

# news of engineering forensics

# MDE Inc.

## Plastics Piping Forensics

by Keith G. Cline, P.E.

Plastic components surround us and are an integral part of our everyday lives. More and more of the water piping and plumbing components that are installed in residential and commercial buildings are made completely or partially of plastics. However interchangeable these may be with metallic parts, there are many significant differences in the installation and use, that can cause failure.

Residual stresses from manufacturing reduce the load required for failure to occur and increase

the likelihood of environmental stress cracking (ESC). Improperly manufactured injection molded components also have weld line defects where failures often initiate.

Plastic compression fittings for faucet and toilet connections are intended to be installed hand tight only; over-tightening can cause cracking and potentially lead to significant water damage. Using a wrench to tighten a plastic fitting will do more harm than good and should never be done. Water filter caps can also be over tightened and lead to significant water damage to kitchen cabinetry and flooring. Threading metallic pipe into plastic threads can easily overstress and split the plastic fittings.

Over use of glue can weaken plastic pipe and fittings; it is imperative that manufacturer's directions be followed to ensure a proper joint. Additionally, exposure to common household chemicals can quickly degrade some plastic. An example is toilet tank disinfectant; acetal flush valves will become brittle and weakened with this exposure, leading to failure and flooding.

Years often pass between an improper installation and the failure. MDE has the experience, expertise and analytical capa-

bilities required to determine the root cause of these failures and aid in determining who is ultimately responsible for the damages that occur.

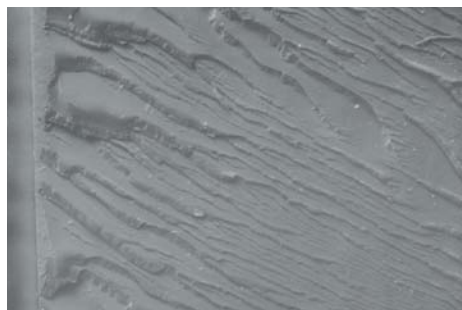
MDE's scanning electron microscope (SEM) is used to determine the fracture initiation location and the fracture type (e.g. brittle, ductile, fatigue). Manufacturing defects, installation damage and service induced cracking can be properly identified with the SEM. Additionally, the attached energy dispersive x-ray analyzer (EDS) can identify chemicals present that may have caused the failure.



Microscopic view of water filter failure

Fourier transform infrared analysis (FT-IR) is performed to determine the composition of polymers, adhesives and contaminants to aid in determining the root cause of failures. Thermogravimetric analysis (TGA) can determine if the composition of the material is correct and if the plastic has degraded due to the influence of heat or chemical exposure.

New plastic materials continue to enter the market and posing new challenges to understanding failure mechanisms. MDE has the expertise and equipment needed to test and understand these materials and failure mechanisms to assist in any forensic examination.



SEM of water filter failure

## Upcoming Seminars

**MDE professionals are scheduled to speak at the following courses / seminars:**

- 8/5/04, Keith Cline, P.E. will be presenting "Failure of a High-Capacity Forklift Fork" at the Microscopy and Microanalysis 2004 Conference, Savannah, GA.
- 9/26/04 Susan Evans, CIH, CSP, P.E. will be presenting "Drips, Runs and Errors" (Otherwise Known as Water Infiltration, Mold Colonization and Construction Defects) at the 11th Annual Washington Construction Law Conference, in Seattle, Washington, sponsored by the Seminar Group.
- 10/14-15/04 Susan Evans, CIH, CSP, P.E. will be presenting "Mold Growth in Exposed Oriented-Strand Board Sheathing" at the 2004 Northwest Occupational Health Conference in Portland, OR.

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# Wastewater Piping Problems

by Mark G. Nordstrom, P.E.

Sewer and septic system problems have been a pervasive area of concern. Most people probably don't spend a lot of time thinking about what goes on under the ground - at least until something goes wrong, and things get messy. Municipal sanitary sewers and private septic systems are relatively simple. However, both require routine inspection and maintenance, as they are vulnerable to numerous potential problems.

Age can be one culprit. Even with proper maintenance, private on-site septic systems have a generally accepted life of thirty years, which will vary depending on the specific situation and the history and frequency of use. Municipal systems will also suffer from age. Municipalities can often avoid problems by identifying and replacing old or damaged mains utilizing remote video cameras for inspection. However, many individual sites have old and failing systems that connect to newer mains. Both septic systems and sewer pipes are vulnerable to damage from growing tree roots. Improper or insufficient maintenance can leave sewer and septic systems vulnerable.

It is the responsibility of the property owner to maintain the on-site sewer service line from the structure to the city main. This is often the perceived failure point (i.e. blame) when failures or backups occur. MDE recently investigated a sewer service backup that a municipality claimed was caused by a problem in the owner's on-site

sewer service. Further research uncovered written accounts by city employees of numerous and ongoing problems in the nearby city mains, including an eye witness account of a bowling ball in a ten inch city main on the day of the service backup.

MDE has the expertise to investigate sewer, septic, and other piping problems for causes of failure or backup, damages to pipes, or weak spots in the system. MDE can also analyze ongoing survey, maintenance and repair programs, and other records to assess a system's condition and performance over time.

## Graphic Evidence

by J. Lee Durston

People retain 87% of what they see and only 10% of what they hear. This fact has guided the schools of thought in education, marketing, and even psychology. Visual assistance has become readily used in courtrooms where the attorney's or expert's job is to educate, market, and even stir up emotion as he/she spells out a sequence of events or illustrates a point. The new trend is using computer generated graphics to enhance a jury's understanding of the facts. But what is admissible?

Much of the demonstrative evidence produced with computers today is like it's predecessors but with a sharper look and lower cost. Traditional charts, diagrams, graphs, etc. can be made with precision and eye catching boldness. 3D renderings give diagrams and illustrations a much

more realistic look. In general, these are just as admissible as the older handmade versions.

Questions arise when movement is added to picture. An important point to make is the difference between an animation and a simulation. These terms are often misused interchangeably. A simulation is a hypothetical 3D rendered scenario that is based on pre-existing data. Much of the work is done by a computer, based on math and probabilities. Fire-math modeling is an example of this work. With acquired data and pre-existing knowledge of fire science a 3D rendered simulation can illustrate how a fire would most likely move through a building.

In contrast, an animation is a 3D rendering of an event based on expert witness testimony of what exactly took place. A 3D animation shows an accurate representation of fact. The animation is based on forensic evaluation, witness statements, and reconstruction of the scene.

As you might predict, a simulation is subject to more rigorous review in regards to issues of admissibility. An animation, when treated in much the same way as a traditional chart or a diagram is generally not subject to Daubert review or hearsay prohibitions.

MDE Inc.'s extensive legal graphics capabilities serve to compliment the wide array of technical expert services offered by MDE. For more information call Lee Durston. 206.622.2007



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