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Representative Forensic Engineering Cases/Projects:

Metallic Water System Failures - Completed (8) failure analyses involving metallic water-piping systems. Piping materials included galvanized steel, carbon steel and copper. Two of these cases involved litigation. In each case the chemistry of the water was analyzed and evaluated for aggressiveness towards the particular pipe material being used. In three of the cases microbiological-influenced corrosion (MIC) was investigated as a contributor to the failure. Chemical corrosion inhibitors were being used – either correctly or incorrectly – in two of the cases and that usage was investigated. Other factors considered included flow velocities, pre-treatment with a biocide, the effect of debris in the water and poor welds at the pipe joints.

Personal Injury Due to Failure of Riding Lawnmower – Completed an analysis of the failure of an operating handle used to raise and lower the cutting blade deck on a riding lawnmower. The handle failed at welds and released an internal spring that flew up and caused serious eye injury to the mower operator. The investigation included evaluation of the material and welds used, the mechanical design of the operating handle and the role of low-cycle fatigue. Detailed mechanical design calculations were completed. The work involved a suit brought by the injured person. The case was settled before trial after the report was delivered.

Failure of Steam Boiler Tubes – Carbon steel water wall tubes in a large electric power steam boiler were investigated after selected tubes split open and the boiler had to be shutdown. Both fireside and waterside deposits were found on the failed tubes. Heat transfer calculations were completed to define the likely, maximum in-service temperatures experienced by the tube material. The failed tubes had greatly reduced allowable yield stresses at the raised temperatures predicted from the heat transfer calculations.

Failure of Cast Iron Valve Body – The in-service failure of a cast iron valve body used in a fire water protection system was investigated. The extent of internal corrosion, the mechanical properties of the cast material and the general quality of the casting were evaluated along with the specific service conditions. It was concluded that the cause of the failure was a very high strain rate produced by the rapid closure of an upstream automatic valve and the resulting water hammer effect that occurred in the failed valve.

Failure of Truck Tanker Trailer – The failure of a rubber-lined, steel tanker trailer that resulted in the release of several hundred gallons of hydrochloric acid onto a highway and acid burns to the ankles of the truck driver was investigated. The incident involved a suit and providing a deposition. It was found that the failure originated on the exterior surface of the carbon steel tanker shell under a rolled stiffener used to reinforce the trailer. Condensation collected on this unpainted portion of the tanker and over many years penetrated the shell thickness. The affected area was under the stiffener and could not be detected by routine inspections. A settlement between the parties was reached.

Investigation of Corrosion on a Weathering Steel Crane in a Marine Environment – Extensive atmospheric corrosion on an uncoated, multiple-ton crane fabricated from weathering steel (A588) used in a severe marine environment was investigated. Use of chloride field detection kits indicated chloride ion concentrations on the crane were very high in attacked areas. Weathering steel is not intended for marine applications. Recommendations were given to sandblast the crane to remove the existing salt and then apply a suitable coating system.

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Failures of Lower Body Sections of Fire Fighting Trucks – The cause of premature failures by corrosion on coated steel and aluminum body panels of fire trucks used in the Cleveland, Ohio area was investigated. The problems were caused by incorrect design details that did not permit the specified surface preparation and coating system to be correctly applied or did not permit the salt-rich slush from winter streets to be drained or washed away on the trucks. Recommendations for improved design details were made.

Injury of a Child in a Sporting Goods Store – The cause of an accident in which a steel stand used to suspend a “heavy bag” boxing bag tipped over in a retail store and caused severe leg injury to a young boy was investigated for an attorney. The stand was not bolted to the floor. The child was playing around the bag and running into it to make it swing. Calculations showed that a relatively small horizontal force was sufficient to make the stand tip over. The case settled.

Investigation of Major Crack of Weld in 9-foot Diameter Industrial Fan – Visual and laboratory evaluations indicated the weld cracked due to mechanical fatigue caused by lack of penetration of the weld that provided a stress concentration location. Corrosion was ruled out as being causative.

Failure of a Valve Push Rod in a Marine Engine – Fracture of this rod in the in-board engine of a small yacht was investigated as part of an insurance claim. It was found that the fracture originated from a small nick on the surface of the push rod due to stress concentration, propagated due to fatigue and final fracture was ductile in nature. Failure of the push rod allowed more costly damage to other engine components. The work was part of an insurance investigation.

Personal Injury Case Involving a Recreational Boating Accident – Assisted an attorney representing the owner/operator of a bass boat that struck an underwater object and caused the still-running outboard motor to flip inside the boat and amputate the hand of a passenger in the rear of the boat. The passenger sued the owner/operator (plus other parties) claiming that the owner had not done sufficient maintenance on the jack-plate motor attachment to the boat and that omission caused the accident. It was shown that the owner had done normal maintenance on the jack-plate but small-scale damage (fretting) that could not be easily detected plus other contributing factors had likely caused the accident. A deposition was taken. The case settled.

Materials Selection & Consulting for Proposed Chemical Manufacturing Plant - Provided materials engineering services to an industrial design/build contractor that was preparing the chemical process and mechanical design for a large chemical plant. The client sought outside help with specifying best corrosion-resistant materials. Different materials were needed for various parts of the plant depending on the particular equipment involved, the chemical make-up of the local process stream, susceptibility to the various forms of corrosion and the maximum local, operating temperature.

Investigation of Corrosive Effects of Chinese Drywall – Provided corrosion engineering services for an attorney to complete a technical assessment of the incidence, cause and effects of corrosion of copper air-conditioning and other copper components plus copper and silver electrical contacts in over one hundred homes with drywall manufactured in China installed. Macro-scale and laboratory evaluations were completed, multiple literature sources were reviewed, a report was written and my deposition was taken. Opposing counsel stipulated as to the cause of the corrosion damage just before my scheduled appearance at the arbitration hearing for the case.