

# DEKRA PROCESS SAFETY'S GLOBAL TEST DIRECTORY –

Standard Testing & Custom /  
Specialized Testing





## The Importance of Process Safety Data and Laboratory Testing

Comprehensive process safety testing is necessary to develop the data on which fire and explosion hazard assessments and incident investigations should be based. Our goal is to prevent and control fires, explosions, and accidental chemical releases in chemical and process industries. Collecting the necessary process safety data, including asset information and process information backed up with effective process safety testing solutions is the cornerstone of achieving this goal.

Our testing portfolio is designed to facilitate a complete understanding of the properties of substances that are used in or arise from a given process. The data derived from these tests can indicate potential risk factors in handling or storing the materials and is used to develop an effective process safety management (PSM) system. Indeed, no PSM system is complete without the data gathered from testing. Our laboratory tests focus on assessing the **flammability**, combustibility, and **thermal properties** of materials, and specifically determining the temperature, pressure, and other conditions under which a fire or explosion will occur.

### Compliance with National and International Regulations

In some cases, process safety tests are also performed to ensure

compliance with national or international regulations or authorities (ATEX and OSHA, for example) that mandate testing to determine the sensitivity, reactivity, and stability of process materials. Compliance is a strong motivator for organizations to order tests, but a robust **PSM system** goes beyond mere compliance. It integrates as much process safety data and information as possible to collectively combine measures that protect the plant, personnel, and environment as the Basis of Safety.

### Developing and Improving Processes with Process Safety Data

A further consideration when it comes to testing is timing. Certainly, when a new process is in the development stage testing makes sense. A thorough knowledge of the properties of all the

“With the right testing, leaders can target mitigation efforts to remove the hazards and assure process safety excellence.”

substances that will come into play provides a framework for designing a safe and effective process and PSM system. This is wise financially speaking in that precautions and safety measures can be integrated from the start rather than retrofitted at an additional cost.

What may be overlooked however, is that once a process is up and running development does not come to a standstill. To keep pace with changes in technology and other innovations, industries are constantly seeking to improve their processes. This may involve

changes in the materials used, machinery, storage, handling, transport and more. Here it is essential to remember that any change can impact the safety of a given process. Fundamental steps, first and foremost testing, need to be revisited and reevaluated in light of alterations to the process.

We understand the tests and the underlying science, and have experience modifying standard tests and developing new tests to generate the data and information that our clients and we need to assess the safety and performance of new products, materials, technologies, and processes.



### Comprehensive Process Safety Testing Services

We are highly-qualified experts in PSM and enthusiastic advisors, supporting our clients to reach safety targets without compromising efficiency and productivity and to create safe operating parameters with precision and confidence. Combining the best scientific capabilities in the business with our deep understanding and experience in testing, we equip you with the information you need when you need it.

# Testing Capabilities

We conduct over 300 tests with standardized testing procedures, with capability to also conduct unusual or complex customized testing.

## Flammability / Combustibility Properties of Powder, Dust, Gas, Vapor, Mist and Hybrid Atmosphere

- > Powder flammability
- > Particle size and moisture content
- > Minimum ignition energy (MIE)
- > Minimum ignition temperature in cloud (MIT cloud)
- > Minimum ignition temperature in layer (MIT layer)
- > Minimum explosible concentration (MEC)
- > Limiting oxygen concentration for combustion (LOC)
- > Explosion severity (Kst, Pmax), 20l and 1m3
- > Thermal stability tests
- > Hybrid atmosphere testing
- > Liquid / gas / vapor flammability
- > Autoignition temperature (AIT)
- > Closed-cup and open cup flash point
- > Fire point testing
- > Upper and lower explosive limits (UEL and LEL)
- > Analysis of gas / vapor explosion severity (Kg and Pmax)
- > Limiting oxygen concentration for combustion (LOC)
- > Minimum ignition energy (MIE) – of a gas or vapor
- > Aerosol and foam flammability
- > Flame speed measurements
- > Custom high temperature and high pressure flammability testing per clients specific needs

## Fire and Flammability Tests

- > ASTM: flammability, burn, ignition, temperature
- > CA (California) technical bulletins
- > BIFMA: Business & Industrial Furniture Manufacturing Association
- > BOSTON FD: classification and fire tests
- > CPSC 16 CFR: parts 1630, 1631, 1632, and 1633 carpet, rug and mattress
- > FMVSS 302: Federal Motor Vehicle Safety Standards
- > NFPA: fabric, mattress, upholstery, drapery, furniture
- > Port authority of NY/NJ: 14 CFR FAR Part 25
- > UL: flammability and safety fire tests

## Explosive Properties

- > DSC and structured analysis for explosive classification (or exemption)
- > Koenen tube, time / pressure test, shock test
- > Impact sensitivity and friction sensitivity
- > Effect of fire and thermal stability
- > Blast chambers for energetic-materials testing
- > RTD resistance to detonation for fertilizer products

## Electrostatic Testing for Powders, Liquids, FIBC's, Liners, Footwear, Process Equipment...

- > Liquid and powder resistivity / conductivity
- > Charge relaxation time
- > Liquid / powder chargeability
- > Materials surface resistivity & charge relaxation: bags, gloves, surfaces, boots
- > Determination of electrostatic properties of GRG containers: surface resistivity, resistance to earth, etc

## Refrigerant Flammability per ASHRAE 34

- > Fractionation Validation Analysis & Tests
- > Flammability & Burning Velocity Measurement
- > ASHRAE SSPC-34 Application - Preparation and Submission

## Thermal Stability

- > Differential scanning calorimetry (DSC)
- > Carius tube (with measurement of gases evolved)
- > Accelerating rate calorimetry (ARC)
- > Adiabatic dewar & VSP calorimeter tests
- > Specific tests for drying processes: fluid bed, spray, bulk storage
- > Powder basket test

## Chemical Reactions

- > Reaction calorimetry using Mettler RC1
- > Option of testing up to 10 barg
- > Measurement of gas evolved
- > Mass spectrometry analysis of gases

- > Reaction calorimetry using THT-micro reaction
- > Calorimeter ( $\mu$ RC)
- > Rapid results
- > Small sample size (1-100 milligrams,  $\mu$ l)
- > Heat capacity measurement
- > Adiabatic ARC calorimetry for advanced stability analyses
- > Adiabatic dewar & VSP calorimetry for runaway reaction simulation
- > Batch or semibatch processes
- > Closed-cell calorimetry to measure runaway kinetics and thermal stability
- > Viscosity tests on fluid vented
- > Tests to characterize fluid during venting (whether or not reaction tempering occurs)

## Regulatory UN Tests / Transport

- > UN Class 1 - explosives
- > Ignition sensitivity including BAM fall hammer, BAM friction and Koenen tube, etc
- > Explosion severity: time / pressure, gap tests fire analysis, etc
- > UN Class 2, aerosols
- > Chemical heat of combustion, ignition distance, enclosed space ignition, mist flammability, etc
- > UN Class 3 - flammable liquids
- > Flash point, fire point and sustained combustion
- > UN Class 4
- > Division 4.1: self-reactive substances and highly-flammable solids
- > Division 4.2: self-heating solids, pyrophoric solids and liquids
- > Division 4.3: substances evolving flammable gases when in contact with water
- > UN class 5
- > Division 5.1: solid and liquid oxidizing substances
- > UN class 8
- > Corrosive substances, including dermal irritation and metal corrosion

## DOT CA2010040008 Competent Authority - UN/DOT Hazard Classification Tests

Examination / witnessing for DOT hazard classification recommendation

- > Test series 1 – to determine if a substance has explosive properties
- > Test series 2 – to determine if a substance is too insensitive for inclusion in class 1

- > Test series 3 – to determine if a substance is not too dangerous for transport in the form tested
- > Test series 4 – to determine if an article, packages article, or packaged substance is too dangerous for transport
- > Test series 5 – to determine if a substance may be assigned to division 5
- > Test series 6 – to assign a substance or article to division 1.1, 1.2, 1.3 or 1.4 or exclusion from class 1
- > Test series 7 – to determine if an article may be assigned to division 1.6
- > Test series 8 – to determine insensitivity of ammonium nitrate emulsion (ANE) and blasting explosive
- > Tests for self-reactive and organic peroxide substances – test series A, B, C, D, E, F, G, H for hazard classification
- > Tests relating to the following hazard classes: 1 explosives (substance, article, device), 2 (gases), 3 (flammable liquid), 4 (4.1, 4.2, 4.3), 5 (5.1, 5.2), 8 (corrosive) & 9 (misc. hazard)

## Military Test Protocols

- > NATO unclassified AOP-7: critical height, critical diameter, critical temperature, detonation velocity, impact sensitivity, ERL Bruceton
- > MIL-STD 1751A: safety and performance tests for the qualification of explosives (high explosives, propellants, and pyrotechnics)
- > NAVSEAINST TB-700-2: ammunition and explosives hazard classification tests
- > Stanag standards 4240, 4375, 4382, 4443, 4490, 4491 including: slow heat/slow cook off, sympathetic reaction, liquid fire, variable confinement tests

## Physico-Chemical Properties

- > Freezing/Melting point
- > Boiling Point
- > Relative density
- > Vapor pressure
- > Surface tension
- > Water solubility
- > Partition coefficient
- > Flash point
- > Flammability of solids
- > Flammability of gases
- > Flammability in contact with water
- > Flammability in contact with air
- > Explosive properties (including waiver statements)

- > Liquid autoflammability
- > Solid autoflammability (relative autoignition temperature)
- > Oxidizing properties (including waiver statements)
- > Viscosity
- > Dissociation constants in water
- > Granulometry & particle size analysis
- > Karl Fischer Analysis
- > UV-VIS Absorption Spectra

### Custom/Specialized Testing

Apart from custom flammability and explosives testing, other specialized tests, both small and large-scale, can be conducted at our small scale research facility or large scale test site depending on the nature of testing. Some of the special / custom tests conducted by DEKRA Process Safety under exotic conditions include but are not limited to:

- > Thermal stability tests
- > Electrostatic test
- > Explosibility tests
- > Corrosion tests
- > High voltage flash-over test
- > Mechanical integrity test
- > Department of transportation tests
- > Chemical reactor safety testing
- > Pilot plant safety validation
- > Large scale burn and fire tests
- > Large scale dust explosion tests

- > Specialized propulsion testing
- > Bon fire testing
- > Rocket motor / propellant testing
- > High temperature and high pressure flammability
- > Tests to REACH protocol for SDS
- > Safety datasheet (SDS) preparation
- > Battery performance and safety
- > Fire suppression
- > Critical height, critical diameter, TNT equivalence
- > Shock Sensitivity
- > Large Scale Gap / Super Large Scale Gap

### Specialist Capabilities

- > Handling of toxic / active materials
- > High-temperature / pressure equipment and testing
- > Testing to REACH protocol
- > Battery performance and safety testing
- > Remote large-scale testing facility
- > Large cement firing bunker with remote-fire system
- > Small scale research facility with high pressure cells
- > Energetic materials: testing on explosives, propellants, pyrotechnics to DOT, UN etc. protocols
- > Safe handling of explosive, energetic, pyrophoric, propellants, pyrotechnics or potentially-hazardous materials
- > Innovative engineering solutions and test design services
- > Explosives process hazards and characterization
- > Facility siting requirements

#### DEKRA Process Safety

The breadth and depth of expertise in process safety makes us globally recognized specialists and trusted advisors. We help our clients to understand and evaluate their risks, and work together to develop pragmatic solutions. Our value-adding and practical approach integrates specialist process safety management, engineering and testing.

We seek to educate and grow client competence to provide sustainable performance improvement. Partnering with our clients we combine technical expertise with a passion for life preservation, harm reduction and asset protection. As a part of the world's leading expert organization DEKRA, we are the global partner for a safe world.

We have offices throughout North America, Europe, and Asia.

For more information, visit [www.dekra-process-safety.com](http://www.dekra-process-safety.com)

To contact us: [process-safety-usa@dekra.com](mailto:process-safety-usa@dekra.com)

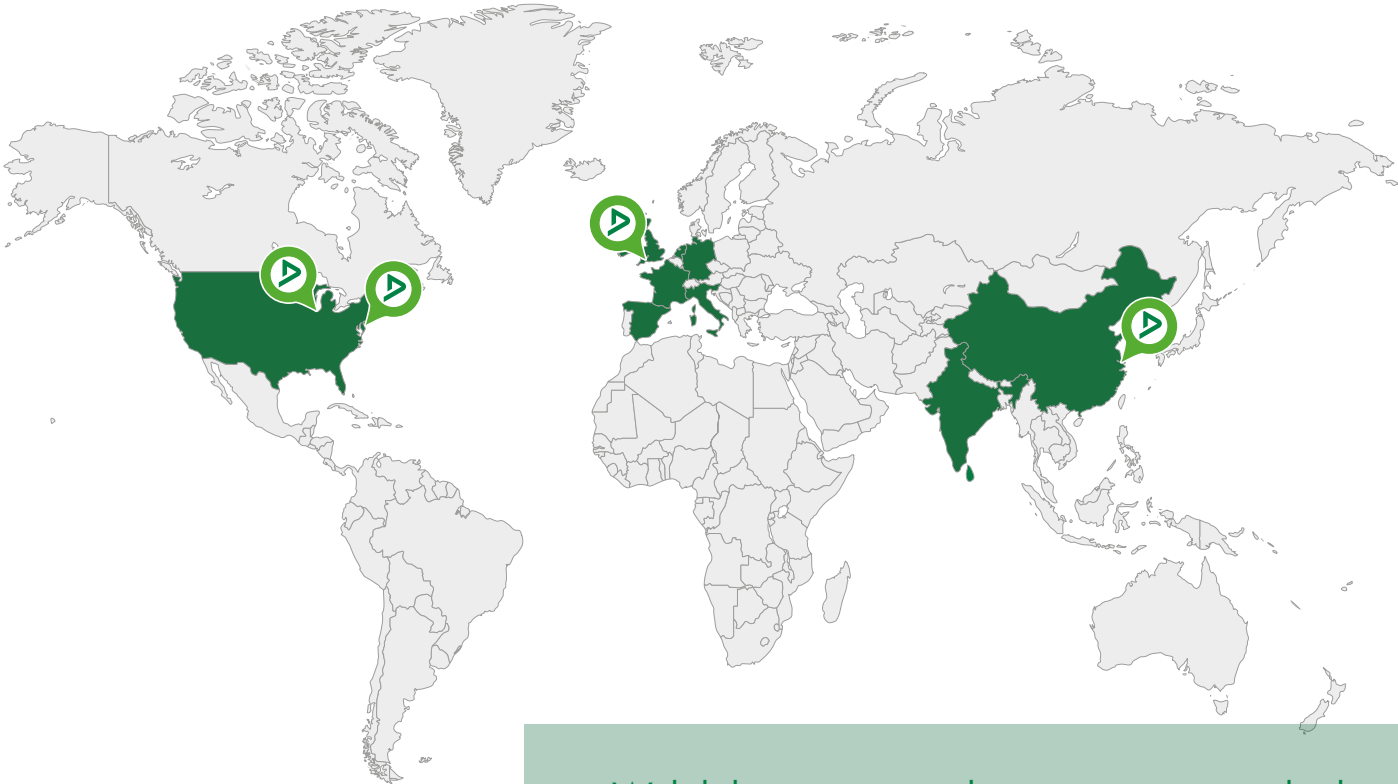
Would you like to get more information?

Contact Us

## Global Laboratory Testing Combined with Consulting Services from Safety Specialists

As a global player in process safety, we have the resources to meet the needs of clients active internationally, regionally or locally, no matter the size or scale of operations. With state-of-the-art and accredited laboratories in North America, Europe and Asia as well as a large-scale testing site, we are equipped to carry out tests in accordance with ISO 9001, OHSAS 18001, GLP and ISO 17025 and provide comprehensive process materials testing, standard or non-standard.

Our real strength, however, is our experts and their commitment to customer-centered service. Senior process safety specialists focus on understanding your specific needs to determine which tests are necessary, how the results can be interpreted in the context of your organization and how to apply the findings to promote safety and a well-designed PSM system. While we offer one-stop shopping, we are vehemently not one-size-fits-all. We pride ourselves on a flexible approach aiming to respond to your needs and working toward the shared goal of process safety excellence, enhanced efficiency and productivity.



With laboratories on three continents, and a large-scale testing facility, DEKRA Process Safety is a leading provider of process safety testing services. On the 100 plus acre large-scale test site any solid, liquid or gas can be tested for initiation sensitivity, speed of propagation, and explosiveness.

