

Green Construction and Fire Protection

by Dominick G. Kasmauskas, CFPS

Most everyone in the construction trades by this time has heard of “green” construction and the LEED (Leadership in Energy and Environmental Design) rating system, sometimes called the “check list.” Many in the fire sprinkler industry have taken part in “green” projects, such as new and rebuild projects of airport terminals, residential, high rises, businesses, storage – every occupancy type. It is almost impossible to open a newspaper or construction trade magazine and not see an article regarding green construction or environmental and energy efficiency articles. Surprisingly, the push to build “green” and help save our planet continues despite recent construction cost increases. Some “green” technology and products can have an increased cost over similar non-green materials. The architectural firm, which is often also the LEED AP® – “Accredited Professional,” – covered later in this article, will have an idea of the return on investment (R.O.I.) due to the buildings sustainability and energy conservation components, plus the healthier environment for occupants, which is where the real pay back is.

In this article we should have a better understanding of the impact of buildings and unwanted fires, the United States Green Building Council (USGBC) and their mission, the LEED Checklists for a series of construction concerns, the possible impacts to the fire sprinkler industry thus far, and where and how do we want to lead our industry into the green concept further to obtain more recognition.

What is LEED?

According to the USGBC web site, “the **Leadership in Energy and Environmental Design (LEED)** Green Building Rating System is a voluntary, consensus-based national rating system for developing high-performance, sustainable buildings. LEED addresses all building types and emphasizes state-of-the-art strategies in five areas: sustainable site development, water savings, energy efficiency, materials and resources selection, and indoor environmental quality.”

There is a choice of ratings (Green, Gold, Silver or Platinum) to be obtained through the documentation of “points” being taken during the design process of the building. The concept and design of a new commercial buildings, for example, will be judged by certain percentages of Recycled Content of the materials used, Water Use Reduction devices installed, Light Pollution reduction for interior or exterior lighting, reduction of Heat Islands (“the thermal gradient differences between developed and undeveloped areas.”)

The Built Environment Impact and the Need for “Green”

According to the USGBC’s website, the built environment is impacting a major part of our future. In past building designs and construction practices, before “green,” could we rightfully and seriously expect a healthy future if we did nothing to adjust?

In the United States alone, buildings account for:

- 72% of electricity consumption,
- 39% of energy use,
- 38% of all carbon dioxide (CO₂) emissions,
- 40% of raw materials use,
- 30% of waste output (136 million tons annually), and
- 14% of potable water consumption.

Anyone that understands fire sprinkler systems also understands that the fire sprinkler industry has been having a positive impact on our environment for over 130 years without much credit. Which one or two items do you think the fire sprinkler industry positively impacts the most? CO₂ emissions and potable water consumption are two obvious choices. Traditional firefighting suppression forces are probably not calculated in the water consumption. The “Potable Water Consumption” percentage would be significantly higher if it was. How about waste from buildings without the benefit of having automatic fire sprinkler protection? How many tons of burned or non-recyclable building material and interior furnishings as the result of fires are being thrown into the landfills?

Now, continue to think laterally...how much new product is produced to replace the burnt structural material, replacement of lost commercial operation machinery, process materials, and furnishings? What is the energy consumed to manufacture the needed replacements? How much energy is needed to ship and install? What amount of energy is being used to transport workers and tools to rebuild or replace fire damaged structures? Burnt building materials should be evaluated for recycling but most likely will end up in a landfill as most material will be beyond recycling or reuse capabilities. Not just the burnt material is discarded from a structure involved in a fire. The peripheral materials will also need replacement either by code or design of the new part of the structure or by insurance and liability driven issues for the contractor in order to guarantee the new work.

For example, if a roof is damaged by the fire and firefighting operations, the roofer is not just going to patch a hole. The roofer is going to replace a significant area or possibly the entire roof to be able to warranty the work. In many cases involving a single- or two-family home, the whole roof of a home may be replaced due to age or condition after a fire. Many times exposed neighboring structures have radiant heat damage and will also produce tons of discarded building materials to our landfills.

How much fuel and energy is consumed by fire apparatus operating at a fire scene? (For “pumpers,” figure approximately 4-6 gallons of diesel per hour, aerial devices about 3-4 gallons of diesel, and heavy rescue trucks idling about 2-3 gallons per hour). Next time you see a fire scene on television or pass by one in your travels, take a quick count of how many vehicles are operating there. According to OSHA, 25% of all hazardous particulate air pollution is from fuel combustion coming from diesel engines. Diesel exhaust not only contributes global warming gases, but toxins such as sulfur dioxide, arsenic, acetaldehyde, formaldehyde, benzene, lead, phenols, mercury and manganese.

If the fire department arrives and dumps two or three million gallons of water into a burning building...does it all just disappear? Obviously, a large number of gallons will turn into steam, but most of the firefighting water and water used during overhaul to hit spot fires and cool the remains will settle into the aquifer or run off into streams and lakes. This run-off will carry large amounts of toxic substances with it. Ah, excuse me here, but, where do we get our potable water from? If you are in a rural or sparse suburban area this may not be a concern, but in the shadows of New York City, water quality and water supply amount is quite a concern.

As a former volunteer firefighter in northern New Jersey, I remember a case in a neighboring community where well over four million gallons of water was used to put out a fire at a paint manufacturer. There was a gully located approximately 50 feet from the building. The gully fed into a stream about a ¼ mile away and the fish were jumping OUT of the stream onto the bank because of the toxic, irritating material that was mixed in the water run-off from the firefighting operations.

How many less fire injuries and fire deaths would there be in a fully fire sprinklered United States? We know that we are all going to die someday and the environmental impact of a fire death is probably not much more than that of a death of other types. What about fire injuries? Initially after the injury, there will be quite a bit of medical waste in the caring for each of the new 16,000 or so reported burn patients in the US annually. Medical waste does not go to a landfill, but is incinerated due to it being classified as a bio-hazard. Incineration takes energy, precious energy that could be conserved or used elsewhere. The materials produced to treat burn patients, the energy used for incineration of the medical waste produced, and the energy and fuel used to transport burn patients for years or possibly a lifetime of care and rehabilitation could nearly be circumvented with the universal acceptance of fire sprinklers in all new construction.

Greenhouse gases, most notably CO₂, are significantly reduced when unwanted fires are addressed by fire sprinklers. Dr. James Marsden analyzed the fire problem of the County of Greater Manchester, UK. His estimates were based on 1.86 ounces of CO₂ released per 1.2 yd² per second of burning material. Plus the assumption of a radiant feedback of 66 kW/m² and an estimated arrival and extinguishment time of 15 minutes for the fire department. Estimates of burn areas were 24 yd² for dwellings, 7.2 yd² for cars, 4.8 yd² for rubbish fires, and 120 yd² for industrial or commercial fires. Calculations showed 3 million metric tons (3,306,930 US tons) of

CO₂ released just in that one region from unwanted fires in 2006-07. Fire sprinklers will not guard against automobile fires or most outdoor rubbish fires (yet), but just taking into account the structure fires and the possibility of significantly reduced CO₂ output from one metropolitan region in one year. Now, imagine this globally.

Our industry has positive impacts on all the items listed above regarding the built environment. It is not simply the impact of fire sprinkler systems and their cost during construction and the anticipated lifetime of the structure, which is what the AP® or contractors may be concerned with, but the positive impact they have, just by their very nature. It is what they DON'T allow to happen. It is a multitude of environmental and energy saving benefits for which these lifesaving (and lifestyle saving) systems do not presently get credit (with one small exception noted later.)

Just as fire sprinklers can downsize the ripple effect to local economies after a large unwanted fire in a community, fire sprinklers also down size the ripples that impact our environment and assist in energy conservation. The application of early fire suppression has tentacles that reach far beyond the structure and the unwanted fire. Positive impacts are realized on several energy and environmental issues. Lives are less disrupted or changed in a negative fashion.

It simply comes down to this, “the greenest thing we can do is put the fire out” as stated in a recent discussion of this subject by Michael Klemenz, P.E. of Davis-Ulmer.

USGBC

The United States Green Building Council (www.USGBC.org) “is a 501(c)(3) nonprofit membership organization with a vision of a sustainable built environment within a generation. Its membership includes corporations, builders, universities, government agencies, and other nonprofit organizations. USGBC is dedicated to expanding green building practices and education, and its LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™”.

To give you an idea of the involvement in green and LEED projects, the following is from a USGBC document released November 2008:

Membership

- 17,846 member organizations including corporations, governmental agencies, nonprofits and others from throughout the industry.
- Since 2000, USGBC's membership has more than tripled.

LEED® Green Building Certification System

- LEED for New Construction rating system was first released in 2000,

- LEED for Commercial Interiors and Existing Buildings became available in 2004,

LEED	New Construction	Commercial Interiors	Existing Buildings	Core & Shell	Neighborhood Development	Schools	Retail	Total
Registered Projects	9,555	1,757	2,063	2,147	230	534	107	16,393
Certified Projects	1,420	397	172	127	12	2	20	2,150

- LEED for Core & Shell became available in July 2006 for spec developments,
- LEED for Homes was launched in December 2007,
- LEED for Neighborhood Development, Retail and Healthcare are currently in pilot test.
- Over *4.2 billion square feet* of commercial building space is involved with the LEED green building certification system.
- By 2010, approximately 10% of commercial construction starts are expected to be green, according to McGraw Hill Green Building Smart Market Report 2006.
- Every business day, \$464 million worth of construction registers with LEED.
- There are LEED projects in all 50 states and 69 countries.

Education & Accreditation

- LEED workshop attendance: 91,163
- LEED Accredited Professionals: 69,151
- Greenbuild Expo Attendees 2008: 28,224
- Greenbuild Expo Attendees 2007: 22,835

The LEED AP®

The USGBC notes that “LEED Accredited Professionals (LEED AP) have demonstrated a thorough understanding of green building techniques, the LEED Green Building Rating System, and the certification process. The LEED AP program is administered by the Green Building Certification Institute (GBCI), which was established with the support of USGBC (in 2008) to allow for objective, balanced management of the credentialing program”. The GBCI created from the USGBC assists in the ANSI process.

The LEED AP process began in 2001 by developing an exam process. Critical “green” issues are identified to develop test questions which reflect the roles and responsibilities expected of the LEED AP in the field. Presently the exam fee is \$300 for USGBC members. The exam is 2 hours with additional expectations that the candidate will arrive at least ½ hour early, plus 10 minutes for orientation and instructions, and 10 minutes more for a voluntary exit review.

Having a LEED AP in your organization may be appealing to the Project Management Team. It shows interest and understanding of the detailed process involved in being “green”.

A detailed LEED AP Candidate Handbook containing complete information on what is needed and expected of the candidate as well as studying tips and areas of experience one should hold can be found at www.gbci.org. The handbook lists several web sites to expand one’s studies, how to find exam sites, and very detailed instructions for identification at the exam site and “do-n-don’ts” during the exam.

LEED Version 3 in 2009

In reviewing draft statements, there are not any anticipated changes that would significantly impact the sub-contractor in the next edition of LEED rating system that they are not familiar with in LEED v 2.2.

The largest improvements affect energy conservation and greenhouse gas emissions.

LEED for Homes and ICC-700 (2008)

The “National Green Building Standard” for Homes was released in December 2007 and the National Association of Home Builders (NAHB) has a large stake in this concept. The NAHB started the original 2005 *NAHB Model Green Home Building Guidelines* and is supporting the ICC-700 document.

Beyond the Codes, ICC-700 addresses construction considerations in new dwellings from a completely different scope. Environmental criteria and energy conservation are foremost and go beyond the requirements of the *International Energy Conservation Code* now used in many areas.

As noted in an ICC article in their Building Safety Journal, June 2008 issue, it is “choice vs. mandatory requirements” and more can be found about ICC-700 for those doing fire sprinklers in dwellings at www.iccsafe.org/news/green .

If the NAHB is supporting the ICC-700 document along with other LEED checklists such as “LEED for Homes” and “LEED for Neighborhood Development” and if it is a near possibility to have a point interjected into these two documents also for fire sprinklers, is it possible that the NAHB will be in support of residential fire sprinklers someday? That day may be closer than opponents to fire sprinklers in new home construction may realize.

In NAHB's own numbers, a regularly constructed \$300,000 home will cost about \$308,500. However, they show an ROI within a few years, mostly based on energy and water savings. Considering this and all the other "glitz" that go into new homes, how is it when we crunch the numbers for fire sprinklers in new homes, we're biased?

The NAHB promotes the fact that the increase in the sale price of a new home has other beneficial effects including increased profits to the builder and realtor. So why not include fire sprinklers in all new homes too? Think of the environmental advantages plus the increase in profit? I just can't seem to grasp their logic.

This may all be moot as the 2009 *International Residential Code* (as with the 2006 and 2009 *NFPA 101 Life Safety Code* and *NFPA 5000 Building Code*) contains 13D fire sprinkler requirements for all new dwelling construction now in the body of the code, not just an annex item. The 2009 IRC passed the vote in September, 2008 and recently was upheld unanimously on appeal in December, 2008 by an ICC panel, which was upheld by the Board. Also, recent articles in the news note that builders have not seen the clamoring by home buyers for green homes, the cost of green homes, and the contractors have had difficulties in doing estimates based on availability of green products needed to construct the homes.

Impact on NFSA *Subscriber Members*

Presently, code enforcement's official main duty is just that... meant to officially enforce the code. Should there be adoption of "green" documents and codes above and beyond the adopted codes through local laws or state statutes and referenced standards, a careful analysis should be done to see if there are any conflicts in construction techniques or with existing codes.

A recent article I read noted that code officials, in their duties to research compliance of materials used in construction, should be able to evaluate items for green prescriptions as well.

I wanted to toss this into the article so as to solicit and invite input from code officials and learn of any impact the code enforcement officials, insurance representatives, and like professionals are seeing in their day to day duties regarding green projects.

Working On a Green Site

Green projects need the same involvement by the fire sprinkler contractor in the planning process as any other, maybe more so. Several issues may impact sub-contractors operating on site and each should make sure that they have received all needed instructions for operations.

Vehicles— Are special vehicles needed to operate on site? Vehicles using veggie-fuel, fuel cell, or electrically powered forklifts? How are these vehicles refueled or recharged? What is the expected reenergizing source? Who is responsible?

Site Trailers– Are any special trailers required? Are trailers to be operated on the grid or is energy derived from tying into an independent energy source? Has any fire sprinkler contractor been required to supply solar panels to power any equipment or lighting as of yet?

Recycling– Shipping materials, pallets, and dunnage in particular. How about office waste; paper, cans, bottles? Make sure the requirements and processes are clear to all employees operating on site. Speak with your suppliers and see what processes they are taking part in to be sensitive to the green job sites.

Paperwork– Requirements for documentation should be done electronically; shop drawings, memos, letters, job books, job logs. Will this require software appropriations? There are other project management systems tools to coordinate documents, generate reports, check for compliance, as well as direct web-based collaboration.

Volatile Organic Compounds (VOCs) – There are requirements for low-emitting materials in adhesives and sealants, plus paints and coatings. If you haven't already, you may want to research your materials in your inventory now to see if they are compliant. It may be economically beneficial to review your inventory now if you haven't already.

What are our requirements to meet the LEED check list presently?

Other than those mentioned above – not much. The “Material & Resources” credit sections three through seven in the USGBC’s New Construction & Major Renovation Reference Guide for LEED 2.2 specifically note, “Mechanical, Electrical, and Plumbing components and specialty items shall not be included in this calculation,” meaning the fire sprinkler system components are exempt from point calculations for materials being used in the project. I have this backed up with a short e-mail to me from the USGBC and a letter from another party that inquired about fire sprinklers being considered a “specialty.” This may or may not be an advantage to the LEED AP®. Probably a disadvantage, as in my research, once again our industry is already in the lead. In conversations or research with fire sprinkler manufacturers and other allied manufacturers, most materials produced for our industry (pipe, hangers, fire sprinklers, valves, etc.) are coming from recycled materials. CPVC is recyclable according to the Plastic Pipe and Fittings Association. California Department of Housing and Community Development noted in a report in 2006 that due to the inexpensive aspect of obtaining CPVC (as compared to copper), voluntary recycling of post-consumer CPVC scrap needs to be encouraged. Meeting the LEED requirements may be that avenue.

There is reported use of the “Innovation in Design” section of the LEED checklist to obtain one credit by using fire sprinklers (code driven or a voluntary installment). This section can gain one point more toward their desired level of LEED Certification for exceptional performance above the LEED requirements. The LEED AP® will need to document and apply the strategies and measures of the fire sprinkler concept to obtain that one credit. The AP® must spell out the environmental and health benefits.

So, yes, Virginia, there just may be a Santa Claus. This is a “gift” to industries such as ours.

A Door Not Yet Opened...and if opened can we close it if need be?

Many fire sprinkler contractors and some code officials have asked about the fire sprinkler credits in the LEED checklist and reference guides. There are some future possibilities, but as an industry what are we prepared to handle?

Having our product recognized may not come without some trade-offs. If a future LEED checklist was to recognize fire sprinklers with a credit or two, what would the impact be if all water used during flow tests of any size must be captured in gray water? What are the impacts if all testing water must come from gray water – a gray water tank if lucky? What if the gray water is a retention pond (which opens up an entire different area of a technician’s imagination)? Who will be responsible to coordinate the size of and construct the holding tanks or ponds? What will the challenges be associated with circulating water with enough velocity to perform a proper flow test? Is anyone facing this now or have experience in capturing and using gray water?

A plus may be more electric fire pumps and less diesel fire pumps? What are the advantages in this case? No diesel exhaust, no fuel tanks, much less maintenance. If the building is producing some or all of its own power you now have an extremely reliable power source.

Where Do We Go From Here?

My opinion is to proceed cautiously. Here are areas I think we can explore. One is to obtain a point or two for fire sprinklers for any project in future editions of LEED checklists. The second is to obtain at least one point for having a voluntary fire sprinkler system not required by code or local ordinance. Lastly, some recognition for the “green” homes with a minimum of 13D systems installed.

Our inherent environmental advantages are obvious to anyone and it is time to explore what our just dues could be and should be.

It may be worthwhile to develop an NFSA Green Committee to explore experiences and what the future may hold, or should hold for the industry. Maybe this could include an annual update meeting of NFSA “green” fire sprinkler contractors to identify issues and answers to challenges which our membership needs to be aware. Let me know your thoughts. I expect to be writing update articles for SQ on green issues and what we discuss in this proposed committee could be the basis of these updates.

In Conclusion

Whether involved in green projects or not, I sincerely hope that all fire sprinkler contractors are operating in an environmentally friendly way.

Whether you are a contractor, manufacturer, registered professional, or other fire protection professional, I look forward to hearing from you about your project involvements, any positive or negative impacts you may have in these projects, and any areas of voluntary compliance.

Great appreciation goes to the many folks I spoke with at Davis-Ulmer, SRI Fire Sprinkler, ABCO Peerless (all in NY) and Allan Automatic in California. Plus the several NFSA supplier and manufacturer members, whether we spoke directly, supplied letters, or through the excellent “green” documentation provided on their web sites.

Fire Sprinklers are green. Save your building, save our environment.

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