Risk Management of Fire using Video Based Detection

Measuring the Threat

The annual risk of a fire can be estimated using fire statistics and a thorough evaluation of the impact that an actual fire would have on property values, building content and business disruption. Studies and statistics throughout the United States, Canada, and Europe indicate the probability of a fire to be approximately 1.8% per 100,000 ft^2 of commercial facility. Therefore if you had a 200,000 ft^2 facility the probability of a fire that would require a first responder response would be 3.6%; the probability of a fire for a 50,000 ft^2 facility would be .9% and so on. Obviously industrial facilities such as utilities, chemical plants, oil and gas processing, machinery intense, etc will have a higher risk based on the nature of that business. A good summary that explains the difference in probability and loss associated with a fire is an excerpt form the Fire Safety Policies of the Minister of Public Security, Quebec 2001.

> "An analysis of the fires that have occurred in Quebec over the past decade confirms the existence of a relatively close relationship among the parameters that are used (along with the risk classes determined by those parameters) and the two basic dimensions of fire risks: probability and consequences. Statistics for the common bungalow will serve to illustrate this relationship. Even though the bungalow is the scene of 68% of fires in Quebec because of its widespread presence, the probability that a fire will break out in such a building is still relatively low, indeed, much lower than the probability that a fire will start in an industrial building for example. Between 1992 and 1999, the fire rate for the residential sector was 3.08 per 1,000 buildings (similar to the U.S.) compared to a fire rate of 15.78 per 1,000 in the commercial sector and 41.68 per 1,000 in the industrial sector (See Table 1). In other words, the fire risks for commercial and industrial buildings are respectively, five and thirteen times greater than the fire risks for homes.
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> The residential sector is far and away the sector for which fire statistics show the greatest loss of lives. Reducing the number of deaths due to fire in that sector depends not primarily on the work of firefighters but rather on prevention measures or early fire detection. The evidence for the relation between building use and the effects of fire is no less convincing with regard to property loss. Between 1992 and 1999, the average amount of property loss due to fire in commercial buildings and industrial/manufacturing buildings was $79,268 and $132,138 respectively. In other words, the losses caused by fire in the commercial and industrial sectors are, respectively, three and five times higher than the losses caused by the fire in the residential sector. These figures are presented in absolute values, that is, per $1,000 of building value."

Table 1

USE (Sector)	Fires			Property Loss			
	Average Annual No.	Fire Rate /1000 buildings	Relative Fire Rate	Total Losses (in thousands)	Rate / $1000 value**	Average Loss (in $)	Relative Loss rate
Residential	6,560	3.08	1.00	172,019	1.08	26,224	1.00
Services	480	11.66	3.79	31,329	0.88	65,269	2.49
Commercial	709	15.78	5.12	56,201	3.49	79,268	3.02
Industrial	553	41.68	13.53	73,006	5.49	132,138	5.04

* in constant 1999 dollars

** Rate adjusted according to the tax-assessed value of buildings, excluding their contents

Evaluating a specific situation

It can obviously be observed that industrial facilities have higher incident rates and loss than say a commercial building, which makes sense based on larger size, energy intensive manufacturing, more flammable materials, potentially heated processes, etc.

Once the probability of a fire event is determined then the loss associated with that fire should be estimated. There are many factors that contribute to the damage a fire can cause once it has ignited.

- **Are there automatic detection devices present?** Recent statistics have shown that 72% (U.S.) and 68% (U.K.) of non residential structure fires were in facilities with no automatic detection in the ignition area. A large number of these types of industrial, storage, and large volume areas just do not have an adequate performing detection solution at this time. Point type spot detectors (heat and smoke) are just impractical for these large open areas. Video fire and smoke detection is an ideal solution for these types of applications. Video Fire and Smoke detection is analogous to having a guard stationed permanently in each area. Whenever a camera "sees" a fire or smoke event it will issue a visual alarm.

- **How fast will the fire spread?** The spread of the fire will be affected by the fuel and air available. Is it a large open area? Are there flammable materials in the area that will advance the spread of the fire? The damage associated with a fire increases exponentially with time based on the spread of that fire. Identifying a fire as soon as it generated will allow suppression to contain and extinguish the fire.

- **Once detected, how will the fire be suppressed?** After the fire is detected be it automatically or by someone walking down the street, the emergency response is critical. Is there a guard on site that can immediately respond and put out the fire with an extinguisher versus a remote monitoring center that only has been contacted by a telephonic alarm and would still have to dispatch an emergency responder? Is there a local fire department within minutes of the facility or is the site remotely located with a longer response time?

- **Will the fire event be catastrophic?** Depending on what starts a fire, where it is located, and what fuels are available and how fast it spreads, a fire could be a relative non-event or it could be catastrophic - destroying a facility and causing major asset damage and huge business interruption losses. What would a catastrophic event cost the business - is it possible?

Calculating Fire Risk

If we take the Quebec study as an example the average industrial property loss was $132,138, if we follow the basic rule of thumb that building content and business interruption loss is at least 3 X the property loss – than the average total loss for an industrial facility would be $528,552. We'll assume the probability of a fire in this facility is 4% based on the Quebec study and the assumption the industrial building is a midsized manufacturing facility. Thus the annual cost of fire would be:

Fire Risk ($) = Probability X Single Loss Occurrence

Fire Risk ($) = 4% (.04) X $528,552

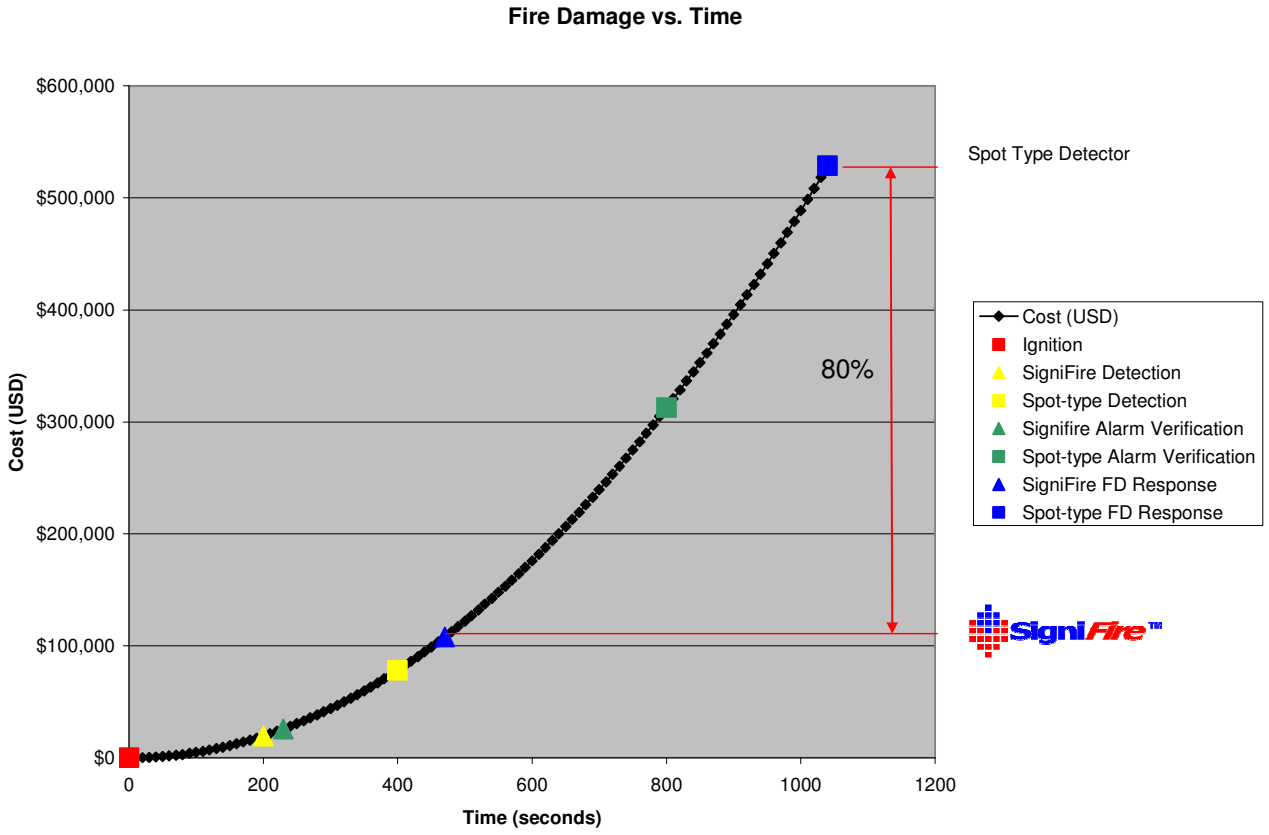
Fire Risk ($) = $21,142

To determine a Return on Investment (ROI) for installing a video based fire and smoke detection system, a determination must be made about how much Fire Risk will be mitigated based on installing a video based detection system. Because fire spread and damage increase exponentially with time, the cost of the fire damage will follow the same pattern. If there is currently no detection present in a facility there would be a drastic reduction in annual fire risk expense.

Detecting an event in seconds with instant visual situational awareness and suppressing the fire immediately (a facility based guard with a fire extinguisher for example) would reduce expected fire expense an estimated 80% to 95%. If there are currently spot type detectors that risk may be reduced 60% to 80%. Attached is a fire-damage versus time curve that incorporates a Signi*Fire*™ and a spot type detector system. The Signi*Fire*™ system will not only detect much earlier 3-5 minutes in smaller volume spaces (as verified in Naval Research Lab testing), but will also give instant visual verification versus someone walking out to a remote part of the industrial facility to verify (which we estimate to be 4 minutes). If we assume the emergency responder reaction time to be 4 minutes for each case then the Signi*Fire*™ system would save approximately 80% of the fire damage versus a spot type detector system.

If we continue with our example and assume this industrial facility has no current automatic fire detection (typical) then the annual reduction in fire risk would be at least an estimated 80%. This would reduce the annual fire risk expense from $21,142 to $4,228 or a savings of $16,914. To cover this type of facility it may take 16 cameras or two SigniFire FSM-8000 DVR processing units. If the installed cost of the system would be $40,000 then the ROI based on a simple payback method would be 40,000/16,914 or

2.4 years. This ROI would be incremental to any ROI based on the security function of the CCTV system which is obviously something most facilities are implementing today.



Conclusion

Video based fire & smoke detection is a safety and security technology that can provide an attractive return on investment. Large volume structures that contain high value assets should consider a performance based analysis including a video fire & smoke detection system that can provide early warning and instant situational awareness thereby drastically reducing the annual expense of fire. An analysis of the probability in conjunction with single loss occurrence should be conducted to understand the potential fire risk and the ability to mitigate that risk using advanced video based fire & smoke detection.

Sources:

U.S. Fire Administration, Non-Residential Structure Fires in 2000, Topical Fire Research Series, Volume 3 – Issue 10 June 2004

Prevention and Control of Arson in Industrial and Commercial Premises, September 2000, Arson Prevention Bureau – United Kingdom

ESDEP Lecture Note, Lecture 4B.1: Introduction of Fire Safety
http://www.kuleuven.ac.be/bwk.materials/Teaching/master/wg04b/10100.htm

Fire Safety Policies of the Minister of Public Security, Quebec 2001.

Utilization of statistics to assess fire risks in buildings, Kati Tillander, VTT Building and Transort – Dissertation for the degree of Doctor of Science in Technology