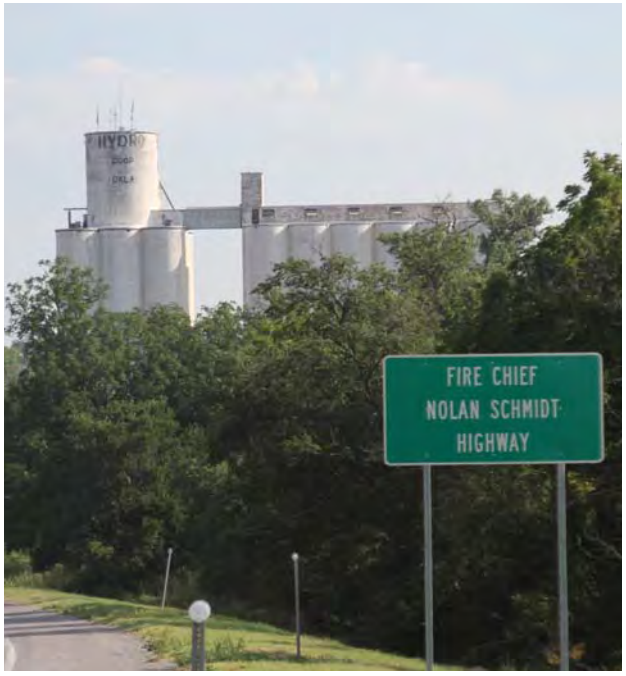


GRAIN BIN EMERGENCIES

AWARENESS

ABSTRACT

Agriculture operations by nature can be inherently dangerous. Avoiding accidents and surviving one, should it occur, both require training. This presentation enables you to recognize common hazards that exist during grain bin operations, understand steps that reduce or eliminate these hazards, and identify initial actions that should be taken in the event of an accident at a grain handling facilities.

Oklahoma State University – Fire Service Training
Grain Bin Emergencies – Awareness

Student Handout

Slide 1

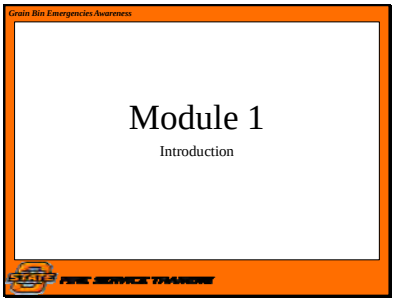
On March 23, 2009, Nolan Schmidt, volunteer fire chief for the Hydro, Oklahoma fire department died fighting a fire inside a Hydro grain bin. Fire Chief Schmidt was one of at least five firefighters who climbed into a bin half full of burning soybeans. Fellow firefighters later cut through the side of the metal bin to remove Schmidt and four other colleagues, who were overwhelmed by thick smoke.

Chief Schmidt and the members of his fire department had been dispatched to a report of a possible fire in a large grain bin. Firefighters entered the bin to investigate. Chief Schmidt ordered firefighters to exit the bin. In order to get out of the bin, firefighters had to climb up a long ladder. One of the firefighters in the bin was fatigued and could not complete the climb. Chief Schmidt entered the bin the assist the firefighter. Both firefighters subsequently lost consciousness.

Firefighters on the exterior cut a hole in the metal wall of the bin and extricated the two firefighters. Chief Schmidt was transported to the hospital but was pronounced dead. The cause of death was listed as asphyxiation due to probable carbon monoxide toxicity.

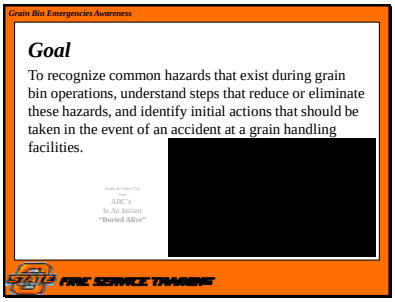
Accidents occur in every occupation. When they occur in agriculture operations or emergency response these accidents can be disastrous. This presentation is intended to prevent such incidents from occurring.

Slide 2



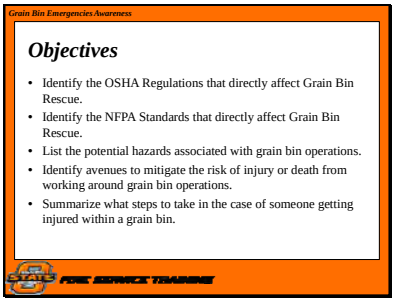
INTRODUCTION

Slide 3



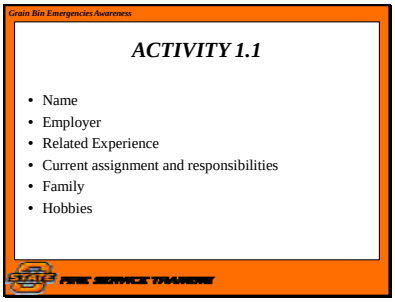
GOAL

Slide 4



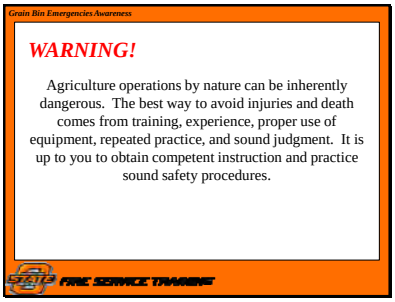
OBJECTIVES

Slide 5



ACTIVITY

Slide 6



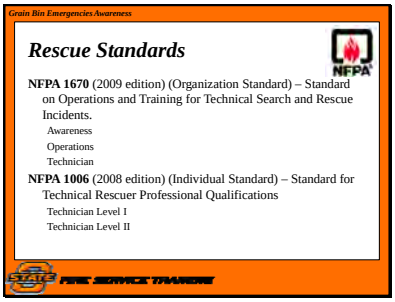
WARNING!

Agriculture operations by nature can be inherently dangerous.

Slide 7

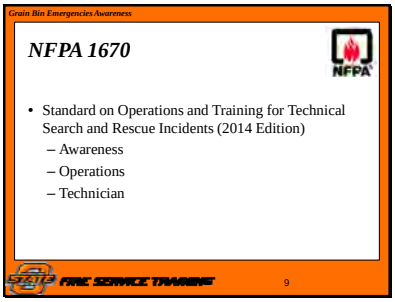
OSHA Regulations

Slide 8



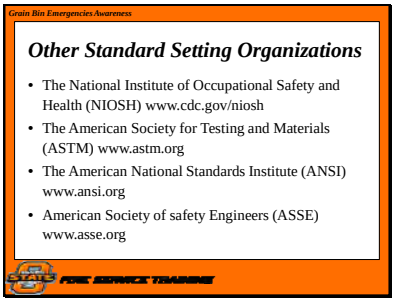
NFPA Standards

Slide 9



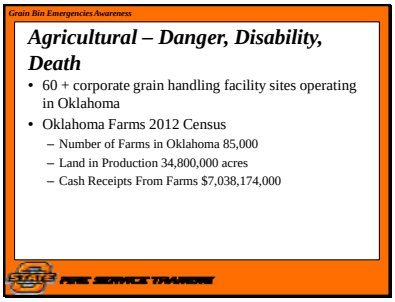
NFPA 1670

Slide 10



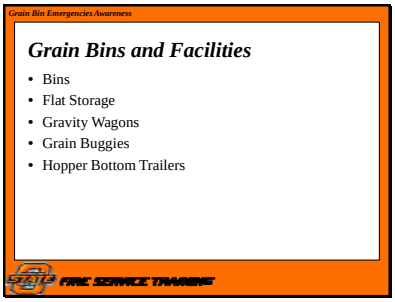
Other Standards

Slide 11



Agricultural – Danger, Disability, Death

Slide 12

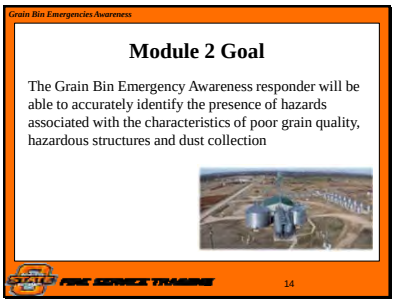


Grain Bins and Facilities

Slide 13

Module 2 – Grain Quality

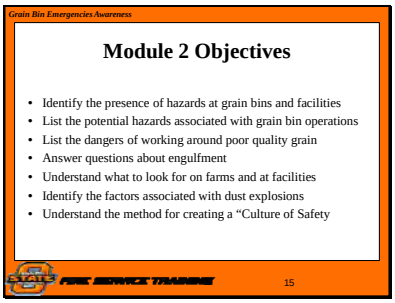
Slide 14



Module 2 Goal

The Grain Bin Emergency Awareness responder will be able to accurately identify the presence of hazards associated with the characteristics of poor grain quality, hazardous structures and dust collection.

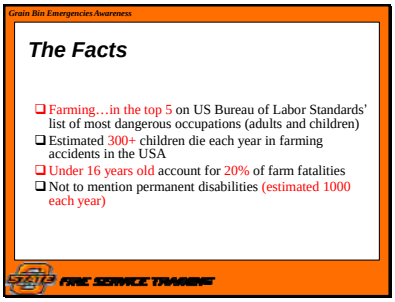
Slide 15



Module 2 Objectives

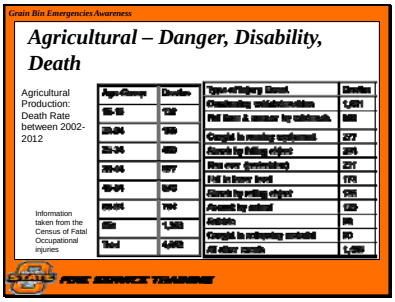
- **Identify the presence of hazards at grain bins and facilities**
- **List the potential hazards associated with grain bin operations**
- **List the dangers of working around poor quality grain**
- **Answer questions about engulfment**
- **Understand what to look for on farms and at facilities**
- **Identify the factors associated with dust explosions**
- **Understand the method for creating a "Culture of Safety**

Slide 16



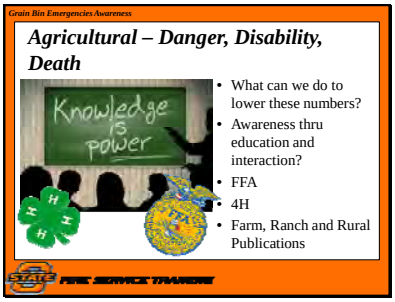
The Facts

Slide 17



Agricultural – Danger, Disability, Death

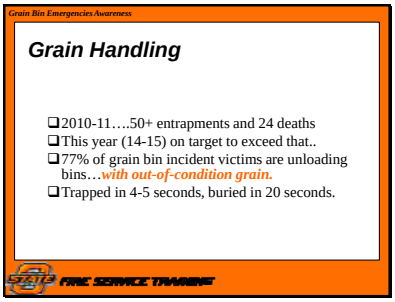
Slide 18



Agricultural – Danger, Disability, Death

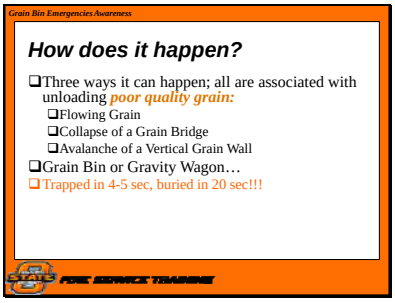
What can be done?

Slide 19



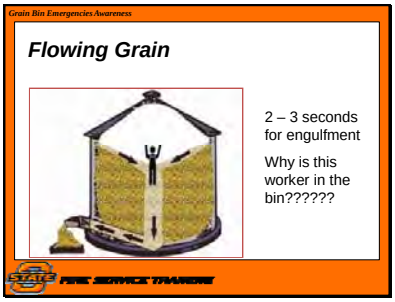
Grain Handing

Slide 20



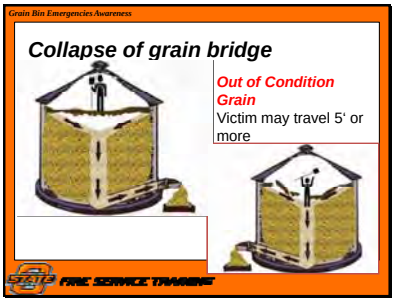
How Does It Happen?

Slide 21



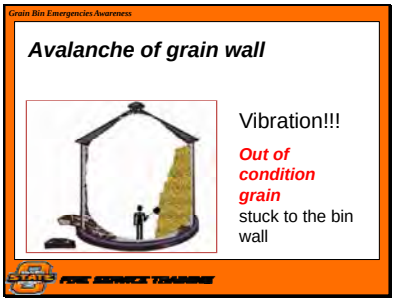
Flowing Grain

Slide 22



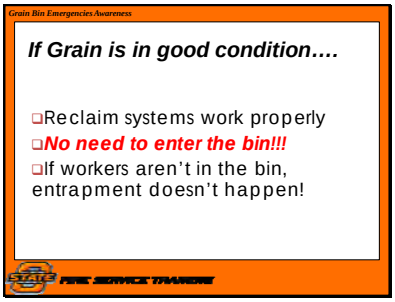
Collapse OF Grain Bridge

Slide 23



Avalanche of grain wall

Slide 24



If Grain is in good condition….

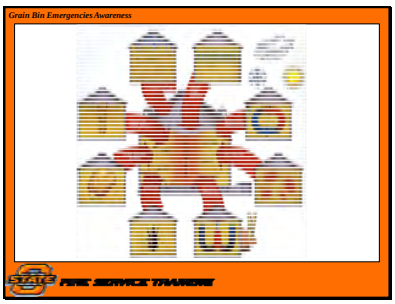
Slide 25

Major Cause:

Slide 26

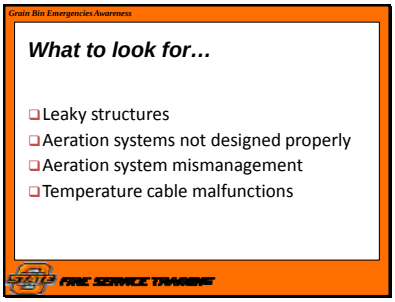
What To Look For…

Slide 27



Moisture management problems

Slide 28



What To Look For…

Slide 29

Inadequate or Plugged Roof Vents

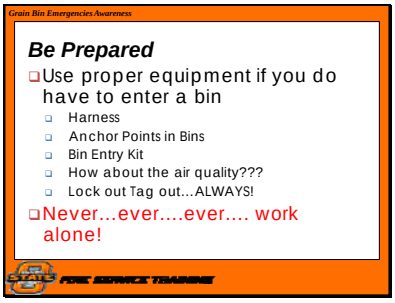
Slide 30

What To Look For…

Slide 31

What To Look For…

Slide 32



Be Prepared

Slide 33

What To Look For…

Slide 34

And What About Explosions?

Slide 35

And What About Explosions?

Slide 36

What Bulb???

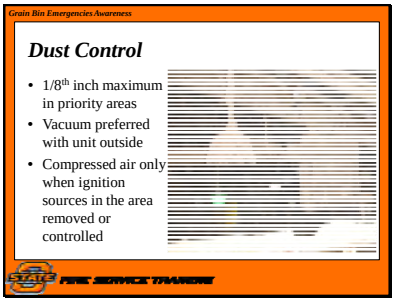
Slide 37

Digital Pictures

Slide 38

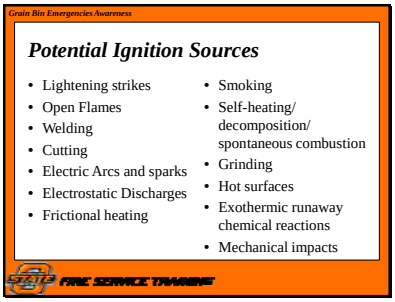
The Remedy

Slide 39



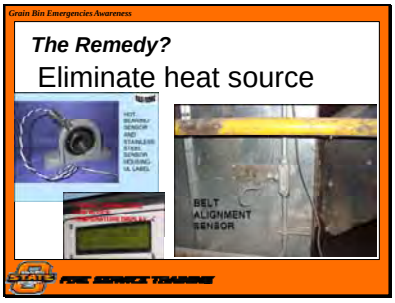
Dust Control

Slide 40



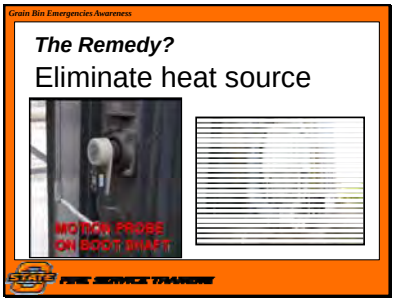
Potential Ignition sources

Slide 41



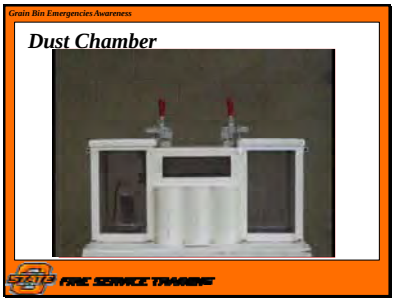
The Remedy

Slide 42



The Remedy

Slide 43

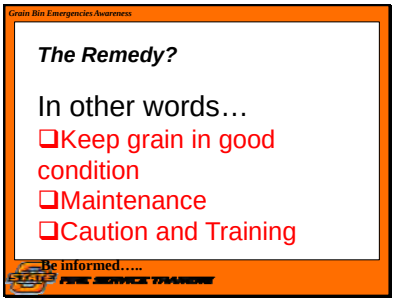


Dust Chamber

Slide 44

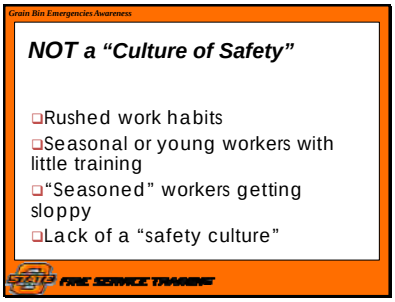
Dust Chamber (slow motions)

Slide 45



The Remedy

Slide 46



Not a "Culture of Safety"

Slide 47

How Do We Fix It?

Slide 48

How Do We Fix It?

Slide 49

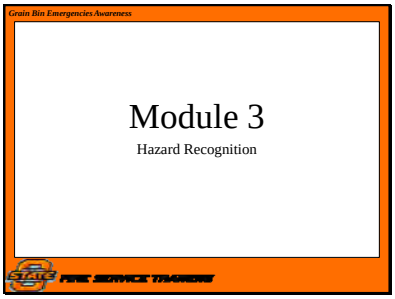
If Grain Is In Good Condition….

Slide 50

Dr. Carol L. Jones
is currently an associate professor in the Biosystems and Agricultural Engineering Department at Oklahoma State University. Her appointment to the BAE faculty began in 2006 after 25+ years in the energy and agricultural fields. Her area of research, extension and teaching is in postharvest technology and material handling of biological products.

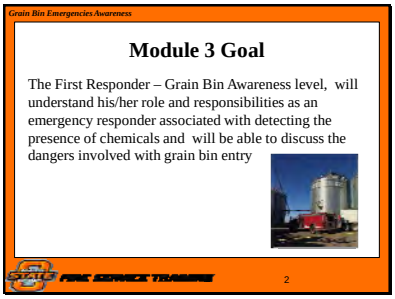
Further questions regarding grain condition and proper storage can be directed to Dr. Jones at Jcarol@okstate.edu.

Slide 51



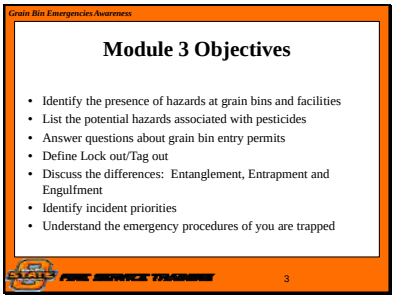
MODULE 3

Slide 52



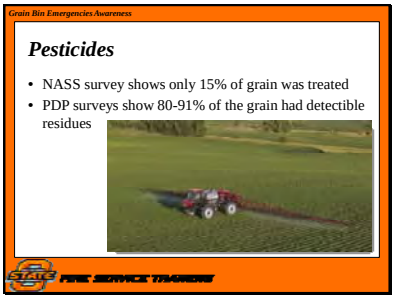
Module 3 – Goal

Slide 53



Module 3 – Objectives

Slide 54



Pesticides

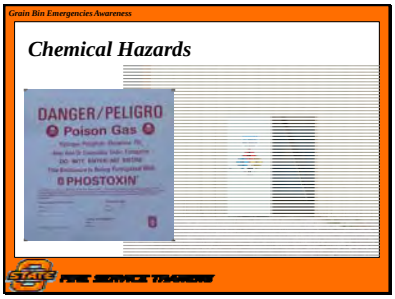
Slide 55

Pesticides

Slide 56

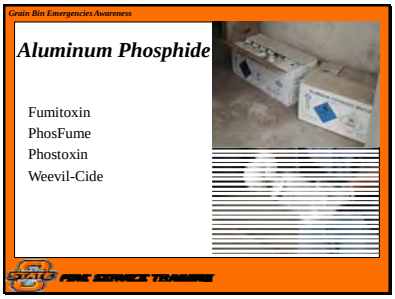
Pesticides

Slide 57



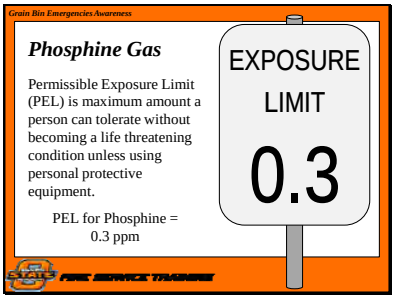
Chemical Hazards

Slide 58



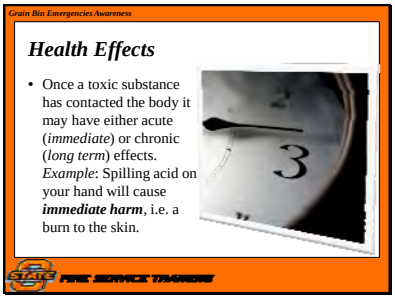
Aluminum Phosphide

Slide 59



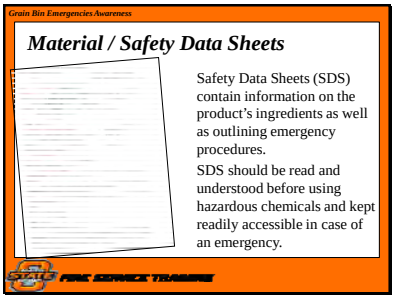
Phosphine Gas

Slide 60



Health Effects

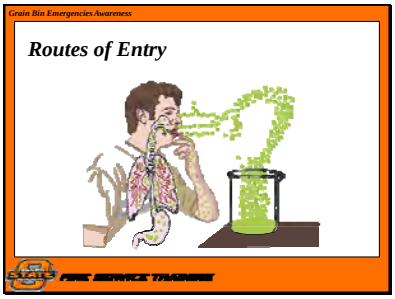
Slide 61



Material/Safety Data Sheets

See attached sample SDS

Slide 62



Routes of Entry

Slide 63

Electrical Hazards

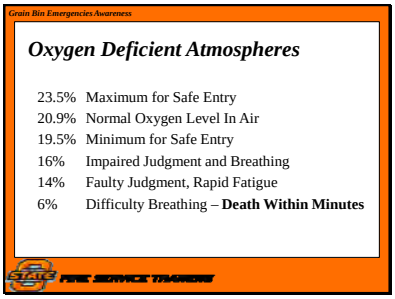
Slide 64

Fall Hazards

Slide 65

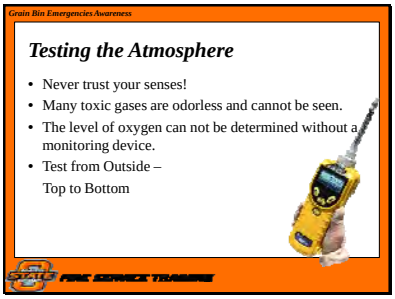
Grain Moving Equipment

Slide 66



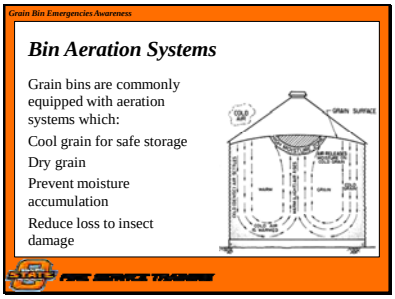
Oxygen Deficient Atmospheres

Slide 67



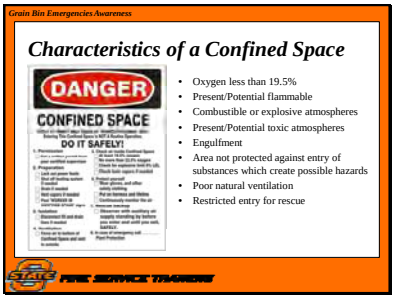
Testing the Atmophere

Slide 68



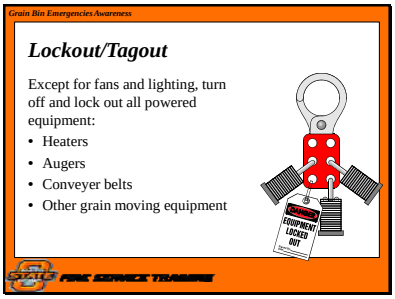
Bin Aeration Systems

Slide 69



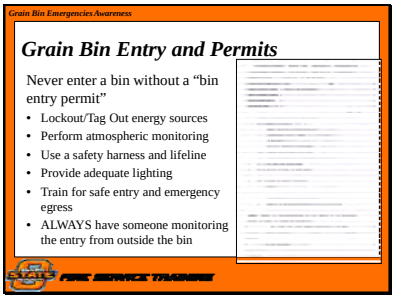
Characteristics of a Confined Space

Slide 70



Lockout/Tagout

Slide 71



Grain Bin Entry and Permits

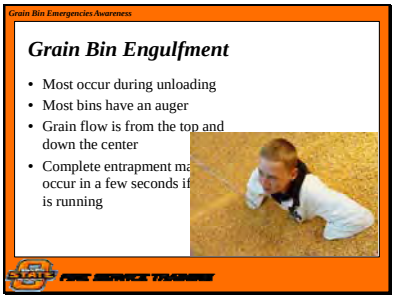
Slide 72

Entanglement

Slide 73

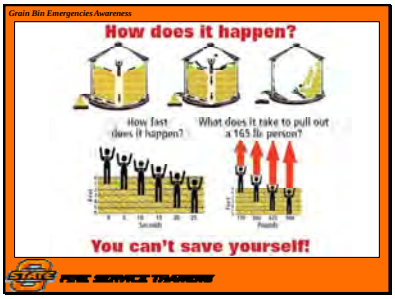
Entrapment

Slide 74



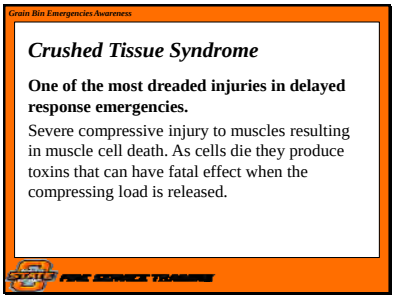
Grain Engulfment

Slide 75



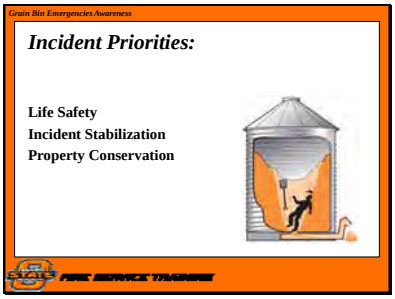
How Engulfment Happens

Slide 76



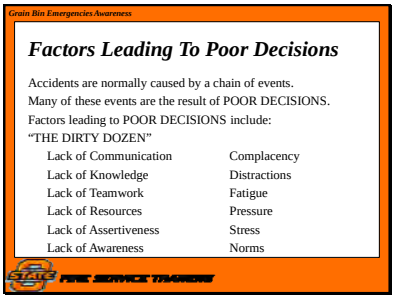
Crushed Tissue Syndrome

Slide 77



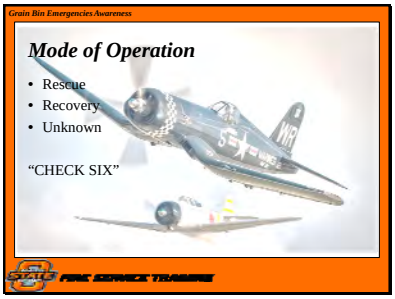
Incident Priorities

Slide 78



Factors Leading To Poor Decisions

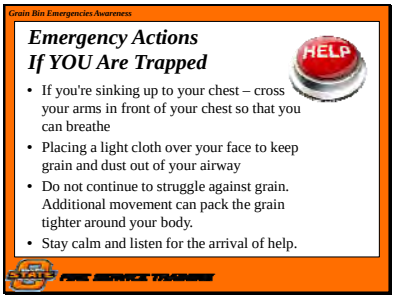
Slide 79



Modes of Operation

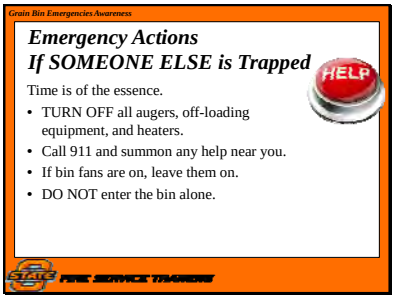
Don't leave blind spots, Check Your Six!

Slide 80



If You Are Trapped

Slide 81

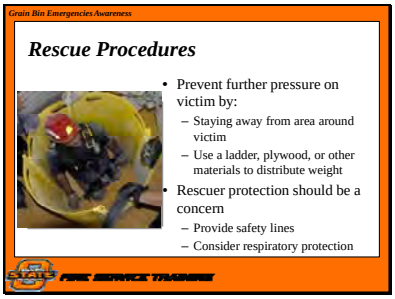


If Someone Else Is Trapped

Slide 82

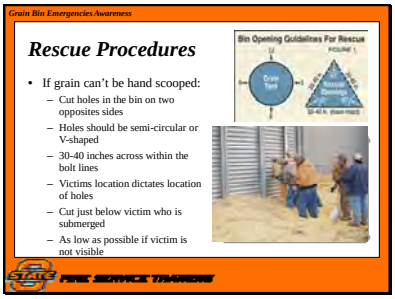
Rescue Procedures

Slide 83



Rescue Procedures

Slide 84



Rescue Procedures

Slide 85

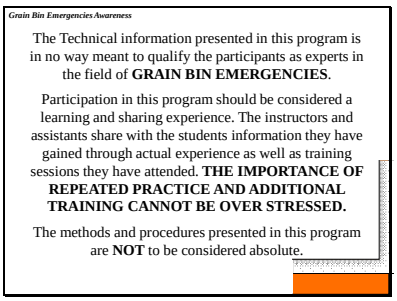
Remember:

Slide 86

Video – Grain Bin Safety

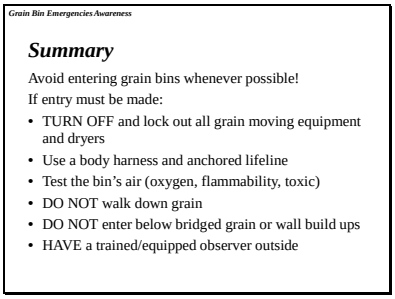
This video may be viewed at www.youtube.com/watch?v=DQSqWbn-3X0

Slide 87



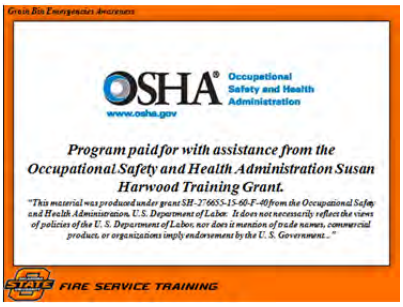
Program Participation

Slide 88



Summary

Slide 89



Program Support

This program was paid for with assistance from the Occupational Safety and Health Administration Susan Harwood Training Grant.

"This material was produced under grant SH-276655-15-60-F-40 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views of policies of the U. S. Department of Labor, nor does it mention of trade names, commercial product, or organizations imply

endorsement by the U. S. Government..."

Slide 90

Program Management and Acknowledgements

Oklahoma State University – Fire Service Training
1723 W. Tyler
Stillwater, OK 74078
1-800-304-5727
www.osufst.org

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

* 1 Identification

· **Product identifier**

· **Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5**

· **Relevant identified uses of the substance or mixture and uses advised against**

· **Product description** Fumigant for Insect & Rodent Control

· **Application of the substance / the mixture**

Fumigants used to treat raw agricultural commodities, processed foods, non-food commodities and rodent burrows.

· **Details of the supplier of the safety data sheet**

· **Manufacturer/Supplier:**

DEGESCH America, Inc.
153 Triangle Dr.
P.O. Box 116
Weyers Cave, VA 24486 USA
Telephone: (540) 234-9281 / 800-330-2525
Telefax: (540) 234-8225
www.degeschamerica.com
degesch@degeschamerica.com

· **Emergency telephone number:**

For human or animal emergencies: 1-800-308-4856 (Rocky Mountain Poison and Drug Center)
For all other chemical emergencies: 1-800-424-9300 (Chemtrec)
Emergency and Information - DEGESCH America, Inc.: (540) 234-9281 / 800-330-2525

* 2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS02 Flame

Water-react. 1 H260 In contact with water releases flammable gases which may ignite spontaneously.

GHS06 Skull and crossbones

Acute Tox. 2 H300 Fatal if swallowed.
Acute Tox. 2 H330 Fatal if inhaled.

GHS05 Corrosion

Eye Dam. 1 H318 Causes serious eye damage.

GHS09 Environment

Aquatic Acute 1 H400 Very toxic to aquatic life.

(Contd. on page 2)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

GHS07

Skin Irrit. 2 H315 Causes skin irritation.

· **Label elements**

· **GHS label elements**

The product is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS02 GHS05 GHS06 GHS09

· **Signal word** Danger

· **Hazard-determining components of labeling:**

Aluminum Phosphide
Ammonium Carbamate
Proprietary

· **Hazard statements**

In contact with water releases flammable gases which may ignite spontaneously.
Fatal if swallowed or if inhaled.
Causes skin irritation.
Causes serious eye damage.
Very toxic to aquatic life.

· **Precautionary statements**

Keep away from any possible contact with water, because of violent reaction and possible flash fire.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wear respiratory protection.
Wear protective gloves / eye protection / face protection.
Avoid release to the environment.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
If swallowed: Immediately call a poison center/doctor.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Specific treatment is urgent (see supplementary first aid instructions on this Safety Data Sheet).
Take off contaminated clothing and wash before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
If skin irritation occurs: Get medical advice/attention.
In case of fire: Use for extinction: CO_2, sand, extinguishing powder.
If on skin: Wash with plenty of water.
Collect spillage.
Store locked up.
Store in a well-ventilated place. Keep container tightly closed.
Store in a dry place. Store in a closed container.
Dispose of contents/container in accordance with local/regional/national/international regulations.

(Contd. on page 3)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

Unknown acute toxicity:
13.3 percent of the mixture consists of ingredient(s) of unknown toxicity.
Classification system:
NFPA ratings (scale 0 - 4)

Health = 4
Fire = 4
Reactivity = 2

The substance demonstrates unusual reactivity with water.
HMIS-ratings (scale 0 - 4)

Health = *4
Fire = 4
Reactivity = 2

Other hazards None known

* 3 Composition/information on ingredients

Chemical characterization: Mixtures
Description: Mixture of substances listed below with nonhazardous additions.

Dangerous Components:

CAS: 20859-73-8 RTECS: BD 1400000	Aluminum Phosphide Water-react. 1, H260; Acute Tox. 2, H300; Aquatic Acute 1, H400	55%
CAS: 1111-78-0	Ammonium Carbamate Eye Dam. 1, H318; Acute Tox. 4, H302; Skin Irrit. 2, H315; Aquatic Acute 3, H402	Proprietary%
RTECS: BD 1200000	Proprietary STOT SE 3, H335	2-12%
	Proprietary STOT SE 3, H335	2-12%
	Proprietary Carc. 2, H351; Acute Tox. 4, H302; Skin Irrit. 2, H315; STOT SE 3, H335; Eye Irrit. 2B, H320	2-12%

Additional information:
Phostoxin Tablets, Phostoxin Pellets, Phostoxin Tablet Prepac, Phostoxin Prepac Ropes, DetiaPhos Tablets and DetiaPhos Pellets react with water to produce phosphine (hydrogen phosphide, PH3, CAS No. 7803-51-2) as shown in Equation 1. Phostoxin and DetiaPhos products are formulated with 55% aluminum phosphide and also contains ammonium carbamate (AC) and inert ingredients. Ammonium carbamate decomposes to liberate ammonia (CAS No. 7664-41-7) and carbon dioxide (CAS No. 124-38-9) as shown in Equation 2.

1) AlP + 3H2O ---> Al(OH)3 + PH3
2) NH2COONH4 ---> 2NH3 + CO2

(Contd. on page 4)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

* 4 First-aid measures

· **Description of first aid measures**

· **General information:**

Symptoms of overexposure are headache, dizziness, nausea, difficult breathing, vomiting, and diarrhea. In ALL cases of overexposure, get medical attention immediately. Take victim to a doctor or emergency treatment facility.

Have product container label and applicator's manual with you when calling a poison control center, doctor, or when going for treatment.

· **After inhalation:**

Get exposed person to fresh aid. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth, if possible. Contact a poison control center or doctor for treatment advice.

· **After skin contact:**

Take off contaminated clothing immediately. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

· **After eye contact:**

Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice.

· **After swallowing:**

Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not give anything by mouth to an unconscious person. Do not induce vomiting unless told to by a poison control center or doctor.

· **Information for doctor:**

· **Most important symptoms and effects, both acute and delayed**

Aluminum phosphide fumigant products react with moisture from the air, acids and many other liquids to release phosphine gas (hydrogen phosphide, PH3). Mild exposure by inhalation causes malaise (indefinite feeling of sickness), headache, ringing in the ears, fatigue, nausea and pressure in the chest which is relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, pain just above the stomach, chest pain, diarrhea and dyspnea (difficulty breathing). Symptoms of severe poisoning may occur within a few hours to several days resulting in pulmonary edema and may lead to dizziness, cyanosis, unconsciousness, and death.

· **Indication of any immediate medical attention and special treatment needed**

No further relevant information available.

* 5 Fire-fighting measures

· **Extinguishing media**

· **Suitable extinguishing agents:** CO_2, sand, extinguishing powder. Do not use water.

· **For safety reasons unsuitable extinguishing agents:** Water

· **Special hazards arising from the substance or mixture**

Phosphine (hydrogen phosphide, PH3)-air mixtures at concentrations above the LEL of 1.8% v/v (18,000 ppm) may ignite spontaneously. Ignition of high concentrations of phosphine gas (hydrogen phosphide, PH3) can product a very energetic reaction. Explosions can occur under these conditions and may cause severe personal injury. Never allow the buildup of phosphine gas (hydrogen phosphide, PH3) to exceed explosive concentrations. Open containers of metal phosphides in open air only and never in a flammable atmosphere. Do not confine spent or partially spent dust from metal phosphide fumigants as the slow release of phosphine gas (hydrogen phosphide, PH3) from these materials may result in the formation of an explosive atmosphere. Spontaneous ignition may occur if large quantities of aluminum phosphide are piled in contact with liquid water. This is particularly true if quantities of these materials are placed in an environment which can provide

(Contd. on page 5)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

partial confinement of the hydrogen phosphide gas liberated by hydrolysis.

If incinerated, product will release the following toxic materials: Oxides of aluminum, phosphorous, nitrogen (NOx), carbon, phosphine gas (hydrogen phosphide, PH3), ammonia and phosphoric acid.

· ***Advice for firefighters***

Aluminum phosphide is not flammable by itself. However, it reacts readily with water to produce phosphine gas (hydrogen phosphide, PH3) which may ignite spontaneously in air at concentrations above its LEL of 1.8% v/v (18,000 ppm). The UEL of phosphine gas (hydrogen phosphide, PH3) is unknown.

· ***Protective equipment:***

As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.

Wear a NOISH/MSHA approved full-face gas mask – phosphine gas canister combination may be used at levels up to 15 ppm or following manufacturers' use conditions instructions for escape. Above 15 ppm or in situations where the phosphine gas concentration is unknown, a NIOSH/MSHA approved SCBA must be worn.

*
6 Accidental release measures

· ***Personal precautions, protective equipment and emergency procedures***

Respiratory protection will most likely be required during cleanup of spilled aluminum phosphide fumigants. If the concentration of phosphine (hydrogen phosphide, PH3) is unknown, NIOSH/MSHA approved SCBA or its equivalent must be worn. Full-face gas mask canister combinations may only be worn at concentrations no higher than 15 ppm.

· ***Environmental precautions:***

Inform respective authorities in case of seepage into water course or sewage system.

· ***Methods and material for containment and cleaning up:***

If possible, dispose of spilled material by use according to label instructions. Freshly spilled material which has not been contaminated by water or foreign matter may be placed back into its original or other air-tight container. Punctured flasks, pouches or containers may be temporarily repaired using aluminum tape. If the age of the spill is unknown or if the product has been contaminated with soil, debris, water, etc., gather up the spillage in small open buckets having a capacity no larger than about 1 gallon. Do not add more than about 1 to 1.5 kg (2 to 3 lbs.) to a bucket. If on-site wet-deactivation is not feasible, transport the uncovered buckets in open vehicles to a suitable area.

Small amounts of spillage, from about 4 to 8 kg (9 to 18 lbs.) may be spread out over the ground in an open area to be deactivated by atmospheric moisture. Alternatively, spilled aluminum phosphide fumigants may be deactivated by the wet method as described in the following:

Wet Deactivation of Spilled Phostoxin & DetiaPhos Products:

1. Deactivating solution is prepared by adding the appropriate amount of low sudsing detergent to water in a drum or other suitable container. A 2% solution or 4 cups of detergent in 30 gallons is suggested. The container should be filled with deactivating solution to within a few inches of the top.
2. The material is added slowly to the deactivating solution and stirred so as to thoroughly wet all of the product. This should be carried out in open air and respiratory protection may be required. At no time should the deactivation drum be covered.
3. No more than about 45 to 50 lbs. of Phostoxin or DetiaPhos should be added to 15 gallons of water-detergent mixture. Prepacs and Ropes may ignite during wet deactivation if they are allowed to float to the surface. Add weights or otherwise ensure that Phostoxin or DetiaPhos products stay submerged until deactivation is completed.
4. Allow the mixture to stand, with occasional stirring, for about 36 hours. The resultant slurry of dust or packaged product will then be safe for disposal.
5. Dispose of the slurry of deactivated material, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, this slurry may be poured into a storm

(Contd. on page 6)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

sewer or out onto the ground.
If possible, dispose of spilled material by use according to label instructions. Freshly spilled material which has not been contaminated by water or foreign matter may be placed back into its original or other air-tight container. Punctured flasks, pouches or containers may be temporarily repaired using aluminum tape. If the age of the spill is unknown or if the product has been contaminated with soil, debris, water, etc., gather up the spillage in small open buckets having a capacity no larger than about 1 gallon. Do not add more than about 1 to 1.5 kg (2 to 3 lbs.) to a bucket. If on-site wet-deactivation is not feasible, transport the uncovered buckets in open vehicles to a suitable area.

Small amounts of spillage, from about 4 to 8 kg (9 to 18 lbs.) may be spread out over the ground in an open area to be deactivated by atmospheric moisture. Alternatively, spilled aluminum phosphide fumigants may be deactivated by the wet method as described in the following:

Wet Deactivation of Spilled Phostoxin & DetiaPhos Products:
1. Deactivating solution is prepared by adding the appropriate amount of low sudsing detergent to water in a drum or other suitable container. A 2% solution or 4 cups of detergent in 30 gallons is suggested. The container should be filled with deactivating solution to within a few inches of the top.
2. The material is added slowly to the deactivating solution and stirred so as to thoroughly wet all of the product. This should be carried out in open air and respiratory protection may be required. At no time should the deactivation drum be covered.
3. No more than about 45 to 50 lbs. of Phostoxin or DetiaPhos should be added to 15 gallons of water-detergent mixture. Prepacs and Ropes may ignite during wet deactivation if they are allowed to float to the surface. Add weights or otherwise ensure that Phostoxin or DetiaPhos products stay submerged until deactivation is completed.
4. Allow the mixture to stand, with occasional stirring, for about 36 hours. The resultant slurry of dust or packaged product will then be safe for disposal.
5. Dispose of the slurry of deactivated material, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, this slurry may be poured into a storm sewer or out onto the ground.

· ***Reference to other sections***
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

* 7 Handling and storage

· ***Handling:***
· ***Precautions for safe handling*** Store in a cool, dry place in tightly closed containers.
· ***Information about protection against explosions and fires:***
Protect from heat.
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
Keep protective respiratory device available.

· ***Conditions for safe storage, including any incompatibilities***
Store away from water, acids, bases, strong oxidizing agents and strong reducing agents.
· ***Storage:***
· ***Requirements to be met by storerooms and receptacles:***
Store products in a locked, dry, well-ventilated area away from heat. Post as a pesticide storage area. Do not store in buildings inhabited by humans or domestic animals.
· ***Information about storage in one common storage facility:*** Not required.

(Contd. on page 7)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **Further information about storage conditions:**
Keep container tightly sealed.
Store in cool, dry conditions in well-sealed containers.
Protect from heat and direct sunlight.
· **Specific end use(s)** No further relevant information available.

*
8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
All ventilation should be designed in accordance with OSHA standard (29 CFR 1910.94). Use local exhaust at filling zones and where leakage and dust formation is probable. Use mechanical (general) ventilation for storage areas. Use appropriate ventilation as required to keep Exposure Limits in Air below TLV & PEL limits.

· **Components with occupational exposure limits:**	
20859-73-8 Aluminum Phosphide	
REL	Long-term value: 2 mg/m³ as Al
TLV	Long-term value: 1* mg/m³ as Al;*as respirable fraction
Proprietary	
PEL	Long-term value: 15*; 15** mg/m³ *Total dust; ** Respirable fraction
REL	Long-term value: 10* 5** mg/m³ as Al*Total dust**Respirable/pyro powd./welding f.
TLV	Long-term value: 1* mg/m³ as Al; *as respirable fraction
Proprietary	
REL	Long-term value: 2 mg/m³ as Al
TLV	Long-term value: 1* mg/m³ as Al;*as respirable fraction
Proprietary	
PEL	Long-term value: 20 mppcf ppm (containing <1% Quartz)
REL	Long-term value: 2* mg/m³ *respirable dust
TLV	Long-term value: 2* mg/m³ *as respirable fraction; E
7803-51-2 phosphine	
PEL	Long-term value: 0.4 mg/m³, 0.3 ppm
REL	Short-term value: 1 mg/m³, 1 ppm Long-term value: 0.4 mg/m³, 0.3 ppm

(Contd. on page 8)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **Change in condition**	
Melting point/Melting range:	AlP = >1000 °C (AlP = >1832 °F) (PH3 = -133.5 °C)
Boiling point/Boiling range:	AlP = >1000 °C (AlP = >1832 °F) (PH3 = -87.7 °C)
· **Flash point:**	Not determined
· **Flammability (solid, gaseous):**	Contact with water or acids liberates extremely flammable gases.
· **Ignition temperature:**	Not determined
· **Decomposition temperature:**	Decomposes at ambient conditions when moisture is present.
· **Auto igniting:**	Spontaneously flammable in air.
· **Danger of explosion:**	Not determined.
· **Explosion limits:**	
Lower:	1.8 Vol % (for PH3)
Upper:	Not established Vol % (for PH3)
· **Vapor pressure:**	AlP = 0 mm Hg PH3 = 40 mm Hg @ -129.4 °C AC = 100 mm Hg @ 26.7 °C
· **Density @ 20 °C (68 °F):**	AlP = 2.85 g/cm³ (AlP = 23.783 lbs/gal) (PH3 = 1.17 g/cm³)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	AlP = Insoluble, reacts PH3 = 26 cc in 100 ml at 17 °C AC = Very soluble, reacts
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	0.0 %
Solids content:	100.0 %
· **Other information**	No further relevant information available.

* 10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
Products are stable to most chemical reactions, except for hydrolysis. Products will react with moist air, liquid water, acids and some other liquids to produce toxic and flammable phosphine (hydrogen phosphide, PH3) gas.
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions**
Contact with water releases flammable gases.

(Contd. on page 10)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

Contact with water releases toxic gases.

· **Conditions to avoid:** Avoid prolonged exposure to air.

· **Incompatible materials:** Water, acids, bases, strong oxidizing agents and strong reducing agents.

· **Hazardous decomposition products:**

Oxides of aluminum, phosphorous, nitrogen (NOx), carbon, phosphine gas (hydrogen phosphide, PH3), ammonia and phosphoric acid.

· **Additional information:**

Phosphine (hydrogen phosphide, PH3) gas may react with certain metals and cause corrosion, especially at higher temperatures and relative humidity. Metals such as copper, brass and other copper alloys, and precious metals such as gold and silver are susceptible to corrosion by phosphine. Small electric motors, smoke detectors, brass sprinkler heads, batteries and battery chargers, fork lifts, temperature monitoring systems, switching gears, communication devices, computers, calculators and other electrical equipment may be damaged by this gas. Phosphine (hydrogen phosphide, PH3) will also react with certain metallic salts and, therefore, sensitive items such as photographic film, some inorganic pigments, etc., should not be exposed.

* 11 Toxicological information

· **Information on toxicological effects**

· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
20859-73-8 Aluminum Phosphide		
Oral	LD50	0.4 mg/kg (rat)
1111-78-0 Ammonium Carbamate		
Oral	LD50	1470 mg/kg (rat)
Inhalative	LC50/96 hours	37 mg/l (Trout)
7803-51-2 phosphine		
Inhalative	LC50/1 h	180 ppm (rat)
7664-41-7 ammonia, anhydrous		
Oral	LD50	350 mg/kg (rat)
Inhalative	LC50/4 h	2000 mg/l (rat)

· **Primary irritant effect:**

· **on the skin:**

May be irritating.

Irritant to skin and mucous membranes.

· **on the eye:**

Direct contact may cause eye irritation.

Strong irritant with the danger of severe eye injury.

Causes serious eye irritation.

· **Additional toxicological information:**

The product shows the following dangers according to internally approved calculation methods for preparations:

Irritant

Very toxic

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**

Group 1 - Carcinogenic to humans

Group 2A - Probably carcinogenic to humans

(Contd. on page 11)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

Group 2B - Possibly carcinogenic to humans
Group 3 - Not classifiable as to its carcinogenicity to humans
Group 4 - Probably not carcinogenic to humans

Proprietary	2B

· **NTP (National Toxicology Program)**
None of the ingredients are listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients are listed.

* 12 Ecological information

· **Toxicity** The hazards for the aquatic environment are unknown.
· **Aquatic toxicity:**
Avoid release into the environment. Runoff from fire control or dilution water may cause pollution.

1111-78-0 Ammonium Carbamate	
EC50	129.1 mg/l (Green algae) 63 mg/l (Water flea)

· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Ecotoxical effects:**
· **Remark:** Very toxic for fish
· **Additional ecological information:**
· **General notes:**
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
Also poisonous for fish and plankton in water bodies.
Very toxic for aquatic organisms
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

* 13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
When being disposed of, spilled or partially reacted Phostoxin or DetiaPhos products are considered hazardous wastes under existing Federal Regulations. If properly exposed, the grayish-white residual dust after a fumigation will not be a hazardous waste and normally contains only a very small amount of unreacted aluminum phosphide. This waste will be safe for disposal. However, the spent residual dust from incompletely exposed Phostoxin or DetiaPhos products may require special care. Triple rinse tablet and pellet flasks and stoppers with water and then offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Rinsate may be disposed of in a storm sewer, sanitary landfill or by other approved procedures. Or, it is permissible to remove lids and expose empty flasks to atmospheric conditions until the residue in the flasks is reacted. Then puncture and dispose of in a sanitary landfill or other approved site, or by other procedures approved by state and local

(Contd. on page 12)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

authorities. Some local and state waste disposal regulations may vary from the following recommendations. Disposal procedures should be reviewed with appropriate authorities to ensure compliance with local regulations. Contact your State Pesticide or Environmental Control Agency or Hazardous Waste Specialist at the nearest EPA Regional Office for guidance.

1. Confinement of partially spent residual materials, as in a closed container, or collection and storage of large quantities of dust may result in a fire or explosion hazard. Small amounts of phosphine (hydrogen phosphide, PH3) may be given off from unreacted aluminum phosphide, and confinement of the gas may result in a flash.
2. In open areas, small amounts of spent residual dust or spent packaged products may be disposed of on site by burial or by spreading over the land surface away from inhabited buildings.
3. Residual dust from Phostoxin or DetiaPhos products may also be collected and disposed of at a sanitary landfill, or other approved sites or by other procedures approved by Federal, State or Local authorities.
4. From 3 to 5 kg (7 to 10 lbs.) of spent dust from 2 to 3 flasks of Phostoxin or DetiaPhos may collected for disposal in a 1-gallon bucket. Larger amounts, up to about one-half case, may be collected in burlap, cotton or other types of porous cloth bags for transportation in an open vehicle to the disposal site. Do not collect dust from more than 7 flasks of tablets, 10 flasks of pellets (about 11 kg or 25 lbs.) in a single bag. Do not pile cloth bags together. Do not use this method for partially spent or "green" dust. Caution: Do not collect dust in large drums, dumpsters, plastic bags or other containers where confinement may occur.

· **Uncleaned packagings:**
· **Recommendation:**
Triple rinse tablet and pellet flasks and stoppers with water and then offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

* 14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	UN1397
· **UN proper shipping name**	
· **DOT**	Aluminum phosphide
· **ADR**	UN1397 Aluminum phosphide, ENVIRONMENTALLY HAZARDOUS
· **IMDG**	ALUMINIUM PHOSPHIDE, MARINE POLLUTANT
· **IATA**	ALUMINIUM PHOSPHIDE
· **Transport hazard class(es)**	
· **DOT**	

· **Class**	4.3 Substances which, in contact with water, emit flammable gases
· **Label**	4.3, 6.1

(Contd. on page 13)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **ADR**

· **Class**	4.3 (WT2) Substances which, in contact with water, emit flammable gases
· **Label**	4.3, 6.1

· **IMDG**

· **Class**	4.3 Substances which, in contact with water, emit flammable gases
· **Label**	4.3/6.1

· **IATA**

· **Class**	4.3 Substances which, in contact with water, emit flammable gases
· **Label**	4.3 (6.1)
· **Packing group**	
· **DOT, ADR, IMDG, IATA**	I
· **Environmental hazards:**	Product contains environmentally hazardous substances: Aluminum Phosphide
· **Special marking (ADR):**	Symbol (fish and tree)
· **Special precautions for user**	Warning: Substances which, in contact with water, emit flammable gases
· **Danger code (Kemler):**	462
· **EMS Number:**	F-G,S-N
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: Forbidden On cargo aircraft only: 15 kg
· **ADR**	
· **Excepted quantities (EQ)**	Code: E0 Not permitted as Excepted Quantity

(Contd. on page 14)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **IMDG**

· **Limited quantities (LQ)**	0
· **Excepted quantities (EQ)**	Code: E0 Not permitted as Excepted Quantity
· **UN "Model Regulation":**	UN1397, Aluminum phosphide, ENVIRONMENTALLY HAZARDOUS, 4.3, 6.1, I

* 15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **Sara**

· **Section 355 (extremely hazardous substances):**	
20859-73-8	Aluminum Phosphide

· **Section 313 (Specific toxic chemical listings):**	
20859-73-8	Aluminum Phosphide
	Proprietary
	Proprietary

· **TSCA (Toxic Substances Control Act):**	
20859-73-8	Aluminum Phosphide
	Proprietary
	Proprietary
	Proprietary
	Proprietary
	Proprietary

· **Proposition 65**

· **Chemicals known to cause cancer:**
None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**
None of the ingredients are listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**	
Proprietary	D, I, II

· **TLV (Threshold Limit Value established by ACGIH)**	
Proprietary	A4
Proprietary	A4

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients are listed.

(Contd. on page 15)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **GHS label elements**
This product is labeled according to FIFRA.
The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**

GHS02 GHS05 GHS06 GHS09

· **Signal word** Danger

· **Hazard-determining components of labeling:**
Aluminum Phosphide
Ammonium Carbamate
Proprietary
· **Hazard statements**
In contact with water releases flammable gases which may ignite spontaneously.
Fatal if swallowed or if inhaled.
Causes skin irritation.
Causes serious eye damage.
Very toxic to aquatic life.
· **Precautionary statements**
Keep away from any possible contact with water, because of violent reaction and possible flash fire.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wear respiratory protection.
Wear protective gloves / eye protection / face protection.
Avoid release to the environment.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
If swallowed: Immediately call a poison center/doctor.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Specific treatment is urgent (see supplementary first aid instructions on this Safety Data Sheet).
Take off contaminated clothing and wash before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
If skin irritation occurs: Get medical advice/attention.
In case of fire: Use for extinction: CO_2, sand, extinguishing powder.
If on skin: Wash with plenty of water.
Collect spillage.
Store locked up.
Store in a well-ventilated place. Keep container tightly closed.
Store in a dry place. Store in a closed container.
Dispose of contents/container in accordance with local/regional/national/international regulations.

· **National regulations:**

The product is subject to be labeled according with the prevailing version of the regulations on hazardous substances.

(Contd. on page 16)

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g) and GHS Rev 03.

Printing date 04/02/2015 Reviewed on 04/02/2015

Trade name: Phostoxin® Tablets - U.S. EPA Reg. No. 72959-4; Phostoxin® Pellets - U.S. EPA Reg. No. 72959-5; Phostoxin® Tablet Prepac - U.S. EPA Reg. No. 72959-9; Phostoxin® Prepac Ropes - U.S. EPA Reg. No. 72959-8; DetiaPhos® Tablets - U.S. EPA Reg. No. 72959-4; DetiaPhos® Pellets - U.S. EPA Reg. No. 72959-5

· **State Right to Know**

CAS: 20859-73-8 RTECS: BD 1400000	Aluminum Phosphide Water-react. 1, H260; Acute Tox. 2, H300; Aquatic Acute 1, H400	55%
CAS: 1111-78-0	Ammonium Carbamate Eye Dam. 1, H318; Acute Tox. 4, H302; Skin Irrit. 2, H315; Aquatic Acute 3, H402	Proprietary%
RTECS: BD 1200000	Proprietary STOT SE 3, H335	2-12%
	Proprietary STOT SE 3, H335	2-12%
	Proprietary Carc. 2, H351; Acute Tox. 4, H302; Skin Irrit. 2, H315; STOT SE 3, H335; Eye Irrit. 2B, H320	2-12%
	Proprietary	2-12%

All ingredients are listed.

· ***Chemical safety assessment:*** A Chemical Safety Assessment has not been carried out.

16 Other information

The information and recommendations in this safety data sheet are, to the best of our knowledge, accurate as of the date of issue. Nothing herein shall be deemed to create warranty, expressed or implied and shall not establish a legally valid contractual relationship. It is the responsibility of the user to determine applicability of this information and the suitability of the material or product for any particular purpose.

· ***Date of preparation / last revision*** 04/02/2015 / -

· ***Abbreviations and acronyms:***

ADR: The European Agreement concerning the International Carriage of Dangerous Goods by Road
ADN: The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
Water-react. 1: Substances and Mixtures which, in contact with water, emit flammable gases, Hazard Category 1

Acute Tox. 2: Acute toxicity, Hazard Category 2
Acute Tox. 4: Acute toxicity, Hazard Category 4
Skin Irrit. 2: Skin corrosion/irritation, Hazard Category 2
Eye Dam. 1: Serious eye damage/eye irritation, Hazard Category 1
Eye Irrit. 2B: Serious eye damage/eye irritation, Hazard Category 2B
Carc. 2: Carcinogenicity, Hazard Category 2
STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3
Aquatic Acute 1: Hazardous to the aquatic environment - AcuteHazard, Category 1
Aquatic Acute 3: Hazardous to the aquatic environment - AcuteHazard, Category 3

· **** Data compared to the previous version altered.***

SDS created by MSDS Authoring Services www.msdsauthoring.com (877) 204-9106