PHYSICAL SECURITY TECHNOLOGY FOR TANK STORAGE FACILITIES

New-generation perimeter intrusion detection sensors combined with video analytics and intelligent lighting can dramatically enhance detection, deterrence and response capabilities while meeting budgetary constraints and operational realities

THE PHYSICAL security of storage facilities for oil, natural gas, and refined products is critical for public safety. A deliberate attack on a facility could result in injury or loss of human life, harm to the environment, and severely impact supply chains of energy and other critical products. Even less serious incidents, such as vandalism, theft or simple trespassing can also result in substantial damages to high-value assets, potential liability and interruption of operations.

Storage facilities and refineries can cover large areas, while the constant flow of workers and materials create significant security challenges. Traditionally, security at these sites consists of fences, surveillance cameras, access control, and on-site personnel. These measures provide a solid foundation, but security gaps exist – a fence by itself only keeps out opportunistic intruders, cameras record incidents but don't stop them, and security personnel need to be deployed strategically at larger facilities.

Physical security technology can augment the effectiveness of both physical infrastructure and security personnel. When designed and deployed correctly, it is a cost-effective element of a facility's risk-management programme.

SECURITY STARTS AT THE PERIMETER

Perimeter intrusion detection systems form the first line of defence, detecting intruders before they get inside. While there are many types of sensor technologies that protect perimeters, some are more suitable for storage facilities than others. When looking at different systems, consider these factors:

- Coverage – Does the system protect the entire perimeter (e.g. no blind spots)?
- Probability of detection – Does the system quickly and accurately detect attempts to breach the perimeter each and every time?
- Nuisance alarm rate – Does the system only generate alarms for real or simulated intrusion attempts? If the system generates alarms during normal conditions or high winds, security may start to suffer because of complacency when responding to alarms.
- Ease of installation and configuration – How easy is the system to install and configure? Can the system be configured remotely from an equipment room, so maintenance staff can avoid travelling out to the perimeter whenever an adjustment is required?
- Integration with security and video management systems (SMS/VMS) – Can the information generated by the system be presented in a way that improves situational awareness? For example:
  - Can the SMS/VMS display the precise location of intrusions attempts on a map?
  - Can the alarms be integrated with the VMS for automated camera control?
  - Is there full logging of activity so that incident reports can be generated?

FENCE-MOUNTED SENSORS

Fence-mounted perimeter intrusion detection sensors are a durable, cost-effective solution, turning existing fences into smart fences by detecting and

locating attempts to cut, climb, or lift the fence fabric. They are field-proven, difficult to defeat, and work reliably in rain, snow, and wind. When an intruder is detected, the generated alarm (which includes the intrusion zone or precise location) can be used to trigger other on-site security resources, including pan-tilt-zoom (PTZ) cameras and deterrence devices like sirens, loudspeakers, or security lights. The system can be monitored by centralised security personnel, enabling them to assess the situation remotely and dispatch a response if required.

Fibre optic-based systems are the most popular choice for storage facilities, especially those with larger perimeters. Non-conducting, intrinsically safe in explosive atmospheres, and immune to lightning and EMI, fibre optic sensors can be used anywhere within the facility. Often with support for extended coverage distances (for example, Senstar's FiberPatrol system supports up to 80 km or 61.2 mi), a single unit, installed indoors in a safe location, can protect a facility's entire perimeter. Using advanced sensing techniques like coherent optical time-domain reflectometry (C-OTDR), the systems offer high-value security features such as precision ranging, environmental compensation algorithms, and cut immunity.

Precision ranging, which is a major improvement over previous generation 'block' sensors, provides many benefits. Not only can intrusion location information be used to direct surveillance cameras, it enables sensitivity levels to be adjusted for specific areas of the fence (for example, to accommodate for changes in fence construction). Ranging capabilities can reduce nuisance alarms as well, since the system can distinguish between site/area-wide disturbances caused by high winds and a legitimate escape attempt. Finally, ranging reduces operational costs by enabling maintenance staff to quickly locate and resolve issues.

One question that always gets asked about fence-mounted sensors: What happens if someone cuts the cable? When the sensor cable is cut, either accidentally or in an attempt to defeat the sensor, the system immediately reports the incident, including its exact location. Moreover, systems based on time-domain reflectometry technology retain the ability to detect and localise intrusions up to the point of the cut. When installed in a redundant-loop configuration, the sensor becomes cut-immune, in that it continues to provide detection on the full perimeter even after a cable cut.

Perimeter gates, typically equipped with electronic access control and closely monitored via surveillance cameras, can also be enhanced with perimeter sensors. Swing gates can use the same

fence sensor protecting the perimeter by routing the cable onto each moving panel (the cable is trenched from one side to the other). For sliding gates other technologies are more effective. If the area can be viewed from a clear, overhead location, virtual detection zones can be monitored via outdoor people and vehicle tracking video analytics. Another solution is wireless gate sensors, where an embedded accelerometer analyses gate movement in three-dimensions, enabling the sensor to distinguish between gate activity, intrusion attempts, and environmental conditions. The sensor communicates with a nearby processor over an encrypted and monitored wireless link. If a suspicious event occurs – intrusion attempt, communication link failure, or an attempt to remove the sensor from the gate – an alarm is immediately generated.

INTELLIGENT LIGHTING

Intelligent, low-voltage lighting is a new trend in perimeter security. Installed on fences outside of designated hazardous areas, LED-based luminaires provide uniform, wide-spectrum illumination targeted along the fence line. This improves the quality of video feeds by avoiding hot spots while a high colour rendering index (CRI) value means colours are accurately shown, greatly assisting officers with identification. LED-based lighting also dramatically reduces electrical consumption while a 10-year-plus lifespan virtually eliminates maintenance.

These benefits are useful but how do they relate to perimeter sensors? This is where 'intelligent' comes into play. Sensors embedded in the luminaires themselves detect the fence vibrations caused by someone attempting to cut, climb or lift the fence fabric. In addition to notifying the SMS/VMS, the luminaires in the immediate area can instantly switch to full power or strobe. Knowing they are detected, potential intruders may rethink their actions.

VIDEO ANALYTICS

Video analytics have greatly improved over recent years, benefiting from today's higher performance/lower cost computing resources, as well as HD cameras with impressive low-light, infrared and thermal capabilities. Advances in computer vision research have led to the development of sophisticated video analytic software optimised for outdoor/indoor people tracking, left/removed object detection, PTZ auto-tracking, face and licence plate recognition, crowd detection, and much more. These software modules may be included as part of a VMS or embedded on individual cameras.

Rather than being an alternative to traditional fence-mounted sensors, video analytics offer an exciting new set of technologies that greatly enhance perimeter security at relatively low cost. For example, video analytics can leverage a facility's existing camera infrastructure to detect and track people near both sides of the perimeter fences, providing early warning of potential security events before they can occur.

INCREASED SECURITY, INCREASED PUBLIC SAFETY

Perimeter intrusion detection technology, including fence-mounted sensors, intelligent lighting and integrated video analytics, can help meet the goal of reliably detecting attempts to bypass perimeter fencing and gates. The key concerns when evaluating these systems for use at tank storage facilities is to ensure they reliably detect intrusion attempts while avoiding false alarms, avoiding blind spots and other security gaps, are cost-effective for sites with large perimeters, and can be properly integrated to enhance overall security response capabilities. Implementation of the appropriate physical technology along with security practices can help mitigate risks to environmental and public safety.

For more information

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01 A high-security fence enhanced with Senstar's FiberPatrol ranging fibre optic perimeter intrusion detection sensor. Any attempt to cut, climb, or lift the fence fabric is immediately detected

02 Video surveillance footage showing a site protected by both an outdoor people tracking video analytic and the Senstar LM100 Hybrid Perimeter Intrusion Detection and Intelligent Lighting System