the containment system used is deficient in being able to prevent leachate generation and leachate migration to groundwater underlying the landfill for as long as the wastes in the landfill will be a threat. This situation provides ample justification for not approving the MDEQ proposed draft license.

MDEQ Draft Hazardous Waste Management Facility Operating License
Wayne Disposal, Inc. MID 048 090 633

Presented in this section is a discussion of some of the significant deficiencies in the MDEQ Draft Hazardous Waste Management Facility Operating License.

Overall, it is found that the MDEQ review of the WDI landfill site #2 (Master Cell VI) is superficial and the draft facility operating license does not conform to MDEQ regulations as set forth in Act 64. This draft operating license fails to consider the information that has been developed in the last 10 years on the properties of the WDI hazardous waste landfill containment (liner) system to protect the groundwater resources associated with the landfill from pollution by landfill leachate for as long as the waste in the landfill will be a threat. Also, this draft operating license fails to properly evaluate the reliability of the groundwater monitoring system and liner leak detection system to detect waste constituent migration from the landfill to the groundwaters underlying the landfill.

WDI's landfill site #2 Master Cell VI is an unsuitable location for continued operation of this landfill. The landfill containment system design recommended for approval in this draft operating license and the natural geological strata will not prevent the pollution of the groundwaters hydraulically connected to the landfill.

Specific Comments

Page 11, Part II, "GENERAL FACILITY CONDITIONS," A. "DESIGN AND OPERATION OF FACILITY" states,

> *"The licensee shall maintain and operate the facility to prevent the possibility of a fire, explosion, or any sudden or non-sudden release of hazardous waste or hazardous waste constituents to the environment, including air, soil, or waters of the State which could threaten human health or welfare or the environment. {R 299.9602, R 299.9606, R 299.9607, and 40 CFR §§264.31 and 264.51, which are ABR in R 299.11003.}"*

As discussed herein, in time, the WDI landfill site #2 hazardous waste landfill will pollute the waters of the state and thereby threaten human health, welfare and the environment. The basis for this conclusion is that:

· the wastes in the landfill will be a threat effectively forever;

- the landfill cover will not prevent moisture from entering the landfill for as long as the wastes represent a threat;

- moisture that enters the landfill will generate leachate, which is a threat to groundwater quality;

- the leachate generated in the landfill ultimately will not be collected by the leachate collection and removal system and therefore will pass through the liner system into the underlying strata, eventually reaching the groundwaters of the state;

- the groundwater monitoring program that has been developed by WDI and recommended for approval by MDEQ in the draft license is deficient compared to that needed to detect pollution of groundwaters by landfill leachate for as long as the wastes are a threat;

One of the key issues in evaluating the adequacy of the draft operating license to conform to regulations is the requirements established for closure and especially post-closure care of the landfill. Attachment 6, A-29, to this draft license presents the Post-Closure Plan.

On page 3, first paragraph of this attachment, it states,

"This plan addresses those activities necessary for the proper management of the facility during the 30-year post-closure period."

It states in the next paragraph,

"The primary areas of responsibility include monitoring, inspection, and maintenance activities and their frequencies. During post-closure, damaged or malfunctioning equipment or structures will be repaired or replaced as necessary to maintain the facility in proper condition."

It is clear that WDI and MDEQ have only planned for a 30-year post-closure care period. US EPA RCRA and State of Michigan Act 64 do not limit the post-closure period to 30 years, as the draft permit proposes to do. The purpose of post-closure monitoring, maintenance, etc. is to protect health, welfare, groundwater resources and interests of the people that are within the sphere of influence of the landfill. Since the wastes in this landfill will be a threat to public health, groundwater resources and the interests of those within the sphere of influence of the landfill effectively forever, the post-closure period has to be effectively forever.

The MDEQ draft license is deficient in establishing the conditions of post-closure care that are being imposed on WDI. The public is entitled to high degrees of protection over the period of time that the wastes are a threat. There should be no question about this requirement, and it must be explicitly stated in the operating license conditions and requirements. Further, there must be a well-defined, valid dedicated trust fund of sufficient magnitude to address all plausible worst-case failure scenarios for the existing landfill as well as any proposed continued operations of it. That approach has not been followed.

There can be little doubt that under the current draft license, at some time in the future, WDI will not carry out the requirements set forth in the MDEQ Act 64 and the RCRA proposed post-closure care activities. WDI must be required to provide a detailed discussion of how the post-closure activities would be implemented for as long as the wastes would be a threat and how such activities will be funded during this time. Also, WDI should discuss the magnitude of the funding that will be needed and the source of funds to address these post-closure care activities when needed at any time in the future. The information provided by WDI should contain sufficient detail to enable the regulatory agencies and the public to critically review its reliability.

Page 5 of Attachment 6 lists the maintenance activities of the final cover. The draft license does not require any maintenance of the low permeability layers in the cover. These are the key layers in preventing moisture from entering the landfill, which generates leachate. The low permeability layers of plastic sheeting and compacted clay will deteriorate over time. There will be need for reliable inspection and maintenance of these layers. Evidently, MDEQ plans to allow WDI to close this landfill without maintaining the purpose of the cover, namely to prevent moisture from entering the landfill and producing leachate that will pollute groundwaters for as long as the waste in the landfill will be a threat. While cover maintenance is required for a 30-year post-closure care period, based on the amount of funds allocated for this maintenance, adequate maintenance of the cover is not provided for during this period, much less the infinite period during which the waste in the landfill will be a threat. This is a significant deficiency in this draft license.

Page 7 of "A-29 Post-Closure" (Attachment 6) states under "Leak Detection, Collection, and Removal System,"

> *"The primary anticipated maintenance concerns will be pump operations. Should damage or failure occur to this system, repair or replacement of the defective equipment will be performed promptly. Damaged surface pipes will also be repaired."*

This statement is a superficial assessment of potential problems associated with the leachate detection, collection and removal system. The primary area of concern with respect to this system is the integrity of the flexible membrane liner. When the flexible membrane liner develops holes, cracks or areas of deterioration, it will no longer be effective in transporting leachate to the sump so that the leachate can be pumped out. This will lead to groundwater pollution.

Since the integrity of the liner is less than that of the contaminating lifespan of the wastes, and since the liner system cannot be repaired without removing the wastes from the landfill, it is clear that the approach outlined by WDI in maintaining key components of the landfill containment system is fundamentally flawed in protecting groundwaters from pollution by landfill leachate. Under these conditions a landfill of the type that WDI proposes to continue to operate at its landfill site #2 cannot be permitted at such a site since obviously continued operation of this landfill will lead to groundwater pollution in violation of MDEQ regulatory requirements.

Section "A-29, Post-Closure" (Attachment 6), page 8, under "4.0 MONITORING ACTIVITIES" states,

> *"In accordance with 40 CFR part 264.310(b)(2). during the post-closure care period, the leachate collection and removal system will continue to operated until leachate is no longer detected."*

This approach is not technically valid and represents one of the potential problems in interpretation of RCRA. There could be a period of time after closure of the landfill when the cover for the landfill will have sufficient integrity to prevent moisture from entering the wastes. However, especially under the proposed license where WDI is not required to maintain the integrity of the low permeability layers of the cover during the post-closure care period, the cover will, in time, fail to prevent moisture from entering it. This situation could readily lead to one in which leachate is no longer detected for a period of time, but in time, leachate would be generated again within the landfill due to the deterioration of the low-permeability layers of the cover.

The fundamental approach that is used to address post-closure activities by WDI in its application for continued operation and MDEQ in its draft operating license is flawed. It is not designed to comply with the regulations of protecting public health, groundwater resources and the interests and welfare of those potentially impacted by the landfill. It is basically designed to dispose of wastes at cheaper-than-real-cost, which then results in a significant threat to those in the vicinity of the landfill who wish to use these lands for their appropriate purposes.

The same section states,

> *"In accordance with 40 CFR Part 264.310(b)(3), the groundwater monitoring system will be maintained and monitored throughout the post-closure period. The leak detection systems will also be maintained and monitored throughout the post-closure period."*

This is another of the superficial statements that occur in the application and the draft license and which present unreliable information on the post-closure activities. There are no provisions to maintain the plastic sheeting layers (flexible membrane liner) in the leak detection systems for as long as the wastes represent a threat. Since there are no provisions to maintain the low permeability layers of the cover so that moisture does not enter the landfill during the time when any moisture that enters the landfill could generate leachate that threatens groundwater quality, WDI and MDEQ should be required to explicitly discuss how this requirement will in fact be implemented for as long as the wastes in the landfill represent a threat. The requirements that the leak detection system shall be maintained and monitored throughout a properly defined post-closure period cannot be carried out in a meaningful way, with the result that this landfill cannot be licensed for continued operation.

WDI has provided a post-closure inspection report form for the waste disposal site #2 landfill. This report lists "Inspection Criteria." Under "Final Cover System," it states,

"· *The entire landfill surface (final cover) must be examined during the 30-year post closure period for evidence of erosion damage, subsidence that could potentially lead to surface water ponding, animal damage, and the presence of inadequate and inappropriate vegetative cover."*

Again, WDI has only indicated a 30-year period of post-closure care. This is inappropriate; it should be specified that this post-closure care period is for as long as the wastes are a threat, which is understood to be effectively forever. This license cannot be approved with its current wording and comply with regulatory requirements.

WDI should be required to explain how it is going to carry out the third bulleted item under "Final Cover System,"

"· *In general, conditions that lead to increased surface water infiltration will be noted."*

The primary condition that leads to surface water infiltration is the rips, tears, holes or points of deterioration in the plastic sheeting layer that is buried several feet below the surface of the top soil. These holes, rips, tears, etc. are not visible from the surface. This is a superficial statement that has no real meaning, since it cannot be carried out by visual inspection of the surface, and there is no requirement for a leak-detectable cover to be installed on this landfill.

Under "Leachate Collection System," there is no requirement to detect failure of the flexible membrane liner to collect leachate for as long as the wastes represent a threat.

Under "Leak Detection, Collection, and Removal System," there is no requirement for inspection of the flexible membrane liner, which is the key functional component of the system. The reason that this liner cannot be inspected is that it is buried under the solid wastes. WDI and MDEQ are ignoring this issue in relicensing this landfill.

Page 15 of "Part II, General Facility Standards" states,

"The licensee's current closure cost estimate is $3,791,382, and the post-closure cost estimate is $5,466,670."

The post-closure costs are far lower than what will be necessary, even within the 30-year period, much less the infinite period that the wastes will be a threat.

Page 16, "Part II General Facilities Standards," discusses financial assurance. An independent third party should critically review the reliability of the financial instruments proposed by WDI and accepted by MDEQ to provide the funds needed to address all plausible worst-case scenario failure needs as well as routine monitoring and maintenance of the cover, including periodic replacement of the low permeability layers of the cover. Further, these funds should be of sufficient magnitude to remove (exhume) the wastes from the landfill, properly treat them and relocate the treated residues at an appropriate site that provides for protection.

US EPA Region 5 RCRA Hazardous Waste Draft Permit

The US EPA Region 5 has issued a draft permit for the continued operation of the WDI landfill site #2 Master Cell VI as a hazardous waste landfill. A review of this draft permit coupled with the information provided by WDI on the characteristics of landfill site #2 and Master Cell VI shows that the US EPA Region 5 has conducted an inadequate review of the proposed continued operations of this landfill to ensure to a high degree of reliability that it will conform to RCRA requirements.

Page 9 of this draft permit, under section IV.A., "Corrective Action at the Facility," states as one of the requirements for continued operation of this landfill,

> "*In accordance with Section 304(u) of RCRA and the regulations promulgated pursuant thereto, the Permittees must institute Corrective Action as necessary to protect human health and the environment for all releases of hazardous waste(s) or hazardous constituent(s) from any solid waste management units (SWMUs) at the facility, regardless of the time at which waste was placed in such units.*"

This requirement establishes the regulatory requirements for perpetual care of this landfill. The waste in this landfill will be a threat to human health and the environment from releases from the landfill for effectively an infinite period of time. Many of the waste components will not decompose. So long as the dry-tomb character of the landfill is maintained, i.e., the wastes are effectively isolated from moisture, the wastes will remain a threat to public health and the environment, and therefore corrective action could be needed.

WDI, in its application for continued operation of landfill site #2 as a hazardous waste landfill, has indicated that it only plans to provide post-closure care for 30 years. Further, the post-closure care funding that WDI proposes to make available, $5,466,670, is inadequate to meet proper post-closure care activities during the minimum 30-year period required under RCRA. WDI has not provided the assured funding that will be needed to implement corrective action for as long as the wastes in the landfill will be a threat. This funding should be of sufficient magnitude to address all plausible worst-case failure scenarios that could occur in Master Cell VI during the period of time that the wastes in this cell will be a threat. Because of the deficiencies in the application in addressing the post-closure care corrective action requirements set forth in the draft permit, this draft permit cannot be approved and comply with RCRA requirements.

Comments on "Draft for Public Comment"
WDI and Ford Motor Company Proposal
for Approval to Dispose of PCBs

US EPA Region 5 has developed a "Draft for Public Comment" permit which would allow WDI to dispose of PCB wastes in the WDI landfill site #2 Master Cell VI. Comments on selected aspects of this draft are presented below.

On page 6, "Findings," under item 4, it is stated under a.,

"The local clay pan impedes hydraulic communication between the Cell and underlying water bearing units."

Under b. it states,

"The clay pan is continuous and relatively water tight because it has been demonstrated to have prevented significant downward natural seepage of water since 1953 even though there is approximately five feet of head groundwater standing on it in the shallow sandy overburden directly overlying the clay pan."

Under d, it states,

"The bottom of the Cell liner system is underlain by at least 10 feet of recompacted clay with the permeability tested and certified as less than 1 x 10^{-7} cm/sec."

These series of findings indicate that, while there is a so-called clay pan (layer of low-permeability clay) underlying the landfill, this clay layer is not impermeable (it only "impedes" hydraulic connection). In time, PCB wastes and other wastes released through Master Cell VI's liner system will penetrate the low-permeability clay layer and begin to pollute the underlying groundwaters, rendering them unusable for domestic and many other purposes.

Page 7, item 4e, states,

"*The Upper Aquifer's artesian water pressure head reaches to the base of the Cell's liner and in some places it is slightly higher than the Cell floor. Therefore, there is a natural no flow zone below the Cell and a laterally extensive slow flow zone in the clay around the Cell.*"

The reliability of this finding is questioned at this time, much less over the infinite period that this landfill will be a threat. Changes in pumping of groundwater and/or climate could change the characteristics of the so-called no natural flow zone underlying the waste cells. Further, even with no natural flow, there will be diffusion of PCB and other waste components through the clay layer. At this time, there is insufficient characterization of the hydrogeology underlying Master Cell VI to support the findings set forth in this draft permit.

It states on page 7, finding 5a,

> *"The Upper Sand Unit, which is an unprotected, highly permeable, water-bearing, gravelly sand classified as unusable by Michigan Department of Public Health regulatory agencies. The sand around the Cell did not meet the minimum 25-foot depth to water criterion and was removed from the Cell during the construction and was replaced with a ten-foot thick compacted clay isolation barrier."*

Evidently, this so-called isolation barrier is the cutoff dike and drain referred to by WDI in its application. As discussed herein, such a dike can reduce the amount of flow into the waste cell; however, this system will have to be maintained forever. No provisions have been made for such maintenance.

Failure to inspect and maintain the isolation barrier for as long as the waste in the landfill cells will be a threat to public health and/or groundwater quality (likely an infinite period of time) will result in moisture entering the landfill that can generate leachate due to the high water table surrounding the landfill. This leachate can leave the landfill through the bottom or through the sides of the landfill if leachate is not adequately removed from the landfill for as long as the wastes in the landfill will be a threat.

The lateral transport of leachate through the sides of the landfill into the surficial groundwater system represents a potentially significant source of waste constituents that can pollute the surface waters of the region by PCB wastes and many other types of wastes. Such pollution is an even greater threat to public health and the environment than the pollution of groundwaters, as a result of the fact that many of these waste components bioaccumulate in aquatic life, causing fish and other aquatic life to be unsuitable for use as food by humans and wildlife. As a result of bioaccumulation, surface water quality standards for PCBs and some other waste constituents are far lower than drinking MCLs.

The issue of adequate protection of the surficial groundwaters hydraulically connected to the waste cell from pollution by waste-derived constituents for as long as the waste in the landfill will be a threat has not been adequately or reliably addressed by the regulatory agencies in issuing draft permits for the continued operation of Master Cell VI, as well as the acceptance of PCB waste in this cell.

On page 7, findings 5b and 5c discuss permeability characteristics of the underlying geological strata. While it indicates in 5c that these are laboratory values, there is no indication that laboratory values are not necessarily reliable. It is possible that, if properly evaluated, the permeability of the natural strata underlying the waste cell is greater than 10^{-7}cm/sec at some locations. There has been insufficient testing of permeability using reliable methods to properly characterize the geological strata underlying the waste cells.

On page 8, finding 8a states,

> "*two 80 mil high density polyethylene synthetic membrane liners each of which are more than double the minimum thickness specified for a TSCA commercial landfill in 40 CFR § 761.75*"

8b and 8c also discuss other characteristics of the liners. While these liners may be more protective than the minimum specified in TSCA, they obviously will not provide the level of protection needed to conform to TSCA requirements of preventing the release of PCB waste components from the landfill unit for as long as the waste in the landfill will be a threat.

Beginning on page 14 to mid-page 15 are the requirements for groundwater monitoring. There is no discussion, however, of the reliability of this monitoring approach in support of the requirements that the landfill is suitable to accept PCB wastes. This is a significant deficiency in the application and should cause it to be rejected as incomplete.

Page 24, item 101, states,

> *"Prior to closure, the Parties must complete a closure/post closure plan approved by the U.S. EPA. This plan must include a perpetual maintenance plan that establishes a monitoring program for post closure and provide for the decontamination and disposal of PCB-contaminated areas above applicable cleanup levels and random testing of areas, equipment or stabilization materials before they are removed from service to assure that no PCBs are present. Construction testing for the final cover must follow the most current version of the EPA document, "Quality Assurance and Quality Control for Waste containment* [sic] *Facilities" (EPA/600/R-93182 September 1993)."*

No specific details are provided as to what might be developed in the future in the way of post-closure plans that would include perpetual maintenance. Detailed information on what would be required if the landfill closed today should be available for the public to review; without this information, the public cannot judge the adequacy of the proposed approach to be reasonably certain that the US EPA will in fact require the funding be available for as long as the PCB waste in the landfill will be a threat to public health, groundwater resources, and the environment to maintain, monitor and to address all plausible worst-case failure scenarios that could develop at this site. Because of the inevitable failure of the landfill containment system and the unreliability of the leak detection and groundwater monitoring systems, the post-closure care funding must be of sufficient magnitude to, at any time in the future, exhume and properly manage the PCB and other hazardous and deleterious wastes managed at this site if it should be found that WDI does not provide the perpetual care needed to ensure public health and environmental protection.

The post-closure funding plan has to be developed now to ensure that adequate funds will be set aside during the operating life of the landfill to address the need for funding during the infinite post-closure care period that will be needed at this site.

No information is provided on page 24, item 103, *"Cell closure requires installation of a final cap subject to Agency Approval."* This information has to be provided now so that the public can judge the adequacy of the Agency's proposed approach for capping this landfill. If the Agency does not propose to provide and maintain a landfill cover (final cap) that will prevent moisture from entering the landfill for as long as the wastes represent a potential threat, then the landfill should not be permitted. Specifying the characteristics of the cap and the amount of funds needed and funding sources for perpetual leak detection and maintenance including periodic cap replacement now would not preclude the Agency, after appropriate public review, from altering the required characteristics of the cap at some time in the future as a result of new information that may be developed on how to better cap landfill cells of this type than is being done today.

Also, the Agency needs to require that WDI specify how it will maintain the cut-off dikes (compacted clay isolation barriers) and surficial groundwater drainage system mentioned in finding 5a so that at no time in the future while the wastes are a threat will the surficial groundwaters enter the waste cells and generate leachate that could leave the waste cells either through the bottom of the landfill or, if leachate is not adequately removed from the landfill, though the sides of the landfill into the surficial groundwaters that surround the landfill cells. WDI should specify the amount of funds that will be needed for the inspection and maintenance, and the source of the funds that will be needed at any time in the future to address the problems associated with siting this landfill at a location where there is a high groundwater table around the landfill.

Page 26, under "Approval," item I, states,

> "*In accordance with 40 CFR § 761.75 and the aforementioned findings, U.S. EPA, has determined that the Application is consistent with TSCA and that the Cell, when operated in compliance with the conditions of this Approval, does not present an unreasonable risk of injury to health or the environment from PCBs.*"

As discussed herein, many of the findings set forth in this draft permit are based on the inadequate, unreliable review of the application submitted by WDI. This landfill as it is proposed should not be permitted for the reasons set forth in this report, since it cannot conform to regulatory requirements of protecting public health, groundwater resources and the environment from PCB waste constituents for as long as the waste in the landfill will be a threat.

US EPA/MDEQ Public Hearing on the Proposed Continued Operation of the WDI Hazardous Waste Landfill and the Expansion of this Landfill's Permitted Waste Streams to Accept PCB Wastes, Belleville, MI, April 23, 1996

On April 23, 1996, the US Environmental Protection Agency Region 5 and the Michigan Department of Environmental Quality conducted a public hearing on the proposed draft licenses and permits covering the continued operation of the Wayne Disposal, Inc., hazardous waste landfill #2 and the expansion of this landfill's permit to accept PCB wastes. Presented below is a review of selected aspects of the transcript of this hearing. Emphasis in this discussion is placed on a review of the adequacy and reliability of the information provided to the public by the regulatory agency personnel. As discussed herein, the US EPA and MDEQ did not provide the public with the information that should have been provided, to enable the public to evaluate the adequacy and appropriateness of the review that the agencies conducted of the WDI application for continuing to operate landfill site #2 Master Cell VI as a hazardous waste landfill disposal area and to accept PCB waste for disposal in this cell.

P. Quackenbush - MDEQ

Mr. P. Quackenbush of the Michigan Department of Environmental Quality, who indicated that he was a landfill license application reviewer, stated on page 7, lines 17-22, that the landfill was originally licensed in 1982 for a total capacity of 11 million cubic yards. He

indicated that there are 1,435,000 cubic yards of remaining capacity in Master Cell 6. This is the cell that will receive wastes under the proposed relicensing and permitting of the landfill.

He stated on page 8, lines 3-6, that Master Cells V and VII have been closed and are currently being monitored and maintained under a post-closure plan that is part of the draft operating license that is under review.

On page 8, lines 14-20, he indicated that the composite primary liner consists of an 80 mil plastic liner and five feet of recompacted clay. Above this liner is a leachate collection and removal system. Underlying this liner is a secondary liner that consists of a 60 mil plastic liner and at least 10 feet of native clay. Between the primary and secondary liner is a leak detection system for the primary (upper) composite liner.

On page 9, lines 8-13, Quackenbush described the proposed cover for the landfill as six inches of intermediate cover over the wastes overlain by three feet of clay. On top of the clay will be a 30 mil plastic liner. Overlying the plastic liner will be a one-foot thick drainage sand layer. Overlying the sand layer will be two feet of "general" soil and six inches of topsoil.

While Mr. Quackenbush discussed the general characteristics of the components of the liner system and cover that WDI has been, for the liner, and will be, for the cover, allowed to construct under the proposed license/permit, he failed to discuss the properties of these components of the cover and liner with respect to being able to carry out their required function, i.e., preventing moisture from entering the landfill for the cover and collecting/preventing leachate from leaving the landfill and entering the groundwaters underneath the landfill for as long as the wastes in the landfill will be a threat. As discussed in this report and in the appended papers and reports, such as, Lee (1994), Lee and Jones (1992) and Lee and Jones-Lee (1993b) and in references cited therein, it is well-known today that plastic sheeting and compacted clay liners of the type described by Mr. Quackenbush can, at best, only postpone groundwater pollution; they will not prevent it for as long as the wastes in the WDI landfill will be a threat.

In time, the cover described by Mr. Quackenbush for this landfill will allow moisture to enter the landfill and generate leachate. The plastic sheeting in the primary and secondary composite liners will eventually deteriorate to the point where it will no longer be effective in collecting leachate. The compacted clay layers, including the so-called natural layer, will eventually allow the transport of leachate through them that will pollute the groundwaters underlying the landfill with hazardous and deleterious chemicals. The landfill cover and liner system described by Mr. Quackenbush cannot prevent leachate generation and leachate from passing through the liner for as long as the wastes in the landfill will be a threat. No one can predict how long the liner system will prevent leachate from passing through it, but this system will fail long before the wastes in the landfill are no longer a threat.

The public who are potentially impacted by this landfill have the right to know this situation. Mr. Quackenbush, in describing the characteristics of the landfill containment system (cover and liners), should have discussed these issues or at least referred to the fact that

representatives of the US EPA and MDEQ would at this hearing, as part of the agencies' presentations, discuss these issues.

On page 9, lines 20-24, Quackenbush stated that the proposed license would allow WDI to accept *"...a wide variety of waste that are subject to land disposal restrictions..."*. These wastes will have to be treated to *"...meet specific standards before they can be placed in the landfill."*

He did not discuss the fact that these treatment standards do not produce the treated waste residue that is not a significant threat to cause groundwater pollution by hazardous and otherwise deleterious chemicals long after the liner system for the landfill has failed to prevent leachate from passing through it. This is an issue that Mr. Quackenbush should have discussed. The public is entitled to know this situation.

Further, Mr. Quackenbush did not discuss the fact that there will be a wide variety of unregulated hazardous chemicals present in the waste residues deposited in this landfill. In addition, Mr. Quackenbush did not discuss the fact that even if there were no hazardous chemicals in the so-called non-hazardous waste components placed in the landfill, which will certainly not be the case, the leachate generated from these wastes will still be a significant threat to groundwater quality, rendering the groundwaters unusable and/or impaired for use for domestic and many other water supply purposes. The public, who is concerned about this landfill, is certainly entitled to know that the wastes that the MDEQ and the US EPA propose to allow to be deposited in this landfill under its continued operations license will be a significant threat to public health, groundwater quality and the environment, effectively forever.

On page 10, Mr. Quackenbush discussed some of the components of the license application. He did not, however, provide any information on the characteristics of these components or their required performance, except to state on lines 13-17,

> *"...closure and post closure plans for the closure and long term care and maintenance of the facility for a minimum of 30 years after the closure has been completed, financial assurance to be maintained for closure, post closure and environmental liability."*

As discussed herein the closure and post-closure plans for Master Cell VI are inadequate to provide the level of public health and environmental protection that the public should have associated with the development of and continued operation of a hazardous waste landfill and a PCB waste landfill in their region.

On page 10, lines 21-23, he stated,

> *"The monitoring that has been done to date has show* [sic] *that there have* [been] *no releases of hazardous constituents from the facility."*

Mr. Quackenbush's statement that the existing landfill cells that have been closed have shown that there have been no releases of hazardous constituents from the facility should have included a discussion of the adequacy of the monitoring that has been done to detect such releases. The

appended report, "Detection of the Failure of Landfill Liner Systems," (Lee and Jones-Lee, 1996b) discusses why failure to detect liner failure in a hazardous waste landfill in the short period of time that the WDI landfill has been operating, should not lead to the conclusion that there will not be liner failure and releases of hazardous and deleterious constituents from the landfill during the time--effectively forever--that the wastes in the WDI landfill site #2 Master Cell VI will be a threat.

This is the issue that Mr. Quackenbush should have discussed. The public is entitled to know the significant qualifications that must be understood in order to properly assess the importance of Mr. Quackenbush's statement about no releases of hazardous wastes having been detected thus far from the existing landfill cells. It is probable that releases of waste components have already occurred but have not been detected and that, in time, there will be large-scale releases of hazardous and deleterious waste components from the existing closed landfill cells as well as the currently active cell (Master Cell VI).

Mr. Quackenbush should have examined and discussed the reliability of the above-quoted statement in order to not mislead the public as he has done into believing that since no leakage from the existing waste cells has been found thus far, in the short period of time that they have been in existence, that this is a reliable indication of what will happen in the infinite period of time that the waste in the landfill will be a threat.

Overall, Mr. Quackenbush's discussion of issues of importance to the public concerning the proposed continuation of operation of this hazardous waste landfill and the expansion of the permit/license for the acceptance of PCB wastes is superficial and inadequate to properly discuss the potential problems of the WDI proposed landfill design, operation, closure, monitoring and post-closure care to protect the groundwater resources hydraulically connected to the base of the landfill from pollution by landfill leachate for as long as the wastes in the landfill will be a threat.

While Mr. Quackenbush stated that a minimum of 30 years of post-closure care funding for maintenance, monitoring and other activities designed to protect the public from adverse impacts of the wastes, was to be provided, he did not discuss the fact that there is no assurance that post-closure care funding for monitoring, maintenance and remediation will, in fact, be available in sufficient amounts to meet plausible worst-case scenario failures for as long as the wastes in the landfill will be a threat. This is an issue that is of great interest to the public.

The US Congress General Accounting Office (GAO 1990) in a report to Congress entitled, "Hazardous Waste Funding of Postclosure Liabilities Remains Uncertain," discussed the fact that current US EPA RCRA regulations do not mandate that the landfill owner/operator will, in fact, provide the necessary funding for post-closure care activities to ensure that the wastes in the landfill do not result in groundwater pollution for as long as the waste components will be a threat.

The GAO has issued a number of other reports on the inadequacies of current hazardous waste management landfilling practices. For example, GAO (1995a) has discussed the fact that

74% of the hazardous waste facilities in the US have had releases to groundwater. The majority of these facilities were constructed prior to the development of the current landfill liner containment systems, in time the plastic sheeting and compacted clay-lined landfills will also have releases to groundwater. Further, the GAO concluded that many of the hazardous waste facilities did not have adequate groundwater monitoring systems.

The GAO (1995b), in a report to Congress, "Superfund Operations and Maintenance Activities Will Require Billions of Dollars," discusses the fact that on-site management of waste at superfund sites using RCRA landfills and other remediation approaches is not now being adequately and reliably implemented by state and federal regulatory agencies. There are significant questions about who is going to provide the *ad infinitum* funding that will be required to operate and maintain the on-site hazardous chemical management facilities. There is no assured funding available for this activity. There can be little doubt that today's RCRA landfills, such as WDI landfill site #2, will become future superfund sites and will require funding as part of the billions of dollars that will be needed at these sites.

The GAO discusses in their 1995b report that many state regulatory agencies do not have the funds necessary to carry out the mandated regulatory functions of inspection and periodic reevaluation of the adequacy of the remediation of a site needed to ensure that the site is not a significant threat to public health, groundwater resources, and the environment. The situation today of inadequate regulatory attention by the US EPA and state regulatory agencies will not likely improve in the future. In fact, if anything, the regulatory agencies will be provided with less funds to ensure that hazardous waste and/or PCB landfills will be adequately and reliably monitored and maintained to meet current regulatory requirements for as long as the waste in the landfill will be a threat.

The GAO review points to a significant problem with current US EPA RCRA Subtitle C regulations, namely that the health, welfare and long-term interests of the public who reside on or use properties within the sphere of influence of the WDI landfill are not necessarily protected under this license/permit. Michigan landfilling regulations also do not ensure that adequate funds will be available for as long as the wastes will be a threat to protect public health, groundwater resources and the environment from pollution by WDI landfill site #2 Master Cell VI leachate. This is an extremely important issue that should have been brought to the attention of the public by Mr. Quackenbush as part of his discussion of the characteristics of this landfill.

The public, justifiably, has great concern about the siting of a landfill and/or the continued operation of a landfill such as WDI proposes to do, where there is inadequate bufferlands between the waste management units and adjacent property owners' lands. They become even more concerned when they find that the regulatory agencies' personnel at a public hearing do not adequately and reliably discuss issues of concern to them. Governmental agency representatives, such as Mr. Quackenbush, have an obligation to fully and accurately describe the characteristics of a proposed landfill containment system as well as any potential problems associated with the components of this system that could lead to the wastes in the landfill polluting groundwaters by hazardous and deleterious chemicals at some time in the future.

Overall, Mr. Quackenbush's discussion of issues was basically pro-applicant, in support of the landfill's relicensing. Mr. Quackenbush took the approach of placing the burden of showing the significant deficiencies in the proposed landfill design, operation, closure and post-closure care that he superficially described in his testimony at the hearing on the public. The burden of such review should first be placed on the public agency representatives who are supposed to be working on behalf of the public in protecting their interests from hazardous and deleterious chemicals present in the wastes.

K. Kelley, MDEQ

Ms. K. Kelley, MDEQ permit engineer, indicated she was a reviewer of the WDI permit application. She stated on page 12, lines 8-12, that the proposed operating license for the Michigan Disposal waste treatment plant facility is similar to the existing operating license. She discussed over the next several pages the characteristics of the various types of tanks, treatment areas and other facilities located at the site.

On page 15, lines 23-25, she mentioned that part five of the license is devoted to environmental monitoring conditions, including groundwater monitoring.

On page 16, lines 9-14, she mentioned that part seven of the license includes expansion of the groundwater monitoring program. No details are provided, however, on the characteristics of these groundwater monitoring programs. The license applicant in the application and the regulatory agency personnel mentioning the groundwater monitoring requirements/program for the waste treatment facility should provide the public with information on the adequacy of this monitoring program to detect potential groundwater pollution before widespread groundwater pollution occurs. Rather than following the arbitrary and often insufficient approach of assuming that a monitoring program will be reliable, a critical in-depth review of the reliability of the program should be conducted. The results of this review should be reported to the public at the public hearing. The public is entitled to know more than just that a groundwater monitoring program has been developed; at a hearing they should be provided summary information on the reliability of this program to protect their health, groundwater resources and interests.

S. Kolak, US EPA

Ms. S. Kolak indicated that she was a US EPA permit writer for the Wayne Disposal, Inc., and Michigan Disposal waste treatment plants. On page 17, lines 8-14, S. Kolak stated,

> *"As a permit writer, I am responsible for reviewing permit reapplication to insure compliance with federal laws, to insure that the facility operations under the federal permit are protective of human health and the environment and to ensure that the application is complete and technically adequate."*

On page 18, lines 8-13, she stated,

"If issued, the federal permit would require both Wayne and Michigan Disposal to comply with land disposal restrictions. This means that Michigan Disposal must treat the hazardous waste to protective levels set by EPA prior to its disposal at the disposal."

The public is entitled to know the adequacy of the treatment requirements that are being imposed on WDI by the regulatory agencies to protect their health, groundwater resources, the environment, interests and welfare. Those familiar with how environmental quality standards are developed know that they are often based on significant compromises between public health protection and cost. This means that those within the sphere of influence of a source of hazardous chemicals, like a waste treatment facility and/or landfill, are exposed to hazardous or deleterious chemicals even though the emissions from this facility meet current standards.

As part of the work that the author has done on superfund site and hazardous waste clean-up as well as on drinking water standards development, he has become aware of the deficiencies in developing regulations. In addition to regulatory requirements being compromises, sometimes they are also badly out-of-date and often lag behind knowledge of when the standards need to be updated by many years to tens of years. Lee and Jones-Lee (1994c) published a review, "Does Meeting Clean-Up Standards Mean Protection of Public Health and the Environment," on this issue.

The public concerned with the potential impacts of the WDI waste treatment site and landfill should have been informed by S. Kolak about the adequacy of the standards that are being met in protecting their health, interests, welfare and the environment. Simply telling the public that the wastes must be treated to protective levels set by the US EPA does not adequately or reliably inform them of the key issues of concern. The facts are that the US EPA's required treatment levels do not produce a waste residue that protects public health and the environment from all harm. As discussed herein, the treated residues that meet US EPA protective levels referred to by Ms. Kolak are still hazardous and can be deleterious to groundwater quality, rendering a domestic water supply well unusable.

A. Taylor, MDEQ

A. Taylor, a geologist with the MDEQ, indicated on page 22, lines 6-10, that MDEQ conducted an investigation of the subsurface soil and rock conditions at the facility to evaluate the site in terms of groundwater quality protection and vulnerability. This was done as part of the review of the original application for the hazardous waste disposal license that was originally issued in 1982.

He states on page 22, lines 11-13,

"The results of this investigation were also used to develop the facility environmental monitoring programs."

On page 24, beginning on lines 15 and 16, Taylor mentions the suction lysimeters that have been installed under Master Cells V and VII where he states that *"They are built detection*

monitoring system." He did not, however, discuss the reliability of these systems in detecting leaks through the liner system before widespread pollution occurs. As discussed herein, suction lysimeters sample a small area compared to the area through which landfill leachate can pass through the liner on its way toward causing groundwater pollution.

It is inappropriate for Mr. Taylor to mention some component of the landfill monitoring system, such as suction lysimeters, implying that they are an important component of protecting groundwater quality without also discussing the reliability of the component in performing as required to achieve regulatory requirements in protecting public health, groundwater resources, and the interests and welfare of those within the sphere of influence of the landfill.

On page 25, Taylor discusses the geology of the landfill site where, beginning on line 17, he states *"...from the surface, from zero to approximately 20 feet at the side, there is a surficial sand and fill unit."* He states in the next paragraph that this sand and fill area was removed during the construction of the landfill and that the landfill is physically and hydraulically separated from it through *"diking and a drain tile system."* Mr. Taylor, however, does not discuss the long-term issues associated with the prevention of the surficial groundwaters surrounding the waste cells from entering the wastes for as long as the wastes are a threat. He also does not discuss the potential problems associated with WDI's failure to remove leachate from this landfill for as long as the waste in the landfill will be a threat, which could lead to surficial groundwater pollution by waste constituents causing surface water pollution. These are important issues that should have been evaluated and discussed with the public so that they understand the adequacy and reliability of the various approaches that WDI has proposed to follow in trying to "engineer" a suitable site for a landfill, when the basic characteristics of the WDI landfill site #2 are such that the original landfill should never have been sited at this location.

On page 26 beginning on line 9, Taylor discusses what he calls the next unit below the sand layer. He states, beginning on line 11, *"It's this silty clay fill, and what this is is a clay rich material which contains some sand and gravel. It's a very good mixture of it and gives us very good permeability characteristics.*" While the transcript in line 15 states, "*It's a very permeable material,*" it appears that he should have said or recorded "very impermeable material." He states on page 26, beginning on line 17 that, *"Wayne Disposal is required to have a minimum of 10 feet of something called one times 10 to the minus seven centimeters per second clay, silty clay beneath the facility."*

On page 27 lines 1 through 3 he states, *"This material forms the sub-base of the hazardous waste cells at the Michigan--at the Wayne Disposal facility."* Below this layer, according to Taylor on page 27 beginning on line 4, are geologic materials which *"...coarsens as you move downward and gradually turns into a silt material called the transition silts."*

He states beginning on page 27 line 7,

"This material does have some fairly good permeability characteristics in terms of it's got a fairly low permeability, but it's not acceptable for a landfill containment, although it would probably meet the permeability criteria."

Page 27 line 12, *"...this silt material overlies a sand here which is considered to be the uppermost aquifer at the facility."* Therefore the uppermost aquifer below this landfill is a sand aquifer system in which there is at least 10 feet of low permeability (1×10^{-7} cm/sec) clay-like material and a higher-permeability silt.

While, as cited above, Mr. Taylor goes to considerable lengths to describe the geological strata underlying the site of the landfill cell, stressing their low permeability and conformance to minimum regulatory requirements, he does not provide the public with a discussion of what this means in the way of protecting the groundwaters underlying the site from pollution by leachate for as long as the wastes in the landfill will be a threat. The public is entitled to know this information.

The facts are that while there is a low-permeability layer of clay underlying the site, the testing of the permeability of this layer has not been adequately or reliably done, since it is based on laboratory testing. Further, the number of tests and their locations are not adequate to describe whether the geological strata underlying the site conform to minimum regulatory requirements. More reliable testing could show that the geological strata underlying the site are not adequate to conform to minimum regulatory requirements.

Mr. Taylor should have also discussed the fact that there is a significant long-term problem associated with this site because of the relatively thin layer of low-permeability clay between the base of the landfill and the aquifer system underlying the site. This low-permeability layer will obviously not prevent leachate derived from this landfill from eventually penetrating through the layer and polluting the groundwaters under the site. The public is entitled to know that this is a significant issue that must be considered in the relicensing/permitting of this site. Basically, Mr. Taylor, in his presentation at the public hearing, did not provide the public with the information that he should have on the characteristics of the geological strata underlying the WDI landfill site #2 Master Cell VI.

Taylor, on page 27 lines 15 through 17 states, *"This resource is monitored by 17 monitoring wells at the facility, and this is a key item that we focus on in terms of environmental protection."* Taylor should have presented the public with a discussion of the results of a detailed analysis conducted, if not by WDI, by MDEQ/US EPA of the reliability of the monitoring well system used in detecting groundwater pollution by leachate before pollution occurs beyond the point of compliance for the monitoring. The three downgradient monitoring wells are located about 400 feet apart. Each well has a zone of capture associated with a sampling event of about one foot on each side. Therefore, there are 398 feet between the wells where leachate-polluted groundwater could pass and not be detected by the wells. Cherry (1990) showed that the leachate plumes generated from leakage through a plastic sheeting-lined system, such as the WDI landfill site #2 Master Cell VI, will produce finger plumes of leachate-polluted groundwater a few feet in width. Lee and Jones-Lee (1994b) published a review of this issue. A

copy of their summary review is appended to these comments. They point out the difficulties of trying to reliably monitor lined landfills with vertical monitoring wells spaced hundreds of feet apart. Basically, the monitoring system proposed for this landfill is flawed and will not protect the groundwater resources downgradient from the landfill. This information should have been provided by Mr. Taylor to the public on the reliability of the groundwater monitoring system that he (MDEQ) is proposing to allow WDI to operate associated with the licensing of the continued operation of Master Cell VI. If he had properly analyzed the situation and provided this information to the public, it would have been obvious that this landfill should not be relicensed with this groundwater monitoring system.*

Taylor states on page 27, lines 19 and 20, that the surficial sand layer contains groundwaters *"...flowing at the site from north to the south-southwest toward Belleville Lake."* He does not, however, discuss that the surficial groundwaters in the sand layer are a potential route for transport of leachate from the landfill to the surface waters of the region at some time in the future if WDI does not remove the leachate from the landfill for as long as the wastes in the landfill will be a threat.

On page 27, line 25 and page 28, lines 1 and 2, Taylor states, *"Wayne Disposal is required to operate redundant environmental monitoring systems at the facility."* On page 28, lines 3 through 7, he states,

> *"The facilities are--or the monitoring programs are designed to detect a release at the earliest possible time, and so if there is a problem, it can be reacted to and corrected before it becomes an environmental problem."*

Someone not familiar with the details of how effective the various monitoring programs are in detecting releases from the landfill before groundwater pollution occurs might be led to believe from Mr. Taylor's statements that these systems are effective in detecting leachate released from the landfill that could cause groundwater pollution. However, as discussed herein, Mr. Taylor failed to properly analyze the reliability of the groundwater monitoring systems. Mr. Taylor should have discussed each of these so-called redundant monitoring systems with respect to their likelihood of detecting leachate released from the landfill before widespread groundwater pollution occurs. This is an issue that the public wants to know.

As discussed herein, the groundwater monitoring wells at the WDI landfill site #2 are unreliable in detecting leachate-polluted groundwaters before widespread pollution occurs. The same situation also applies to the suction lysimeters mentioned above. Each of these systems measures a very small area. There are three monitoring wells that are critical to detecting leachate leakage from Master Cell VI. These wells are spaced several hundred feet apart. Each well has a radius zone of capture of approximately 1 foot. Since the leakage from the liner system will be through plumes that can be a few feet in width near the downgradient edge of the waste management unit, Mr. Taylor's statement on page 28, lines 3 through 6, *"...the monitoring programs are designed to detect a release at the earliest possible time..."* is inaccurate and over-exaggerates the ability of the monitoring system to effectively detect failure of the liner system that will lead to groundwater pollution.

On page 29, Mr. Taylor states, beginning on line 12, *"We have over five years of data on the leak detection systems for master cell six and none of that data has indicated an environmental problem."* Continuing on line 16, *"We have not detected any volatile organic compounds or anything that would suggest that we have a leachate going through the primary liner of the landfill."* Mr. Taylor should have informed the public when leaks through this system would be expected to be observed. It would be longer than five years unless there is a large-scale failure of the liner system. He should have also indicated that the situation experienced over the past five years compared to what would be expected over the infinite time that the waste in the landfill would be a threat is not a reliable prediction of what will occur in the future. Obviously, the period that the WDI landfill has been operating represents such a small part of the total time that the wastes will be a threat as to be inconsequential and certainly not an appropriate basis to judge what will happen in the future.

On page 29 , beginning on line 20, Mr. Taylor states that, *"Master cells five and seven were constructed prior to the leak detection requirements for master cell six, and in this case, a leak detection system was retrofitted in the next to the landfill by the suction lysimeters."* On page 30, beginning on lines 1 through 6, Mr. Taylor describes the suction lysimeters as *"...horizontal wells that drilled underneath the landfill parallel to the bottom of the landfill..."* that are located in the clay where he states beginning on line 4, *"...but they would yield an indication of leakage from the landfill prior to that being able to get into the ground water."* Has Mr. Taylor, or anyone who has reviewed the WDI landfill site #2 application for relicensing, conducted an evaluation of the amount of area actually sampled by these suction lysimeter horizontal wells compared to the area through which leakage could occur? This should be done.

Keller (1994) in a presentation at the California Groundwater Resources Association annual meeting entitled "What Constitutes a Reliable Vadose Monitoring System?" discussed how to evaluate the reliability of vadose monitoring systems. The approaches he has described should be used at the WDI landfill site #2 to determine whether the suction lysimeters that are being used under Master Cells V and VII have any significant probability of detecting leakage from the landfill unit before widespread pollution occurs. Conducting such a review will show that it is inappropriate for Mr. Taylor to imply that the suction lysimeters that have been installed under these landfill cells are reliable monitoring devices to detect leachate penetration of the liner systems for these cells at all of the places where leachate leakage from the cell could have occurred. Further, he should have discussed whether they will be reliable devices to detect future leachate leakage that will occur from these cells for as long as the waste in the cell will be a threat.

A critical examination of the potential for the leachate leakage through the liners on cells V and VII to be detected by the suction lysimeters would show that they have a low probability of detecting leachate before pollution of groundwaters occurs. These issues are subject to quantification. There is no need to follow the superficial approach that is being used by MDEQ in review of the WDI landfill groundwater monitoring system. This landfill's continued operation and expansion in terms of the waste accepted should not be permitted/licensed until a proper evaluation of the reliability of the monitoring system that exists for cells V, VI and VII has been conducted.

On page 31, lines 13 through 17, Mr. Taylor states,

> *"If it would get out, we would first detect it in a leak detection system, and also if for some reason that they got past the leak detection system without being detected, it would detected it in a ground water monitoring program."*

The facts are that ultimately the leak detection system will fail to function effectively to collect leachate since its ability to function depends upon the integrity of the flexible membrane liners in the lower double composite liner. Further, the groundwater monitoring system that has been installed is unreliable in detecting leachate before widespread pollution occurs.

Mr. Taylor states on page 31, beginning on line 18 through 21, *"Again, these systems are redundant for the purpose of identifying any problem at the earliest possible time and then being able to correct it."* This statement is superficial and does not properly describe the reliability of these systems. From the long range perspective, i.e., during a significant part of the time that the wastes in the landfill will be a threat, the liner leakage detection systems are essentially ineffective in detecting leaks. The way leaks would be detected is by off-site production wells. Mr. Taylor should have discussed these issues rather than providing the public with unreliable information on the ability of this system to serve as a reliable leak detection system for the leakage of leachate through the liner system en route to the groundwaters.

Page 32, lines 13 through 16, Mr. Taylor states that, *"To summarize, the geology of this site meets Michigan's hazardous waste siting requirements and is suitable for hazardous waste disposal activities."* This is a pro-applicant statement that does not properly reflect the length of time that the wastes in the landfill will be a threat. Mr. Taylor should have discussed this issue from the public's perspective rather than from a short-term landfill applicant's perspective. There will be people living in the vicinity of this landfill who will want to use groundwaters in this area who should be entitled to groundwaters free of landfill leachate forever. To follow the approach that Mr. Taylor has followed of only examining the system for a short period is superficial and disregards the interests of the public.

Mr. Taylor, on the bottom of page 32, lines 17 through 22, states,

> *"The integrity of the site has been demonstrated by over 15 years of ground water monitoring data. We've had ground water monitoring data for over 15 years from monitoring wells surrounding the site and those -- that data does not indicate leakage from the landfill."*

Again, if he had conducted a proper analysis of the situation he would have indicated that the 15 year period for this site is an inadequate period to make a reliable assessment of whether the wastes in the landfill unit will ultimately pollute groundwater. Mr. Taylor should have pointed this out. Failing to do so shows a bias towards the applicant in licensing of the landfill.

Mr. Taylor states on page 32, lines 23 to 25, *"It is necessary to do continued detection monitoring of the site in order to verify the performance of the system."* Mr. Taylor should have discussed the fact that for year 31, one year after WDIs post-closure period ends, there is no assurance that funds will be available to continue the detection monitoring even if in that year, 31, there is a problem. What about year 50, 100, 200? The wastes in the landfill will still be a threat then. The people in the region will still want groundwater without PCB wastes and other hazardous and deleterious chemicals in it. Why does WDI, with MDEQ support, only examine the potential for this landfill to pollute during a short period of time and has not considered or at least reported on the issues of concern to the public? Namely, will this landfill at anytime in the future pollute the groundwaters rendering them unusable for domestic or other purposes?

Overall, Mr. Taylor has not provided the public with adequate and reliable information on the potential for the proposed continued operation of the WDI landfill site #2 to pollute groundwaters with landfill leachate rendering these waters unusable for domestic and many other purposes.

M. Busse - MDEQ

Mr. Busse on page 35, lines 14 through 16, states, *"The most significant item in that chronology was the consent judgement issued against both companies in October of 1994."* The judgement came from the complaint concerned with mismanagement of hazardous waste. Van Buren Township, as part of their submittal in opposition to the relicensing of this landfill and the expansion of the license/permit to include PCB waste, developed a detailed discussion of the numerous violations and complaints that have been associated with WDI's waste management activities at the site. It is the author's understanding that this tabulation has been submitted into the administrative record covering the US EPA and MDEQ permitting/relicensing of the WDI landfill site #2 Master Cell VI.

Mr. Busse states on page 26, lines 19 through 21, *"And there were penalties. There was a half a million dollar penalty and cost reimbursement."* It is clear that WDI has not conducted its waste management activities in such a way as to be a responsible corporate entity that should be allowed to continue to operate a hazardous waste landfill at this site.

Mr. Busse's discussion of issues does not address issues of concern to the public, such as would his inspections detect the incipient pollution of groundwaters by landfill leachate that has passed through the liner system and is not detected in the ineffective leachate pollution monitoring system. Mr. Busse should have discussed these issues in order to inform the public of not only what he does in his inspections but also the deficiencies of what he does compared to what is needed to protect public health, groundwater resources, the environment and the interests of those within the sphere of influence of this hazardous waste management facility.

T. Shoens - Wayne County Department of the Environment

Mr. Shoens identifies himself as a chemist with the Wayne County Department of the Environment Air Quality Management Division and discussed his role as an inspector of the WDI facility. His activities focus on air quality issues.

Beginning on page 39, Mr. Shoens mentioned the odor problems associated with past operations of the WDI hazardous waste management facility. A review of the public's comments concerning the experiences they have had in living or utilizing properties near the WDI landfill and waste treatment facility shows that WDI has been a poor neighbor that has allowed repeated significant adverse impacts on the public in the vicinity of the landfill. Where a company like WDI fails to conduct its operations in an appropriate manner so that they are not adverse to the adjacent and nearby property owners and users, it is inappropriate to allow the firm to continue to operate.

The operating records shows that the WDI companies have a history of releasing odorous materials from the waste treatment facility. While there may be some that may ignorantly assert that these are only malodorous conditions and not harmful to health, it is well known that malodorous conditions of this type may be significantly adverse to public health. Shusterman (1992), of the California Department of Health, has conducted extensive studies on the adverse public health impacts of malodorous situations. He reports that such situations are significantly detrimental to the health of many individuals experiencing the malodorous conditions.

Lee and Jones-Lee (1994d) in a report to the State of California Environmental Protection Agency Comparative Risk Project entitled, "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview," discusses how releases from landfills can be adverse to the health, air and groundwater quality and the interest/welfare of those within the sphere of influence of a landfill. This sphere of influence can extend several miles or more from the landfill. They recommend that the siting or continued operation of a landfill include, as part of the cost of landfilling, acquisition of sufficient bufferlands owned by the landfill applicant to dissipate all releases of hazardous or otherwise deleterious chemicals from the landfill that are not controlled by the landfill's owner/operator at their point of generation.

The WDI landfill site #2 has been allowed to develop and is proposed to be allowed to continue to operate without sufficient control of releases of hazardous and/or deleterious chemicals from the landfill to protect the health, groundwater resources, the environment and the interests of those who own or use properties within the sphere of influence of the landfill. This approach enables WDI and the waste generators to experience cheaper than real cost waste management at the expense and health of those within the sphere of influence of the landfill. Such an approach should not be allowed to continue.

A review of the operating records of WDI and its affiliated companies leads to the conclusion that these companies should not be allowed to continue to operate. If WDI is issued a license for continued operations, one of the conditions of this license should be that if one more incident of off-site adverse impacts of any type, including odor, occurs, all WDI facilities at this location would be permanently shut down with no possibility of continued operation. This

company(s) should not be allowed to continue to conduct its operations in such a way as to be periodically adverse to those who own or use properties in the vicinity of the landfill.

S. Johnson, US EPA

Mr. Johnson, geologist with the US EPA, indicated that he was responsible for review of the PCB toxic disposal application from WDI.

On page 41, lines 6-11, Mr. Johnson stated,

> *"Approval is based on satisfying all of the technical requirements specified in the regulations and any others that the regional administrator might find is necessary in order to demonstrate that the landfill meets the standards with no unreasonable risk."*

Mr. Johnson stated on page 41, lines 12-15,

> *"Technically it's no unreasonable risk to human health and the environment, but we think it's important to realize that we're out there to protect your health."*

It is important to understand that the basic regulations governing the management of PCBs in landfills were developed in the late 1970s based on the technology that was available during the mid-1970s. The author has yet to find anyone who understands the adequacy of these regulations and who will reliably report on them who will not admit that the TSCA regulations governing PCB landfilling are badly out-of-date. Therefore, meeting these regulations does not mean protection.

Mr. Johnson stated on page 42, lines 17-23,

> *"The material that failed that was removed and it was replaced by satisfactory material. That way we know that the clay pan under which this landfill is constructed is more than just natural material. It's engineered and is specially placed. It makes it's* [sic] *considerably better than uncontrolled material."*

The issue that should have been addressed is not whether the material is better than uncontrolled material. The public wants to know whether this material will prevent leachate from passing through it and polluting groundwaters of interest to them and future generations for as long as the wastes in the landfill represent a threat. Mr. Johnson should have addressed this issue.

On page 43, lines 9-12, Mr. Johnson stated, *"You'll notice up this side I have -- some of these items are marked as meeting the TSCA requirements and some of them exceed the TSCA requirements."*

As discussed above, meeting or exceeding TSCA minimum requirements for landfilling of PCB waste does not mean protection of public health and groundwater resources.

On page 43, lines 19-21, Mr. Johnson stated, *"The TSCA requirements say that if it's in a clay pan, you don't even have to have a ladder* [liner]*."* He goes on to state at the beginning of line 22, *"This facility has three ladders* [liners]*, two synthetic ones and re-compacted clay pan..."*.

Again, this is a misleading presentation of issues that are of concern to the public. The public is interested in whether this system will protect for as long as the wastes are a threat. Mr. Johnson, and for that matter all the other regulatory agency staff, have failed to address this issue. Simply meeting badly-out-of-date regulations does not protect public health, groundwater resources, the environment and the interests of those who own or use properties within the sphere of influence of the landfill and the waste treatment facility.

On page 43, line 25, Mr. Johnson stated with reference to these three liners, *"These were put in there to compensate for the fact the facility is within 50 feet of the ground water table."* While Mr. Johnson does not discuss this, he has admitted by this statement that this site fundamentally does not meet minimum TSCA requirements of a 50-foot separation between the groundwater table and the landfill. While he attempted to minimize this deficiency by indicating that there are a number of liners installed, it is well-known that these liners will not prevent leachate from passage through them for as long as PCB and other wastes in the landfill will be a threat. To assert as Mr. Johnson did, that these three liner systems are more effective than 50 feet of natural clay in protecting groundwaters for as long as the wastes in the landfill represent a threat is inappropriate. Mr. Johnson's comment that a liner which is known to fail is better than 50 feet of natural strata, represents a superficial review of issues and only considers short-term behavior.

Page 44, lines 11-12, Mr. Johnson stated, *"The synthetic landfill liner is much thicker than the minimum requirements."* Again, while this is true, it is misleading. Since both the thinner and the thicker liners will ultimately fail, it is only a matter of time until groundwater pollution occurs. This is the issue that should have been discussed.

Mr. Johnson's statement on page 44, lines 15 and 16, that, *"The composite construction is more than three times more protective than a single liner,"* represents an inappropriate approach in presenting information of interest to the public. While a composite liner can be protective for a short period of time compared to the length of time that the wastes are a threat, ultimately it will fail to prevent leachate from passing through the liner. The public should have been made aware of this situation.

Mr. Johnson states on page 44, lines 17 through 20, that, *"The TSCA cells have double -- under a leak detector. The leak detector is to make sure that no landfill material ever gets out, no liquids get out."* Either Mr. Johnson does not understand the properties of liners with respect to their long-term stability or is deliberately failing to reliably report on them by such a statement. There is no question that that statement is unreliable, is non-factual and does not represent a proper description of the situation. Waste materials placed in this landfill, including PCB waste materials, will "get out" of this landfill containment system during the time that the wastes in this landfill will be a threat. It is important to point out that TSCA does not limit the time that the public health is supposed to be protected by the landfill containment system.

Overall, I find that Mr. Johnson's discussion of information pertinent to permitting of Master Cell VI represents a distorted presentation of issues that are of great importance to the public. The public is entitled to a more appropriate discussion of the issues of concern than Mr. Johnson presented at the April 23, 1996 hearing.

S. Buda - Hearing officer

Mr. Buda, on page 47, lines 15 through 20, discusses the concept of significant testimony which includes *"...significant and environmental hazards to human health and the environment."* The WDI waste management unit that is proposed for relicensing represents a significant hazard to human health, groundwater resources and the environment.

It is stated on page 48, lines 4 through 7, that the license must be approved unless it is found that the landfill *"...presents an unacceptable hazard to the public health or the environment or the application was not sufficiently detailed or adequate and, therefore, misleading."* As the author has documented in the discussions presented herein, the draft license/permit issued by the MDEQ and the US EPA is based on an inadequate, unreliable review of the ability of this landfill to protect public health, groundwater resources and the environment for as long as the wastes in the landfill will be a threat. Further, WDI has not provided adequate or reliable information in its application for relicensing/permitting to justify continued operations. This situation should cause WDI's application for continued operation of this landfill to be disapproved.

Page 48, beginning on line 22 and continuing to page 49, Mr. Buda states that

> *"We will respond in writing to all comments that are significant in the public record. That is done so that we can provide a thorough and accurate response to all comments and concerns, and that written response will be sent to persons indicating they wish to be notified."*

Since having been involved in a number of landfill permitting situations of this type over the years where regulatory agencies do not adequately review the landfill applications prior to issuing a draft permit, such as in this case, it is imperative that an adequate mechanism be established whereby full, public peer review of any responses that the regulatory staff have where they attempt to justify the previously adopted position that this landfill should be allowed to continue to operate and be allowed to accept PCB waste be conducted.

Beginning on page 105 is the transcript of the reconvened hearing for the evening session. Many of the staff made essentially identical presentations in the evening session as were made earlier in the day. The comments presented below are only made on the apparent significant differences between the two presentations.

Page 108, lines 13 through 19, mentions that the Michigan Department of Environmental Quality has specific PCB regulations set forth in Public Act 451, Part 147. The public is interested in the adequacy of these regulations; the MDEQ staff should have discussed any deficiencies in these requirements compared to those that should be in place to protect public

health, groundwaters and the environment from pollution by landfill leachate for as long as the wastes represent a threat.

P. Quackenbush - MDEQ

Mr. Quackenbush, in his evening presentation on page 111, lines 17 through 23, states,

> *"The cover system for this cell number six is a continuous cover that would cover all the sub-cells within that area and it's designed and constructed in accordance with the hazardous waste regulations to promote drainage and prevent precipitation from entering the landfill and generating leachate during the closure and post-closure care."*

It is not clear from Mr. Quackenbush's statement whether he considers that the post-closure care period is only 30 years after closure or for as long as the wastes in the landfill will be a threat. He should have fully defined what he meant in order to eliminate the ambiguity that exists now on whether he is considering only protecting the public's interests for the short period of time that the waste will be a threat or throughout this period.

Anyone who is familiar with the properties of landfill covers of the type which Mr. Quackenbush describes knows that his statement that these covers will unequivocally prevent moisture from entering the landfill is inaccurate and a significant misrepresentation of what will actually occur. As discussed in the enclosed papers as well as in the American Society of Civil Engineers Landfill Closure conference proceedings that was held in October 1995, "Landfill Closures, Environmental Protection and Land Recovery," there are great problems in developing landfill covers that only minimize moisture entering a landfill. At this conference the author presented and invited an overview paper entitled, "Overview of Landfill Post Closure Issues," (Lee and Jones-Lee 1995b). A copy of this paper is appended to these comments. A review of this paper and the references cited therein and the other papers presented at the ASCE conference as presented in the proceedings shows that landfill covers of the type Mr. Quackenbush described as being able to prevent moisture from entering the landfill will not, in fact, prevent moisture from entering the landfill for as long as the wastes in the landfill represent a threat. The clay layer in the cover will, in a short time after installation, experience desiccation cracks. The plastic sheeting layer in the cover will develop holes and cracks and eventually deteriorate. A number of companies such as those discussed in the author's review of landfill post-closure issues are developing leak detection systems for plastic sheeting liners. However, it is well known that they leak at the time of construction and over time deteriorate in their ability to prevent moisture from entering the landfill.

An important aspect of this situation that Mr. Quackenbush and others need to explain to the public is how the regulatory agencies are going to ensure that WDI maintains the cover for this landfill so that it will prevent moisture from entering the landfill for as long as the wastes in the landfill will be a threat. The key layer in the cover preventing moisture from entering the landfill is the plastic sheeting layer. This layer, according to Mr. Quackenbush, is buried below about 2.5 feet of covering material. Without installing a leak detectable cover system and

maintaining and operating it forever, there is no way to determine when holes, cracks, rips, tears or points of deterioration develop in the plastic sheeting layer by visual inspection of the ground, i.e., the topsoil layer. It is impossible for WDI, with the proposed landfill cover system, to "prevent" moisture from entering the landfill for as long as the wastes represent a threat.

It is also important to understand that the operation of a leak detectable cover on a landfill will require that considerable funds be devoted to the operation and maintenance of the cover, including periodic replacement of the cover. Since the wastes in the landfill will be a threat forever, the cover must prevent moisture from entering the landfill forever. Ultimately, the liner system underlying the landfill will deteriorate and since it cannot be repaired without removing the wastes, the ability of this landfill containment system to prevent groundwater pollution will be dependent upon the integrity of the cover. Mr. Quackenbush and the others have not thought out the realities of installing and maintaining a reliable cover on this WDI landfill cell for as long as the wastes represent a threat.

On page 113, Mr. Quackenbush once again mentions the components of the license but does not discuss some of the key issues such as closure and post-closure plans. Evidently Mr. Quackenbush expects the public to accept his superficial general discussion of issues as being adequate for their protection.

A. Taylor - MDEQ

On page 135, lines 1 and 2, Mr. Taylor states, *"In terms of the hydrogeology of the site, it is a proven site today."* He does not define what he means by a "proven site." Does he mean that the hydrogeological characteristics of the site are well understood? If so, why did he not or the others discuss how long it would take for waste derived constituents to move from the base of the landfill through the so-called low permeability layers into the groundwater system underlying the landfill? Also, why did he not discuss the significant deficiencies in the hydrogeologic information that exists for the site? This information should have been provided. It would show that under plausible worst-case scenario failure situations, it is only a matter of time until groundwater pollution occurs.

Mr. Taylor states on page 136, lines 2 through 8,

> *"In summary, the geology of the site meets Michigan's hazardous waste siting requirements and is suitable for hazardous waste disposal activities. The integrity of the site has been demonstrated by over 15 years of ground water monitoring data."*

Again, as in his earlier presentation, Mr. Taylor has unreliably represented the ability to detect leachate leakage from the waste management units based on the 15 years of operation and extrapolate this period to the period of time that the waste in the landfill will be a threat, i.e., forever. Mr. Taylor has presented inadequate and unreliable information to the public on these issues.

S. Johnson - US EPA

On page 146, lines 8 through 10, Mr. Johnson states, *"You'll notice right next to those key works I say whether the facility meets or exceeds the minimum requirements."* Again, as with his earlier testimony, Mr. Johnson is taking the approach of comparing the landfill being developed today with requirements which were developed in the late 1970s based on mid-1970 technology. The public is entitled to a more appropriate review of issues than provided by Mr. Johnson.

On page 149, lines 20 and 21 state, *"Under the TSCA program, we don't have a -- and so what we have is the situation we call perpetual care. As long as the PCB is in place, they're required to maintain it. That exceeds the minimum requirements."* In order for such a statement to have any meaning, Mr. Johnson or someone else must inform the public how using the financial instruments available, WDI can provide perpetual care for as long as the PCB waste in the landfill will be a threat (forever). It is important to note that WDI only proposes to maintain the landfill 30 years after closure. The public is entitled to know how Mr. Johnson's statement about perpetual care will be accomplished, with particular reference to who will fund this perpetual care, the amount of funds needed, and the source of funds that will be available at any time in the future to meet routine monitoring and maintenance and plausible worst-case scenario failure situations.

Peer Review of Technical Issues

In order to resolve conflicts on technical issues, the author (Lee and Jones-Lee 1995c) recommends that if the regulatory agency personnel, WDI or its consultants, or others, claim that their position on technical issues is appropriate, which is contrary to the positions set forth in these comments as well as in the backup documents provided, then these issues should be peer reviewed by independent knowledgeable individuals. This peer review should be conducted in a full public peer review arena to provide decision makers an assessment of the technical validity of the relative positions on particular issues. The author is confident that a proper peer review of any technical issue in question will show that the regulatory staff or others' positions which are contrary to those set forth in these comments, are technically invalid and inappropriate and that they are based on a superficial review of the basic science and engineering that is pertinent to the topic under question.

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