Hazardous Locations
Overview

Presented By:

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Hazardous Locations Team Leader
Topics of Discussion

- What is a Hazardous Location?
- What causes an explosion?
- Potential ignition sources
- Protection concepts 101
- Classification Schemes (ATEX/IEC vs. NEC)
- Designing/Certification for HazLoc
Hazardous Locations Overview, Ignitions Sources, and Protection Concepts
What is Potentially Explosive Atmosphere Certification and why might you need it?

Any industry that processes, uses or manufactures materials that may give rise to a flammable atmosphere (gas, mist, liquid, dusts or even small fibres) may have a potentially explosive atmosphere. Such industries/processes include:

- Oil and Gas Drilling
- Petrochemical Refining and Processing
- Fuel Storage
- Chemical manufacturing
- Car Manufacturing
- Water Treatment
- Power Generation
- Pharmaceutical
- Distilleries
- Food manufacturers
- Aviation
- Military
- Painting
Facts about Disaster

- 11 Missing, presumed dead
- $350,000,000 cost for rig (now 5,000 ft below water)
- $350,000,000 spent so far – BP
- 200,000 gallons (5,000 barrels) leaking per day in the Gulf - $75/barrel = $375,000/day
- $2 – 14 billion estimated in clean-up and compensation (preliminary)
- Damage to shipping lanes, tourism, fishing/shrimping industry, and wildlife/environment
- Faulty cement casing around well; failed pressure testing hours before explosion
- Faulty BOP; Kill Switch not activated
What is an explosion?

In order to create an explosion there has to be fuel (for example and explosive gas such as hydrogen), and oxidizer (such as the oxygen in air) and a source of ignition energy (for example, a hot surface or an electrical spark).

These three items are commonly referred to as ‘the fire triangle’.
The Fuel

The explosion properties of our fuel (gasses, vapours, combustible dusts) have been studied and organized by their flammability limits and ignition temp etc. in order to suitably assess the potential of an explosion and to take appropriate preventative measures to avoid an explosion.
Fuel Properties

All flammable gasses, vapours and mists require to be mixed with oxygen to make them burn. There is about 20-21% of oxygen in the air we breath. Mixtures of a flammable gas and certain percentages of air will burn if ignited.

Too much or too little oxygen, the mixture will not ignite. The upper and lower concentrations of gas in atmospheric air, by volume, are known as their flammability or explosive limit.
Explosion Properties

Lower Explosive Limit (LEL)
The concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive.

Upper Explosive Limit (UEL)
The concentration of flammable gas or vapour in air, above which the gas atmosphere is not explosive.
## Explosion Properties

### Examples of Explosive Limits

<table>
<thead>
<tr>
<th>Substance</th>
<th>LEL (%)</th>
<th>UEL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td><strong>Propane</strong></td>
<td>2</td>
<td>9.5</td>
</tr>
<tr>
<td>Ethylene</td>
<td>2.7</td>
<td>34</td>
</tr>
<tr>
<td>Acetylene</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td><strong>Hydrogen</strong></td>
<td>4</td>
<td>75.6</td>
</tr>
</tbody>
</table>
Explosion Properties

– At a critical concentration called the **most easily ignited concentration** (MEIC), the amount of energy required to cause ignition is minimal.

– The critical energy at the MEIC is called **minimum ignition energy** (MIE).
Fuel Properties

Temperature

Every material has a spontaneous ignition temperature, SIT (or AIT, auto ignition temperature) at which it will ignite spontaneously.

If the temperature of a mixture is raised, the amount of electrical energy required for ignition will decrease, reaching zero at the AIT.
Temperature classification

- Equipment is identified with a temperature class.
- Either identified by a ‘T’ rating or by a temperature in degrees C.
- The temperature class identifies the hottest temperature that the equipment can obtain.
- This can be either the inside or the outside of the equipment depending on the protection concept.
Temperature Class
The full list of temperature codes are

<table>
<thead>
<tr>
<th>Max. Surface Temperature</th>
<th>NEC® 500 CEC®</th>
<th>CENELEC/IEC (Group I)</th>
<th>NEC® 505</th>
<th>ATEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>450° C (842°F)</td>
<td>T1</td>
<td>T1</td>
<td>T1</td>
<td></td>
</tr>
<tr>
<td>300° C (572°F)</td>
<td>T2</td>
<td>T2</td>
<td>T2</td>
<td></td>
</tr>
<tr>
<td>280° C (536°F)</td>
<td>T2A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>260° C (500°F)</td>
<td>T2B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230° C (446°F)</td>
<td>T2C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>215° C (419°F)</td>
<td>T2D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200° C (392°F)</td>
<td>T3</td>
<td>T3</td>
<td>T3</td>
<td></td>
</tr>
<tr>
<td>180° C (356°F)</td>
<td>T3A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>165° C (329°F)</td>
<td>T3B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>160° C (320°F)</td>
<td>T3C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>135° C (275°F)</td>
<td>T4</td>
<td>T4</td>
<td>T4</td>
<td></td>
</tr>
<tr>
<td>120° C (248°F)</td>
<td>T4A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100° C (212°F)</td>
<td>T5</td>
<td>T5</td>
<td>T5</td>
<td></td>
</tr>
<tr>
<td>85° C (185°F)</td>
<td>T6</td>
<td>T6</td>
<td>T6</td>
<td></td>
</tr>
</tbody>
</table>

Note: For Group I (CENELEC/IEC) applications, electrical apparatus has fixed temperature limits i.e., 150° C and 450°C.
The resulting temperature codes for the substances listed previously (temperature classification) are shown below:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Temp Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>T1</td>
</tr>
<tr>
<td>Propane</td>
<td>T1</td>
</tr>
<tr>
<td>Ethylene</td>
<td>T2</td>
</tr>
<tr>
<td>Acetylene</td>
<td>T2</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>T1</td>
</tr>
</tbody>
</table>
Example:

<table>
<thead>
<tr>
<th>Material</th>
<th>Flashpoint (deg C)</th>
<th>LEL (%)</th>
<th>UEL (%)</th>
<th>Ignition Temp (deg C)</th>
<th>T Class</th>
<th>Gas Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>-188</td>
<td>4.4</td>
<td>17.0</td>
<td>537</td>
<td>T1</td>
<td>IIA</td>
</tr>
<tr>
<td>Ammonia</td>
<td>NA</td>
<td>15</td>
<td>33.6</td>
<td>630</td>
<td>T1</td>
<td>IIA</td>
</tr>
<tr>
<td>Kerosene</td>
<td>38</td>
<td>0.7</td>
<td>5.0</td>
<td>210</td>
<td>T3</td>
<td>IIA</td>
</tr>
</tbody>
</table>
Combustible Dust

Around 50 explosions are reported per year, ranging from small deflagrations to building destroying detonations which lead to large numbers of fatalities. They are usually associated with the grain and mining industries, however they can occur whenever a process uses particulate materials, either as feed stocks, intermediates or products.
Potential Ignition Sources

- Hot surfaces
- Flames
- Mechanically generated sparks
- Stray electric currents
- Static
- Lightening
- Radio Frequency (Range 1 & 2)
- Ionising Radiation
- Ultrasonic
- Adiabatic compression and shock waves
- Exothermic reactions (inc. self ignition of dusts)
Protection Concepts

- ATEX, IEC and NEC 505 use the same protection concepts.

- NEC 500 only uses Ex d, Ex i, DIV 2 and Purge. Only intrinsic safety is very similar.

- European Equipment must meet Constructional Requirements & Tests.
Flameproof (Explosion-proof) Ex d

- It is assumed that the surrounding explosive atmosphere can enter the enclosure and that there will be internal explosions during the life of the equipment. The enclosure therefore has to be strong enough not to fracture or distort under the internal pressures generated.
- Contains explosions and prevents propagation
- Applications: Switchgear, motors, lights
Intrinsic Safety

Low energy levels prevents incendive sparking and hotspots
Purged and Pressurized

Excludes gas by positive pressure differential
3 types: Static, leakage compensation and continuous dilution

Applications: Control cabinets, analyser units and analytical instruments
Increased Safety Ex e

The apparatus must not arc, spark, or produce ignition capable hot surfaces in normal operation.
OIL IMMERSIONN

Steel Vessel

Oil

Electrical Apparatus

Ex o
POWDER FILLING Ex q

Protection of high power electronics

Applications: starters for Ex e lighting, capacitors etc
Encapsulation

Protects by immersion in encapsulant

Typical applications: Solenoid valves, power supplies
Encapsulation Ex ‘m’

- Encapsulant
- Electrical Apparatus
- Explosive Atmosphere
- Cable Entry
Type ‘n’ Protection for Zone 2

Methods:

- Non sparking/arcing parts
- Restricted breathing
- Simplified pressurization
- Energy limiting apparatus

- Sealed or encapsulated device
- Enclosed break
- Hermetically sealed
- Encapsulated
Protection Concept for Dust Classified Areas

The protection concept for dust hazards is to prevent the dust from entering the enclosure or apparatus. Additionally, the maximum surface temperature of the equipment to which the dust can be exposed shall not exceed the ignition temperature of the dust.

The IP (Ingress Protection) rating system provides a means of classifying the degree of protection from foreign bodies and liquids.

IEC/EN 60529 covers electrical equipment and apparatus.
Classification Schemes, Certification, and Design Guidelines
Manufacturers of electrical equipment (and non-electrical for Europe) must be aware that if they sell to industries that have potentially explosive atmospheres they may be asked for ‘certification’, and that often the equipment will need to be certified by a Notified or NRTL Body such as Intertek.
Given the onerous nature of an explosion, special certification schemes have been set up to control the design and certification of equipment for potentially explosive atmospheres.

*mandatory under law/procurement specifications*
An Explanation of ATEX, NEC and IEC Systems

- Environments that generate potentially explosive atmospheres classify the dangerous areas based on the likelihood and duration of the explosive atmospheres presence.
- This is referred to as a “Zone” (Europe and NEC 505) or “Division” (NEC 500)
### Equipment Groups

Apparatus is divided into Equipment groups:
- **Group I** for mines susceptible to methane (firedamp).
- **Group II** for explosive gases for locations other than mines.
- **Group III** for dusts.

#### Zoning Definitions

<table>
<thead>
<tr>
<th>Gas: EN 60079-10</th>
<th>Dust: EN 61241-10</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>A place in which an explosive atmosphere is continually present</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>A place in which an explosive atmosphere is likely to occur in normal operation occasionally</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>A place in which an explosive atmosphere is not likely to occur in normal operation, but if it does only occur for short periods</td>
</tr>
</tbody>
</table>

#### Equipment Categories

<table>
<thead>
<tr>
<th>ATEX Category</th>
<th>Typical Zone Suitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 G</td>
<td>Equip. suitable for Zones 0,1,2</td>
</tr>
<tr>
<td>1 D</td>
<td>Equip. suitable for Zones 20,21,22</td>
</tr>
<tr>
<td>2 G</td>
<td>Equip. suitable for Zones 1,2</td>
</tr>
<tr>
<td>2 D</td>
<td>Equip. suitable for Zones 21,22</td>
</tr>
<tr>
<td>3 G</td>
<td>Equip. suitable for Zone 2</td>
</tr>
<tr>
<td>3 D</td>
<td>Equip. suitable for Zone 22</td>
</tr>
</tbody>
</table>

www.intertek.com
Equipment Categories

Further divided into categories:
- M1 and M2 for mining
- Category 1 (Zone 0, 20), 2 (Zone 1, 21) and 3 (Zone 2, 22) for all other industries.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I (Mines)</td>
<td>M1</td>
<td>Methane &amp; Dust</td>
<td>Very High</td>
<td></td>
<td>Two Faults, Remain energized and functioning</td>
</tr>
<tr>
<td>I (Mines)</td>
<td>M2</td>
<td>Methane &amp; Dust</td>
<td>High</td>
<td></td>
<td>Severe normal operation, De-energize in exp. atm.</td>
</tr>
<tr>
<td>II (Above Ground)</td>
<td>1</td>
<td>Gas, Vapor, Mist, Dust</td>
<td>Very High</td>
<td></td>
<td>Two Faults</td>
</tr>
<tr>
<td>II (Above Ground)</td>
<td>2</td>
<td>Gas, Vapor, Mist, Dust</td>
<td>High</td>
<td></td>
<td>One Fault</td>
</tr>
<tr>
<td>II (Above Ground)</td>
<td>3</td>
<td>Gas, Vapor, Mist, Dust</td>
<td>Low</td>
<td></td>
<td>Normal operation</td>
</tr>
</tbody>
</table>
Zone Definitions

A place in which an explosive atmosphere in the form of a gas/vapour (or cloud of combustible dust) in air.

Zone 0 (Zone 20)
   ....is present continuously, or for long periods or frequently.

Zone 1 (Zone 21)
   ....is likely to occur in normal operation occasionally.

Zone 2 (Zone 22)
   ....is not likely to occur in normal operation but if it does occur, will persist for a short period only.
Hazardous Area Classification: Europe

Zone System

Gases Mists & Vapours
  • Zone 0,1 or 2

Combustible Dusts
  • Zone 20, 21 or 22
Class/Division Definitions

**Class I** - Contains flammable gases or vapors in quantities large enough to produce an explosion.

**Class II** - Is hazardous due to the presence of combustible dust in the air.

**Class III** - Contains easily ignitable fibers or flyings in the air. However, the quantities of fibers and flyings suspended in the air are not likely to be large enough to cause an explosion.

**Division 1** - There is a high probability of an explosive atmosphere in normal operation. This can be for part of the time, up to all the time.

**Division 2** - There is a low probability of an explosive atmosphere being present during normal operation.

*Group designations further define the types of gases, and dusts (A, B, C, D) (E, F, G)*

*Example of an American certification would be:*

- Class I, Div 1, Groups A, B and C; Class II, Div 2, Groups F and G
Hazardous Area Classification: North America

Class & Division System
- Gases Mists & Vapors
  Class I Div 1 or 2
- Combustible Dusts
  Class II Div 1 or 2
- Fiber & Flyings
  Class III Div 1 & 2

Zone System
- Gases, Mists & Vapors Only
- Zone 0, 1 or 2

Note: The majority of Areas Classified in North America are Class and Division
Correlation – Somewhat?

<table>
<thead>
<tr>
<th></th>
<th>Flammable Material</th>
<th>Flammable Material</th>
<th>Flammable Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present Continuously</td>
<td>Present Intermittently</td>
<td>Present Abnormally</td>
</tr>
<tr>
<td><strong>IEC/EU</strong></td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td><strong>US NEC® 505</strong></td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td><strong>US NEC® 500</strong></td>
<td></td>
<td>Division 1</td>
<td>Division 2</td>
</tr>
<tr>
<td><strong>CA CEC</strong></td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td><strong>Section 18</strong></td>
<td></td>
<td>Division 1</td>
<td>Division 2</td>
</tr>
<tr>
<td><strong>CEC Annex J</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Classification per IEC 60079-10*
*EU classification per EN 60079-10*
*US classification per ANSI/NF PA 70 National Electrical Code® (NEC®) Article 500 or Article 505*
*CA Classification per CSA C22.1 Canadian Electrical Code (CEC) Section 18 or Annex J.*
Gas Groups (ATEX, IEC and NEC 505)

• Group II is further divided into three sub-divisions (groups):
  – **IIA**, for atmospheres containing propane or gases of an equivalent hazard.
  – **IIB**, for atmospheres containing ethylene or gases of an equivalent hazard.
  – **IIC**, for atmospheres containing hydrogen or gases of an equivalent hazard.

<table>
<thead>
<tr>
<th>Gas Group</th>
<th>Substance:</th>
<th>Hazard Class</th>
<th>ATEX:</th>
<th>NEC 500:</th>
<th>NEC 505:</th>
<th>Lower Exposure Limit</th>
<th>Upper Exposure Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any Gas</td>
<td>Class I</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acetylene</td>
<td>IIC</td>
<td>Group A</td>
<td>IIC</td>
<td>II</td>
<td>2.3 %</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td>Hydrogen</td>
<td>IIC</td>
<td>Group B</td>
<td>II</td>
<td>II</td>
<td>4 %</td>
<td>77 %</td>
</tr>
<tr>
<td></td>
<td>Ethylene</td>
<td>IIB</td>
<td>Group C</td>
<td>II</td>
<td>II</td>
<td>2.3 %</td>
<td>36 %</td>
</tr>
<tr>
<td></td>
<td>Propane (mining)</td>
<td>IIA</td>
<td>Group D</td>
<td>II</td>
<td>II</td>
<td>1.7 %</td>
<td>11 %</td>
</tr>
<tr>
<td></td>
<td>Methane (mining)</td>
<td>I</td>
<td>Group D</td>
<td></td>
<td></td>
<td>4.4 %</td>
<td>17 %</td>
</tr>
<tr>
<td></td>
<td>Metal (Conductive) Dust</td>
<td></td>
<td>Group E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coal (Carbonaceous) Dust</td>
<td>Class II</td>
<td></td>
<td>Group F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grain Dust</td>
<td>Class II</td>
<td>Group G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IEC Zone System

- IEC
  - Group I
  - Group II
  - Group III
    - Gas Sub
      - Group IIA
      - Group IIB
      - Group IIC
<table>
<thead>
<tr>
<th>Typical Gas</th>
<th>US (NEC® 505)</th>
<th>CA (CEC Section 18)</th>
<th>EU</th>
<th>IEC</th>
<th>US (NEC® 500)</th>
<th>CA (CEC Annex J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylene</td>
<td>Group IIC</td>
<td></td>
<td></td>
<td></td>
<td>Class I/Group A</td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>(Group IIB + H₂)</td>
<td></td>
<td></td>
<td></td>
<td>Class I/Group B</td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>Group IIB</td>
<td></td>
<td></td>
<td></td>
<td>Class I/Group C</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>Group IIA</td>
<td></td>
<td></td>
<td></td>
<td>Class I/Group D</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>Group I*</td>
<td></td>
<td></td>
<td></td>
<td>Mining*</td>
<td></td>
</tr>
</tbody>
</table>

*Not within scope of NEC®. Under jurisdiction of MSHA. Not within scope of CEC.*
Designing for Hazloc

What Market?

US, Canada, ATEX, IECEx, INMETRO, GOST-R/Roztechnadzor, ……etc

What Classification?

- Class I, II, III Division 1, 2
- Zone 0, 1, 2

What Protection Technique?

What Enclosure Rating?
# Certification Differences

## Europe
- Notified Bodies
- IEC Ex TL’s & CB’s

### Standards
- CENELEC
- CEN
- IEC

### Components
- ATEX or IEC Ex
- European Standards

## North America
- NRTL

### Standards
- Nationally Published Standards (ie UL, CSA, FM, ISA, ANSI)

### Components
- Must be either Listed or Recognized by NRTL
- North American Standards
Equipment that needs ATEX

Product Certification- Electrical

- CAT 1 (Zone 0, 20) & CAT 2 (Zone 1, 21) Requires a Notified Body & QM
- CAT 3 (Zone 2, 22) Can be Self Certified

Product Certification- Non-Electrical

- CAT 1 (Zone 0, 20) Requires a Notified Body & QM
- CAT 2 (Zone 1, 21) Requires A TCF to be Lodged
- CAT 3 (Zone 2, 22) Can be Self Certified
North America

- NEC, Article 500 – 505
- CEC, Article 18
- Div. System with some use of Zone System (Zone Equipment sometimes accepted in Div.)
- Suitability per the following:
  1. Listing/Labelling – *Intertek*
  2. Evaluation by Qualified Agency – *Intertek*
  3. Accepted by AHJ – Evidence…*Intertek*
ETL & cETL Listing For Hazloc

- Requires Ordinary Location certification
- Potential Enclosure rating testing
- Certification to Protection Technique Standards
Listing vs. Classification

Examination of all risks:
Explosion, along with shock, fire, mechanical, etc.

HazLoc + OrdLoc = Listing

HazLoc Only = Classification
Other Evaluations Required…

• Indoor vs. Outdoor Use
  – Type 1 (indoor only)
  – Type 3/3R (rain) - outdoor
  – Type 4/4X (hose)

• Evaluation per UL 50/50E and CSA C22.2 #94
IEC Ex Scheme

- Multilateral Certification Scheme
- Ex Product Certification
- Ex Quality System Certification
- Obtain National Certification

Requires:
- Evaluation and Testing by IEC Ex TL
- Certification of Product and QA by IEC Ex CB
Service Line Review

- **Product Certification**
  - ATEX – EU and other adoptive regions (Middle East)
  - IECEx – Members of the International IECEx Scheme
  - US/CAN – cETLus

- **Field Labels**

- **Site Safety**
  - Consultancy
  - Inspections and Risk Assessments (Assemblies or Plant)
  - Audits & Certification

- **Training**
  - Open
  - Bespoke
Our Hazardous Location Credentials

- OSHA recognized Nationally Recognized Testing Laboratory (NRTL) for Hazardous Location Divisional Listing in the U.S.
- Standards Council of Canada accredited Certification Body (CB) and Testing Organization (TO)
- Notified Body and UKAS Accredited for the ATEX Directive, 94/9/EC.
- IECEX Certification Body (CB) and Test Laboratory (TL)
- Full Hazloc Training including an Accredited COMPEX Training Center - Chester
- Site Safety Services (Risk Assessment, Area Classification and Inspection)
- Specialist in Oil Tools, Rigs and Skids.
- We certify products for compliance to National and International published standards which satisfy the applicable requirements of the National Electrical Code (NEC) in the U.S., the Canadian Electrical Code (CEC) in Canada, IECEX and the European Union's ATEX Directive.
- Some of the standards we test to include those of ANSI, UL, IEC, CSA, MIL Specs, FM, and CENELEC and CEN.

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Questions?