Explosion Safety for small production facilities

A pragmatic approach

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Chemical Process Engineer (MSc, MTD, PhD)

1999 AkzoNobel
Process Engineer; Maintenance & Project manager;
HSES&Q manager; BU Process Safety program manager

2015 OCI Fertilizers
Corporate Process Safety & Occupational safety manager

2018 DSM
Global Process Safety expert
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2023 dsm-firmenich
Process Safety lead Business Unit TTH
Process Safety lead dsm-firmenich

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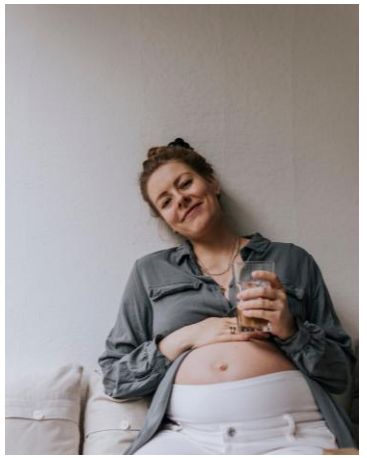


Health, Nutrition & Care

Small unit does not mean small risk

Powder and liquid handling can create serious fire and explosion hazards, even at relatively small sites

Powder handling

Charging, mixing, milling, sieving, drying and dust collection can create combustible dust clouds. Static discharge, hot surfaces or mechanical sparks can provide an ignition source.

Liquid handling

Transfer, mixing, packing, distillation of flammable liquids can release vapours. Ventilation, containment, static control and suitable equipment are essential.

Capability challenge

Many small production sites do not have a process safety or explosion safety expert on site. They rely on practical guidance and accessible expert support.

The unit may be small, but the hazard and potential consequences are not.

Compliance is necessary, but not simple

Explosion safety is regulated globally, but local rules still require competent application

Different frameworks

IEC/ISO, ATEX, NFPA and national requirements apply in different regions. Technical principles increasingly overlap, but legal obligations remain different.

Compliance approach

Using the applicable regulation and recognized standards provides the formal starting point for zoning, equipment design, inspection and maintenance.

Site responsibility

The production site remains responsible for meeting applicable legislation, even when design or assessment work is outsourced.

The rules establish the requirement; the organization must make the requirement work.

The difficult part is interpretation

Standards cannot resolve every substance, equipment and operating question

Substances

Combustibility, minimum ignition energy, flash point, conductivity and process temperature influence the required safeguards.

Process

Charging, mixing, milling, transfer, cleaning and maintenance create different release and ignition scenarios.

Equipment

Ex certification alone does not confirm that the complete installation, interfaces and operating conditions are suitable.

Local challenge

Smaller units may buy Ex equipment, but local suppliers do not always understand the complete installation. Without local expertise, the site depends on consultants or corporate specialists.

Correct interpretation requires knowledge of the standard and the actual plant.

Consultants provide expertise, not ownership

External specialists can close a knowledge gap, but the site must understand and implement the outcome

Value

Knowledge of local legislation, independent specialist input and efficient access to skills that are not continuously needed.

Limitations

Quality differs by individual and region. Advice may be conservative, generic, costly or difficult for the site to translate into practical work.

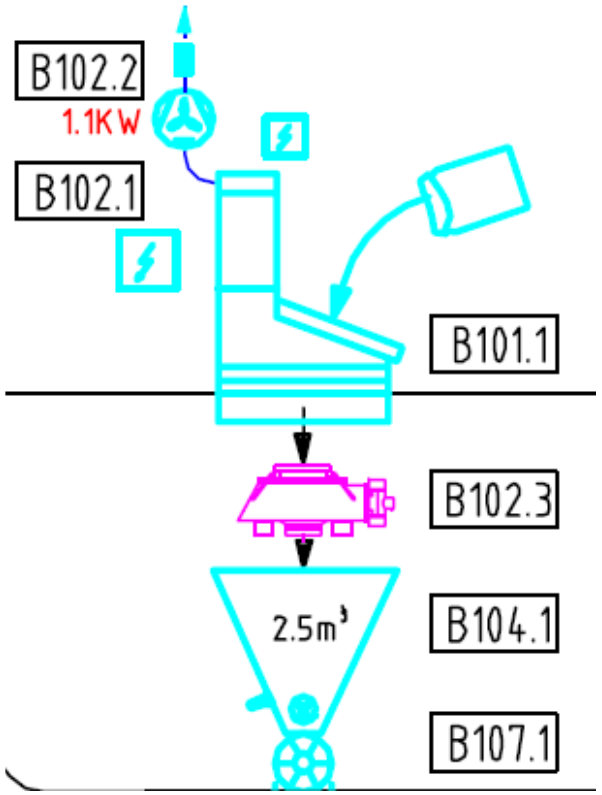
Company response

Qualify the individual consultant, use a consistent company method and involve site representatives throughout the assessment.

A compliant report is not the same as a safe operating installation.

Performance revealed an implementation gap

Requirements and expert reports existed, but recurring events showed that safeguards were missing or ineffective



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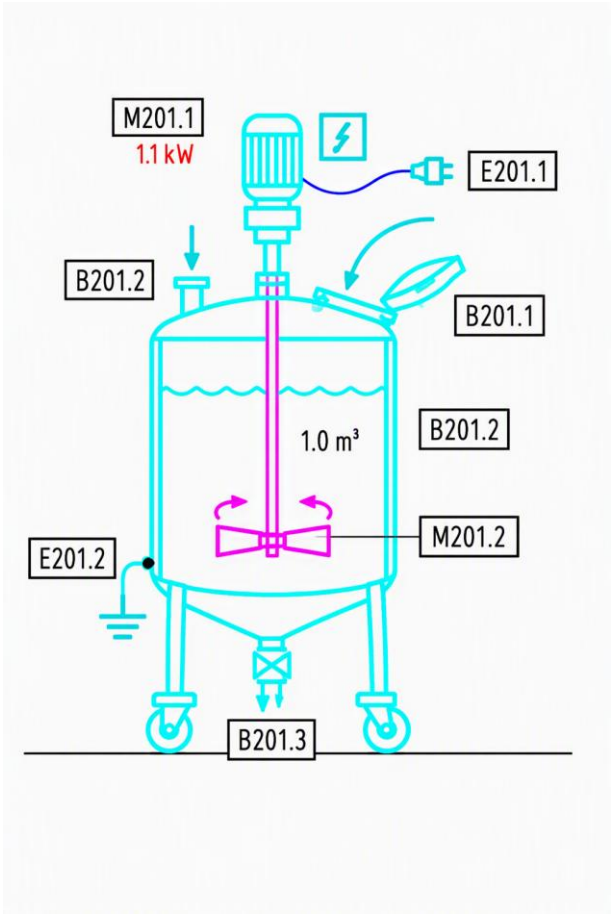


Performance revealed an implementation gap

Requirements and expert reports existed, but recurring events showed that safeguards were missing or ineffective

Observed events

Smouldering incidents, fires and explosions occurred periodically, with smaller production sites presenting a particular challenge.

Recurring causes

Missing grounding connections, safeguards not installed or maintained, and operating teams not understanding why measures were required.

Central lesson

The persistent weakness was translation into design verification, daily operation and sustained action closure.

We needed to move from having requirements to making them work reliably in the field.

A pragmatic company approach

Experts perform the difficult analysis once and convert the outcome into repeatable solutions

1. Assess

Experts assess representative equipment and operating conditions.

2. Standardize

Define the safeguards normally required within the state boundaries.

3. Verify

Sites identify the applicable unit and verify the actual field condition.

4. Escalate

Non-standard conditions, unclear questions and gaps go to an expert.

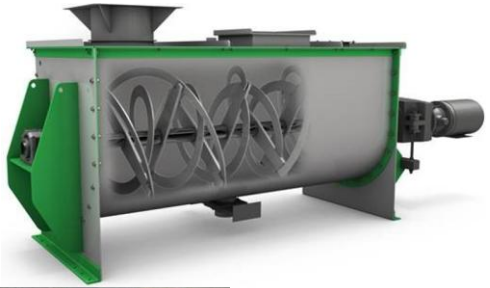
Assess once, standardize the safeguards and scale across comparable units.

Safe Powder and Liquid Handling

Goal: To provide an easy solution for standard powder or liquid operations without deep specialist knowledge

3 step approach:

1. Identify the Risk Group based on Safety characteristics of the powder or liquid
2. Select the table, which applies to your unit operation, and check the applicable zone
3. Check implementation of the safety measures according the Risk Group



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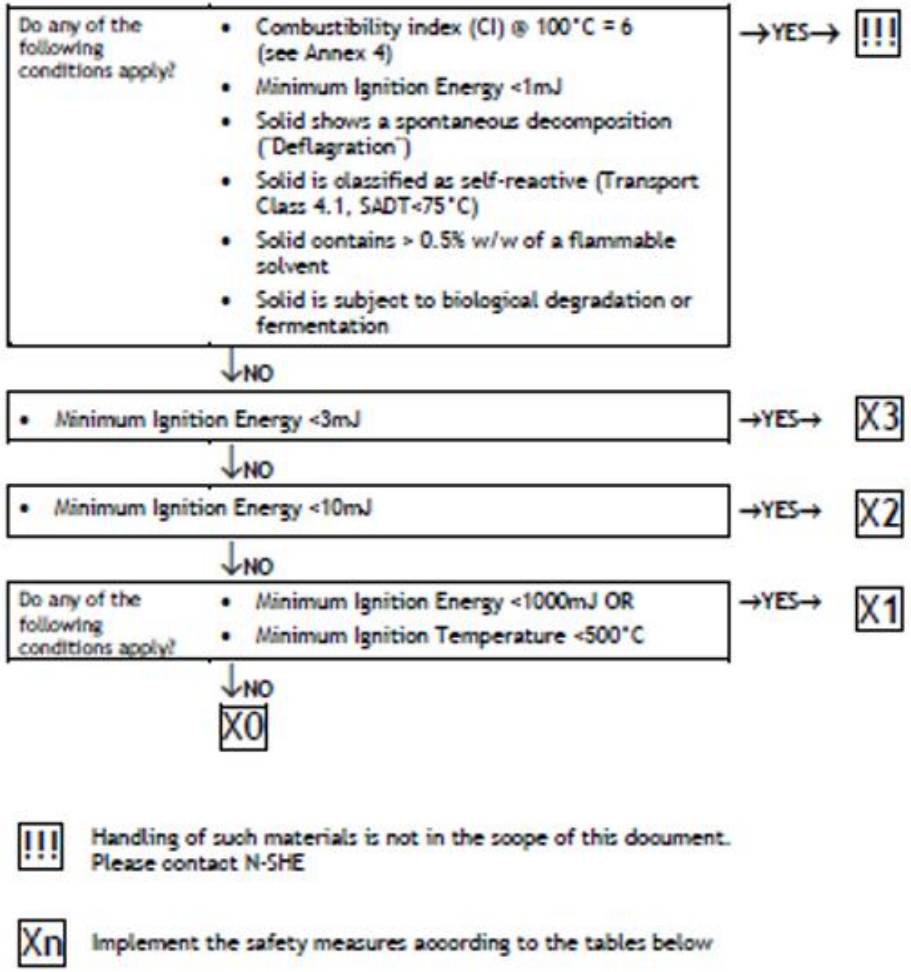
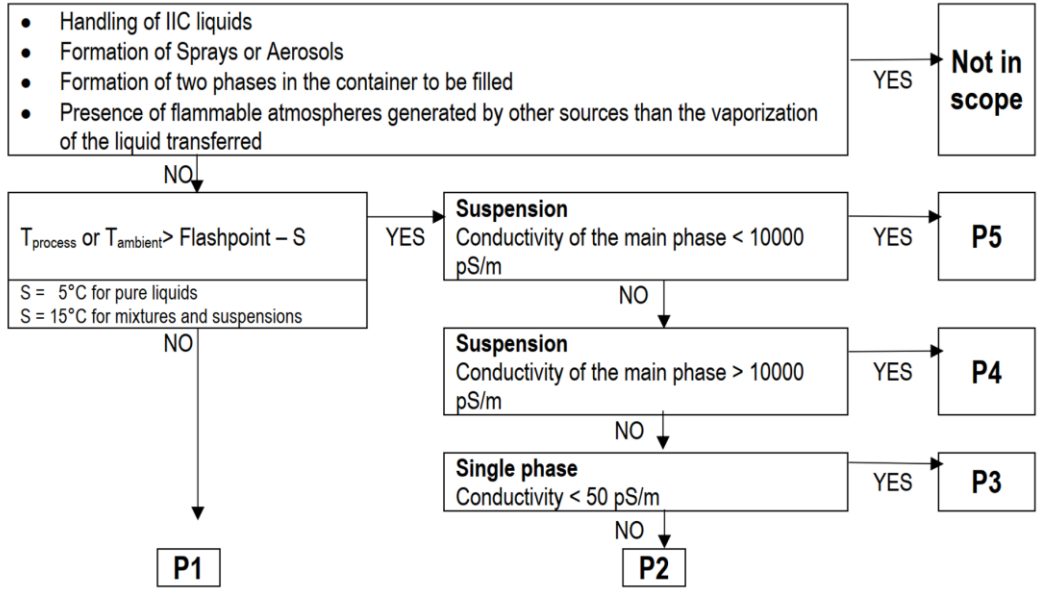
1: Identification Risk Group

Powder units



Liquid units



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For Internal Use Only

2: Select the appropriate table for the unit

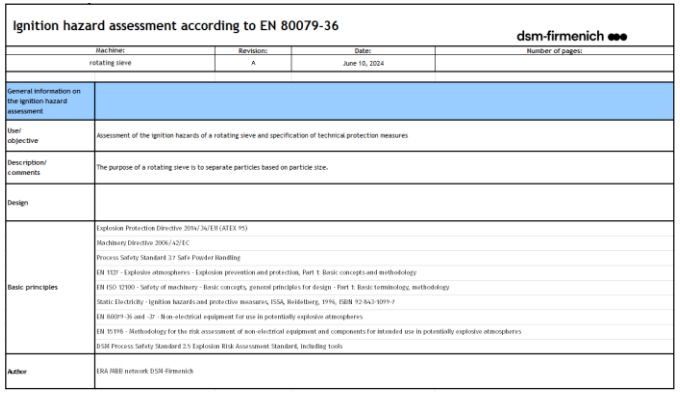
Powder units

IHA 15 Fan
IHA 17 Opposed jet mill
IHA 19 Air Separator
IHA 20D Spray Dryer
IHA 22 Fluidized Bed Drying
IHA 23 Pneumatic Transport into equipment
IHA 24 Dust Extraction System
IHA 26 Vibrating Sieve
IHA 27 Screw Conveyor
IHA 31 Bucket Elevator
IHA 32H Mixer (horizontal)
IHA 32V Mixer (vertical)
IHA 33 Filling Powder into FIBCs and Containers
IHA 34 Chain Conveyor
IHA 35 Cyclone
IHA 36 Rotating Sieve
IHA 37 impact mill
IHA 39 Rotary Valve
IHA 40 Manual and slow dosing into equipment

Liquid units

IHA 01a Liquid compounding - fixed vessels
IHA 01b Liquid compounding - mobile vessels
IHA 15 Fan
IHA 02 Centrifuge
IHA 03 Liquid fluid vacuum pump
IHA 04 Agitator with double mechanical seal
IHA 05 Pump with double mechanical seal
IHA 06 Pump with magnetic coupling
IHA 07 Submersible pump
IHA 08 Gear pump
IHA 09 Canned motor pump

Ignition Hazard Assessments per unit



Ignition hazard assessment according to EN 80079-36

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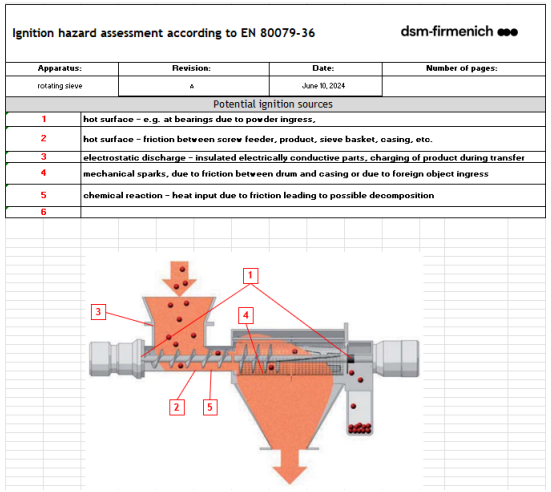
Machine:	Revision:	Date:	Number of pages:
rotating sieve	A	June 10, 2024	

General information on the ignition hazard assessment	
User/ objective	Assessment of the ignition hazards of a rotating sieve and specification of technical protection measures
Description/ comments	The purpose of a rotating sieve is to separate particles based on particle size.
Design	
Basic principles	Explosion Protection Directive 2014/34/EU (ATEX 95) Machinery Directive 2006/42/EC Process Safety Standard 2.7 Safe Powder Handling EN 1127 - Explosive atmospheres - Explosion prevention and protection, Part 1: Basic concepts and methodology EN ISO 12100 - Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology Static Electricity - Ignition hazards and protective measures, ISSA, Heidelberg, 1996, ISBN 92-843-1099-7 EN 80079-36 and -37 - Non-electrical equipment for use in potentially explosive atmospheres EN 15198 - Methodology for the risk assessment of non-electrical equipment and components for intended use in potentially explosive atmospheres DSM Process Safety Standard 2.5 Explosion Risk Assessment Standard, including tools
Author	ERA PABB network DSM-Firmenich

Cover Sheet & Codes



Ignition hazard assessment according to EN 80079-36

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Apparatus:	Revision:	Date:	Number of pages:
rotating sieve	A	June 10, 2024	

Potential ignition sources	
1	hot surface – e.g. at bearings due to powder ingress,
2	hot surface – friction between screw feeder, product, sieve basket, casing, etc.
3	electrostatic discharge – insulated electrically conductive parts, charging of product during transfer
4	mechanical sparks, due to friction between drum and casing or due to foreign object ingress
5	chemical reaction – heat input due to friction leading to possible decomposition
6	

Drawing & Ignition sources

Ignition hazard assessment according to EN 80079-36

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Apparatus:	Revision:	Date:	Number of pages:
rotating sieve			2

No.	Ignition hazard		Assessment of the frequency of occurrence without using additional measures					Measures used to prevent the ignition source becoming active			frequency of occurrence including all protective measures					remark
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	
	Potential ignition source	Cause (which conditions cause an ignition hazard?)	Normal operation	During expected malfunction	During rare malfunction	Not to be considered	Reason	Description	Basis (standards, technical rules, experimental results)	Evidence	Normal operation	During expected malfunctic	During rare malfunction	Not to be considered	resulting EPL	reference to internal document / additional explanations
1	Hot surface	ingress of powder into bearing and/or seal		X			powder has contact with seal of bearing, increasing of friction inside bearing and/or seal leads to overheating if circumferential speed > 1m/s	1. Bearings are outside housing OR 2. If rim speed < 1 m/s - no additional measures needed OR 3. If rim speed > 1 m/s: - Bearing and seals flushed with air or nitrogen, flow is controlled OR 4. Bearing and seal temperature monitoring switches off agitator if Tmax is exceeded. Tmax = Minimum (2/3*MIT[°C], LIT(5mm) - 75°C) 5. - Regular check of sensor - Inspect I&C.	EN 80079-37	Description, operating manual				X	Da	

IHA analysis by expert

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Step 3: Implement the safety measures

Check implementation of the **safety provision** according the **Risk Group**

"checklist" for user

Ignition hazard assessment according to EN 80079-36

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Equipment	Revision	Date	Number of pages:
Rotating Sieve	2024a	June 10, 2024	3

Summary of measures IHA 33.20 - Rotating Sieve inside zone 20 - EPL = Da

#	Type of ignition source	description	zone inside	zone outside	safety provision	provision type	PL	remark
3	hot surface	**equipment around the unloading point of sieve:** Hot surface by electrical and non-electrical devices	-	21, 22	**If the devices are located in a zoned area (Zone 21 or 22):** it must be explosion proof with EPL Db or Dc with: Tmax(surface) < Minimum of {2/3xMIT[°C], LIT(5mm) -75°} LIT(5mm) = Layer Ignition Temperature of a 5mm deposit. Remark: For zone 22 if cleaning processes are in place, which ensure that dust deposits are eliminated, the determination of the temperature class for the equipment can be made on the basis of MIT only, i.e. neglecting LIT. **If the devices are located in a Zone 1 or 2 area:** it must be explosion proof with EPL Gb or Gc with consideration of: - temperature class - gas group **If the devices are located in a combined Zone (gas+dust) both has to be applied.** **Check also devices that are located inside equipment or project into it.**	MEC		
9	electrostatic discharge	**For powder class X2, X3:** persons working with sieve: - Buildup of charge on electrically insulated person	20	21, 22	If filling is manually done persons working at the filling station must be grounded (dissipative footwear, conductive floor)	OR		
10	electrostatic discharge	**For powder class X1, X2, X3:** liners/coatings/bellows/gaskets/compensators of sieve: - Charging of insulating material	20	21, 22	Nonconductive liners/ coatings/ bellows/ gaskets/ compensators are not permitted in pneumatic transfer pipes or for transfer by gravity through a vertical duct of >3m unless the breakthrough voltage is less than 4kV. Check also the coatings of equipment, valves and flaps inside	MEC		
12a	mechanical sparks (due to foreign material ingress) circumferential speed of sieving element < 1m/s	**For powder class X1, X2, X3** **circumferential speed of rotating element < 1m/s:** foreign material gets caught between sieving element and sieve, which generates mechanical sparks. Mechanical ignition souces are not effective for tip speeds < 1m/s	20	-	maximum rotation speed below 1 m/s must be ensured (guaranteed by supplier or by ISP or organizational measure) If speed < 1m/s can not be guaranteed use speed range 1-10 m/s of this typical	other		

A checklist is not a risk assessment

Completion without understanding can create false confidence

Superficial completion

Copying an example, changing the site name or checking boxes without field evidence does not demonstrate control.

Meaningful verification

Inspect the installation, gather evidence, confirm that the safeguard is effective and record deviations.

Judgement and escalation

Recognize when the question is misunderstood, the checklist does not fit or expert review is required.

The objective is not a completed checklist; the objective is effective safeguards.

Build capability close to the hazard

Local teams manage routine verification; specialists address complexity and exceptions

Operators and maintenance

Recognize explosion hazards, follow operating controls, use grounding and bonding correctly, and report missing or damaged safeguards.

Site practitioner

Apply the checklist, verify evidence, maintain the inventory and action plan, and involve the expert when conditions are unclear or outside the standard solution.

Explosion-safety expert

Develop typical assessments, interpret standards, assess exceptions, review complex decisions and coach practitioners until sufficient experience is established.

Push capability as low as practical, while keeping expert support accessible.

Create an environment for success

Tools, training, coaching and governance must operate as one implementation system

1. Prepare

Identify materials, processes and representative units before the visit.

2. Train on site

Use the site's own equipment to explain the questions and safeguards.

3. Start together

Build the inventory and complete the first verification with the site team.

4. Convert to action

Agree gaps, priorities, owners, evidence and required expert decisions.

5. Continue locally

The site completes the remaining units and closes actions.

6. Support remotely

Experts remain available for questions, gaps and situations outside the checklist.

Do not train and leave. Train, assess, implement and follow through.

From compliance on paper to safety in practice

The approach succeeds when expert knowledge becomes local action and safeguards remain effective over time

Standardize where possible

Use expert-developed risk assessments and safeguard packages for genuinely comparable units.

Focus on safety

Use compliance as the foundation, but judge success by safeguards installed, understood, verified and maintained.

Sustain the system

Build local capability, define escalation routes, provide a supporting organization and close identified gaps.

Our objective is not to make every small site an explosion-safety expert.

It is to give every site the knowledge, practical tools and expert support needed to keep explosion risks under control.

We bring progress to life™

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