John Fildes, Ph.D.
Spotlight Business Consulting LLC
www.SpotlightBC.com
jfildes@SpotlightBC.com
(630) 248-0836

Investigating Chemistry and Materials Issues

Dr. Fildes often investigates incidents involving industrial and chemical processes and equipment, consumer products, aviation incidents, building materials, utility operations, roadways and foundations, and sensors and controls, to name a few. For example, he investigated corrosion of aircraft and industrial equipment; the performance of lubricants, wear-resistant coatings, paint and protective coatings, and building products; the failure of composite materials and adhesives used in aircraft and industrial equipment; the volatility and evaporation of fluids; the permeability and transport of moisture in cavities and materials; the properties of aggregates and concrete; the absorption of moisture and expansion of wood and engineered wood products; cracking and failure of asphalt and concrete; the chemical conditions that exist in industrial process equipment and the performance of materials exposed to these conditions; and the cause of odor and flammability of spray polyurethane foam.

The Role of Chemistry

It is not enough to be an expert in a narrow technical domain. The incidents Dr. Fildes investigates are often characterized by being multidisciplinary in scope, complex, and involving uncertainty and missing information. He deals with materials that are no longer made or that are no longer available for testing, that have been used in a non-conventional manner or environment, and with situations involving poor and incomplete documentation. For example, he has estimated the volatility of oils that are no longer made but are still in use, the expansion and contraction of engineered flooring installed in different seasons, and the water content of aggregates in foundations that were already removed and not available for testing.

Physical chemistry is central to investigating the performance and failures of chemical processes and materials, and provides the foundation of materials science, and of the methods to measure and model the performance of materials. For example, Dr. Fildes has established the cause of failures involving asphalt and concrete where performance involves chemical reactions, mechanical properties, packing of aggregates, and environmental conditions. He has also established the cause of failures and the performance of materials in mechanical systems involving lubricated rubbing contact, the understanding of which requires chemistry and mechanics.

Dr. Fildes conducts investigations using the scientific method, which is the standard adopted by the Supreme Court, and the approach of academia and industry to R&D. Investigations related to insurance claims and litigation, be they large of small, are about asking questions that illuminate the key issues and answering them clearly in a way that is authoritative and compelling. Dr. Fildes' strong analytical skills are essential to overcoming complexity and uncertainty and filling the gaps due to missing information. For example, he established the cause of corrosion in chemical process equipment where several metallurgists could only identify the type of corrosion. Dr. Fildes' investigations often change the course of litigation. He is easy to work with and provides objective, accurate, and actionable insight.

Experience and Case Study

Dr. Fildes has investigated several aircraft and helicopter crashes involving fatalities. Two helicopter crashes were alleged to have occurred because of a repair procedure that was claimed to have degraded an advanced material. A technical investigation of this type involves design, materials, mechanical engineering, chemistry, and certification and standards. Dr. Fildes' multi-disciplinary work was the basis for establishment of Northwestern University's federally funded Advanced Materials Processing Center.

The other side used a narrow approach and based their case on Finite Element Analysis (FEA) of stresses and failure modes of advanced materials. Dr. Fildes' approach in contrast was more comprehensive being based on the physical chemistry aspects of the materials and the thermodynamics of the repair procedure. This allowed identification of the key underlying issues, which FEA analysis did not. Dr. Fildes was able to demonstrate that the repair procedure was not capable of producing high enough temperatures to degrade the materials. Knowing what to expect, Dr. Fildes performed testing with a realistic sized part that was instrumented with temperature sensors, and this clearly showed that the repair did not cause a sufficient temperature increase to degrade the material, and it did so in a way that was credible, authoritative, compelling, and easily understood by people who lacked a technical background.

In another case involving the breakup of a helicopter blade, Dr. Fildes was the only of the several experts to review the manufacturing log and identify a manufacturing defect that was consistent with features observed in the cured resin of the failed blade. This defect explained the cause of the failure.

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Dr. John Fildes

John Fildes, Ph.D. is uniquely qualified through experience and training to provide insight on the role of science and engineering in litigation. In addition to conducting highly successful technical investigations for high-stakes litigation involving a wide spectrum of metals and materials, chemical processes, and sensors and controls. He also organized and conducted over $27.5 million in funded projects including research, development, and collaborations involving Government labs, large companies, and leading universities. John was instrumental in establishing and served as co-Director of Northwestern University's federally funded Advanced Materials Intelligent Processing Center, which was a was a highly successful collaboration involving University staff and professors, McDonnell Douglas (now part of Boeing), the Office of Naval Research, the Naval Air Warfare Center, and the Naval Sea Warfare Center and small companies. He is a doctoral-level scientist who has 50 published papers, reports and presentations, and has 3 patents. John's credits involve:

- *John's pioneering work was the basis for formation of Northwestern University's federally funded Advanced Materials Intelligent Processing Center. John's R&D involved advancing the state of knowledge of the sequence of thermoset cure reactions and their relation to performance and again, and the development of models and model-based processing methods that were the basis for equipment tested by McDonnell Douglas, Northwestern, and a small composites company, Production Products – St. Louis.*
- *John has investigated the failure of composite aircraft prats, the relationship of process deviations to composite performance, the relationship of resin chemistry and installation procedures to spray foam odors and fires, the expansion and contraction of wood products, and chemical issues involved in roadway resurfacing processes.*
- *John's R&D experience with statistics in experimental design and data analysis has been used in construction litigation cases where estimates of water leakage and materials failures were made from a small sample of units.*

Our gatekeeper approach provides:

- ✓ *The quickest and best possible outcome.*
- ✓ *A unique opportunity for early resolution based on knowing 60% to 80% of what might ultimately be uncovered.*
- ✓ *Superior technical insight for even complex and multidisciplinary issues.*
- ✓ *A reliable basis for expert testimony that meets rules for admissibility established by the Supreme Court.*
- ✓ *A strategic advantage with corporate clients since they already appreciate that this approach improves outcomes and lowers costs through use of all existing knowledge and elimination of duplication.*

Our gatekeeper approach uses information research and analytics early in technically related cases and *establishes the* key *MAKE OR BREAK technical issues and everything that is known about them.* This approach requires someone who has the extensive experience with both contemporary R&D methods and litigation-related expert witness investigations so as to adapt the corporate R&D technical investigation process to the unique aspects of litigation expert witness investigations. Our experience to do this is reflected in our process to bring litigators the R&D technical investigation techniques that have revolutionized industrial R&D, providing litigators with the better outcomes and lower costs that industry has achieved in overcoming similar investigation challenges.

1. Define the Technical Issues – Inspections, insight from litigation parties, and broad literature searching are conducted to gather information from prior related cases, trade association publications, patents, manufacturer's marketing materials and reports, and Internet forums to establish the key technical issues.

2. Use Analytics to Establish What is Known About the Technical Issues – The data gathered above is analyzed using contemporary tools for data mining and modeling to adapt the available data and fill the gaps that always exist in litigation investigations.

(3) Reliably Define the Testing Needed – The data that has been collected and analysis that has been done ensures that: existing knowledge is not recreated, the remaining work is properly focused, and all involved parties understand the challenges, methods, and progress.

(4) Coordinate, Oversee, and Effectively Communicate – This approach ensures that the overarching technical concepts are effectively framed and communicated, and it eases report preparation. The results are well supported, clear, and compelling even to people not knowledgeable of science and engineering.