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IAN D. PEGGS

**geosynthetic materials science,
failure and forensic analyses,
construction quality assurance (CQA),
nondestructive testing
risk assessment**

SUMMARY

Over twenty five years experience in polymer, geosynthetics, and composite research
Geosynthetics Consultant and Instructor
Previously President and co-Founder of GeoSyntec, Inc., USA (now GeoSyntec Consultants)
Former Vice-President and Principal of GeoServices, Inc. (now GeoSyntec Consultants)
Former Manager of Polymer Engineering, Hanson Materials Engineering (now CANSPEC), Canada
Active in international standards development and geosynthetics education
Performed more than 200 liner leak integrity surveys and failure analyses on lining systems
Author of more than 200 papers and presentations on geosynthetics
Registered Professional Engineer: Alberta, Canada
Registered Professional Engineer: Maine, USA
Special Recognition IGS Award 1994
Nominated for IGS Award 1998
Awarded composite liner patents 1998

EDUCATION

Sheffield University, UK: Ph.D., Physical Metallurgy 1967
Imperial College of Science & Technology, London University: B.Sc. (Eng.), First Class, Honors
Fabrication Metallurgy, 1963

PROFESSIONAL HISTORY

March 1991 - present

I-CORP INTERNATIONAL, Inc., President, Principal, Ocean Ridge, Florida, USA

1986 - 1991

GeoSyntec, Inc., (President) and GeoServices Inc./GeoSyntec Consultants (Principal, Vice-President, and Manager, Materials Testing Laboratory), Florida, USA

1985 - 1986

Geosyntech Ltd., Director, Joint Venture between Hanson Materials Engineering and EBA Engineering, Alberta, Canada

1981 - 1986

Hanson Materials Engineering, Manager, Polymer Engineering Division, Alberta, Canada

1967 - 1979

Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment, Head, Thermophysical Properties Laboratory, Manitoba, Canada

ACHIEVEMENTS

Introduced geomembrane CQA to Canada in 1983;

Introduced transmission microscopy microstructural analysis to geosynthetics;

Identified stress cracking phenomenon in HDPE geomembranes;

Developed advanced geomembrane seam specifications, published in 1987;

Introduced infrared thermography for the nondestructive measurement of geomembrane seam strength, 1994;

Awarded IGS Award (1994) for contributions to the Influence of Polymer Microstructure on the Performance of Geomembranes. Nominated for IGS Award of Excellence (1998) for paper "HDPE Geosynthetics – Premature Failures and Their Prediction";

Awarded United States Patent 5,788,413 for Geocomposite Membrane (1998);

Initiated www.geosynthetica.net industry web site (1999); and,

Diplomate of the American Board of Forensic Engineering and Technology (2000).

EXPERIENCE

Dr. Peggs has been involved with the failure analysis, research and development, and testing of polymeric materials in bulk, composite, and coating form since 1977. He has had extensive experience with all geosynthetics since 1981 and has specific interest in the nondestructive examination, microstructure, and performance of geomembrane seams. He initiated the use of the multifrequency ultrasonic shadow technique for nondestructive seam inspection and has developed microtome techniques for the microstructural examination of seams. He has been involved with the preparation and management of construction quality assurance programs for geomembrane-lined impoundments and landfills in the U.S., Canada, Europe, South Africa and SE Asia. Dr. Peggs has also been involved in failure analyses for many clients throughout North America, Europe and Australia on high-strength geotextile seams, geotextiles, geomembranes, geomembrane seams, plastic pipe, and fiberglass components. He is presently developing infrared thermography technology as the first technique for the nondestructive measurement of geomembrane seam bond strength.

He has performed survivability and durability studies on geomembranes and geotextiles and is Past-Convener of the International Organization for Standardization (ISO) TC38/SC 21 Working Group on the Durability of Geotextiles. He is also past-chairman of the RILEM (TC-144-GMP) Technical Committee on Geomembranes.

He has presented more than 200 papers, seminars, and workshops on geosynthetics for manufacturers, installers, and users of geosynthetics.

Dr. Peggs became involved with the investigation, development, and testing of non-metallic materials, including polymers, during the time that he headed Atomic Energy of Canada's Thermophysical Properties Lab in its Materials Development Branch beginning in 1967.

In 1981, Dr. Peggs became involved with geosynthetics when he initiated and managed the Polymer Engineering Division of Hanson Materials Engineering (now Canspec), a large materials consulting company in Alberta, Canada. His work there in failure analysis, consulting, specifications development, research and development, and quality assurance for geosynthetic lining systems, plastic pipe, and other polymeric materials led to a joint venture between Hanson Materials Engineering and EBA Engineering. Dr. Peggs then became director of the joint venture, GeoSyntech Ltd., which provided specialized geosynthetics consulting and testing services to clients throughout Canada and the United States.

In 1986, Dr. Peggs joined with Joseph E. Fluet, Jr. and J.P. Giroud of GeoServices, Inc. Consulting Engineers (now GeoSyntec Consultants) to establish GeoSyntec, Inc., a geosynthetics testing laboratory in Boynton Beach, Florida. This laboratory became one of the foremost, and most comprehensive, geosynthetics testing laboratories in the world, with clients throughout North America and in 13 countries around the world.

In 1991, Dr. Peggs formed his own geosynthetic materials performance consulting company, I-CORP INTERNATIONAL, which performs state-of-the-art international geosynthetics technology development, and teaches others how to perform state-of-practice projects in over 25 countries. The Industry Insight newsletter, with subscribers in 32 countries, was initiated in 1994. The newsletter was superseded by the www.geosynthetica.net technical resource web site sponsored by the geosynthetics industry. The site is visited by about 750,000 engineers each year.

Typical projects that Dr. Peggs has managed include failure analyses of geomembrane liners, geosynthetic clay liners, and plastic pipes; stress cracking and microstructure investigations of geomembrane seams; curing and microstructure investigations of fiberglass laminates; aging and degradation studies of polypropylene geotextiles; leak surveys on geomembranes under soil and waste cover; interface friction and surface texture/profile studies; failures in HDPE sheet liners on concrete walls; developing a manufacturing and fabrication QC program for PP geomembranes; and investigation of rapid crack propagation in HDPE geomembranes and more recently PP liners and floating covers. These projects have been conducted on liners in ponds, vaults, and landfills; covers; seams; and filters, for a variety of clients that include many utilities, international corporations, engineering consulting firms, hazardous waste firms, geomembrane manufacturers and installers, oil companies, metals companies, marine surveyors, contractors, municipalities, insurance companies, and lawyers.

In 1996 Dr. Peggs applied for patents on a geocomposite membrane GCL. United States Patent 5,788,413 for Geocomposite Membrane was awarded in 1998 – others followed. Dr. Peggs also organized the First US/Germany Geomembrane Workshop in Berlin.

AFFILIATIONS AND COMMITTEE WORK

Dr. Peggs has been heavily involved in committee work relating to the geosynthetics industry and organizations committed to education and development of testing standards, such as:

- International Geosynthetics Society
 - Committee on Standards
 - 4th International Conference 1990 - Session Chairman, Creep and Durability
 - 5th International Conference 1994 - International Abstract Review Panel
 - Session Chairman
 - Environmental Discussion Panel
 - 6th International Conference 1998 - Workshop Chairman, Leakage Through Liners
 - 1st European Conference - Chairman, Workshop on Leak & Flaw
 - Detection in Geomembrane Liners
 - 7th International Conference 2002 - Special Session Chairman (Lining on steep slopes and walls)
 - 3rd European Conference 2003 - Session Chairman

- North American Geosynthetics Society
 - Geosynthetics '93 - Session Chairman
 - Discussion Panel
 - Geosynthetics '95 - Session Chairman
 - Moderator: Panel Discussion on Perspectives on Durability
 - Geosynthetics '97 - Session Chairman
 - Discussion Panel, Standardization vs. Innovation
 - Geosynthetics '99 - Mini-Symposium Chairman
 - Geosynthetics '01 - Session Chairman
 - Geosynthetics '03 - Course Chairman (Forensic Analysis of Geomembranes)
 - Geosynthetics '05 (GeoFrontiers '05) - Session Chairman
 - Workshop Co-Chairman "Insurance Risk Assessment in Geosynthetic Projects"

- International Organization for Standardization
 - Past-Chairman, TC38/SC21 Working Group 5 on the Durability of Geotextiles
 - Past Member, TC38/SC21/WG1: Liaison with CEN TC189
 - Past Observer to CEN TC189 on geosynthetics

- American Society for Testing and Materials
 - Member, Committee D35 on Geosynthetics
 - Chairman, three Committee D35 Workshops on Geosynthetics Test Methods (1986, 1987)
 - Chairman, 1989 ASTM Symposium on Microstructure and the Performance of Geosynthetics
 - Chairman, Committee D35 Workshop on Geosynthetics Forensic Analysis & Remediation, 1993
 - Chairman, Committee D35 Workshop on Textured & Structured Geomembranes, Phoenix, 1995

- National Sanitation Foundation
 - Member, Joint Committee (#54) on Flexible Membrane Liners (Committee terminated 1997)

- International Union of Testing and Research Laboratories for Materials and Structures (RILEM)
 - Past-Chairman, Technical Committee TC 144-GMP on Geomembranes

- Geosynthetics World (no longer published)
 - Member, Editorial Board
 - Contributor of regular editorial column
- Geotechnical Fabrics Report (IFAI)
 - Member, International Technical Advisory Committee
- Society of Plastics Engineers
 - Senior member
- NICET Geosynthetic Materials Installation Certification Program
 - Member, Main Advisory Committee
 - Member, PVC Geomembranes and Geogrid Subfield Advisory Committees
- American College of Forensic Examiners, USA
 - Diplomate American Board of Forensic Engineering & Technology
- International Association of Geosynthetic Installers
 - Proctor for Welder Certifications
- American Water Works Association
 - Member and Standards Committee "Geomembrane Liners and Covers for Potable Water Reservoirs"
- IFAI International Achievement Awards Judge 2001, 2002, 2003, 2005

PUBLICATIONS AND PRESENTATIONS

In Dr. Peggs' 25 years of experience investigating and testing polymers, primarily geosynthetics, he has acquired a great deal of information concerning materials durability and how that characteristic corresponds to the success or failure of the application of a given material in its environment. Dr. Peggs shares this valuable information in his publications and presentations as listed below:

Books

- 1978 Thermal Expansion: Proceedings of the 6th International Symposium on Thermal Expansion, Ed. Peggs, I.D., Plenum Press, New York, NY, USA, 1978.
- 1991 Geosynthetics: Microstructure and Performance, Ed. Peggs, I.D., ASTM STP1076, Philadelphia, PA USA, 1991.
- 1991 Geomembranes: Identification and Performance Testing (Chapters 12 and 13), Eds. Rollin, A., and Rigo, J.M. Chapman and Hall, London, 1991.
- 1993 Landfilling of Waste: Barriers, Chapter 4.6 - Testing Program to Assure the Durability of Geomembranes, Eds. Christensen, T.H., Cossu, R., Stegmann, R., Chapman & Hall, Boundary Row, London, UK, 1994.

Papers and Presentations

- 83-1 Peggs, I.D., and Little, D., "Fractography of Polymers", 16th Annual Technical Meeting of the International Metallographic Society, Calgary, Alberta, 1983.
- 85-1 Peggs, I.D., "Why Quality Control? A Graphic Case History", Geotechnical Fabrics Conference '85, Cincinnati, OH, 1985

- 85-2 Peggs, I.D., "Evaluating Geomembrane Performance", Geotechnical News, June, 1985.
- 85-3 Peggs, I.D., "Seams in Synthetic Liners", Seminar on the Engineering of Waste Management Systems, Saskatoon, Saskatchewan, August 1985.
- 85-4 Peggs, I.D., Briggs, R., and Little, D., "Developments in Ultrasonics for Geomembrane Seam Inspection", Proceedings of the 2nd Canadian Symposium on Geotextiles and Geomembranes, Edmonton, Alberta, Sep. 1985, pp. 153-156.
- 85-5 Peggs, I.D., and Little, D., "The Effectiveness of Peel and Shear Tests in Evaluating Geomembrane Seams", Proceedings of the 2nd Canadian Symposium on Geotextiles and Geomembranes, Edmonton, Alberta, September 1985.
- 86-1 Peggs, I.D., "Liquid Waste Impoundment in Surface Ponds -- Synthetic Liner Considerations," presented at the Petroleum Waste Management Conference, Calgary, Alberta, January 1986.
- 86-2 Peggs, I.D., and Little, D., "Development of a Procedure to Evaluate the Fusion Quality of Geomembrane Seams", Alberta Environment Report, RMD L-93, 1986.
- 86-3 Peggs, I.D., "Guidelines for the Quality Assurance of Geomembrane Liners for Environmental Protection", Alberta Environment Report, 1986.
- 87-1 Peggs, I.D., "Evaluating Polyethylene Geomembrane Seams", Geosynthetics '87, IFAI, Roseville, MN, 1987, pp. 505-518.
- 87-2 Peggs, I.D., and Rose, S., "Practical Aspects of Geomembrane Seam Welding", Geotechnical Fabrics Report, Vol. 5, No. 1, IFAI, Roseville, MN, Jan/Feb 1987, pp. 12-16.
- 87-3 Peggs, I.D., "A Testing Program for Geomembranes and other Geosynthetics Used in Lining Systems", Seminar presented at the Spec-Con Southeast Conference, Orlando, FL 1987.
- 87-4 Peggs, I.D., "Peel and Shear Testing Geomembrane Seams", ASTM Workshop on New Developments in Geosynthetics Testing, Cincinnati, OH 1987.
- 87-5 Kimmet, J., Peggs, I.D., and Tisinger, L.G., "Differential Scanning Calorimetry Interpretation of Results Obtained on Polyethylene Geosynthetics", Proceedings of the 10th Annual Madison Waste Conference, Madison, WI, September 1987, pp. 127-145.
- 87-6 Peggs, I.D., "Brittle Fracture of Polyethylene Geomembrane and Pipe", Seminar presented to Union Carbide Polyolefin Specialists Division, 1987.
- 88-1 Peggs, I.D., "Microstructural Studies on Geomembranes and Geomembrane Seams", invited presentation at RILEM meeting, Montreal, Canada, June 1988.
- 88-2 Peggs, I.D., and Carlson, D.S., "Stress Cracking of Polyethylene Geomembranes: Field Experience", Durability and Aging of Geosynthetics (Ed., R.M. Koerner), Elsevier Applied Science, London, 1989, pp. 195-271.
- 89-1 Peggs, I.D., Tisinger, L.G., and Bonaparte, R., "The Durability of a Polypropylene Geotextile in an Unpaved Road Structure, Geosynthetics Geomembranes and Silt Curtains in Transportation

Facilities, ISBN 0-309-04968-7 Transportation Research Record 1248, Transportation Research Board, National Research Council, Washington, D.C., 1989, pp. 1-12.

- 89-2 Peggs, I.D., and Carlson, D.S., "Brittle Fracture of Polyethylene Geomembranes", Geosynthetics: Microstructure and Performance, ASTM STP 1076, Philadelphia, PA, 1990, pp. 57-77.
- 89-3 Peggs, I.D., and Charron, R.M., "Microtome Sections for Examining Polyethylene Geosynthetic Microstructure and Carbon Black Dispersion", Geosynthetics '89, IFAI, Roseville, MN, 1989, pp. 421-432.
- 89-4 Peggs, I.D., "Fractography of Polyethylene", Invited presentation at the Workshop on Testing Methods and Fracture Surface Analysis in Polyethylene", Union Carbide, Polyolefin Specialties Division, March, 1989.
- 89-5 Peggs, I.D., "Geomembranes: Opportunities and Problems", Invited presentation at the Inauguration of Drexel University's Student Chapter of North American Geosynthetics Society, March, 1989.
- 89-6 Peggs, I.D., "Stress Cracking in Polyethylene Geomembranes", Austrian Innovation Research Workshop, Linz, Austria, May 1989 (1 of 18 invited participants).
- 89-7 Peggs, I.D., "Evaluating our Tests," Interview section of Geotechnical Fabrics Report, Roseville, MN, May/June, 1989.
- 89-8 Peggs, I.D., and Pearson, D.L., "Leak Detection and Location in Geomembrane Lining Systems", presented at the ASCE Florida Section Annual Meeting, Fort Lauderdale, FL, September 1989.
- 89-9 Peggs, I.D., "Conformance and Performance Testing of Geotextiles and Related Geosynthetics", Proceedings of the International Geotextile Seminar (Ed., Ichizou Yamaoka), Osaka, Japan 1989, pp. 175-221.
- 89-10 Peggs, I.D., "Destructive Testing of Polyethylene Geomembrane Seams: Various Methods to Evaluate Seam Strength", Seaming of Geosynthetics, Elsevier Science Publishing Co., Inc., NY, 1989, pp 125-133.
- 90-1 Peggs, I.D., and Carlson, D.S., "The Effects of Seaming on the Durability of Adjacent Polyethylene Geomembrane", Geosynthetic Testing for Waste Containment, ASTM STP 1081, Philadelphia, PA, 1990, pp 132-142.
- 90-2 Tisinger, L.G., Peggs, I.D., Dudzik, B.E., Winfree, J.P., and Carraher, C.E., Jr., "Microstructural Analyses of a Polypropylene Geotextile after Long-Term Outdoor Exposure", *Ibid.* pp 335-354.
- 90-3 Peggs, I.D., "Durability Testing of Geosynthetics", Geosynthetics in Geotechnics, 1990 Chicago Geotechnical Lecture Series, American Society of Civil Engineers (Geotechnical Division of the Illinois Section) and the Illinois Institute of Technology, Chicago, IL, 1990.
- 90-4 Peggs, I.D., "Durability of Geosynthetics" presented to the Florida Society of Professional Engineers, West Palm Beach, FL, April 19, 1990.
- 90-5 Peggs, I.D., Carlson, D.S., and Peggs, S.J., "Understanding and Preventing 'Shattering' Failures of Polyethylene Geomembranes", Geotextiles, Geomembranes and Related Products, Balkema, Rotterdam, 1991, pp 549-554, Vol 2.

- 90-6 Peggs, I.D., and Carlson, D.S., "Examination of the Microstructure of Geomembranes and Seams by Light Transmission Microscopy", *ibid.* pp 590.
- 90-7 Giroud, J.P., Thompson, J., Fluet, J.E., Jr., Peggs, I.D., and Ingold, T., "Geosynthetic Lining Systems", a seminar presented jointly by GeoServices Inc., Consulting Engineers and Jason Consultants S.A. at the 4th International Conference on Geotextiles and Geomembranes, The Hague, The Netherlands, May, 1990.
- 90-8 Giroud, J.P., and Peggs, I.D., "The Geomembrane Waste Age: The Eighties - And Nineties", *Waste Age*, 1990, pp 20, 22, and 130.
- 90-9 Peggs, I.D., "Testing Labs in the Geo-Industry", *Innerview* section of *Geotechnical Fabrics Report*, 1990, Vol. 10, No. 4, Roseville, MN, USA, Jul.-Aug. 1990, p. 44.
- 90-10 Giroud, J.P., and Peggs, I.D., "Geomembrane Construction Quality Assurance", *Waste Containment systems: Construction, Regulation and Performance*, Geotechnical Special Publication No. 26, ASCE, pp. 190-225, 1990.
- 90-11 Peggs, I.D., "Microstructural Examination of Fiberglass Yacht Hulls", presented to Ft. Lauderdale Mariners Club, October 1990.
- 90-12 Peggs, I.D., and Swan, R.S., Jr., "Testing Geosynthetics Used in Landfill Caps", 4th GRI Symposium, Geosynthetic Research Institute, Philadelphia, PA, December 1990.
- 91-1 Peggs, I.D., Winfree, J.P., and Giroud, J.P., "A Shattered Liner Case History: Solution and Remediation," *Geosynthetics '91*, IFAI, Roseville, MN, 1991, pp. 495-505.
- 91-2 Peggs, I.D., "Fingerprinting (How Close is Close?) and Beyond", *Workshop on Chemical Fingerprinting of Geosynthetics*, USEPA, Cincinnati, OH, August 1991.
- 91-3 Peggs, I.D., "Testing Program to Assure the Durability of Landfill Liners", *Proceedings of the 3rd International Landfill Symposium*, Sardinia, October 1991, CISA, Cagliari, Italy, pp 651-665, Vol. 1.
- 91-4 Peggs, I.D., "PVC and HDPE Geomembranes in Municipal Waste Landfill Liners and Covers: The Facts", presented to Michigan Department of Natural Resources, October 1991. Also presented to environmental regulators in New York, Florida, Pennsylvania, California, Arkansas, and Wisconsin.
- 91-5 Peggs, I.D., THE IAN PEGGS COLUMN, *Geosynthetics World*, Vol. 2, Issue 5, December 1991. Regular column.
- 92-1 Peggs, I.D., "Whither PVC?", "Innerview" section of *Geotechnical Fabrics Report*, Roseville, MN, Jan/Feb 1992, pp 44-48.
- 92-2 Peggs, I.D., "Geomembrane Problems and Their Prevention", A.G. Weeks and Partners Seminar, Maidstone, England, March 1992.
- 92-3 Peggs, I.D., "Geosynthetics CQA: Why and How?", North Carolina Chapter of ASCE, Charlotte, SC, April 1992.

- 92-4 Peggs, I.D., "Geosynthetic Lining Systems: Assuring Performance and Durability", Swedish Geotechnical Institute, Stockholm, Sweden, June 1992.
- 92-5 Kanninen, M.F., Peggs, I.D., and Popelar, C., "Assuring Durability of HDPE Geomembranes." Standardization News, ASTM, Philadelphia, September 1992. pp 2-7.
- 92-6 Peggs, I.D., and Steinle, E.R., Jr., "Geosynthetics Construction Quality Assurance: A Change in Philosophy", IGS News, International Geotextile Society, Vol. 8, No. 3, Easley, SC, November 1992, p 4.
- 93-1 Peggs, I.D., "Why Landfill Liner CQA Is Essential", Journal of the Institute of Waste Management, Northampton, England, March 1993, p 46.
- 93-2 Peggs, I.D., "Practical Geoelectric Leak Surveys with Handheld, Remote, and Water Lance Probes: Concrete Basin and Waste Cell Liners", Proceedings Geosynthetics '93, Industrial Fabrics Association International, Roseville, MN, March 1993 pp 1523-1532.
- 93-3 Peggs, I.D., Lewis, S., and Riegl, P., "Evaluation of a Friction/Drainage Structured Geomembrane", *ibid.* pp 1053-1064.
- 93-4 Kanninen, M.F., Peggs, I.D., and Popelar, C.H., "A Methodology for Forecasting the Lifetimes of Geomembranes that Fail by Slow Crack Growth", *ibid.* pp 831-844.
- 93-5 Peggs, I.D., Lewis, D.R., and Dewijn, T., "Geomembranes for the Containment of Pulp Mill Hot Black Liquors: Problems and Remediation", *ibid.* pp 1357-1372. Nominated for Award of Excellence.
- 93-6 Cadwallader, M., Cranston, M., and Peggs, I.D. "White-Surfaced HDPE Geomembranes: Assessing Their Significance to Liner Design and Installation", *ibid.* pp 1065-1080.
- 93-7 Peggs, I.D., Bowen, R., Rigo, J.M., Hoekstra, S., and Courard, L., "Development of Optimum Seaming Parameters for an FCEA Geomembrane", *ibid.* pp 1013-1026.
- 93-8 Peggs, I.D., "Geosynthetics Materials Failures: An Overview", Antec '93, Society of Plastics Engineers, New Orleans, LA, May 1993, pp 2021-2025, Vol. 2.
- 93-9 Peggs, I.D., and Steinle, E.R., Jr., "Construction Quality Assurance for Landfill Lining System Geomembranes", *ibid.* pp 20188-2020, Vol. 2.
- 93-10 Peggs, I.D., Landfill Liners: Geomembrane Quality Assurance. CQA Seminars Presented for Manstock Geotechnical Consultancy Services, Manchester, and London, UK, April 1993.
- 93-11 Peggs, I.D., "MSW Landfill Liners: Assuring Quality and Durability", Solid Waste & Power, Kansas City, MO, May/June 1993, Vol. VII/No.3, pp 53, 54, 56, 58, 59.
- 93-12 Lewis, D.R., Peggs, I.D., Kilius, D.E., and Dewijn, T., "Geomembrane Liners for Black Liquor: Problems and Remediation". Proceedings Canadian Pulp and Paper Industry Environment Conference, Whistler, British Columbia, Canada, May 1993.
- 93-13 Peggs, I.D., PVC Geomembranes in Municipal Waste Landfill Liners and Covers: The Facts. Land and Water, July/August 1993, pp 36-39.

- 93-14 Peggs, I.D., "Geomembranes for Waste Containment Liners and Cover: Is There a Choice?", Proceedings The 4th International Landfill Symposium, Sardinia, October 1993, pp 121 - 127, Vol 1.
- 93-15 Peggs, I.D., "Advances and New Thinking in Landfill Liner Construction Quality Assurance Practices", Proceedings The 4th International Landfill Symposium, Sardinia, October 1993, pp 325 - 332, Vol 1.
- 93-16 Peggs, I.D., "Geosynthetic Forensic Analysis & Testing", Geotechnical News, BiTech Publishing, Vancouver, B.C., 1993.
- 93-17 Peggs, I.D., "HDPE Geomembrane Seams: Acceptance Criteria and Critical Defects". Proceedings The 7th GRI Conference, Geosynthetic Liner Systems: Innovations, Concerns and Designs, Philadelphia, PA, December 1993, pp 24-31.
- 94-1 Peggs, I.D., "Infrared Thermographic Nondestructive Testing of HDPE Geomembranes Seams: A Feasibility Study", Modern Double Lined Landfill Management Seminar, New York State Department of Environmental Conservation, New York, January 1994.
- 94-2 Peggs, I.D., Kanninen, M. "HDPE Geosynthetics: Premature Failures and their Prediction", Transportation Research Board Annual Meeting, Washington, January 1994.
- 94-3 Peggs, I.D., Interview Geosynthetics World, Linz, Austria, April 1994, pp 7-8, Vol. 4, No. 4.
- 94-4 Peggs, I.D., "Geomembranes for Lining Systems: Materials Performance and Quality Assurance", EXPOMIN '94, Santiago, Chile, May 1994.
- 94-5 Peggs, I.D., Miceli, G.F., McLearn, M.E., "Infrared Thermographic Nondestructive Testing of HDPE Geomembranes Seams: A Feasibility Study", 5th International Conference on Geotextiles, Geomembranes and Related Products, Singapore, September 1994, pp 941 - 944.
- 94-5 Peggs, I.D., Rollin, A.L., "Seam in HDPE Geomembranes: The Quality Target", *ibid.* pp 949 - 952.
- 94-7 Peggs, I.D., Glos, G., Haxo, H.E., "A Geomembrane Liner Failure: Design, Installation, and Communication Lessons Learned", *ibid.* pp 1077 - 1080.
- 94-8 Richardson, G.N., Peggs, I.D., Barton, W., "30 Year Lifetime Landfill Exposed Geomembrane Cover: Performance Criteria, Material Selection, and Design Features", *ibid.* pp 1097 - 1100.
- 94-9 Peggs, I.D., "Classification and Standards Applicable for Geosynthetics", "Basic Construction Techniques: Laying, Cutting, Jointing", "Waste Containment and Pollution Control (including leak detection): Design, Construction QC, and New Developments", "Liner Leak Survey, Failure Analysis & Remediation", "Implementation of an Independent CQA Plan for Waste Containment". Short courses at The Asian Institute of Technology, Bangkok, 1994.
- 94-10 Peggs, I.D., "Performance Characteristics of PVC Geomembranes", PVC Geomembrane Institute videotape, 1994.
- 95-1 Peggs, I.D., "The Meaning of CQA", Geotechnical Fabrics Report, Vol. 13, Number 1, IFAI, Roseville, MN, 1995, pp. 14-15.

- 95-2 Peggs, I.D., "Landfill Liners: Geomembrane Quality Assurance", Manstock Geotechnical Consultancy Services Ltd., Seminars, Manchester and Glasgow, UK, February 1995.
- 95-3 Peggs, I.D., Gloss III, G.H., Haxo, H.E., "Lessons Learned from a Large Pond Geomembrane Failure", Proceedings of Geosynthetics: Lessons Learned from Failures, Geosynthetics '95, IFAI, Roseville, MN, 1995, pp. 255-262.
- 95-4 Peggs, I.D., Kanninen, M.F., "HDPE Geosynthetics: Premature Failures and Their Prediction", Geosynthetics International, Vol. 2, No. 1, pp. 327-339.
- 95-5 Peggs, I.D., "Research on Testing and Welding of PE Geomembranes" Workshop, DSM Polyethylenes, Maastricht, The Netherlands, April 1995.
- 95-6 Peggs, I.D., "Geomembrane Liners: Applications, Selection, and Performance", KAITOS-DAY, Helsinki, Finland, April 1995.
- 95-7 Peggs, I.D., "Assessing Geomembrane Seam Strength - Nondestructively!", Geotechnical Fabrics Report, Vol. 13, Number 5, IFAI, Roseville, MN, 1995, pp. 16-20.
- 95-8 Peggs, I.D., "An Integrated Quality Program for the Specification and Installation of Geomembrane Lining Systems for Solid Waste and Liquid Containment", indesca-plastilago, Venezuela, July 1995.
- 95-9 Peggs, I.D., "Geomembrane Performance" Workshop, Bregenz, Austria, 29 September 1995.
- 95-10 Peggs, I.D., Trauger, R., "A Practical Integrated Quality Testing Program for Geosynthetic Clay Liners", MSW Management, Vol. 4, No. 5, Forester Communications, Santa Barbara, CA, 1995, pp. 42-47.
- 95-11 Peggs, I.D., Glos, G., and Haxo, H.E. Jr., "A Geomembrane Liner Failure: Design, Installation, and Communication Lessons Learned", Geosynthetics: Lessons Learned from Failures, IFAI, Roseville, MN, pp. 255-262.
- 96-1 Peggs, I.D., "Geomembrane Specifications" - Smith, Pachter, McWhorter & D'Ambrosio.
- 96-2 First Germany/USA Geomembrane Workshop, "HDPE Geomembrane Seaming and Testing", Berlin, Geotextiles and Geomembranes, Oxford, UK, Vol. 14 No. 12 December 1996.
- 96-3 Peggs, I.D., "A Reassessment of HDPE Geomembrane Seam Specifications", Proceedings of Geosynthetics: Applications, Design and Construction, 1996, Balkema, Rotterdam, pp 693-696.
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