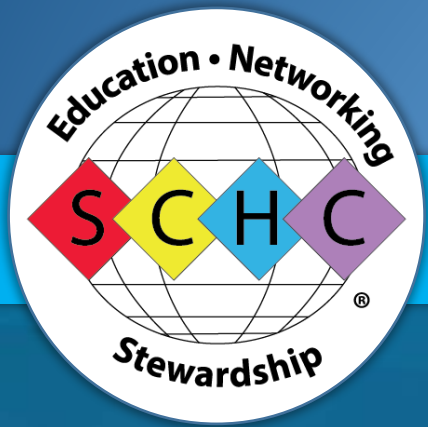


Developing Practical & Useful Content for SDS Section 5 (Firefighting Measures)

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Safety Challenge

Let's Share More about Fire Safety!

- Find at least one thing to take back to your organization to share with others
- Connect on LinkedIn and continue the discussion
- Ask questions!



Please chat during the webinar and feel free to reach out to me with additional questions or comment.

Outline for Today's Discussion:



Common Formatting of Section 5 Information



Overview of SDS Section 5 Utilization & Users



Sources and Methods for Practical Section 5 Information



Identifying & Communicating Unique Firefighting Hazards

Three Case Studies with Examples; Considerations for Combustible Dust



Summary & References

SDS Section 5: The Basics

- The techniques and equipment recommended for extinguishing a fire involving the chemical and hazards that may be created during combustion, including:
 - Suitable Extinguishing Equipment, and Information about Equipment not Appropriate for Particular Situations.
 - Advice on Specific Hazards that Develop from the Material during a Fire, such as Hazardous Combustion Products
 - Recommendations on Special Protective Equipment or Precautions for Firefighters and Emergency Responders

SDS Section 5: Key Audience Perspectives

- Facility Employees
- Facility Safety & Emergency Response Professionals
- Local (Facility Focused) Firefighters & Emergency Planners
- Distribution Providers
- Emergency Responders in the Distribution Chain
 - Municipal Fire Departments
 - Specialized Hazmat Teams
- End Users

Extinguishing Fire: Key Audience Perspectives

- A Bias that Dry Chemical Fire Extinguishers Always Work!
- Use of Firefighting Foam is becoming Environmentally Complex
 - Concerns about efficacy of “Replacement Foams”
- Reactions of Extinguishing Agents & Chemicals during Fire are Not Typically Expected
- “Letting it Burn” is not Typically Considered

SDS Section 5: One Part of Critical Information for Emergency Responders

- Section 1: Identification (Emergency Contact Information)
- Section 2: Hazards Identification
- Section 4: First Aid Measures
- **Section 5: Firefighting Measures**
- Section 6: Accidental Release Measures
- Section 8: Exposure Controls / Personal Protection
- Section 9: Physical and Chemical Properties
- Section 10: Stability and Reactivity
- Section 11: Toxicological Information
- Section 13: Disposal Considerations
- Section 15: Regulatory Considerations



SDS Section 5: A Simple Example (n-Heptane)

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Use water, dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

For safety reasons unsuitable extinguishing agents: Do NOT use straight streams of water.

Special hazards arising from the substance or mixture:

Thermal decomposition can lead to release of irritating gases and vapors. Vapors can flow across ignition source and flashback. Use water spray to blanket fire, cool fire exposed containers. Explosion hazard when exposed to flame, heat, or oxidizers.

Advice for firefighters:

Protective equipment: Wear protective eyewear, gloves, and clothing. Refer to Section 8.

Additional information (precautions): Avoid inhaling gases, fumes, dust, mist, vapor, and aerosols. Avoid contact with skin, eyes, and clothing. Use normal procedures. Poisonous gases may be produced in fire. Use protective clothing. Use NIOSH - approved breathing equipment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO₂, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical

: Extremely flammable liquid and vapor. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. This material is very toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products

: Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters

: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters

: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

SDS Section 5: Key Informational Sources

- Emergency Response Guidebook (ERG)
- Manufacturer's Fire Testing Reports
- Trade Association Fire Testing Data
- Firefighting Technical Manuals (Specialized Chemicals)
- Fire Protection Consultants
- NFPA Fire Protection Guide to Hazardous Materials (Obsolete)

FLAMMABLE LIQUIDS (WATER-IMMISCIBLE)		GUIDE 128
EMERGENCY RESPONSE		
FIRE		
CAUTION: The majority of these products have a very low flash point. Use of water spray when fighting fire may be inefficient.		
CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.		
Small Fire		
<ul style="list-style-type: none">• Dry chemical, CO₂, water spray or regular foam.		
Large Fire		
<ul style="list-style-type: none">• Water spray, fog or regular foam.• Avoid aiming straight or solid streams directly onto the product.• If it can be done safely, move undamaged containers away from the area around the fire.		
Fire Involving Tanks or Car/Trailer Loads		
<ul style="list-style-type: none">• Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.• Cool containers with flooding quantities of water until well after fire is out.• For petroleum crude oil, do not spray water directly into a breached tank car. This can lead to a dangerous boil over.• Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.• ALWAYS stay away from tanks engulfed in fire.• For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn.		

Identifying & Addressing Unique Fire Hazards

- Water Reactive Materials
- Pyrophoric Materials
- Unstable/Reactive Conditions Initiated by Contamination
- Combustible Dust
- **Concerns & Considerations:**
 - Traditional Firefighting Methods will not be effective
 - Provide Enough Information to Warn; Consider Additional References
 - Manufacturers & Trade Associations are Becoming Increasingly Valuable Resources for Information

Water Reactive Materials

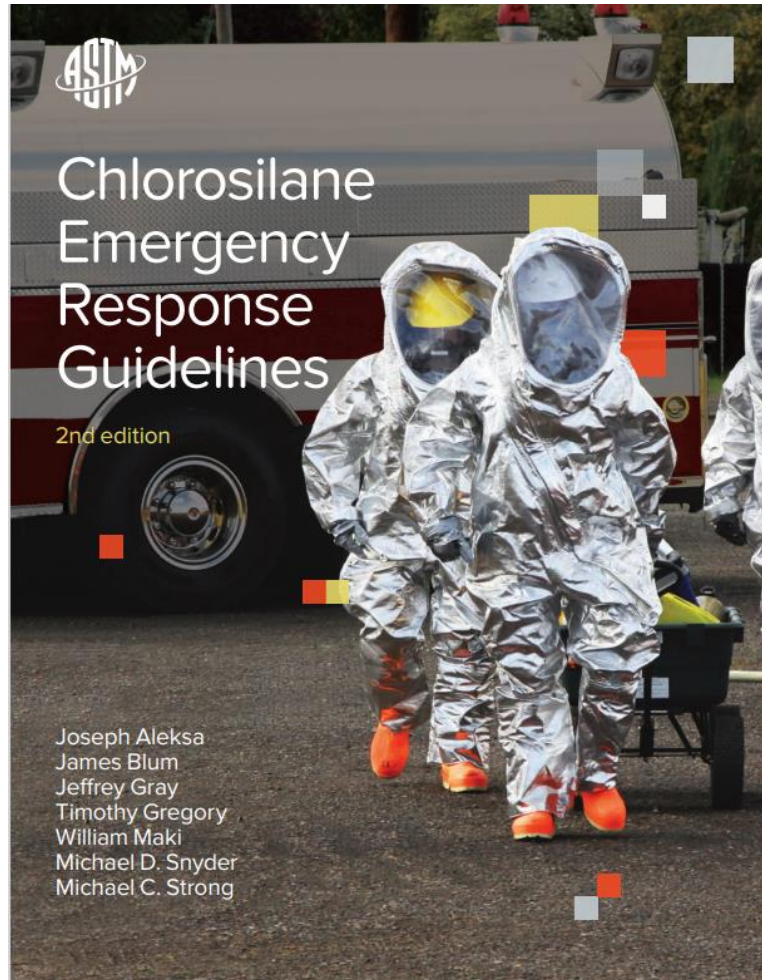
- **Definition:**

- Substances that are considered Dangerous When Wet because they undergo a chemical reaction with water.
 - The reaction may release a gas that is either Toxic or Flammable. Heat generated when water contacts materials, may provide initiation for fire or explosions to occur.

- **Key Considerations:**

- Many of these Materials rely on use of Firefighting Foam for Extinguishment.
- Firefighting Foam contains Water – the method used is Critical!
- Water reaction byproducts are important to understand.
- Obtaining Specialist Help is Key!
- Additional References for Emergency Preplanning Audiences is Helpful.

Water Reactive Materials: Chlorosilanes



SUBSTANCES - TOXIC AND/OR CORROSIVE (FLAMMABLE/WATER-SENSITIVE)		GUIDE 155
EMERGENCY RESPONSE		
FIRE		
• Note: Most foams will react with the material and release corrosive/toxic gases. CAUTION: For Acetyl chloride (UN1717), use CO₂ or dry chemical only.		
Small Fire		
• CO ₂ , dry chemical, dry sand, alcohol-resistant foam.		
Large Fire		
• FOR CHLOROSILANES, DO NOT USE WATER; use AFFF alcohol-resistant medium-expansion foam.		
• If it can be done safely, move undamaged containers away from the area around the fire.		
• Avoid aiming straight or solid streams directly onto the product.		
Fire Involving Tanks or Car/Trailer Loads		
• Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.		
• Do not get water inside containers.		
• Cool containers with flooding quantities of water until well after fire is out.		
• Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.		
• ALWAYS stay away from tanks engulfed in fire.		

Water Reactive Materials: Chlorosilanes

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Water spray. Alcohol-resistant foam. Carbon dioxide. Dry chemical.

Unsuitable extinguishing media : Water.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Highly flammable liquid and vapor. Irritating fumes of hydrogen chloride and organic acid vapors may develop when material is exposed to water or open flame.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Carbon dioxide (CO₂) Dry powder

Unsuitable extinguishing media

Foam Water

Pyrophoric Materials

- **Definition:**

- Materials which can spontaneously ignite on contact with air without any external ignition source.

- **Key Considerations:**

- Fire will typically reignite if it is extinguished, and source is not controlled.
- Unburned explosion may accumulate and create explosion upon reignition.
- Cooling adjacent containers with water is appropriate.
- Obtaining Specialist Help is Key!
- Additional References for Emergency Preplanning Audiences is Helpful.

Pyrophoric Materials: Silane

EMERGENCY RESPONSE

FIRE

- DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.

Small Fire

- Dry chemical or CO₂.

Large Fire

- Water spray or fog.
- If it can be done safely, move undamaged containers away from the area around the fire.

Fire Involving Tanks

- Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. Runoff to sewer may create fire or explosion hazard. Catches fire spontaneously if exposed to air. May re-ignite itself after fire is extinguished. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Pyrophoric Materials: Silane

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Escaping gas cannot be extinguished.
Unsuitable extinguishing media : **Do not use halon fire extinguisher..**

5.2. Special hazards arising from the substance or mixture

- Fire hazard : **Danger! PYROPHORIC, FLAMMABLE, high pressure gas..** If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.
- Explosion hazard : MAY FORM EXPLOSIVE MIXTURES WITH AIR.
- Reactivity : **The substance may spontaneously ignite on contact with air.**

Unstable/Reactive Conditions Initiated by Contamination

- **Definition:**

- Substances that are generally Stable under normal conditions, but can become extremely reactive upon contamination
 - The reaction may release a gas that is either Toxic or Flammable. Heat generated during reaction can initiate fire.

- **Key Considerations:**

- Many Extinguishing Agents Can Serve as Source of Contamination
- Reaction Byproducts & Hazards Are Key
- Obtaining Specialist Help is Key!
- Additional References for Emergency Preplanning Audiences is Helpful.

Unstable/Reactive Conditions Initiated by Contamination: Silicon-Hydride Compounds

Materials Handling Guide: Hydrogen-Bonded Silicon Compounds

5. FIREFIGHTING MEASURES

Extinguishing media

Suitable extinguishing media: Water spray. Alcohol-resistant foam. Carbon dioxide (CO₂).

Unsuitable extinguishing media: Dry chemical.

Special hazards arising from the substance or mixture

Hazardous combustion products: Silicon oxides. Carbon oxides.

Unusual Fire and Explosion Hazards: Applying foam will release significant amounts of hydrogen gas that can be trapped under the foam blanket.. Exposure to combustion products may be a hazard to health..

Developed by the Operating Safety Committees of the
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in partnership with the
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Combustible Dusts



- OSHA's Amended HCS to Include Combustible Dust
 - Consider both Explosions & Flash Fire Hazards
- Need to Keep Combustible Dust Pentagon in Mind
- US Chemical Safety Board Highlights Combustible Dust as One of Five Drivers of Critical Chemical Safety Change
- Fire Extinguishing Techniques that will Create Suspension introduce Additional Hazard
- Good Guidance for Communicating These Hazards:
 - OSHA: [Firefighting Precautions at Facilities with Combustible Dust](#)
 - NFPA 652: [Standard on the Fundamentals of Combustible Dust](#)

Trade Association Responses

- Training Materials & Emergency Response Manuals
 - Silicone Industry Focus on Chlorosilane and Si-H Safety
- **Future Focus – SEMI S30: Safety Guidelines for Use of Energetic Materials in Semiconductor R&D and Manufacturing Processes**
 - Outlines Minimum Safety Information that Chemical Suppliers Need to Make Available to End-Users
 - Includes specific dossier requirements, including Firefighting Methods
 - Focuses on Newly Developed Molecules that have any of the following:
 - High Instantaneous Power Density; High Energy of Decomposition; Pyrophoric; NFPA 704 Instability Rating of 3 or 4

Closing Thoughts

- Section 5 Matters!
 - Ensure Consistency with Other SDS Sections
- Remember the Many Audiences Needs for Section 5 SDS Information
- Confirm Fire Extinguishing Methods for Newly Developed Molecules
 - Dry Chemical doesn't work for everything!
- Keep in Mind that References Help Many Audiences
- Support Initiatives for Improved Fire & Safety Data Documentation from Organizations like SEMI.org and the Global Silicones Council
- Review the References at End of Presentation

About our Speaker



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References

- US DOT Emergency Response Guidebook
 - [Emergency Response Guidebook \(ERG\) | PHMSA \(dot.gov\)](#)
- ASTM MNL33-2ND: Chlorosilane Emergency Response Guidelines
 - [MNL33-2ND Chlorosilane Emergency Response Guidelines \(astm.org\)](#)
- Global Silicones Council: Safety Handling Guide – Hydrogen Bonded Silicon Compounds
 - [SAFE HANDLING OF SiH SILICONE PRODUCTS \(globalsilicones.org\)](#)
- SEMI S30 – Safety Guidelines for Use of Energetic Materials in Semiconductor R&D and Manufacturing Processes
 - [S03000 - SEMI S30 - Safety Guideline for Use of Energetic Materials in – semi.org](#)
- OSHA – Firefighting Precautions at Facilities with Combustible Dust
 - [OSHA_3644.pdf](#)
- NFPA – Evaluating Effectiveness of Fluorine-Free Firefighting Foams
 - [Fire Protection Research Foundation Fluorine-free Foam Report](#)