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The sooner you know™

Nuclear




ADVANCED RISK MITIGATION SOLUTIONS

Characteristics of

Nuclear Infrastructure

- Large fuel loads
- High density of material and equipment
- Toxic, flammable and/or corrosive gases and liquids
- Critical control/shut down components and equipment
- Accessibility restrictions
- Can be slow to evacuate
- High ceilings
- Compartmentalization
- Hot areas
- High density of obstructions
- Neighboring support structures in close proximity

Fire

Risks

- Electrical and/or mechanical equipment faults and failures
- Hot surfaces
- Process upset
- Overheating due to excessive friction or equipment malfunction or overloading
- Human error – Facility personnel and outside vendors or contractors
- Bad housekeeping




Consequences of Fire

Consequences can be devastating

- Life safety of personnel
- Fire induced circuit faults preventing safe shutdown
- Disruption of service
- Health and welfare of local communities
- Lost revenue
- Long-term implications on the environment




Essentials of

Fire Protection Strategy

- Fire protection strategy is an essential element of risk mitigation taking into account factors that include:
  - Local codes and standards
  - Economic loss from loss of function or records
  - Economic loss from value of equipment
  - Safe shutdown
  - Process upset effecting reliability of data
  - Regulatory impact
  - Impact to reputation
  - Life and welfare of building occupants
  - Life and welfare of public
  - Environmental implication

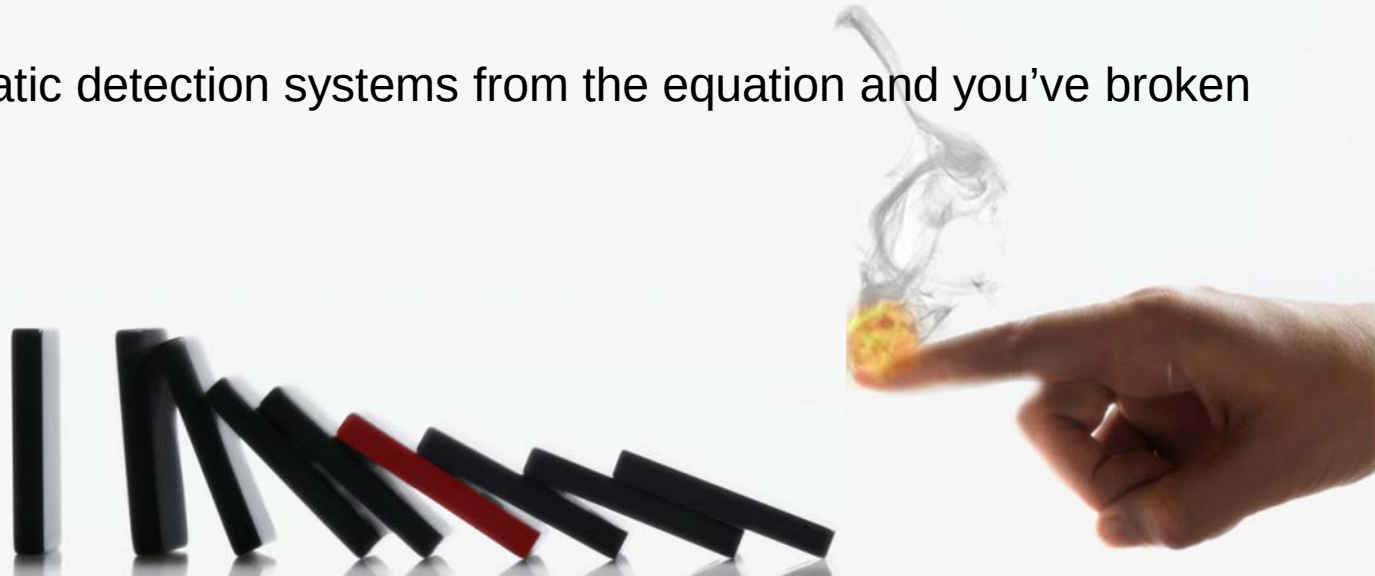
Role of

Fire Detection

Automatic fire detection systems play an essential role in the overall fire protection strategy:

- First line of defense against fire (thermal) / smoke (non-thermal) threats
- Early intervention by personnel to mitigate potential incidents
- Potentially mitigates need for fire department response
- Initiation of sequential systems or procedures

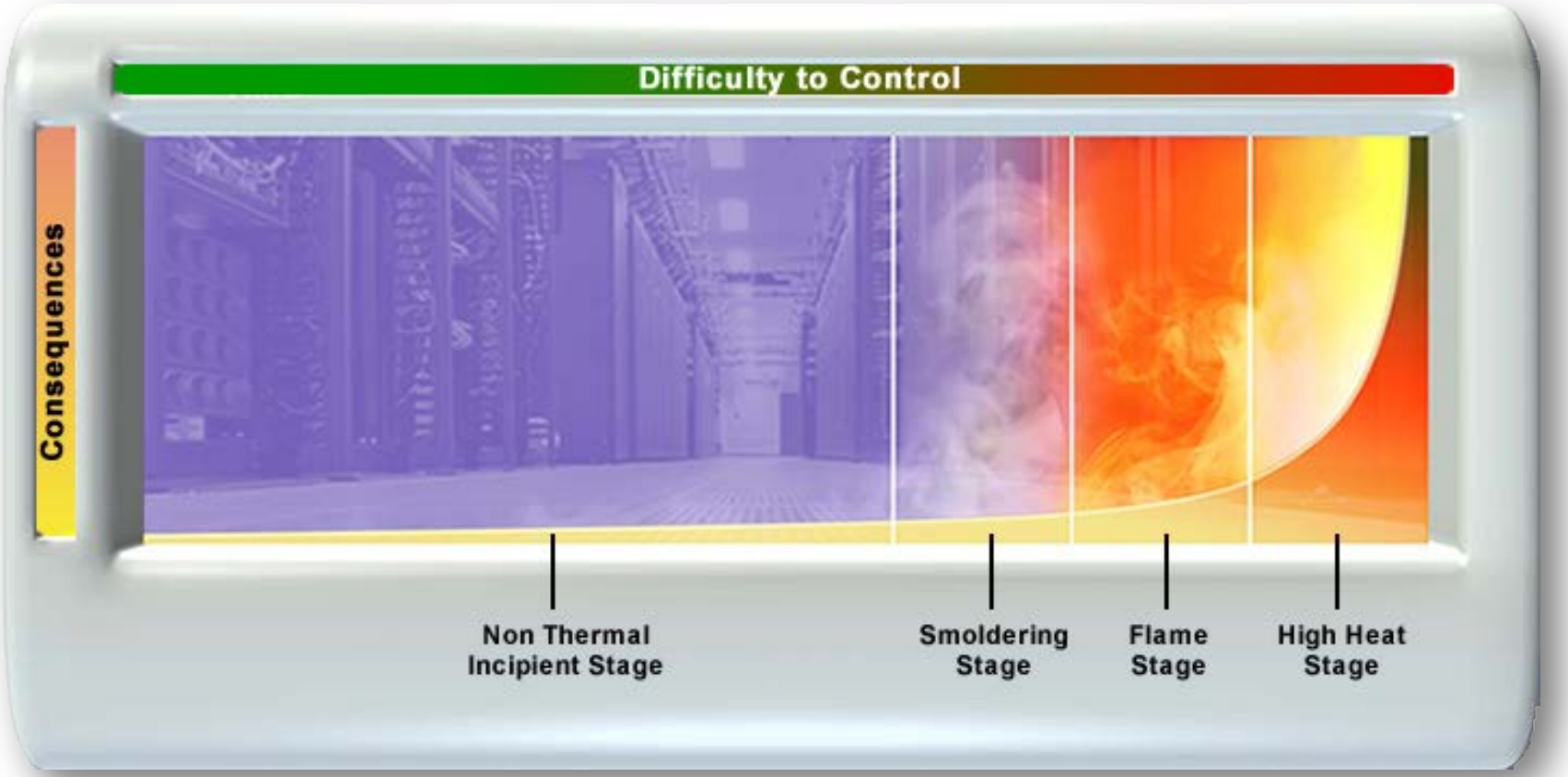
Remove automatic detection systems from the equation and you've broken the sequence



Mitigating Fire Risks

Early Detection & Control

Detection in the early stages of fire development minimize consequential damage as containment becomes increasingly more difficult the deeper seeded fires become



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Challenges

Challenges for conventional fire detection technologies

- Airflow
- Dilution
- Stratification
- Barriers
- Temperature
- Interference
- Integrity
- Ambient smoke
- Contamination
- Accessibility

Protecting Nuclear Infrastructure

Early Warning Threat Deterrent Technologies

VESDA ®
Air Sampling Smoke Detection

VESDA ECO™
Air Sampling Gas Detection

OSID™
Open-Area Smoke Imaging Detection

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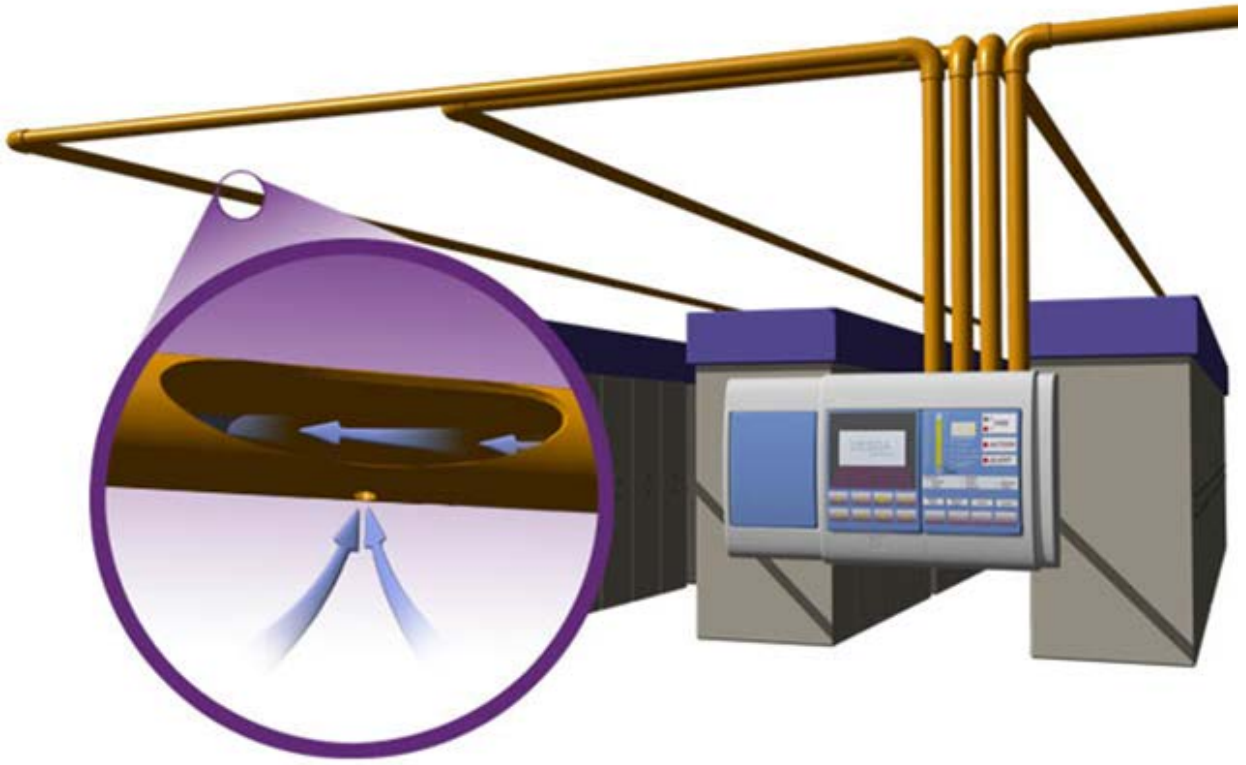
VESDA Air Sampling

Smoke Detection

Air-Sampling Detection System (ASD)

is a system which draws air from an area, via a pipe network, back to a central detector which continuously monitors for traces of smoke



VESDA ASD

Key Benefits

- Absolute Sensitivities
- Active vs. passive
- Predictable
- Cumulative
- Wide sensitivity
- Monitors entire fire progression
- Multiple alarm thresholds
- Low maintenance
- Comprehensive analytics

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How

VESDA Works

Absolute Smoke Measurement Device

- High stability fixed calibration
- Alarm thresholds between 0.0003 and 6.4% obs/ft
- Optical light-scattering detection principle
- Solid state laser light source

Reliability

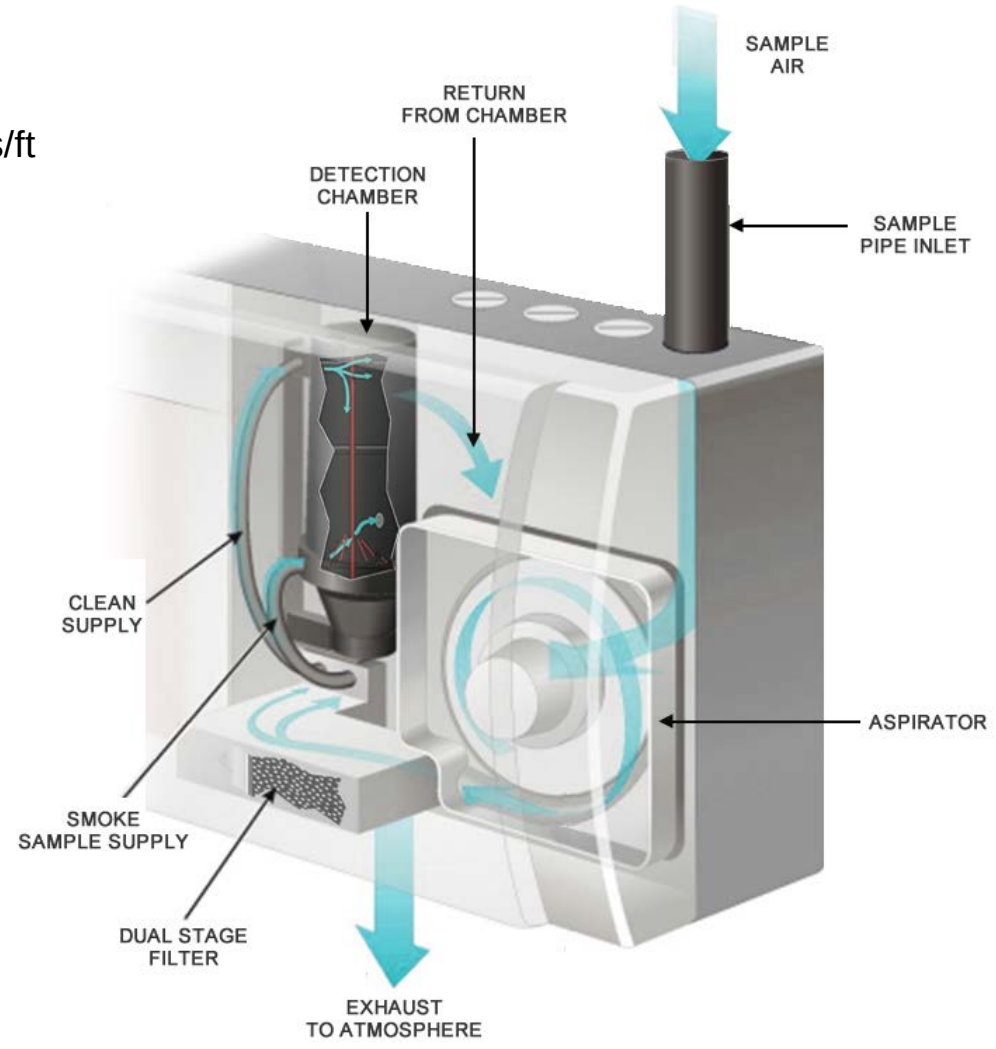
- High tolerance and rejection of nuisance alarms caused by dust, steam and insects, etc.
- High-stability optics

Integrity

- Active monitoring of all critical detector functions
  - Flow, optics and calibration
- Optics automatically cleaned

Sensitivity

- Highest sensitivity by design
- Absolute smoke measurement
- Advanced signal- processing algorithm



VESDA Detector Models

Wide Selection of Models Meets Needs of All Applications

VLF-250 VLF-500

High sensitivity small area, single pipe

VLC-500 VLC-505

High sensitivity medium area, single pipe

VLP

High sensitivity large area, 4 pipe

VLS

High sensitivity large area, 4 pipe, addressable

VFT

High sensitivity micro-bore, 15 pipe, addressable

Industrial VLI

High sensitivity large area, 4 pipe, Harsh Environments

Coverage and

Sampling Techniques

- Area detection (UL268 primary detection)
- Concealed space detection

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Coverage and

Sampling Techniques

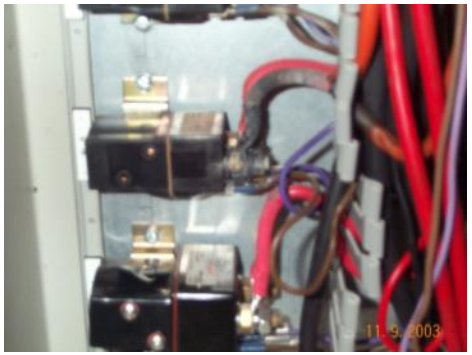
- Return air grille sampling
- In-duct sampling (UL268A duct detection)

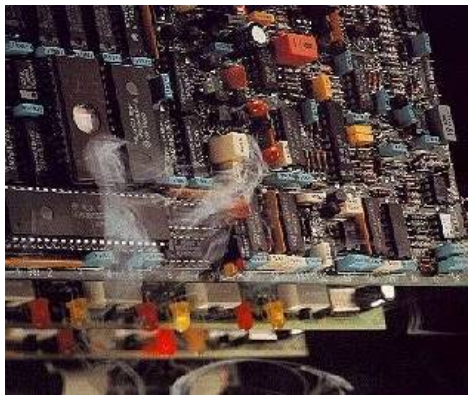
Coverage and

Sampling Techniques

In-Cabinet

- Places detection within areas of greatest risk
- Fully or partially enclosed cabinets create smoke barriers
- Electrical components housed in cabinets exhibit incipient behavior during degradation
- Degradation may occur over extended periods
- High sensitivity detection provides earliest response
- Directs personnel to source





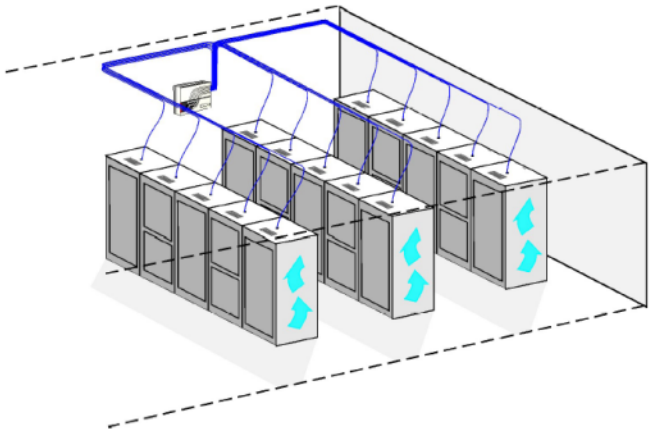
Coverage and

Sampling Techniques

In-Cabinet Detection using VESDA VFT-15

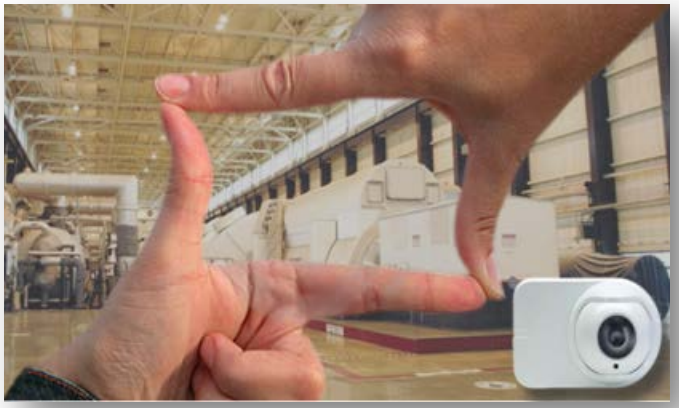
- Single detector protects as many as 15 individual cabinets
- ***Addressability to the individual cabinet***

VESDA VFT-15



Open Area Smoke

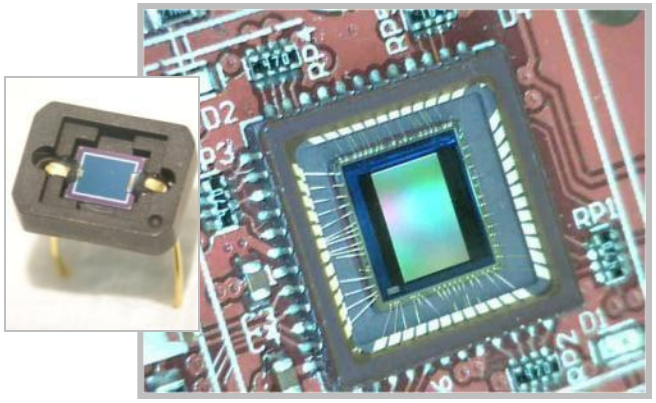
Imaging Detection (OSID)



Open-area Smoke Imaging Detection (OSID) is new innovation in projected beam smoke detection

OSID provides a low-cost, reliable and easy-to-install solution that overcomes typical beam detection issues such as nuisance alarms and alignment difficulties.

- Dual-wavelength light frequencies
- Digital imaging vs. photodiodes
- A unique method for aligning
- Smarter algorithms



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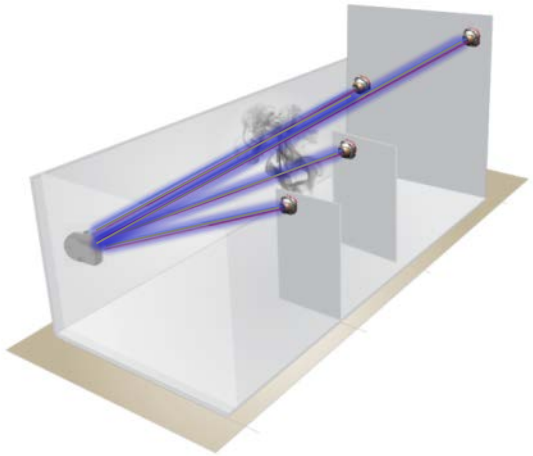
OSID

- Immune to dust, steam, insects, objects and structural movement
- Operates in all ambient lighting conditions
- Easy to align – sets up in minutes
- Beam distances up to 492 ft.
- Long range, 90 degree, 45 degree coverage options
- Building shifts up to 4 degrees!
- Multiple emitters to one imager – avoids obstructions
- Compatible with any fire alarm control panel



Aspirating

Gas Detection

ASD-based Gas Detection. A new approach to environmental monitoring

VESDA ECO overcomes the fundamental limitations of fixed-point gas detectors to ensure early and reliable gas detection so an appropriate preventative or emergency response can be taken.

- Cost-effectively adds gas and environment air quality detection capabilities to existing or new ASD systems.
- Unobtrusive
- Simple expansion to monitor multiple gases
- Centralized
- Integrates

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VESDA
ECO

- Factory calibrated sensors
- Plug and play replaceable sensor cartridges
- Single or dual sensors
- Class 1 Div 2

Available Gases

Lowest Flammable Limit (LFL)	Volume Concentration (v/v)	Volume Concentration (ppm)
H_2 Hydrogen 0-100%		H_2 0-2000
		Cl_2 Chlorine 0-5
CH_4 Methane 0-100%	O_2 Depletion only 0-25%	CO Carbon Monoxide 0-500
C_5H_{12} Pentane 0-100%		SO_2 Sulphur Dioxide 0-10
C_3H_8 Propane 0-100%	O_2 Depletion + Enrichment 0-25%	NH_3 Ammonia 0-100
NH_3 Ammonia 0-100%		NO_2 Nitrogen Dioxide 0-10
Gasoline Vapour 0-100%	CO_2 Carbon Dioxide 0-5%	H_2S Hydrogen Sulphide 0-100
Alcohols 0-100%		

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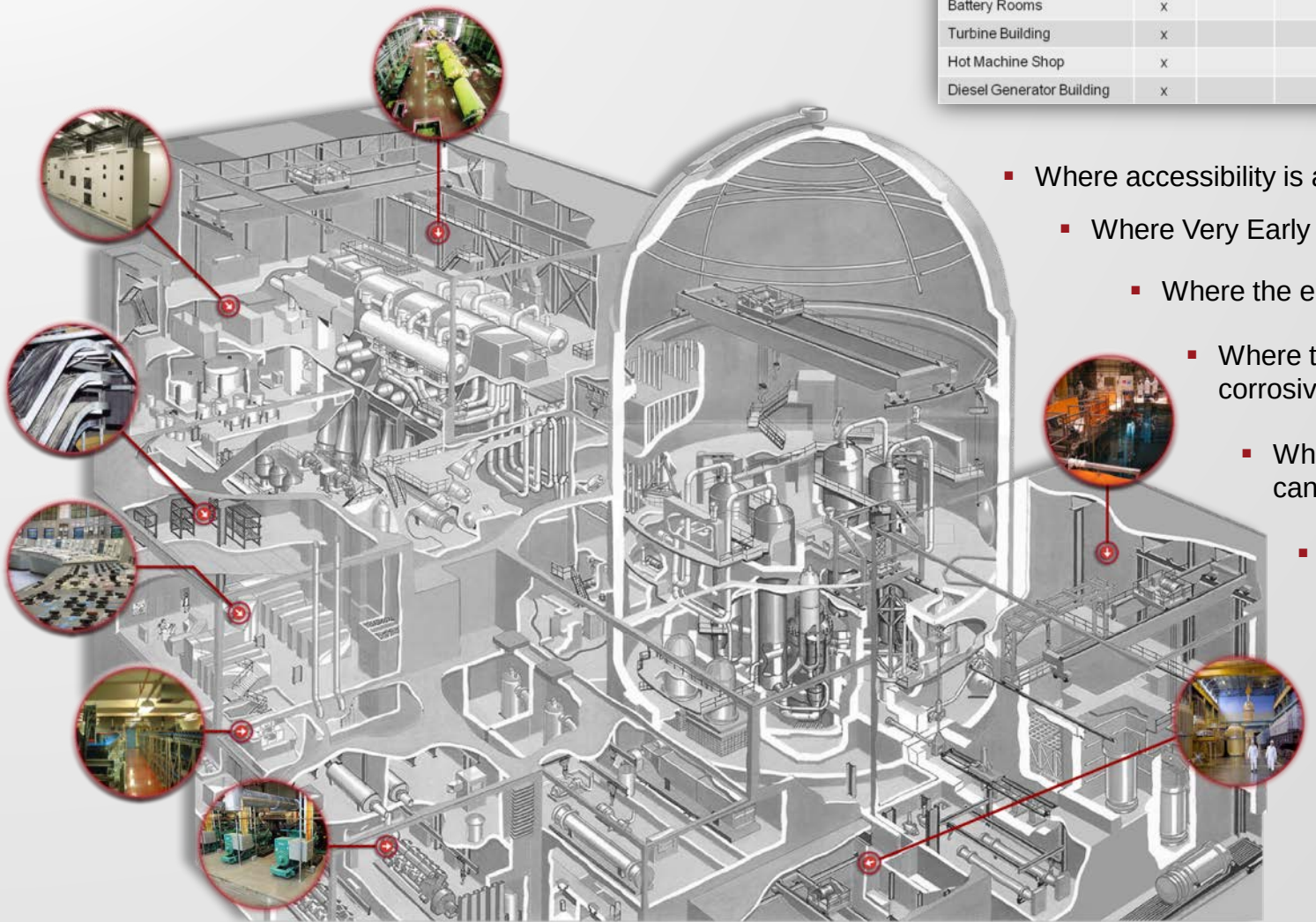
Solutions for all

Environments

Area	Application				Xtralis Solution							
	Open Area	Ceiling or floor void	HVAC Monitoring	In-Cabinet	VLF	VLC	VLP	VLS	VLI	VFT-15	OSID	VESDA ECO
Electrical switch gear, relay rooms and annexes	x		x	x	x	x	x	x		x		
Control Building	x	x	x	x	x	x	x	x	x	x		x
Cable Spreading Rooms	x				x	x	x	x				
Fuel Building	x				x	x	x	x	x		x	x
Battery Rooms	x			x	x	x	x	x		x		x
Turbine Building	x			x	x	x	x	x	x	x	x	x
Hot Machine Shop	x				x	x	x	x	x		x	
Diesel Generator Building	x			x	x	x	x	x	x	x		x



- Where accessibility is an issue
  - Where Very Early Warning is the objective
    - Where the environment is hostile
      - Where toxic, flammable or corrosive gasses threaten safety
        - Where nuisance alarms cannot be tolerated.
          - For proven performance
            - In large open spaces

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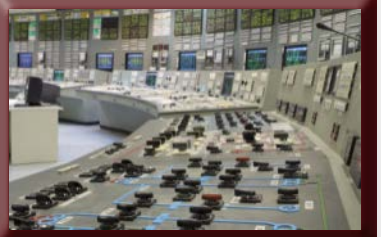
Application Solutions

Particle Accelerators
VESDA sampling points can be installed in strategic locations throughout the tunnel providing Very Early Warning Fire Detection. Remotely mounted detector provides central location for testing and is out of harms way.



Control Building
VESDA sampling points are typically installed at the ceiling and inside or above equipment cabinets. Sampling points can also be located in the ceiling void, floor void and at the return air grille of Air Handling Unit(s) to monitor the entire environment for smoke.

Diesel Generator Building
VESDA sampling points can be installed at the ceiling and within electrical equipment cabinets. Addition of VESDA ECO gas detection on sampling pipe network provides monitoring for unsafe levels of NOS.

Battery Room
VESDA sampling points can be installed at the ceiling. Addition of VESDA ECO gas detection on sampling pipe network provides monitoring for Hydrogen accumulation.

Application Solutions

Cable Spreading Room
Xtralis VESDA sampling points are typically installed above cable trays or along the ceiling. The VESDA detectors can be installed at a central service point for easy access.

Electrical Equipment Cabinets
Xtralis VESDA sampling points are typically installed inside of or directly above electrical equipment cabinets. Use of VESDA VFT-15 addressable sampling system can pinpoint to the individual equipment cabinet potentially reducing time to investigate affected cabinet thus maximizing PRAs.

Fuel Building
Xtralis Open-Area Smoke Imaging Detection (OSID) can be installed to monitor the entire environment for smoke. VESDA sampling ports can be installed above spent fuel pool and inside or above electrical equipment cabinets.

Hot Machine Shop
Xtralis Open-Area Smoke Imaging Detection (OSID) can be installed to monitor the entire environment for smoke.

Hot Cells

Challenging Environment
Characteristics of Hot Cells present a unique challenge for conventional fire detection technologies.

VESDA, a suitable solution

- No electronics in the piping network
- Detector externally located outside cell
- Easily accommodates detection of gases

Engineered for suitability

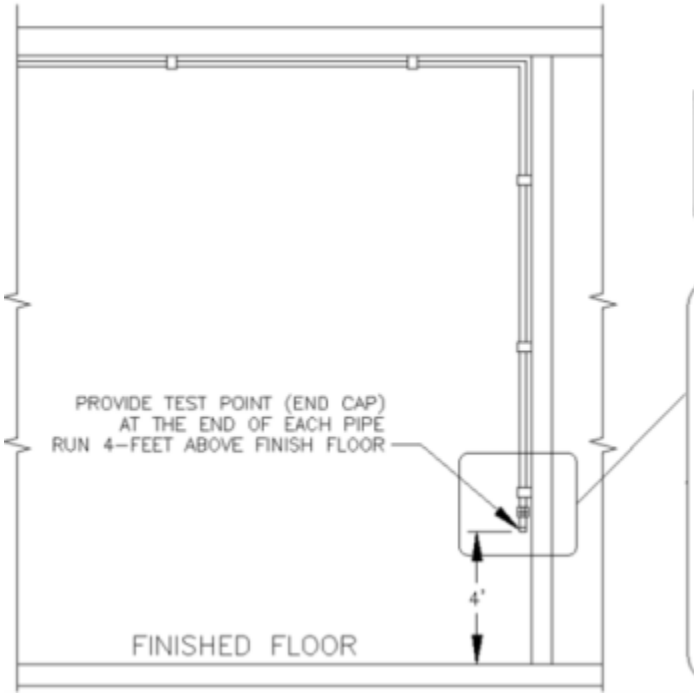
- Stainless steel pipe network
- Detector mounted in protective housing outside cell
- Detector exhausted back into cell
- Bag out filter

Accessible

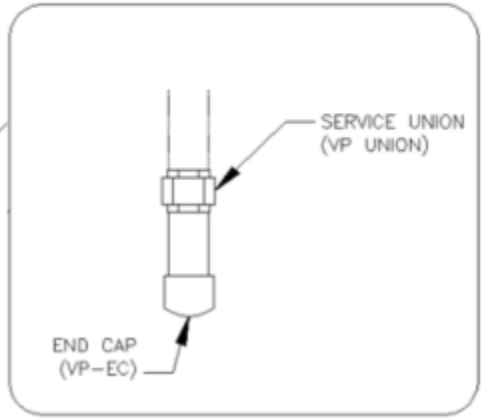
Test Point

On ASD detectors serving the ceiling, above ceiling and below the raised floor (if present), most remote sampling port (end vent) can be configured as a test point for accessible testing of suction pressure and smoke transport time.

- The test point is constructed using a vented end cap
- Provide adhesive label identifying system parameters to facilitate routine inspection



Install Date:	_____	**Test Point #:**	_____
Detector Zn #:	_____	**Transport Time (sec):**	_____
Pipe #:	_____	**Suction Pressure (Pa):**	_____



Application Experience

DOE Infrastructure

- Argonne National Laboratory
- Brookhaven National Laboratory
- Fermi National Accelerator Laboratory
- Idaho National Laboratory
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- Sandia National Laboratories
- SLAC National Accelerator Laboratory
- Thomas Jefferson National Accelerator Facility

Questions?