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Forensic Evaluations of Built-Up Roofing Storm Damage Claims and the Appraisal Process

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Abstract

Severe weather, which is a regular occurrence in the American Southwest, includes more than high temperatures and haboobs (dust storms). Severe thunderstorms, often accompanied by high winds and hail, are regularly experienced and have the potential to cause damage to roofing systems and other exterior building components. Insurance claims for storm damage — both legitimate and unwarranted — have come under increased scrutiny due to indistinct and altered dates of loss, the amending and broadening of damage causes, and the offering of technically unsupportable opinions by individuals who are less than qualified. Further, these claims often end in appraisal hearings that are decided by umpires for whom there are no minimum educational or experiential requirements.

Keywords

Forensic engineering, storm damage, roofing, appraisal, wind, hail, weather, advocacy, scientific basis, public adjuster

Introduction

Hail — and the effects of hailstone impacts to roofing materials — has become an increasingly controversial topic over the past decade, with the number of insurance claims for hail damage reported in the United States increasing by 84% from 2010 to 2012 (Fennig 2013). This rise in claims has been accompanied by an increase in disputes, promulgated by third-party intermediaries (i.e., public adjusters, roofing contractors, consultants, attorneys, etc.).

Built-up roofing (BUR) systems have been in use for more than 100 years, and have a history of good performance and durability. The system uses alternating layers of bitumen and reinforcing fabrics that compose plies. The initial ply is typically mechanically fastened to the roof deck. Additional layers are subsequently adhered via hot tar/asphalt or cold-applied adhesives and laid in an overlapping ("shingle") fashion. The top ply (referred to as the cap sheet) usually incorporates some form of ultraviolet radiation protection, such as a coating, gravel ballasting, or embedded roofing granules. Once assembled, the system is referred to as a "roofing membrane." **Figure 1** illustrates the overlapping installation as well as a photograph of a finished roof membrane system.

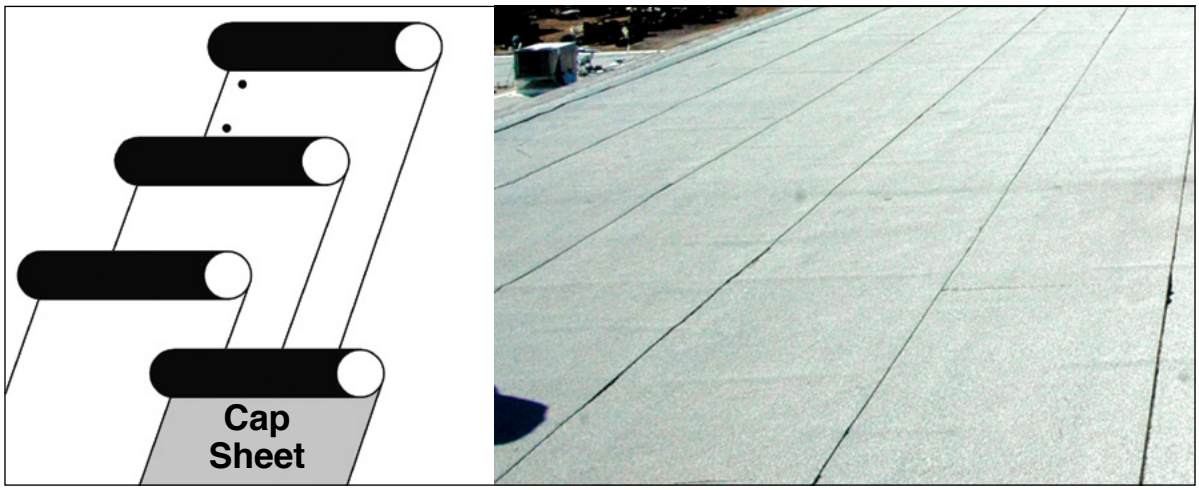

Figure 1
Built-up roofing.

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Testing to evaluate the effect of hailstone impacts to BUR systems was first studied by the United States Department of Commerce (Greenfeld 1969). Additional testing has been conducted by independent organizations, including Haag Engineering in 1988 and 1993 (Marshall 2006). Testing was also conducted by this author to validate the results established by others and provide first-hand knowledge of the effects of hail stone impacts to roofing systems. The results of these tests consistently show that BUR has exceptional hailstone impact resistance, such that hailstones that are more than 2 inches in diameter are a typical "threshold" for functional damage. Examinations of BUR systems immediately following large hail events support the results of the aforementioned testing (Roofing Industry Committee on Weather Issues 2012).

The effects of wind on BUR systems have been well documented and are typically readily apparent (Roofing Industry Committee on Weather Issues 2007). Aside from damage resulting from wind-blown projectiles, wind damage will typically occur in the form of lifted, torn, and/or missing roofing material. Once compromised, wind is able to penetrate underneath the roofing membrane, rendering it more susceptible to additional wind damage.

In addition to third-party testing and field observations, manufacturers of BUR materials regularly test these systems to obtain wind and hail ratings. Although there is an abundance of test data published, including large-scale post-storm field inspection reports, this information is given varying degrees of credence by the ruling body in disputed matters. Disputed insurance claims can end up in litigation or what is referred to as an appraisal hearing. This paper will present two case studies that compare the differences in structure and handling of technical experts and opinions between insurance appraisal and litigation processes.

Litigation

In a typical litigation process, there are several criteria an expert must meet in order to have his/her testimony admitted.

> A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:
>
> (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
> (b) the testimony is based on sufficient facts or data;
> (c) the testimony is the product of reliable principles and methods; and
> (d) the expert has reliably applied the principles and methods to the facts of the case.

While the court allows an expert to rely upon his or her experience to formulate opinions, the court demands that those opinions be based on the facts of the case and supported by accepted scientific principles, methodologies, and studies. Litigation also follows a formal process that allows parties to request pertinent information through discovery or interrogatories and deposition testimony. This process includes the timely disclosure of expert opinions, and allows for a formal rebuttal of such opinions.

Appraisal Hearings

Most insurance policies contain what is referred to as an "appraisal clause." If it is determined that the claimed damage is covered — and the insured disagrees with the amount of money the carrier has offered — he or she can invoke the appraisal clause. In this process, both the carrier and insured will each hire an appraiser to independently evaluate the loss and determine the appropriate financial compensation. The appraisers must then select a third appraiser, termed an "umpire." The matter is resolved when any two appraisers (typically the umpire and one other) agree on an amount to be paid by the carrier.

Once an umpire is selected, both appraisers will submit paperwork in support of their determinations. Items submitted typically include technical reports, maintenance records, weather reports, and contractor estimates. The umpire will then review the material and hold an appraisal hearing. In this hearing, which is typically held in a conference room (or similar location), both appraisers will be allowed to present their arguments, based only on documents submitted prior to the hearing. In some instances, the hearing will also involve observations of the subject property. In the days, weeks, and sometimes months after the hearing, the umpire will make a decision. Sometimes, this process is more of a negotiation than the umpire simply assigning a monetary value to a loss.

There are no legal criteria that one must meet to become an umpire. Rather, insurance policies typically

dictate that an umpire must be "competent and disinterested" or independent. Therefore, umpires involved in these matters come from a variety of backgrounds, many of which do not involve dispute resolution (the essence of the matter). Additionally, there are no qualification requirements for technical opinions. It is not uncommon to see technical arguments presented without any basis in the established facts or recognized scientific data and literature.

Background in Arizona

On Oct. 5, 2010, several severe thunderstorms passed through the Phoenix metropolitan area. These storms produced large hailstones (up to 3 inches in diameter), which caused damage to thousands of roofing systems. While the majority of claims were filed in the months following the event, some continued to be filed several years after the event. Many of the later claims were initiated by roofing contractors, public adjusters, or attorneys and resulted in disputes as to the cause and extent of damages.

Case Study #1 – Large Commercial Strip Mall

This claim involved a large commercial strip mall covered with BUR systems of varying age and condition installed on a panelized roof structure. The insurance claim in this instance was filed more than a year after the reported date of loss, was accompanied by a report from an out-of-state firm comprised of public adjusters and roofing consultants, and was handled by a public adjuster with said firm (it should be noted that public adjusters are typically paid a percentage of the amount awarded by the carrier). The report (dated April 30, 2012) made the following claims:

- "Lot [*sic*] of the granules has been displaced, leaving the unprotected membrane and fibers."

- "The hail has impacted the roof membrane, separating the bitumen between the plies of felt, which, in turn, will allow for water intrusion… This is sometimes known as bruising…"

- "The modified built-up roof should be removed down to the decking and a new comparable roofs [sic] system installed."

On May 16, 2012, this author conducted a site inspection of the roofing systems at the subject location, which presented in varying conditions consistent with their respective ages. The 24-year-old roof, for example, had extensive granule loss, wrinkles in the membrane running perpendicular to the length of the plies, and repairs of varying styles throughout (some bituminous, some elastomeric, and additional layers of roofing). Spatter marks and condenser coil fin deformation on rooftop-mounted air conditioning equipment indicated that the largest hailstones in this location were approximately ¾ inches in diameter.

Spatter marks are most commonly created when hailstones impact surfaces with oxidized paint; the impact removes the oxidized paint, exposing the underlying darker paint. Measuring these marks provides insight into the size of hail experienced. The condenser coils of rooftop-mounted air conditioning units are covered with vertically aligned aluminum fins, which are relatively easy to deform, and are therefore readily affected by hail. Examination and measurements of the fin deformation also provide insight into the size of hail experienced. This data — combined with experience at locations where hail size was documented (typically via cell phone photos and video) and compared to spatter and fin deformation observed — allows an investigator to determine the size of hail experienced in an area.

A report was submitted by this author on May 22, 2012, offering the following:

- The maximum size of hail experienced at the subject location was approximately 1 inch in diameter.
  - Photographs of the observed spatter were provided in support of this statement. **Figure 2** presents a photograph of one of the largest spatter marks observed at this location.

- The widespread granule loss on the roofing systems was not a result of the subject storm.
  - Historical aerial images provided by Google Earth were presented, demonstrating similar amounts of granule loss before and after the storm.

- Areas of missing granules were not consistent with hailstone impacts.
  - References to simulated hailstone impact testing were provided in support of this conclusion.

- No bruising was observed or tactilely experienced.
  - Bruising has historically been defined as the fracture of the fibers within the mat of the roof

(Greenfeld 1969, Marshall 2006), and is considered the benchmark for functional damage.

- The roof had several patched areas of various ages. Most of the patchwork was inappropriately applied and would likely only have mitigated leaks — not stopped them.

- There were several "soft spots" in which the roof would sag noticeably when walked on, consistent with long-term water intrusion.

- The ultimate conclusion provided was that the roof did not sustain any functional damage as a result of hailstone impacts.

After this report was issued, several other reports were offered in support of the claim of hailstone impact damage to the roofing systems. The first of the additional reports was submitted by a licensed engineer, also from out-of-state, dated Oct. 14, 2012. Within his report, the engineer made the following claims:

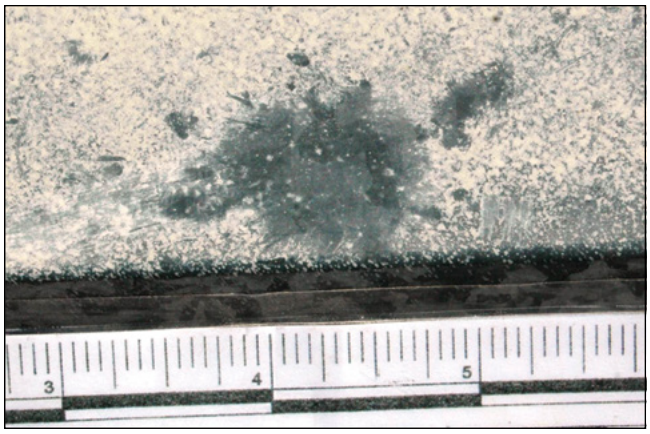

Figure 2
Spatter mark from hailstone impact (ruler demarcated in inches).

- "The velocity and size of the hail (½ to 1½ inches)…"

- "The size of hail impacts ranged from ½ inch to 1¾ inch."

- "According to the National Climate Data Center [*sic*], up to 2½-inch-sized hail was reported at the Scottsdale Airport, approximately 15.9 miles from the site."

- "Evidence shows penetration and/or damage to the membrane representative of these roofs. The roofs were functioning as intended prior to the storm damage. This damage creates water intrusion pathways through the top sheet."

Another report (dated Oct. 14, 2012) was submitted by an out-of-state civil and structural engineering firm. This report was sealed and submitted on two separate dates (12/3/12 and 12/10/12), offering the conclusion, "It is my professional opinion that the integrity of the bituminous membrane was compromised by the impact caused with what is consistent with hail." In this report, no determination was made with respect to the size of hail experienced other than it was consistent with what was reported during the storm.

A fourth report was submitted by an out-of-state architect (dated Oct. 17, 2012), who offered, "In my professional opinion, the roof … was damaged by hail. Impressions made to the roofing membrane are consistent with that of hail."

The basis provided in all four of the reports was photographs of areas of granule loss and statements that the authors had investigated hail damaged roofing systems in the past. Given that no scientific basis had been provided to support claims of hail damage, a request was made to collect roof samples from three of the roofing systems, have them desaturated, and examine the fiberglass mat microscopically for fractured fibers (i.e., bruising). The sample collection locations were determined by the parties alleging hail damage and were sent to a third-party laboratory for desaturation and examination.

Laboratory results revealed "no noted damage" to two of the samples. In the third sample, the laboratory noted a "soft spot in the glass where the binder used in the fabrication of the glass mat is missing; the glass fibers are continuous across this area." A second report was issued by this author on March 15, 2013, explaining the lab results, providing their correlation to previously cited testing, and reaffirming the original opinions offered.

Between March and December 2013, the original public adjuster unexpectedly died. In December, an appraiser (hired by the insured) submitted the previously mentioned reports, all alleging hail damage to the roofing systems. He also proposed that the roofs suffered from wind damage (an entirely new claim) in the form of ply separation from uplift forces. Seams were identified throughout the roof, with a focus on wrinkles in the

membrane as physical evidence of wind damage. Interestingly, the appraiser regularly worked as a public adjuster. After he was brought in, the amount of damages claimed nearly doubled, the type of claim changed, and he was the only person offering technical support of the alleged wind damage.

In lieu of this new assertion, another site inspection was conducted by this author to evaluate the roofing systems with regard to wind damage. In addition to the inspection, weather research was conducted to compare the subject storm with historical data. Finally, tenant interviews were performed to address claims that the roof had begun leaking only after the Oct. 5, 2010 event.

On Feb. 18, 2014, a third report was submitted by this author, addressing the recently introduced claim of wind damage. This report presented the following pertinent information:

- Several openings in the roof system were identified, none of which were related to wind damage:
  - Leak locations typically involved poor or missing flashing along parapets, around AC equipment and roof drains, as well as unsealed fastener penetrations.
  - The overwhelming majority of leaks identified from the interior of the building were identified near AC penetrations — associated with poor flashing.

- Tenant interviews (with tenants occupying suites before and after the subject storm event) confirmed that the roof had been leaking for more than 10 years "with any measurable amount of rain." Tenants also stated that the building maintenance person would periodically replace ceiling tiles but not fix the leaks.

- Historical weather data showed that the winds experienced during the Oct. 5, 2010 storms were consistent with those experienced in the area on a regular basis. Between the time of construction and the date of loss, 20 separate events were identified where equal or higher wind speeds were experienced.

- Ultimately, no wind damage was identified on the roofing systems.

- The wrinkles in the roofing system were related to expansion and contraction of the underlying roof structure. While the structure can expand and contract with temperature fluctuations, the roofing will not contract once stretched. Therefore, when the structure contracts, the roofing wrinkles to accommodate the change. These wrinkles were observed at 8 feet on center and corresponded with purlin locations.

- Several references were provided in support of these opinions (Roofing Industry Committee on Weather Issues 2007, Giffin 2009). In addition to these references, photographs of wind damage from previous investigations were provided as well as historical aerial images obtained through Google Earth, showing that conditions claimed as wind damage on the roof existed before the subject storm event.

The property did experience hail damage to the condenser coils of rooftop-mounted air conditioning units (fin deformation). Therefore, storm damage was identified and a monetary value assigned, allowing the insured to invoke the appraisal clause.

As part of his appraisal presentation (submitted on June 6, 2014), the appraiser for the insured authored a report that focused on wind damage, and did not identify any hail damage. The physical evidence of wind damage identified in the report included wrinkles in the system, which he argued were the result of wind uplift forces that created openings for roof leaks. In support of his argument, he provided invoices for building maintenance, documenting the purchase of replacement ceiling tiles, a letter from the property maintenance company stating that the roof had only started leaking after the storm, and information obtained from tenant interviews stating that the roof had only started leaking after the storm. He also provided two documents from the Proceedings of the Fourth International Symposium on Roofing Technology. The following noteworthy observations were made with respect to this report and supporting documentation:

- Maintenance records showed the purchase of 27 ceiling tiles four months prior to the subject storm and $2,000 of roof repair/ceiling tile replacement two months before the subject storm. No invoices were provided for roofing repairs after the storm.
  - The statement from the management company that the roof did not leak prior to the storm directly contradicts the invoices provided.

- The references provided from the symposium contained photographs and statements regarding wind damage that contradicted the photographs and statements in the report.

An example of wind damage, as identified by the public adjuster, is shown in **Figure 3**.

Figure 3
Area identified as wind damaged.

The appraisal hearing (conducted on June 18, 2014) was attended by both appraisers, the umpire, this author, a roofer hired by the public adjuster/appraiser for the insured, and a roofer hired by the carrier. Initially, all parties walked the roofs of the buildings, explaining their positions and identifying supporting physical evidence. At the onset of this portion of the process, the public adjuster stated that the roofs had not sustained hail damage; therefore, there was no reason to address the hail damage portion of the claim. However, he remained adamant that the roof had sustained wind damage, which had caused several roof leaks. Because areas similar to that shown in **Figure 2** were claimed to be wind damage — and therefore paths of intrusion — it was proposed that the roof be cut open in these areas to determine if this was the case. While the public adjuster was adverse to this, the umpire decided it should be done. Several areas were cut open (chosen at random by the public adjuster), and all demonstrated adhesion between plies with no evidence of leaks.

Upon completion of the physical examination of the roofs, attempts were made to interview tenants to address discrepancies between the provided statements. Only one tenant was available who had been in the buildings prior to the storm. This tenant refused to speak with anyone, reportedly because she was upset that previous statements she had made were misrepresented. At that point, the proceedings moved to a conference room nearby where the matter was discussed, and references were reviewed. During this discussion, the umpire stated that he had been presented with no physical evidence that the building had sustained wind or hail damage. During this hearing, maintenance records were reviewed with the umpire that established the roofs had a significant number of leaks prior to the subject event — and that the property management company (both in writing and at the hearing) had misrepresented this information.

After the umpire reviewed the facts of the case (spending well over 100 hours), he decided that the roofing systems were damaged by the identified storm and that they therefore needed to be replaced by the carrier. He stated in writing that he was presented with no physical evidence of storm damage or storm-generated openings. However, because tenants had stated that the roof leaked more after the storm than it did prior (more than three year's difference in time), the systems must have been damaged by the storm.

Case Study #2 – Five Building Hotel Complex

This claim involved a relatively large hotel complex in Tucson, AZ. The property contained four two-story buildings with BUR systems covered with gravel ballasting. However, in some areas, the gravel was displaced/removed, and the roofing was covered with granulated cap sheets (of varying color) or an elastomeric coating. The roof over the office and banquet hall was covered with built-up roofing with an elastomeric coating (the cap sheet did not appear to originally contain roofing granules). Finally, there was a detached restaurant associated with the hotel with a steep pitched roof covered with metal tiles and a low pitch roof covered with built-up roofing with an elastomeric coating. **Figure 4** provides an overview of the complex taken from Google Maps.

When the matter was initially presented, a report had been issued by an out-of-state engineering firm with four authors — a certified environmental inspector, two professional engineers, and an engineer in training. This report contained the following opinions:

- "The granulated modified bitumen roof covering would require 1¼ inches or larger size hard density hailstones with a perpendicular impact velocity of 55 to 75 mph to produce impact energy large enough to puncture or tear the exposed surface of the membrane."

Figure 4
Image of roof from Nov. 20, 2009.

- According to the National Climatic Data Center (NCDC), the area had experienced hail up to 1 inch in diameter on Sept. 10, 2011, July 15, 2012, and Aug. 21, 2012. (Reported date of loss was July 7, 2011.)

- Any roof areas without ballast were damaged by hail.

- A section of the roof over the office area had been displaced due to wind forces.

The report did not contain any historical weather data or analysis other than mentioning the three dates where 1-inch hail was experienced in the city. There were no photographs of hail spatter indicating the size experienced, and none of the photographs of the roof demonstrated hail damage. Instead, photographs provided large overviews depicting severe deterioration and splitting of the membrane, and highlighted two large dents in a rooftop appurtenance. There was a photograph showing the roofing pulled up from a corner and folded on itself over the office area.

The insured in this matter was represented by a public adjuster. In support of allegations that the failing condition of the roof was a recent occurrence — and due to storm damage — the public adjuster also submitted a letter from an in-state architect dated Aug. 6, 2012. The letter discussed a building review performed for the owner 60 days prior, stating: "As part of our general review, we performed a visual inspection of the roofs. We found the roofs to be well maintained with no visible damage."

After review of these documents, the property was researched. Information provided through the county assessor revealed the buildings were originally constructed 44 years prior. Historical aerial images obtained from Google Earth showed the roofs in a deteriorated condition in 2009 — two and a half years prior to the reported date-of-loss. **Figure 4** provides a portion of this image. The date has been magnified in **Figure 4**. The darker areas of the roof are locations where the ballast material is displaced or removed, and the underlying roofing is exposed.

A site inspection revealed roofing systems that were severely aged and littered with patchwork, ranging from added layers of roofing to large sections covered with an elastomeric coating. There were also numerous soft spots and one area experiencing structural failure. **Figure 5** presents a photograph showing the cracked and peeling nature of the roofing.

Areas similar to that shown in **Figure 5** were observed throughout the roofing systems over the two-story buildings. No areas of impact damage were observed on any of the roofs. Spatter marks observed throughout the property were consistent with only minor hail, approximately 0.25 inches in diameter. Additionally, conversations with onsite maintenance personnel during the inspection revealed that the roof had been leaking for years. This was consistent with observations of the interior spaces.

Figure 5
Split/failing section of roofing.

Regardless of this information, the public adjuster continued to pursue the claim, and several documents were produced by the opposing engineer, providing personal and technical criticisms. In lieu of this, a second report was authored on April 14, 2014, addressing the technical criticisms, providing photographs from other investigations where large hail was experienced and caused damage, and providing extensive weather data.

The uplifted section of roofing in this matter was clearly from wind, and payment for repair was provided by the carrier. The public adjuster did not claim that any other portions of the property were damaged by wind.

The umpire selected for the appraisal process was a local attorney. A site inspection was conducted as part of the appraisal hearing; however, experts were not asked to attend. At the conclusion of the hearing, the umpire did not make a ruling, but wanted additional time to review all of the information. On May 12, 2014, the umpire submitted the following in a letter addressed to both appraisers:

> *We met at the property and looked at portions of the roof. We then conferred at my office and could not reach an agreement… I have reviewed again all of the reports including all the photographs. I have thought it out, and my conclusion is that based on the preponderance of the evidence there was no hail damage…*

Conclusions

In both cases discussed, the claims were filed well over a year after the reported event, the claims alleged water intrusion resulting from the storm, and the buildings had roofing systems that were poorly maintained, worn, had leaked for years, and were in need of replacement.

Case Study #1 was unique in that the claimed source of damage changed from hail to wind over a year and a half after the claim was filed — and only after the hail damage claim was investigated and shown to be without merit. In addition, all technical arguments and claims made regarding the presence of wind damage were offered by the insured's appraiser, not a qualified expert. Finally, the umpire did not appear to have taken the physical evidence and established scientific literature into account when making his determination.

In Case Study #2, damages were alleged that were unsupported by any of the physical evidence or established scientific literature. However, in this matter, the umpire placed credence on the importance of scientifically backed expert opinions and the available physical evidence.

While laws exist that govern the admissibility of expert witness opinions in litigation matters, they are not applicable in appraisal forums. Comparing the two, the appraisal process is much less formal, allowing technical opinions to be offered by persons not established as experts, and there is no formal discovery process, which inhibits the ability to disprove junk science or the lack of science altogether. Two matters were presented where technical opinions contradicted the facts of the case (including onsite testing) as well as established scientific principles and data. However, both cases had entirely different outcomes, likely due to the abilities of the umpires selected, including the way in which they approached expert testimony and dispute resolution.

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