Xtralis Case Study

Tamworth Equestrian Centre (AELEC)

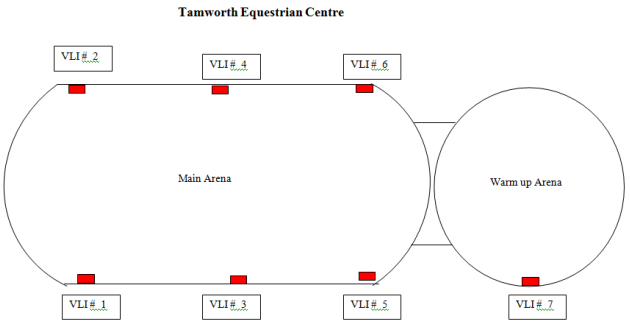
Introduction

This Case Study provides an overview of the replacement of the fire detection system originally installed at the Australian Equine and Livestock Events Centre (AELEC) which is situated in Tamworth, on the North West Slopes of New South Wales, Australia.

The study briefly describes the performance of the original Ionisation Point detection system, the subsequent field investigation and implementation of a VESDA VLI - Aspirating Smoke Detection system (ASD) a product specifically designed for industrial applications. It details the improvements compared to the original fire detection system and outlines the performance results of the VLI system.

The AELEC complex was required to have a fire protection system in keeping with Australian building regulatory requirements.

The venue hosts a variety of Equine and Livestock related functions and events throughout the year. The need to accommodate a mix of spectators, competitors and livestock posed a number of challenges in the installation of a suitable fire protection system. In view of the type of construction and operation, the fire protection system was designed as an “Alternate Solution” as opposed to a ‘Deemed to Satisfy Solution’ and implemented to meet the BCA (Building Code of Australia) performance requirements. The primary concern with regard to fire engineering was limited to the public indoor Main Arena and public Sales Ring / Warm – Up Arena.



The building consists of the equivalent of three contained storeys and is classified as a Large Isolated Building in the BCA due to its 14,263 square metre floor area and 128,528 cubic metre volume.

The ‘Alternative Solution’ was offered as an alternative to the ‘Deemed to Satisfy’ requirement for mechanical exhaust and sprinkler systems in a large isolated building, including consideration to travel distance from the Indoor Arena Floor and fire hose reel coverage to the Indoor Arena.

In part, the Fire Safety Engineering Report relied upon the effectiveness of the automatic smoke detection and alarm system and the training and ability of the Fire Wardens for the design assumptions of the ‘Alternative Solution’ to work to satisfy the performance requirements of the BCA.

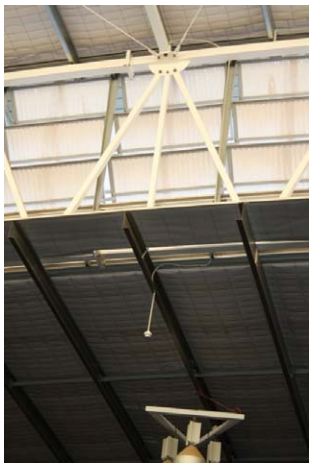
The Fire Safety Engineering Report specifically called up an AS 1670.1 smoke detection system which was then installed.

Original System

The “Electrical Specification” stated that Intelligent Point Type “Analogue Addressable Self Compensating” smoke detectors were to be installed. The specification required that ‘ionisation type’ smoke detectors be installed, due to the alleged unsuitability of photo-electric type smoke detectors, given that high airborne dust levels would be generated by the various events.

The automatic smoke detection system subsequently installed at the AELEC complex was a typical example of an intelligent analogue addressable self compensating point type detection system comprising both ionisation and heat point detectors.

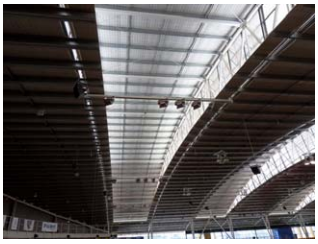
Since the completion of the installation the ionisation detection system at the AELEC complex experienced an extraordinary number of nuisance alarms and maintenance faults.



In view of the number of nuisance alarms from the ionizations detection system, AELEC management sought an independent appraisal of the system from consultants (Mecelec Design and Management Pty. Ltd). This company was ultimately engaged to survey the installed system and report on the findings. The findings covered various aspects of the designed system and clearly made reference to the fire detection system.

The height at which the ionisation point type detectors were installed (between 18 and 20 metres) above any potential fire made them entirely ineffective due to the effects of dilution, agglomeration (smoke particle size increase as distance from fire source increases) and the non aggregating capability of point type detectors. Additionally point type detection in this environment proved to be unsuitable due to the difficulty of maintenance. The detectors at roof level were virtually unreachable without the use of expensive ‘high reach’ equipment.

The point type detection system was totally unsuitable due to the amount of dust and dirt present in this environment. The continued problems resulted in the client isolating the entire system throughout the Arena and Sales Ring / Warm up area. This was due to the high level of nuisance alarms and automatic maintenance alerts (dirty detector alerts).



In order to meet the natural smoke ventilation requirements of the Fire Safety Engineering Report, the centre design is permanently open to natural atmospheric conditions. Metal louvers were part of the solid window sections on the first floor level, opened and closed according to the conditions. The open stock entrances to the Sales Ring /Warm-Up Arenas all influenced the original detection performance.

The building is also typically exposed to high moisture levels (both morning and evening mist) and temperatures that range from the very low (sub zero in winter) to the very high (above 40 degrees Celsius in summer) due to its geographical location.

Mecelec's report summary clearly stated that in their opinion the installed system was entirely inappropriate to this application due to the following reasons:

- Ionisation type smoke detectors are not permitted for use in egress paths, (The Main Arena and Sales Ring / Warm up area form part of the paths of travel to exits)
- Ionisation type smoke detectors cannot detect visible smoke particles greater than 1 micron in size (the smoke most likely to be generated from a fire in this type of construction and application)

- The extreme height of the detector placement would mean that the effects of agglomeration and dilution would make the detectors non effective.
- All ionisation detectors installed suffered from severe contamination.

Consultant's Recommendations

In view of the fire system report to AELEC, Mecelec were further engaged to recommend an appropriate fire detection system for the conditions present at the centre, which would also support the existing extinguishers and hydrants. To provide an effective fire detection system, the prime considerations were, dealing with the high levels of dust from active events, varying airflows resulting from the self ventilated building design and meeting the evacuation requirements.

Mecelec recommended that a multi-point ASD system would be best suited and the most effective smoke detection technology to operate in the environmental conditions present at the site. They sighted the following reasons:

- ASD pipe work can be installed at height whilst the aspirated detectors can be installed at normal service working height level
- ASD systems can be configured for high sensitivity to account for smoke dilution factors,
- Smoke sampled at multiple points simultaneously is aggregated and the system activated at much lower real smoke levels than point systems can achieve,
- There is no need to access the pipe network at the high level once the system is installed as all maintenance is carried out at normal working height level,
- The system will be nuisance alarm free from dust due to ASD system filtration and dust rejection.

Mecelec's findings culminated in the recommendation of a VESDA ASD system with external pre-filters, water trap mechanisms with valving and air injection points for routine back flushing of the sampling pipe network. It was acknowledged that the ASD system would require a regime of strict maintenance and routine filter replacements to ensure reliable performance over the life cycle of the system.

Having previous experience with ASD technology in similar environments, Mecelec advised that the multi-point ASD system could be readily retrofitted to the installation utilising the existing analogue addressable fire alarm control panel and wiring.

Mecelec advised AELEC, that they would be willing to work with Dynamic Fire, the installation contractor to assist in the design, programming and commissioning of a VESDA ASD system and further to oversee the new installation. In consultation with the local authorities, AELEC accepted the proposal and agreed to install a VESDA ASD solution.

VESDA VLI ASD System

During the time Mecelec were preparing their report to AELEC, a new VESDA ASD product had been developed by Xtralis, specifically designed for industrial applications and sites where environmental conditions are considered harsh, VESDA VLI. The conditions at the AELEC complex were ideally suited to the VLI detector which was ready for field trials.

A suggestion was put forth to AELEC that the VESDA VLI, a new industrial ASD system was ideal to protect their centre. The following reasons were sighted:

- VLI is specifically designed for industrial applications where harsh conditions exist.
- New patented, fail-safe, intelligent filtration with several mechanical and electronic features ensuring minimal impact of harsh conditions on detection performance and detector life. These include IP54 enclosure, inertial separation, secondary filtration, clean air barrier and clever modular design.
- Absolute smoke detection combined with a new "Clean Air Zero" function ensuring detector sensitivity is maintained throughout the life of the detector and safeguarding against nuisance alarms.

AELEC and the Tamworth City Council agreed to work with Xtralis and Mecelec to trial the VESDA VLI ASD system and adopt it for the centre, upon a satisfactory trial period completion.

Upon agreement with all parties, discussions were then held between Mecelec and Xtralis whereby a design was prepared for the centre using the new VESDA VLI industrial detector.

Pre-installation Smoke Tests

Smoke tests were conducted to understand the way in which air moved in the various areas of the complex and how smoke would be affected by the natural ventilation aspects of the structure. Smoke testing also provided an indication of how smoke dilution and stratification conditions would impact on detection.

Smoke testing was carried out with representatives present from AELEC, Xtralis, Mecelec and Dynamic Fire the installation contractor. Testing was conducted using cold smoke in several locations, including the main arena performance area, the grandstand area and the Warm-up arena. These locations where chosen primarily to ascertain how the airflow moved within the complex.

Following the smoke testing a pipe network design was prepared. A total of seven VESDA VLI detectors were required. A greater concentration of sampling points was included, considerably more than the number of point detectors installed in the original fire detection system to cover the same area.

The high density of sampling points was necessary at roof height to provide an increased capability of detection given the air movement and dilution.

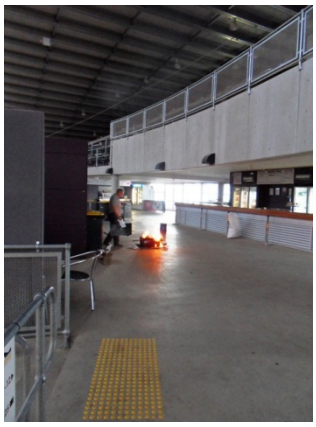
Six (6) VLI detectors were installed in the main arena, set out with three (3) detectors on either side of the building. The circular Sales Ring / Warm up Arena had a single VLI detector installed.

The sampling holes in the pipe networks were sized accordingly for the conditions using the VESDA modelling software program (ASPIRE2). To minimise the dust contamination build up all sampling holes were countersunk.

System Fire Testing

Mecelec consultants required comprehensive fire testing of the ASD systems at AELEC. This was to ascertain the detection capability of each VLI detector. This was done by the creation of several “waste bin” type fires, those most likely to occur within the complex. The fires were of a size in the vicinity of 24 kw Avg, and were conducted at various locations in the main arena and Sales/Warm up Arena.

Fires were a compilation of waste material, including cardboard, paper, cotton rags, plastics, diesel and timber.



Smoke Transport Times (TT) of each modelled VESDA VLI system based on the ASPIRE2 calculations were well within the 90 second TT required by Australian Standard AS1670.1.

The TT of the six (6) systems in the main arena averaged at around 68 seconds whereas the Sales/Warm up Arena was approximately 81 seconds.

Additional System Aspects

Other system aspects for this installation are as follows:

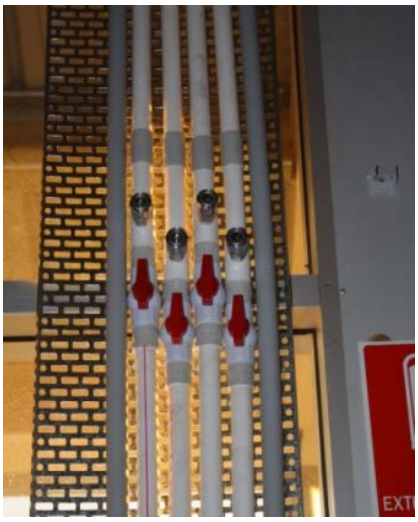
- The VLI detectors were required to be located in the public areas and to guard against inadvertent tampering or vandalism they were installed inside individual steel enclosures.
- Detectors are connected on a dedicated Ethernet network to allow remote monitoring.
- Remote displays will be mounted in the Fire Alarm panel enclosure at the entry point to the complex for ease of system identification and status observation and control.
- All smoke threshold levels were set based on the fire tests conducted during commissioning. The Sales Ring /Warm-Up Arena system was set slightly more sensitive due to the more exposed conditions.

The AELEC VLI trial began in March 2011 and continued for several months during which time numerous equestrian events have been held. A number of minor upgrades and adjustments were implemented to the detectors during the trial period and the detectors as installed have now become the permanent fire detection system at the complex.

Maintenance

The installed VLI detectors are maintained in accordance with Australian Standard AS 1851.1 2005. However, given the nature of the site and particular environmental conditions regular pipe system purging is also undertaken.

This purging is accomplished through the installation of simple compressed air connection fittings located in the pipe network close to the VLI detector. Purging assists to dislodge dust and contaminants from the counter sunk sampling holes and to thoroughly clean the pipe network.



To ensure reliable ongoing performance the purging or back-flushing of the VLI pipe network is carried out monthly. This combined with VLI's unique innovative design comprised of fail-safe filtering technology and other key features, further provides the ASD system with increased longevity over other systems, at the same time providing reduced total cost of ownership over the life of the system.

Environmental Details

Parameters	
Temp (min) – Winter	-2ºC
Temp (max) – Summer	42ºC
Daily Temp (avg – Winter/Summer)	18 - 34ºC
Humidity (min)	46%
Humidity (max)	81%
Humidity (avg)	54%
Ventilation Details (AELEC)	Natural Air
Background	0.02 to 0.1% obs/m
Detector Pipes in Use	4
Average Total Pipe Length	300 m
Average Flow through Detector	125 ltr/min
Average Alert	0.2% obs/m
Average Action	0.3% obs/m
Average Fire -1	0.4% obs/m
Estimated for 1st Intelligent Filter Change	2.5 Years +
Pipe Network Maintenance (Back flush)	Monthly
Smoke Test	Yearly
Arena floor	Sand / Soil and Sawdust mix

Summary

The installation of the VLI aspirating system at AELEC, clearly shows that this industrial detector is well suited to this application and environment, at the same time capable of providing very effective detection.

It is also evident that the VLI system is capable of detecting very low levels of smoke in these very large open areas where high levels of dust exist combined with varying air flow conditions and smoke dilution yet providing very early warning detection.

www.xtralis.com
The Americas +1 781 740 2223 **Asia** +852 2916 8876 **Australia and New Zealand** +61 3 9936 7000
UK and Europe +44 1442 242 330 **Middle East** +962 6 569 1083

Doc. 20840_01