Comments on Environmental Impact Statement for the Proposed Central Waste Management Facility at Ballyduff Beg, Co. Clare Inagh, Ireland

Developed by Fehily Timoney & Company

Comments Submitted by

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I have been asked to review excerpts from the Clare environmental impact statement (EIS) DEE and waste license application for the proposed landfill development in, Ballybeg, Inagh, Ireland. My comments on these materials are provided herein.

Overall Comments

Of the approximately two dozen Environmental Impact Statements/reports/assessments that I have reviewed over the past ten years, I find that the EIS for the proposed Central Waste Management Facility at Ballyduff Beg, Co. Clare, is one of the most superficial and self-serving (on behalf of landfill development) discussion of potential impacts of landfills that I have encountered. The authors of this EIS either are ignorant of the literature and the basic facts governing the impacts of landfills or they have deliberately distorted the information is available literature.

Most proposed landfills EISs are designed to gain approval for the landfill. This is an outgrowth of the situation where those who develop such EISs know that if they do not provide support for the landfill by failing to discuss the significant long-term problems of the landfill, they will not gain future work. This issue is discussed in,

Lee, G.F., and Jones-Lee, A., "Practical Environmental Ethics: Is There an Obligation to Tell the Whole Truth?," Published in condensed form as "Environmental Ethics: The Whole Truth" Civil Engineering 65:6 American Society of Civil Engineers (1995)

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This EIS is an example of why EISs for landfills have no technical credibility.

Specific Comments

Page 1, the last paragraph, "2.2 Development Size and Lifespan," states that, "The landfill operation will be carried out in accordance with best landfill practice. The proposed landfill falls far short of developing a landfill that will protect public health and the environment and the adverse impacts of these wastes deposited in a landfill for as long as the waste in the landfill will be a threat. The proposed design for this landfill is not the "best"landfill practice. The single composite liner incorporated into this landfill design will at best only postpone for relatively short period of time we in ground water and ultimately surface water will be polluted by landfill leachate compared to the time that the waste in the landfill will be a threat. I have been concerned about the potential impacts of landfills on ground water resources for about 35 years. My work has included university based research on landfill liners. In 1998 to Dr. Anne Jones-Lee and I have published several reviews of the problems with conventional land design that involve a single composite liner of the type proposed for the Central Waste Management Facility landfill. In 1998 we updated our discussions of these issues in a comprehensive review entitled,

Lee, G.F. and Jones-Lee, A., "Assessing the Potential of Minimum Subtitle D Lined Landfills to Pollute: Alternative Landfilling Approaches," Proc. of Air and Waste Management Association 91st Annual Meeting, San Diego, CA, available on CD ROM as paper 98-WA71.04(A46), 40pp, June (1998). Also available at www.gfredlee.com.

It discusses not order the problems with the proposed landfill design of this type but also how landfills can be developed that will be protective that are appropriately sited.

Not only will the liner system test proposed for this landfill eventually leak large amounts of leachate, the groundwater monitoring system proposed for this landfill will have a low probability of detecting the ground water pollution before substantial pollution occurs. The problems of trying to reliably monitor a plastic sheeting lined landfill are discussed in,

Lee, G.F. and Jones-Lee, A., "Deficiencies in Subtitle D Landfill Liner Failure and Groundwater Pollution Monitoring," Presented at the NWQMC National Conference *Monitoring: Critical Foundations to Protect Our Waters,* US Environmental Protection Agency, Washington, D.C., July (1998).

A credible EIS would have discussed these issues and provided information on how landfills can be developed that will be protective.

Section 2.3, Nature and Sources of Waste," states, "Hazardous or toxic and dangerous wastes, or liquid waste will not be accepted." This EIS here have stated that there is no way to prevent hazardous chemicals that are used in the household and commercial establishments from being deposited in a municipal landfill of this type. The leachate produced from this landfill will be a significant threat to cause groundwater and surface water pollution.

Section 2.4, "Landfill Design," states, "The landfill will be designed using the Best Available Technology Not Entailing Excessive Cost (BATNEEC). The design objectives are to provide the

necessary conditions to prevent pollution of the air, soil, groundwater and surface water." The second paragraph under 2.4 states:

> *"The proposed landfill design comprises a composite lining system of 1m thickness of engineered boulder clay with a permeability of less than or equal to 1 x 10^{-9} m/sec, overlain by a 2mm thick high density polyethylene (HDPE) artificial liner which has a permeability of 1 x 10^{-13} m/sec."*

The proposed design for the liner system is equivalent to the US EPA minimum Subtitle D single composite liner. This type of liner system is well-recognized to at best only postpone when groundwater pollution occurs. It will not prevent it for as long as the waste in the landfill will be a threat to cause groundwater pollution. It is clear that the so-called "Best Available Technology Not Entailing Excessive Cost" is controlled primarily by keeping the cost low at the expense of future generations' groundwater quality and the potential impacts of hazardous and deleterious chemicals in the waste. A reliable, full disclosure EIS would have discussed the fact that the one meter thickness of clay will be penetrated by leachate once it enters the clay liner within less than 40 years. The high density polyethylene (HDPE) plastic sheeting landfill liner which is stated to have a permeability of 10^{-13} m/sec, will be penetrated by diffusion, as discussed by Daniels and Somebody (insert date), within two years. Further, dilute aqueous solutions of the organic solvents which are used for cleaning around the home can pass through the HDPE liner within a few days by permeation. The deficiencies in this proposed design are well-understood (see discussion by Lee and Jones-Lee 1998 cited above)

The statement is made in the last paragraph under Section 2.4 that even if the HDPE liner is damaged during landfilling, the groundwater will be protected from pollution by the clay liner and seven to twelve meters of low permeability subsoil beneath the engineered layer; however, no information is provided on the characteristics of this so-called "low-permeability" subsoil. Without reliable information on the subsurface geology it is not possible to evaluate the reliability of the statement .As noted above, the one meter clay liner will be penetrated, in accord with design permeabilities, within 30 to 40 years.

Section 4.1, "Soils and Geology," as well as other locations, states in paragraph 5 that, "The soils at the site have a low permeability." Again no information is provided on the permeability of the subsoil that demonstrates that that statement is correct. Further, there is no information on whether there are high permeability areas within the soils which could serve as pathways for leachate migration. Such migration pathways are common is many geological systems of this type.

Section 5.2, "Hydrogeology," on the third page of this section, third paragraph, states that the groundwater flow is such that it discharges to nearby streams. This means that the eventually leachate polluted groundwaters will cause surface water pollution as well. The pollution of surface waters by leachate is of particular concern because of its impact on fish and other aquatic life.

A map is provided showing the location of landfill activity and the 500-meter active landfill offset area. This is being interpreted as indicating that there is only a 500 meter land buffer between waste deposition areas and adjacent properties. If this interpretation is correct, this means that the owners/users of adjacent properties will face severe impacts from odors and other releases from the landfill during the landfill active life.

Section 5.2.1.1, "Groundwater Usage," indicates on the second page that there are a number of nearby shallow wells as well as springs. Further, Table 5.6 indicates that some of the local wells are used for drinking water. No analysis is provided on the threat that the proposed landfill represents to the existing water wells as well as the water wells a could be developed to in the vicinity of the land shall all over the thousand years that could be impacted by the landfill while this landfill was still a threat to public health and the environment. .

Section 2.9.4, "Leachate Management," discusses the characteristics of the proposed cap for the landfill. This cap will consist of a clay layer and HDPE plastic sheeting. This plastic sheeting will be overlain by a topsoil layer. While at the time of placement this type of cap will greatly reduce the moisture entering the landfill, over time the clay layer will develop significant cracks, and the plastic sheeting layer will deteriorate. Significant moisture will then enter the landfill waste to generate leachate.

On the next page, the statement is made that the maximum leachate depth allowed will be one meter. One meter of leachate above the liner represents a significant head that can lead to increased rates of pollution of groundwaters through holes that will develop in the HDPE liner and penetration through the clay liner.

Figure 2.10 provides design information on the leachate storage lagoon, which indicates that a single composite liner will be used. No discussion is provided on the potential for this landfill leak leachate take into the underlying groundwater system

Appendix C provides predicted leachate volume calculations. A reliable EIS would have discussed the fact that these calculations are applicable to a new landfill cover system and do not apply for as long as the waste in the landfill will be a threat. Over time, the permeability of the cover will increase significantly, leading to greater leachate production from the closed landfill than predicted.

In this section, there are also "Potential Leakage Rate" calculations. These calculations are highly unreliable over the period of time that the waste in this landfill will be a threat. The waste in this landfill will be a threat, effectively, forever. To assume, as is done in these leakage rate calculations that the landfill liner system will only have four 10 mm holes over this period of time is highly unrealistic.. There is no question that, in time, the HDPE liner will significantly deteriorate, and there will be large areas of deterioration, which will allow significant leachate to pass through the liner at a much higher rate than that predicted in this EIS.

Section 2.9.5, "Landfill Gas Management," mentions that flaring of landfill gas will be used; however, there is no discussion of the problems of landfill gas flares generating dioxins, which are significant threats to public health and the environment.

Section 2.9.6, "Environmental Monitoring," does not provide information on the characteristics of the monitoring programs that are proposed to be used at this landfill. Without detailed information on these programs, it is not possible to judge their reliability.

In a section under "Gas Yields," in Attachment D.5, mention is made that it is expected that the gas production will continue for 20 to 30 years. Are plastic bags used as containers for waste disposal? Will these bags be shredded before placement in the landfill? If so, gas production will occur over a much longer period of time. Further, the low permeability cover on the landfill will inhibit moisture from entering the landfill for a period of time, which will extend the period of gas production, since for a while after landfill cell closure the rate of gas production will be limited by the moisture content of the wastes.

The first order decay model was used for estimating gas production is not applicable to a landfill of this type once it is closed. Under those conditions the limitation of moisture entering the landfill will control landfill gas production. The landfill gas production graphs presented are highly unreliable, compared to what will actually occur in this proposed landfill.

My qualifications to undertake this review are summarized below.

Qualifications to Undertake This Review

My (Dr G. Fred Lee) work on municipal landfill impact matters began in the mid-1950s while I was an undergraduate student in environmental health sciences at San Jose State College in San Jose, California. My course and field work involved review of municipal solid waste landfill impacts on public health and the environment.

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

I obtained a PhD degree specializing in environmental engineering from Harvard University in 1960. As part of this degree work I obtained further formal education in the fate, effects and significance and the development of control programs for chemical constituents in surface and groundwater systems. An area of specialization during my PhD work was aquatic chemistry.

For a 30-year period, I held university graduate-level teaching and research positions in departments of civil and environmental engineering at several major United States universities, including the

University of Wisconsin-Madison, University of Texas at Dallas and Colorado State University. During this period I taught graduate-level environmental engineering courses in water and wastewater analysis, water and wastewater treatment plant design, surface and groundwater quality evaluation and management, and solid and hazardous waste management. I have published over 850 professional papers and reports on my research results and professional experience. My research included, beginning in the 1970s, the first work done on the impacts of organics on clay liners for landfills and waste lagoons.

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

My work on the impacts of municipal solid waste landfills began in the 1960s where, while directing the Water Chemistry Program in the Department of Civil and Environmental Engineering at the University of Wisconsin-Madison, I became involved in the review of the impacts of municipal solid waste landfills on groundwater quality. In the 1970s, while I was Director of the Center for Environmental Studies at the University of Texas at Dallas, I was involved in the review of a number of municipal solid waste landfill situations, focusing on the impacts of releases from the landfill on public health and the environment.

In the 1980s while I held the positions of Director of the Site Assessment and Remediation Division of a multi-university consortium hazardous waste research center and a Distinguished Professorship of Civil and Environmental Engineering at the New Jersey Institute of Technology, I was involved in numerous situations concerning the impact of landfilling of municipal solid waste on public health and the environment. I have served as an advisor to the states of California, Michigan, New Jersey and Texas on solid waste regulations and management.

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

In 1989, I retired after 30 years of graduate-level university teaching and research and expanded the part-time consulting that I had been doing with governmental agencies, industry and community and environmental groups into a full-time activity. A principal area of my work since then has been assisting water utilities, municipalities, industry, community and environmental groups, agricultural interests and others in evaluating the potential public health and environmental impacts of proposed or existing hazardous, as well as municipal solid waste landfills. I have been involved in the review of approximately 50 different landfills in various parts of the United States and in other countries.

Dr Anne Jones-Lee obtained a bachelors degree in biology form Southern Methodist University and a PhD degree in Environmental Sciences from the University of Texas at Dallas in 1978. For 11 years she taught and conducted university graduate level environmental engineering and environmental sciences courses and conducted research on various aspects of water quality management. She and Dr. G. Fred Lee have worked together as a team since the mid 1970s.

Dr. Anne Jones-Lee and Dr. G. Fred Lee have published extensively on the issues that should be considered in developing new or expanded municipal solid waste and hazardous waste landfills in order to protect the health, groundwater resources, environment and interests of those within the sphere of influence of the landfill. Our over 40 professional papers and reports on landfilling issues provide guidance not only on the problems of today's minimum US EPA Subtitle D landfills, but also how landfilling of non-recyclable wastes can and should take place to protect public health, groundwater resources, the environment, and the interests of those within the sphere of influence of a landfill. I make many of my publications available as downloadable files from my web site (www.gfredlee.com).

In the early 1990s, I was appointed to a California Environmental Protection Agency's Comparative Risk Project Human Health Subcommittee that reviewed the public health hazards of chemicals in California's air and water. In connection with this activity, Dr. Jones-Lee and I developed a report, "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview" (Lee and Jones-Lee, 1994a), that served as a basis for the human health advisory panel to assess public health impacts of municipal landfills.

In addition to teaching and serving as a consultant in environmental engineering for over 39 years, I am a registered professional engineer in the state of Texas and a Diplomate in the American Academy of Environmental Engineers (AAEE). The latter recognizes my leadership roles in the environmental engineering field. I have served as the chief examiner for the AAEE in north-central California and New Jersey, where I have been responsible for administering examinations for professional engineers with extensive experience and expertise in various aspects of environmental engineering, including solid and hazardous waste management.

My work on landfill impacts has included developing and presenting several two-day short-courses devoted to landfills and groundwater quality protection issues. These courses have been presented through the American Society of Civil Engineers, the American Water Resources Association, the National Ground Water Association in several United States cities, including New York, Atlanta, Seattle and Chicago, and the University of California Extension Programs at several of the UC campuses, as well as through other groups. I have been and continue to be an American Chemical Society tour speaker, where I am invited to lecture on landfills and groundwater quality protection issues, as well as domestic water supply water quality issues throughout the US.

SUMMARY BIOGRAPHICAL INFORMATION

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EDUCATION

Ph.D. Environmental Engineering & Environmental Science, Harvard University, Cambridge, Mass. 1960

M.S.P.H. Environmental Science-Environmental Chemistry, School of Public Health, University of North Carolina, Chapel Hill, NC 1957

B.A. Environmental Health Science, San Jose State University 1955

ACADEMIC AND PROFESSIONAL EXPERIENCE

Current Position:

Consultant, President, G. Fred Lee and Associates

Previous Positions:

Distinguished Professor, Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ, 1984-89

Senior Consulting Engineer, EBASCO-Envirosphere, Lyndhurst, NJ (part-time), 1988-89

Coordinator, Estuarine and Marine Water Quality Management Program, NJ Marine Sciences Consortium Sea Grant Program, 1986-1988

Director, Site Assessment and Remedial Action Division, Industry, Cooperative Center for Research in Hazardous and Toxic Substances, New Jersey Institute of Technology et al., Newark, NJ, 1984-1987

Professor, Department of Civil and Environmental Engineering, Texas Tech University, 1982-1984

Professor, Environmental Engineering, Colorado State University, 1978-1982

Professor, Environmental Engineering & Sciences; Director, Center of Environmental Studies, University of Texas at Dallas, 1973-1978

Professor of Water Chemistry, Department of Civil & Environmental Engineering, University of Wisconsin-Madison, 1961-1973

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

PUBLICATIONS AND AREAS OF ACTIVITY

Published over 850 professional papers, chapters in books, professional reports, and similar materials. The topics covered include:

Studies on sources, significance, fate and the development of control programs for chemicals in aquatic and terrestrial systems.

Analytical methods for chemical contaminants in fresh and marine waters.

Landfills and groundwater quality protection issues.

Impact of landfills on public health and environment.

Environmental impact and management of various types of wastewater discharges including municipal, mining, electric generating stations, domestic and industrial wastes, paper and steel mill, refinery wastewaters, etc.

Stormwater runoff water quality evaluation and BMP development for urban areas and highways

Eutrophication causes and control, groundwater quality impact of land disposal of municipal and industrial wastes, environmental impact of dredging and dredged material disposal, water quality modeling, hazard assessment for new and existing chemicals, water quality and sediment criteria and standards, water supply water quality, assessment of actual environmental impact of chemical contaminants on water quality.

LECTURES

Presented over 750 lectures at professional society meetings, universities, and to professional and public groups.

GRANTS AND AWARDS

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

GRADUATE WORK CONDUCTED UNDER SUPERVISION OF G. FRED LEE

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

ADVISORY ACTIVITIES

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

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

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

- Landfills and Groundwater Quality Protection
- Water Quality Evaluation and Management for Wastewater Discharges, Stormwater Runoff, Ambient Waters and Pesticide Water Quality Management Issues
- State Stormwater Quality Task Force Activities
- Impact of Hazardous Chemicals -- Superfund, LEHR Superfund Site Reports
- Contaminated Sediment -- Aquafund, BPTCP
- Domestic Water Supply Water Quality
- Excessive Fertilization/Eutrophication
- Reuse of Reclaimed Wastewaters
- Watershed Based Water Quality Management Programs:
  Sacramento River Watershed Program,
  Delta -- CALFED Program, and
  Upper Newport Bay Watershed Program
  San Joaquin River Watershed DO and OP Pesticide TMDL Programs

Stormwater Runoff Water Quality Science/Engineering Newsletter

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Municipal Solid Waste Landfills and Groundwater Quality Protection Issues Publications

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

Overall Problems with "Dry Tomb" Landfills

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

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

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Lee, G.F. and Jones-Lee, A., " Developing Landfills that Protect People: The True Costs," MSW Management 7(6:18-23, Nov/Dec (1997).

Liner Failure Issues

Lee, G.F. and Jones-Lee, A., "Assessing the Potential of Minimum Subtitle D Lined Landfills to Pollute: Alternative Landfilling Approaches," Proc. of Air and Waste Management Association 91st Annual Meeting, San Diego, CA, available on CD ROM as paper 98-WA71.04(A46), 40pp, June (1998). Also available at www.gfredlee.com.

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

Lee, G.F. and Jones, R. A., "Geosynthetic Liner Systems for Municipal Solid Waste Landfills: An Inadequate Technology for Protection of Groundwater Quality?" Waste Management & Research, 11:354-360 (1993).

Lee, G.F., "Comments on Tisinger and Giroud `The Durability of HDPE Geomembranes'," Letter to the Editor, Geotechnical Fabrics Report, Minneapolis, MN Submitted by G. Fred Lee & Associates, El Macero, CA, 4pp (1994).

Lee, G.F. and Jones-Lee, A., "Disadvantages of Synthetic Liners for Landfills," Letter to the Editor, National Environmental Journal, Submitted by G. Fred Lee & Associates, El Macero, CA, 2pp (1994).

Groundwater Pollution by Leachate

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

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

Groundwater Monitoring

Lee, G.F. and Jones-Lee, A., “Deficiencies in Subtitle D Landfill Liner Failure and Groundwater Pollution Monitoring,” Presented at the NWQMC National Conference *Monitoring: Critical Foundations to Protect Our Waters,* US Environmental Protection Agency, Washington, D.C., July (1998).

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Post-Closure Care

Lee, G.F. and Jones-Lee, A., "Landfill Post-Closure Care: Can Owners Guarantee the Money Will Be There?" Solid Waste & Power, 7:35-38 (1993).

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