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CURRICULUM VITAE

Dr. Wayne W. Tennesey, P. Eng.
TESTLABS INTERNATIONAL LTD.
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PROFESSIONAL EMPLOYMENT

Metallurgist/Corrosion Engineer, Mechanical Engineer who practices forensic engineering in the following areas: Metallurgical and Polymeric Materials Failure Analysis, Fire/Explosion Investigation.

GENERAL INTRODUCTION

Dr. Tennesey has practiced as a metallurgical and mechanical engineer as well as a corrosion engineer for 39 years.

For 20 years Dr. Tennesey has been President of Testlabs International Ltd. He performs corrosion and fracture/failure analysis, forensic engineering, accident and fire investigations, materials testing and sophisticated fatigue and heat treating design for insurance, legal and industrial clients. He has published and presented papers in the areas of failure analysis of metals and coatings, fracture mechanics, corrosion of stainless steel and orthopedic surgical implants, and coating failures.

AREAS OF SPECIALIZATION

- Corrosion survey and ultrasonic thickness measurements
- Corrosion and fracture failure analysis of metallic components
- Fire/explosion investigation
- Failure analysis and testing of industrial equipment
- Expert witness testimony for litigation
- Insurance loss investigation
- Coating failure analysis
- Traffic accident reconstruction
- Coating specification for hostile environments
- Recommendation of corrosion control measures
- Specification of materials for corrosive and high temperature environments
- Chemical analysis of metals and surfaces
- Hardness and tension testing
- Metallography

EXPERT WITNESS EXPERIENCE

Dr. Tennesey, P. Eng., has served as an expert witness in court on several occasions:

- on behalf of Manitoba Hydro, regarding the Statute of Limitations involving the design and construction of three turbine generators in 1963 which exploded on March 10, 1992 causing Manitoba Hydro to suffer a loss of profits totalling \$30,000,000.00, December 1997. Manitoba Hydro was granted leave to sue the designers and contractors of the three turbine generators in a judgement delivered June 16, 1998. In June 2008 Manitoba Hydro accepted a settlement offer of \$21,000,000.00 from the insurance company for the contractor of the generating station.
- on behalf of an insurance company seeking damages from a water main contractor when the retaining rods connecting a city water main to an institutional building corroded and separated, causing extensive flood damage, 1996.
- on behalf of an engine rebuilding company in Winnipeg, Manitoba regarding the failure analysis of a damaged engine; December, 1994
- for Manitoba Workman's Compensation Board vs. Canada Post for compensation of a fatal accident involving a mechanic working below a scissor lift; January 1992
- for the Crown in which Consumer and Corporation Affairs Canada was prosecuting a retailing company for false advertising of automotive parts
- for Winnipeg Hydro, in a fire loss in which it was alleged that defective wire couplers had contributed to a fire; December 1990
- for the R.C.M.P. in a criminal manner involving a death caused by drinking and a broken steering component of a boat
- for Workplace Safety and Health Division, Province of Manitoba in the inquest of a fatal accident involving a worker and a garbage truck
- a private contractor in Regina, Saskatchewan in a product liability case involving a major manufacturer of heavy construction equipment.

PERTINENT EXPERIENCE

1. Other product liability and insurance loss situations recently carried out or currently underway include:
 - (a) on behalf of Manitoba Hydro, regarding the Statute of Limitations involving the design and construction of three turbine generators in 1963 which exploded on March 10, 1992 causing Manitoba Hydro to suffer a loss of profits totalling \$30,000,000.00, December 1997. Manitoba Hydro was granted leave to sue the designers and contractors of the three turbine generators in a judgement delivered June 16, 1998. In June 2008 Manitoba Hydro accepted a settlement offer of \$21,000,000.00 from the insurance company for the contractor of the generating station.
 - (b) December 2000, an approximate \$800,000.00 settlement was reached involving an injury to a member of the audience at the Winnipeg Folk Festival, Birds Hill Park when a lighting tower fell over during high winds.
 - (c) August 2000, Retained by the Manitoba Workplace Safety and Health Division to provide a metallurgical investigation of an accident involving a reverberatory furnace in the copper smelter (Hudson Bay Mining and Smelting, Flin Flon, MB)
 - (d) June 2000, an approximate \$1,300,000.00 settlement was reached in a hog barn fire involving the improper use of spalled concrete as evidence to suspect arson as the cause of fire.
 - (e) September 1995, an **80% settlement was achieved** for an accident involving injury to a child as a result of a **fractured bicycle fork**, based on our metallurgical failure analysis report.
 - (f) In April, 1994 was retained by the Office of the Fire Commissioner, Province of Manitoba, Fire Investigation Section to undertake a failure analysis of a flexible connector from the explosion/fire at 745 Pembina Highway, Winnipeg, Manitoba.
 - (g) Jointly retained by CP Rail and CN Rail to investigate a railroad derailment, which occurred in Manitoba. The derailment involved a loss of approximately \$1,000,000.00.
 - (h) Retained as a metallurgist/fire investigator by a legal firm/insurance company in a fire loss where it was alleged several hundred thousand dollars of jewellery (including Rolex watches and a Cartier watch) "vapourized and disappeared" in a fire. The insurance company was successful in negotiating a reduction of their fire loss as a result of our report.
 - (i) Retained as an engineering expert witness by a legal firm/insurance company against the manufacturer of a grain auger, which fell onto a farmer, leaving him a paraplegic. The resulting lawsuit is in excess of \$1,000,000.00.
 - (j) Retained as a failure analysis expert by Sears Canada Inc. to investigate the failure of a stacking crane in a computerized warehouse, which fell several floors, injuring and disabling two workers. It was found that the manufacturer of the carpet stacker had used a defective/low strength shaft, which directly caused the accident.

3. During 30 years of consulting engineering, there has been opportunity to study and examine a wide variety of corrosion failures involving metals, including; mild steels, gray cast iron, stainless steels, copper alloys, aluminium alloys, etc.
4. Published and presented three articles in the field of corrosion. Has presented one paper on coating failures (please see list of publications).
5. Teaching corrosion to 4th year mechanical engineers, University of Manitoba - Sessional Lecturer for 3 years.
6. Published and presented two articles on fracture and cracking of industrial components (please see list of publications).
7. Regularly attend conferences on the failure analysis of metallic components and fire investigations/forensic engineering.

EDUCATION

- 1969 - B.Sc. in Mechanical Engineering, University of Manitoba.
- 1972 - M.Sc., Corrosion Engineering, University of Manitoba - Thesis Topic: Corrosion of Type 316L Stainless Steel.
- 1972 - Registered as a professional engineer, Province of Manitoba.
- 1981 - Certificate of Attendance - Failure Analysis of Structural Welds in Highway Bridges and Large Structures, Course Instructor: Mr. Carl E. Hartbower, Principle Welding Engineer, Federal Highway Administration, Washington, DC, American Society for Metals, April 7-9, 1981, Metals Park, Ohio.
- 1982 - Ph.D., University of Manitoba, Metallurgical Sciences Laboratory, Thesis Topic: Mechanical Properties of Directionally Solidified Cobalt - Tantalum Carbide Composite Castings.
- 1987 - Attended 1987 International Symposium for Testing and Failure Analysis, American Society for Metals, November 11-13, 1987, Los Angeles, CA.
- 1989 - Attended Minnesota Fire - Arson Investigation Conference, March 16-18, 1989, Minneapolis, MN. Took part in workshops on:
 - (a) vehicle fire investigations,
 - (b) basic fire cause determination,
 - (c) thermal runaway.
- ** 1990 - Certified Fire and Explosion Investigator, Reg. No. 3342-306, National Association of Fire Investigators, Chicago, Illinois.
- 1990 - Certificate of Completion of the NACE Course - Basic Corrosion, Written Examination Score was 98.0%, February 4-9, 1990, Winnipeg, Manitoba.**
- 1990 - Certificate of Attendance - Coating Failure Analysis and Instrumentation for Coating Inspection, Steel Structures Painting Council, 1990 Pulp and Paper Seminar, Tacoma, Washington, July 9-11, 1990.

- 1991 - Certificate of Completion of the NACE Course, **Protective Coatings and Linings**, Written Examination Score was 87.0%, February 24 - March 2, 1991, Winnipeg, Manitoba.
- 1991 - International Conference on Failure Analysis Sponsored by ASM International Papers covered Failure Analysis in Aircraft Industry, Industrial Components such as bearings, automobile weldments, Montreal, July 8 - 11, 1991.
- 1992 - Certificate of Completion of the NACE Course, **Cathodic Protection - Theory & Data Interpretation**, Written Examination Score was 84.0%, March 1-6, 1992, Winnipeg, Manitoba.
- 1993 - Conference of the **Canadian Society of Forensic Scientists** held in Winnipeg, Manitoba. Attended Workshops on **Electrical Fires, Expert Evidence**.
- 1995 - Completed a winter session course in **Non-Destructive Testing and Applied Techniques - Ultrasonic Techniques** at Red River Community College. Written score was B.
- 1998 - Attended **International Association of Fire Investigators** conference in St. Cloud, Minnesota, March 25 - 27. (Evidence collection/arson evidence, gas/electric appliances, fire scene investigation, fire photography, case preparation.)
- 1998 - Attended conference on Analysis of In-Service Failures and Advances in Microstructural Characterization along with special tutorial lecture series: Session 1 - Mechanisms and Fracture Surfaces; Session 2 - Fractography and Microstructures. The 31st Annual Convention of the International Metallographic Society, July 26-29, 1998, Ottawa, Canada.
- 1999 - Attended ASM International Materials Solution Conference and Exposition and the 32nd Annual Convention of the International Metallographic Society, 31 October - 3 November, 1999, Cincinnati, Ohio.
- 2000 - Attended NACE Northern Area International Conference, "Corrosion Prevention 2000", November 6-8, 2000, Toronto, Ontario.
- Attended sessions:
- (a) Options to Protect or Preserve Coated Steel Pipeline
 - (b) Case Histories of Corrosion Problems
 - (c) Monitoring Pipeline Integrity
- 2002 - Attended Society of Plastics Engineers and Bodycoate, Inc. – PLASTICS FAILURE ANALYSIS WORKSHOP, April 15-16, 2002, Chicago, Illinois.
- 2003 - Attended National Advanced Fire, Advanced Arson and Explosion Training Program, October 25-30, 2003, Toronto, Ontario.
- 2003 - Re-certification as a Fire and Explosion Investigator, National Association of Fire Investigators, November 2003, Toronto, Ontario.
- 2006 Level I Thermographer Certification FLIR Systems (Certification No. 29566)

PROFESSIONAL AFFILIATION

- Registered Professional Engineer, Provinces of *Manitoba, Saskatchewan, Alberta, and Ontario*
- Member International Association of Arson Investigators
- Member National Association of Fire Investigators
- **Member National Association of Corrosion Engineers (NACE)**
- Member American Society of Metals International
- Member Steel Structures Painting Council (SSPC)
- **Chairman, Manitoba Chapter of the National Association of Corrosion Engineers (NACE), 1991-92.**

LABORATORY SUPPORT

Testlabs International Ltd. is a metallurgical/mechanical engineering practice and metallurgical laboratory service which offers a scientific approach to materials problem solving.

(a) Analytical Equipment

Testlabs International Ltd. offers a fully equipped metallography laboratory with a large abrasive wet cut-off saw capable of cutting the hardest metals, along with mounting, grinding and polishing equipment. A Nikon light microscope fitted with a video monitor is available for micro-structural analysis. Macro-photography is carried out with a Nikon stereomicroscope or a Nikon digital camera. A Versitron Digital Rockwell hardness tester can be used for Rockwell B and C scale hardness testing.

Also available is scanning electron microscopy and EDX microchemical analysis of fracture surface and corrosion products; Vickers and Vickers microhardness testing for weld hardness traverses, plating and case hardened layers; Krautkramer Portable hardness tester (Rockwell C scale) for on site hardness measurements; field metallography; tension testing (at room, sub-zero and elevated temperatures) and Charpy impact testing. Coating thickness and coating adhesion testing is also available.

(b) Professional Staff Support

- one Ph.D. Mechanical Engineer (corrosion, fire and explosion investigator, plastic failure analysis)
 - one B.Sc. Mechanical Engineer (stress analysis, computer methods, engines, mechanical devices)
 - one Administrative Assistant (Business Administration, Office Management)
 - one Metallurgical Technologist (machining, mechanical testing, metallurgical preparation of sample)
- one bookkeeper / accounts payable person

PUBLICATIONS/PRESENTATIONS

1. Tennessee, W.W. and Cahoon, J.R., "Sensitization", Still a Problem in the Intergranular Corrosion of Stainless Steel Surgical Implants. *Biomater., Med. Dev., Art. Org.*, 1 (4), 635-645 (1973).
2. Cahoon, J.R., Chaturvedi, M.C., and Tennessee, W.W., "Corrosion Studies on Metallic Implant Materials", *Med. Instrum.*, 7 (2), 131-135 (1973).
3. Tennessee, W.W. and Cahoon, J.R., "The Mechanical Properties of Directionally Solidified Co-Cr-Ni-Ta-C Castings". Paper presented at Conference of Metallurgists, Edmonton, August 21-24, 1983.
4. Tennessee, W.W. and Bassim, M.N., "Observations of Crack Size in Failure Analysis Case Studies". Paper presented at Conference of Metallurgists, Edmonton, August 21-24, 1983.
5. Cahoon, J.R. and Tennessee, W.W., "The Tensile and Creep Properties of Directionally Solidified Co-Cr-Ta-C Castings", *Canadian Metallurgical Quarterly*, 23 (4), 459-470 (1984).
6. Tennessee, W.W. and Bassim, M.N., "Applications of Fracture Mechanics in Failure Analysis Case Studies", *Canadian Institute of Mining Bulletin*, 107-112, June 1985.
7. Tennessee, W.W., "Unusual Instances of Stress Corrosion Cracking", a paper presented at the Annual Conference of Metallurgists, Canadian Institute of Metallurgy, August, 1987.
8. Tennessee, W.W., "Failure Analysis of Industrial Coatings", a paper presented at the 1991 NACE Canadian Region Western Conference, February 19-21, 1991, Saskatoon, Saskatchewan.
9. Tennessee, W.W., and Aitchison, J., "Low Temperature Stress Corrosion Cracking of Type 304 Stainless Steel in Hydroelectric Plants, a paper presented at 1995 NACE Canadian Region Western Conference, February 19-12, 1995, Regina, Saskatchewan.
10. Tennessee, W.W., published photomicrograph of microbiologically influenced corrosion (MIC) near a weldment in Type 316L stainless steel - case history of failure in a starch line from a pulp and paper mill, *Advanced Materials and Processes*, Vol. 155, (2), p.26, February 1999.