Explosive Materials Hazards Evaluation

Southwest Research Institute® (SwRI®) offers a full range of experimental and analytical services to evaluate explosive materials hazards. State-of-the-art resources include:

- ❏ Fire research facilities (large and small scale)
- ❏ Explosive and propellant test ranges
- ❏ Vapor and dust explosion facilities
- ❏ Computer modeling software

Gas and Vapor Explosibility Characterization

SwRI has the ability to determine the relationships among fuel, oxidants, diluents, temperature and pressure with respect to ignitibility. Triangular flammability diagrams can be developed for various temperatures and pressures that graphically depict regions of danger and safety. Ignition tests can be performed over regions of flammability to determine the energy required to initiate combustion. Data can be used for completion of Material Safety Data Sheets or to improve the safety of chemical processes.

Standard test procedures include:

- ❏ Various ASTM Flash Point Tests
- ❏ ASTM E1232 – Temperature Limit of Flammability
- ❏ ASTM E681 – Concentration Limits of Flammability of Chemicals (Vapors and Gases)
- ❏ ASTM E918 – Limits of Flammability of Chemicals at Elevated Temperature and Pressure
- ❏ ASTM E2079 – Limiting Oxygen (Oxidant) Concentration in Gases and Vapors
- ❏ ASTM E582 – Minimum Ignition Energy and Quenching Distance in Gaseous Mixtures
- ❏ ASTM G125 – Liquid and Solid Material Fire Limits in Gaseous Oxidants
- ❏ ASTM E659 – Autoignition Temperature of Liquid Chemicals
- ❏ ASTM G72 – Autogenous Ignition in a High-Pressure Oxygen-Enriched Environment

Dust Explosion Hazards

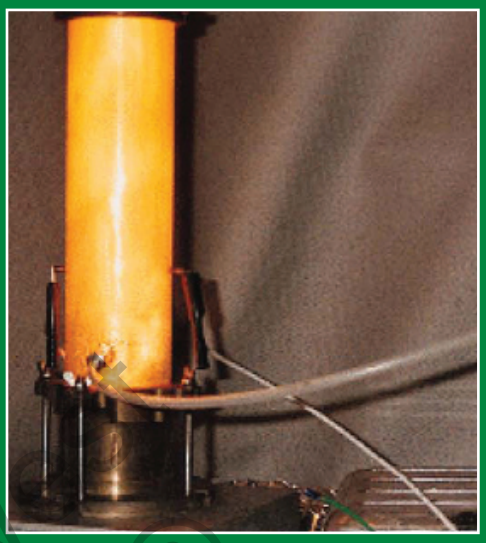
An apparently inert solid can produce extreme hazards when in a powder or dust form due to the ease of its dispersion in air. SwRI is experienced in characterizing dusts for their explosion potential with the following test methods:

- ❏ ASTM E789 – Dust Explosions in a 1.2-Liter Closed Cylindrical Vessel
- ❏ ASTM E1515 – Minimum Explosive Concentration of Combustible Dusts
- ❏ ASTM E1226 – Pressure and Rate of Pressure Rise for Combustible Dusts
- ❏ ASTM E2019 – Minimum Ignition Energy of a Dust Cloud in Air
- ❏ ASTM E1491 – Minimum Autoignition Temperature of Dust Clouds
- ❏ ASTM E2021 – Hot Surface Ignition Temperature of Dust Layers

Blast Effects and Explosion Mitigation

SwRI has extensive facilities for simulation and measurement of small- to large-scale fires, blasts and explosions. SwRI's remote test site allows the safe simulation of explosions too severe to perform on the Institute grounds. Blasts can be measured and viewed with an extensive array of equipment, including:

- ❏ High-speed blast pressures and sound levels
- ❏ High-speed color video
- ❏ Infrared and ultraviolet imaging
- ❏ High-speed strain and acceleration
- ❏ Sonic velocity jet-fire apparatus



DO 16608

Dust cloud explosion inside Hartmann explosibility apparatus

DO 16609

Propagation of ignition through the SwRI 5-L explosibility chamber

FIRE TECHNOLOGY
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NSF
Registered to ISO 9001

DO 18610

Catastrophic failure of a compressed hydrogen cylinder installed on a vehicle

DO 18612

Infrared view of compressed hydrogen cylinder failure

Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,300 employees who perform contract work for industry and government clients.

Benefiting government, industry and the public through innovative science and technology

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Explosion Mitigation

Once fire and explosion hazards have been adequately characterized, steps must be taken to reduce the likelihood of a catastrophic event. Explosion mitigation services include:

- ❏ Active and passive fire protection material design and testing
- ❏ Deflagration and detonation flame arrester evaluation
- ❏ Explosion vent modeling and testing
- ❏ Passive and reactive armor testing

Hazardous Material Storage and Transportation

SwRI performs testing in accordance with the United Nations Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria. Testing includes classification for:

- ❏ Explosives (Class 1)
- ❏ Flammable liquids (Class 3)
- ❏ Flammable/self-heating solids (Class 4)
- ❏ Oxidizing substances (Class 5)
- ❏ Ammonium nitrate fertilizers (Class 9)

Additional testing includes:

- ❏ Evaluation of self-accelerating decomposition temperatures
- ❏ Deflagration/detonation propagation
- ❏ Deflagration/detonation inside packaging
- ❏ Heating and explosions under confinement
- ❏ Explosive power

We welcome your inquiries. For additional information, please contact:

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