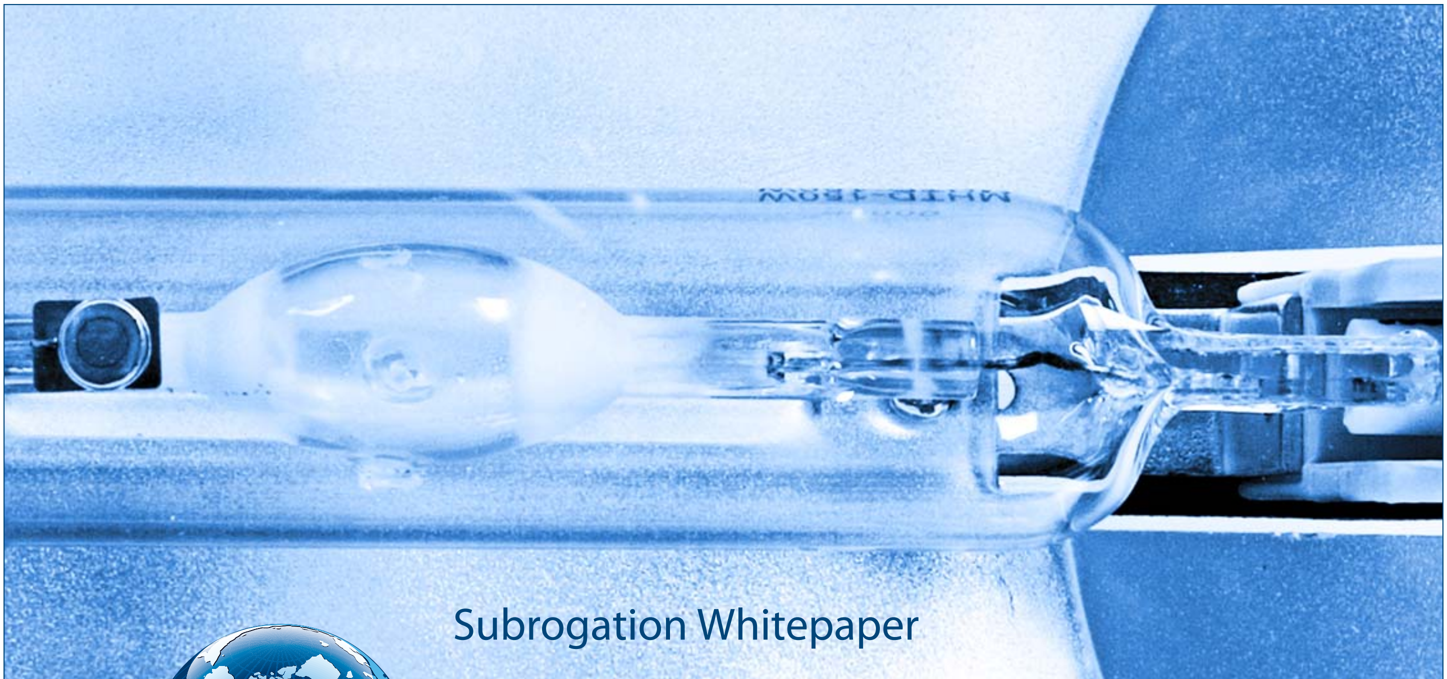

Subrogation Whitepaper

FAIL (UN)SAFE: METAL HALIDE LIGHTING

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INTRODUCTION

Figure 1: Metal Halide Bulb in Open Fixture

Most people would be surprised to learn that some of the world's largest and most prominent manufacturing concerns have, for decades, produced a product which, by design, has a known and avoidable propensity to fail in a fashion which causes fires. Even more surprising, the product in question is something as commonplace and seemingly harmless as a light bulb. (Figure 1).

THE PRODUCT

Metal halide light bulbs (or "lamps" in industry parlance), are part of the "High Intensity Discharge" or "HID" family of lighting products, which also includes mercury vapor and sodium lighting. HID lighting is typically used to illuminate large commercial, industrial, or assembly occupancies, and also has outdoor applications, such as ballparks and parking lots. Metal halide bulbs sometimes also turn up in specialty applications, such as aquarium lighting.

In place of the filament used with incandescent bulbs, metal halide bulbs are equipped with a sealed, quartz glass "arc tube" which contains gases, mercury, sodium, and other metal salts, and electrodes at each end. The arc tube/electrode assembly is, in turn, contained within the bulb's thin outer glass "envelope". Illumination is generated by a sustained electrical arc, as current passes between the electrodes and through the gas in the arc tube. The arc tube operates at high temperature and under high pressure.

Figure 2: Ruptured Metal Halide Bulb in Open Fixture

An asserted advantage of metal halide lighting is the ability of the manufacturer to carefully control the "warmth" or "coolness" of the light emitted by varying the mixture, or "dose" of metals and gases in the arc tube. The countervailing disadvantage, which is scarcely mentioned, let alone emphasized, in the lighting industry's marketing efforts, is the known propensity of metal halide bulbs to explode at the end of their life, which often results in the forceful ejection of 2000º F. particles of quartz glass from the fixture, potentially igniting any combustibles that the particles contact. (Figures 2 and 3).

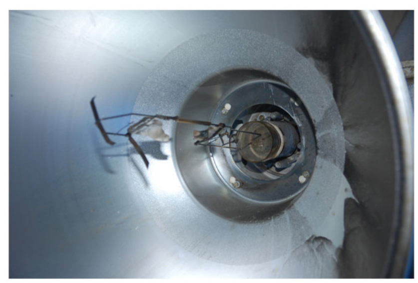

Figure 3: Ruptured Metal Halide Bulb

This violent "end of life" failure mode, euphemistically referred to in the lighting industry as a "non-passive failure", or "NPF", is a consequence of the quartz in the arc tube degrading over time, to the point where it can no longer withstand the high operating pressures. The industry has known of the propensity for such failures virtually from the time the products went on the market in the late 1960's and early 1970's.

"PROTECTED" BULBS

There are only two sure ways to avert the fire hazard associated with metal halide light bulbs. The first is to manufacture the light bulb with the arc tube enclosed within a durable shroud which is capable of containing the arc tube fragments when an explosion occurs. (Figure 4). Light bulbs that are so equipped are known as "explosion-proof" or "protected" or Type "O" (suitable for "open" fixtures) bulbs. The light bulb manufacturers first procured patents on this technology back in the 1980's, and at least one began offering "protected" bulbs as early as 1990. However, the manufacturers continue to sell "unprotected" bulbs, which still represent the vast majority of the bulbs sold.

The proportion of "protected" to "unprotected" bulbs sold in the marketplace is gradually shifting, however, due at least in part to a revision to the National Electrical Code (NEC) which first appeared in the 2005 Edition of the NEC. This Code provision requires "open" metal halide fixtures (enclosed fixtures are discussed below) in new construction to be equipped with special "exclusionary" lamp holders (sockets) that will accommodate only "protected" bulbs. The gradual adoption of the 2005 and later versions of the NEC by state and local jurisdictions throughout the country is forcing a shift toward greater use of "protected" bulbs. However, there are still many existing open and enclosed fixtures that can accommodate "unprotected" bulbs and essentially no restrictions on the continued sale and installation of enclosed fixtures that can accommodate "unprotected" bulbs.

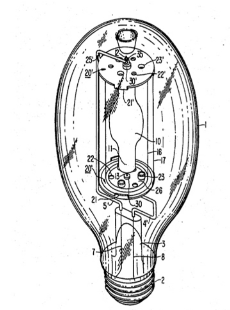

Figure 4: Example of "Protected" Bulb Design

ENCLOSED FIXTURES

The second means of avoiding fires from exploding metal halide bulbs is to utilize a fixture that encloses the bulb with non-combustible material, such as tempered glass. The lighting industry has resisted this approach, as well. Until the adoption of the restrictions recently imposed by the NEC, metal halide bulbs in the 350 to 1000 watt range have, with a couple of exceptions, never been required to be enclosed at all in their most common applications. Bulbs below 350 watts and over 1000 watts are only supposed to be used in "enclosed" fixtures, reflecting an industry judgment that bulbs of these wattages have a greater risk of exploding at the end of their lives. However, the manufacturers consistently deny ever conducting any testing to verify, empirically, what percentage of bulbs of any particular wattage can be expected to explode at the end of their lives, rather than simply burning out (a so-called "benign" failure). The manufacturers also resist disclosure of their knowledge regarding violent failures in the field, and any information in this regard that they grudgingly disclose in formal discovery proceedings in litigation is typically only produced subject to Protective Orders.

Unfortunately, what the industry deems an acceptable enclosure is not necessarily an effective deterrent to fires caused by exploding metal halide bulbs. The Underwriters Laboratories (UL) standard for enclosed metal halide fixtures (there is no UL standard for metal halide bulbs) authorizes the "enclosure" to be made from acrylic and other combustible plastic materials, so long as brand-new samples of the enclosure material pass a "containment test". UL delegated the development of the "containment test" to a lighting industry trade association in the late 1980's. In brief, the test adopted by the industry and then by UL involves heating quartz arc tube segments of specified dimensions to 2012º F. and placing them on a sample of the plastic enclosure material which has been heated to its normal operating temperature. The enclosure material "passes" the test if a layer of cotton located 12 inches beneath the sample is not ignited either by quartz particles which have melted through the sample or by flaming, dripping plastic ignited by the quartz.

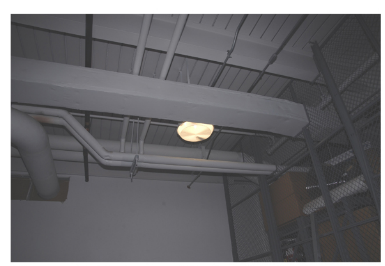

Figure 5: Fixture with Acrylic Enclosure

Failures of plastic enclosures in the field confirm that the UL test does not consistently predict the ability of a plastic enclosure to contain actual bulb explosions. In fact, plastic enclosures sometimes serve as the first fuel ignited by the quartz particles, and then allow flaming, molten plastic droplets to fall on combustibles below. (Figure 6). These incidents call into question whether the UL/lighting industry "containment test" truly represents real world conditions, both in terms of (1) the size of the quartz particles used in the test relative to those encountered in actual explosions (larger particles hold more heat longer and therefore present a greater fire hazard); and (2) the force with which the particles are ejected during an explosion (as compared to the controlled placement of particles on the samples during the test).

Further, the test uses samples of new material, and therefore does not reflect any potential impairment of containment capability from prolonged exposure of the enclosure to heat from the bulb. Similarly, while "normal" operating temperatures are established with newer bulbs, the temperatures to which the enclosures are actually exposed, and the resultant potential for failure, increases as the bulbs age. Plastic enclosures built prior to the adoption of the UL "containment" test, or which are not U.L. listed, are even less likely to contain a ruptured arc tube.

Figure 6: Acrylic Enclosure Failed to Contain Rupture

THE INDUSTRY'S APPROACH TO THE HAZARD

Rather than producing only "protected" bulbs, or at least requiring the use of only non-combustible enclosures for "unprotected" bulbs, the industry's approach to the bulb explosion issue for well over two decades has been to attempt to shift the known risks of the product onto the end-user by placing cryptic instructions on the bulb's packaging sleeve to (1) replace the bulbs before they reach the end of their "rated life" and (2) turn the bulbs off at least weekly for 15 minutes in continuously operated (i.e., 24/7) systems. "Rated life" is expressed in terms of hours of operation and will typically range between 5,000 and 20,000 hours, depending upon the bulb manufacturer, wattage and operating position (i.e., base up, base down, or horizontal). "Rated life" is defined as the median time before failure of a population of bulbs under specific operating conditions. The theory behind the instruction to replace before end of rated life is that, the longer a bulb has been in service, the more likely it is to fail violently when it does fail. One of the possibly not incidental benefits to the manufacturers from compliance with the instruction to replace bulbs prior to end of their rated life is that bulbs which potentially have thousands of additional hours of useful life would be consigned to the trash heap, bolstering the demand for replacement bulbs.

The concept behind turning bulbs off at least 15 minutes weekly in continuously operated systems is that, if a bulb is on the verge of exploding violently and is turned "off", it may simply fail to restart when turned back "on" again, rather than exploding.

There are several problems with the manufacturers' attempt to rely upon these instructions to deal with the inherent design flaw in their products. First, the end-user who is likely to be victimized by a bulb explosion often never sees and has no awareness of the instructions. An occupant can acquire or lease a facility equipped with metal halide bulbs and use that facility for years without ever having to replace a metal halide bulb or see the packaging. When a bulb is replaced, a "reasonable person," experienced with incandescent or fluorescent light bulbs, would have no reason to expect that it would be necessary to read the fine print on the packaging sleeve in order to avert a fire hazard. Ironically, even though many, if not most, electricians, electrical contractors, and design professionals will only become aware of the hazards of metal halide bulbs if and when they encounter an explosion, the manufacturers typically attempt to argue that owners and occupants of facilities equipped with metal halide fixtures should, by virtue of that status alone, have a sophisticated understanding of the hazards associated with the bulbs, even as the manufacturers take pains to downplay those hazards.

Second, anybody who does read the packaging will find dense instructions which reflect the obvious outcome of a struggle between the manufacturers' legal and marketing arms, which the marketing departments have clearly won. In a triumph of marketing nuance over safety concerns, there is no clear statement that simply letting the light bulb burn out could lead to a fire. As a typical example, one manufacturer's packaging suggests that light bulb failures are attributable to "internal or external factors such as ballast failure or misapplication", not that they are the natural, and foreseeable, consequence of properly applied light bulbs, in properly functioning equipment, simply wearing out.

Finally, the industry concedes that faithful compliance with the instructions to preemptively replace bulbs and periodically cycle them off in continuously operated systems will not prevent all bulb explosions. Comment 1 to the Restatement (Third) of Torts: Product Liability, §2(c) sets forth a principle that should be as fundamental to responsible product design as it is to the legal doctrine of product liability:

> In general, when a safer design can reasonably be implemented, and risks can reasonably be designed out of a product, adoption of the safer design is required over a warning that leaves a significant residuum of such risks.

The industry has conceded this. The National Electrical Manufacturers Association's Lighting Systems Division stated, in a 2004 publication, that:

> If there is any doubt that operators or maintenance personnel will completely follow manufacturer's instructions, then S-type [unprotected] lamps should not be used in open luminaires [fixtures]. (emphasis added)

Industry experience with metal halide fires provides ample reason for "doubt" that reliance upon the instructions on the bulb packaging will prevent fires, and compels the conclusion that unprotected bulbs should not be offered for use in open fixtures.

Similarly, an ANSI standard, approved unanimously by a committee of industry representatives in 1996, included language acknowledging that only "protected" bulbs were suitable for use in open fixtures (ANSI C78.387b-1998, §10.1.2). After apparently recognizing the implications of this concession, the same lighting industry representatives omitted this language from the standard a couple of years later.

SAFETY IS NOT AN OPTION

Lighting product manufacturers argue that the marketplace is free to "choose" to purchase or specify "protected" bulbs, which cost more than "unprotected" bulbs. Most of the manufacturers have been reluctant to offer potential purchasers any justification for paying the increased price for "protected" bulbs, presumably because doing so would effectively denigrate the comparative safety of the unprotected bulbs, which comprise the vast majority of their sales. The revisions to the NEC discussed above have forced the manufacturers' hands somewhat, and, as production of the "protected" products has increased to meet the increased demand, the cost difference between the protected and unprotected products has shrunk.

In any case, leaving it to the purchaser or specifier to "choose" a safer and equally functional product, yet continuing to sell "unprotected" bulbs, is akin to selling a car with no windshield wipers, with the caveat that it should only be used on dry days, except that there is no readily apparent hazard with the unprotected bulbs. Also, as suggested above, most victims of metal halide bulb explosions have no advance knowledge of the dangers involved, much less any awareness that they could have "opted" for safety, even assuming that they were ever in a position to make such a choice.

INVESTIGATING AND PURSUING METAL HALIDE CLAIMS

Success in the pursuit of a fire subrogation claim involving the rupture of a metal halide light bulb can depend upon actions taken in the immediate aftermath of the incident. The manufacturers of these products include some of the most sophisticated industrial companies in the world, and their approach to the defense of metal halide fire claims is sophisticated as well. They have teams of experts who have acquired extensive experience and familiarity with the technical issues surrounding metal halide failures. They have unfettered access to present and former industry employees who are experienced with the testing and manufacture of the products. They generally rely upon defense counsel who also have familiarity with the products and experience with the defense of similar claims. This experience makes it more likely that defense counsel will succeed in identifying and exploiting any potential vulnerabilities in the subrogation case.

As in most fire losses, early notice to the product manufacturers is critical, as the manufacturers are typically unwilling to accept even the most seemingly obvious fire causation scenario at face value, at least where their representatives did not observe the scene first hand. Keeping the scene in an undisturbed state can be a challenge. The fragments of the quartz arc tube, which are typically the ignition source of the fire, are quite small, and can be ejected over a large area and then further dispersed by fire suppression efforts. A fire investigator with no previous experience in the litigation of a metal halide fire case, unless properly directed, may not appreciate the importance of meticulously searching and sifting the debris from the area of origin for the arc tube fragments. In cases where the presence or condition of a plastic enclosure for the fixture may be at issue, it can also be important to find any residue from the enclosure in the fire debris. It is also important to identify and fully document the first fuels ignited by either the hot quartz fragments or the dripping, flaming plastic.

It is often a challenge to know whom to put on notice in the first place. It is usually preferable to keep the remains of the ruptured bulb in its socket for the joint scene inspection and, often, only an expert with significant experience with these products will be able to identify the manufacturer of a ruptured light bulb, at least while it remains in the fixture.

Even if substantial portions of the ruptured arc tube cannot be recovered, all may not be lost. It will often be possible to establish the cause of the fire based upon what remains of the bulb in the fixture, coupled with the absence of alternative causes. The potential for success of this approach will be enhanced if the opposing parties have been on scene and afforded their own opportunity to attempt to identify alternative causes.

Other facts that must be developed early in the investigation include:

1. Dates of purchase and installation of the fixture, with due consideration for any statutes of repose that might come into play;

2. Whether the bulb had ever been replaced since the original installation of the fixture or the insured's initial occupancy, and what the insured's practices were regarding bulb replacement, generally;

3. The practices regarding turning the lights on and off. Even in facilities where the lights are turned off on a nightly or other periodic basis, it is not uncommon for at least one lighting circuit to be kept on 24/7 for security purposes and, due to their more extensive usage, these "security" lights are more likely candidates for violent failures; and

4. Whether the insured had experienced previous ruptures or otherwise had any awareness of the issue.

Locating experts to match up against the manufacturers' in-house and retained experts can also be a challenge. With few exceptions, even the otherwise most highly qualified forensic engineers likely will not have anything approaching the extensive experience of their counterparts on the defense side, and the learning curve can be steep and costly. With enough persistence, it is possible to develop a case through the words of the manufacturers' own present and former employees, as recorded in their internal documents. The marketing and legal arms of these manufacturers unfailingly toe the party line with respect to the safety and appropriateness of their products. However, the idea of selling products with a known propensity to fail violently and catastrophically has, over the decades these products have been on the market, sometimes proven more nettlesome to product engineers. In thankfully unguarded moments, these engineers have occasionally reduced their candid thoughts to writing. Such documents can sometimes be used effectively to puncture the manufacturers' façade and demonstrate that, indeed, the "emperor wears no clothes." Because the manufacturers invariably insist that their internal documents only be produced under Protective Orders, the effort to develop such information essentially begins anew with each case, so it helps to know what to ask for.

CONCLUSION

Hopefully, the revisions to the National Electrical Code discussed above, and other forces in the marketplace, will eventually pressure the lighting industry to abandon continued sale of "unprotected" metal halide bulbs. Until then, it is necessary for subrogation professionals to remain alert for fires potentially caused by this hazard, and to respond appropriately. While having their fair share of unique legal, technical and factual issues, if properly investigated and developed from the outset, metal halide light bulb rupture incidents can often present viable theories for subrogation pursuit.

SUMMARY

The discussions and concepts addressed within this article provide an outline of pending and prospective litigation associated with Metal Halide Lighting. Specific decisions as to whether recovery actions should be pursued and against whom will require the review of each claim on the basis of its own facts and circumstances.

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