The following information was generated from the Hazardous Substances Databank (HSDB), a database of the National Library of Medicine's TOXNET system (http://toxnet.nlm.nih.gov) on December 3, 2004.

Query: The chemical name was identified. The following terms were added from ChemIDplus:
diarsenic pentoxide
arsenic anhydride
anhydride arsenique

CAS Registry Number: 1303-28-2

NAME: ARSENIC PENTOXIDE

HSN: 429
RN: 1303-28-2
NO: This record contains information specific to the title compound. Users with an interest in this substance are strongly encouraged to retrieve the Arsenic Compounds record, which has additional information on toxicity and environmental fate of arsenic ions and compounds.

HUMAN HEALTH EFFECTS:

EVIDENCE FOR CARCINOGENICITY:

CLASSIFICATION: A; human carcinogen. BASIS FOR CLASSIFICATION: Based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic. HUMAN CARCINOGENICITY DATA: Sufficient. ANIMAL CARCINOGENICITY DATA: Inadequate. /Inorganic Arsenic/ [U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS) on Arsenic, inorganic (7440-38-2) Available from: http://www.epa.gov/ngispgm3/iris on the Substance File List as of March 15, 2000]**PEER REVIEWED**

HUMAN TOXICITY EXCERPTS:
Arsenic pentoxide is capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially on the palms and soles. [Sittig M; Handbook of Toxic and Hazardous Chemicals p.58 (1981)]**PEER REVIEWED**

SKIN, EYE AND RESPIRATORY IRRITATIONS:
ARSENICAL DUSTS ... ARE IRRITATING TO UPPER RESP TRACT &amp; EYES.
CONJUNCTIVITIS PRODUCED BY ... THESE SUBSTANCES ARE CHARACTERIZED BY ITCHING, BURNING, & WATERING OF EYES. ... /INORGANIC ARSENIC DUSTS/


EMERGENCY MEDICAL TREATMENT:

LIFE SUPPORT:

- This overview assumes that basic life support measures have been instituted.

CLINICAL EFFECTS:

0.2.1 SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

A) Arsenic pentoxide is an inorganic pentavalent arsenic compound. It is an odorless, white crystalline amorphous solid which dissolves in water, forming arsenic acid. It is advisable to treat all arsenic compounds as highly toxic.

B) Arsenic has been linked to cancers of the skin and possibly to bronchogenic cancer. The EPA has classified inorganic arsenical compounds as Class A Oncogens based on sufficient human epidemiological evidence.

C) Acute arsenic ingestion generally produces symptoms within 30 to 60 minutes, but onset may be delayed for several hours if ingested with food. A metallic or garlic taste, vomiting, abdominal pain, dysphagia, and profuse watery (rice-water-like) and sometimes bloody diarrhea may occur. Dehydration, intense thirst, and fluid-electrolyte disturbances are common. Hypovolemia from capillary leaking ("third spacing" of fluids) is a common early event.

D) Systemic arsenic poisoning from occupational exposure is uncommon. Arsenic workers have developed a hoarse voice, nasal irritation and possibly, perforation of the nasal septum, irritation of eyes, skin, and mucous membranes, and rarely, cirrhosis of the liver. Nausea and vomiting are infrequent. Painful ulceration of the wrist and scrotal skin, lips, and nostrils may develop with dust exposure.

E) The primary target organs initially are the
gastrointestinal tract, heart, brain, and kidneys. Eventually, the skin, bone marrow, and peripheral nervous system may be significantly damaged. The peripheral neuropathy appears similar regardless of the route of exposure.

0.2.1.2 CHRONIC EXPOSURE
A) Chronic exposure to arsenic pentoxide was considered to be at least partly responsible for a complex pattern of health effects in one family including: sensory hypesthesias, muscle cramping, recurring pruritic conjunctivitis, otitis media, sinusitis, bronchitis, pneumonia, skin rashes described as "measle-like," reddened and thickened skin on the soles, malaise, decreased sensation in hands and feet, headaches, blackouts, grand mal seizures in the youngest children, epistaxis, easy bruising, alopecia, and premature labor.

0.2.3 VITAL SIGNS
0.2.3.1 ACUTE EXPOSURE
A) Patients may rapidly become hypotensive. Tachycardia may develop secondary to pain, hypovolemia, cardiac effects of arsenic or anxiety.

0.2.4 HEENT
0.2.4.1 ACUTE EXPOSURE
A) Conjunctivitis, photophobia, dimness of vision, diplopia, and lacrimation may occur. A garlic-like odor may be detected on the breath. Recurrent episodes of otitis media and sinusitis were noted in a rural family chronically exposed to arsenic pentoxide from burning impregnated wood in a wood stove.

0.2.4.2 CHRONIC EXPOSURE
A) Hair loss, conjunctivitis, photophobia, dimness of vision, diplopia, and lacrimation may occur. A sensation of burning, dryness and constriction of the oral and nasal cavities may also occur. A garlic-like odor may be detected on the breath.

0.2.5 CARDIOVASCULAR
0.2.5.1 ACUTE EXPOSURE
A) Ventricular tachycardia and ventricular fibrillation (with QT prolongation) have been described after acute arsenic ingestion.

0.2.5.2 CHRONIC EXPOSURE
A) Hypertension, ischemic heart disease, and accelerated atherosclerotic peripheral vascular disease have been associated with chronic exposure in regions of endemic arsenic water contamination.

0.2.6 RESPIRATORY
0.2.6.1 ACUTE EXPOSURE
A) Acute respiratory failure was seen in a patient with severe arsenic poisoning. Pulmonary edema may occur and be life-threatening. Adult respiratory distress syndrome (ARDS) has been reported.

0.2.6.2 CHRONIC EXPOSURE
A) Upper respiratory tract irritation may occur with chronic exposure to arsenic dust or fumes.

0.2.7 NEUROLOGIC
0.2.7.1 ACUTE EXPOSURE
A) Toxic delirium and encephalopathy are possible complications. Peripheral neuropathy is common. Seizures may occur.

0.2.7.2 CHRONIC EXPOSURE
A) Toxic delirium and encephalopathy are possible complications. Peripheral neuropathy is common. Neurological effects of sensory hypesthesia in the hands and feet, frequent headaches, blackout spells, and grand mal seizures may occur.

0.2.8 GASTROINTESTINAL
0.2.8.1 ACUTE EXPOSURE
A) Early symptoms within hours following arsenic ingestion include abdominal pain, vomiting, profuse bloody or watery ("rice-water-like") diarrhea, pain in the extremities and muscles, weakness, and flushing of the skin.

0.2.8.2 CHRONIC EXPOSURE
A) A sensation of burning and dryness of the oral and nasal cavities may occur. Nausea and vomiting are infrequent complaints among arsenic workers.

0.2.9 HEPATIC
0.2.9.1 ACUTE EXPOSURE
A) Hepatocellular damage may occur, but is not common. A common post-mortem finding is mitotic activity of hepatocytes.

0.2.9.2 CHRONIC EXPOSURE
A) Enlarged livers were observed in a group of chronically exposed vineyard workers. Rare reports exist connecting chronic occupational arsenic exposure with the development of hepatic cirrhosis or noncirrhotic portal hypertension. Rats chronically fed sodium arsenate for two years developed marked enlargement of the common bile duct. Mild elevations in alkaline phosphatase and unconjugated bilirubin have been reported in regions of endemic arsenic water contamination.

0.2.10 GENITOURINARY
0.2.10.1 ACUTE EXPOSURE
A) Anuria, hematuria, proteinuria, acute tubular necrosis, renal failure, and chronic renal insufficiency from cortical necrosis have been described.

0.2.12 FLUID-ELECTROLYTE
0.2.12.1 ACUTE EXPOSURE
A) Electrolyte imbalances may occur.

0.2.13 HEMATOLOGIC
0.2.13.1 ACUTE EXPOSURE
A) Hemolysis, pancytopenia, isolated leukopenia, or anemia may occur.

0.2.13.2 CHRONIC EXPOSURE
A) Pancytopenia, isolated leukopenia, or anemia may be seen. Aplastic anemia and acute myelogenous leukemia have been described.

0.2.14 DERMATOLOGIC
0.2.14.1 ACUTE EXPOSURE
A) Common skin findings may include flushing, diaphoresis, palmar hyperkeratosis, peripheral edema, hyperpigmentation, brawny desquamation, and exfoliative dermatitis. Transverse white striae of the nails may be seen. Shingles (Herpes Zoster) may also be a complication.

0.2.14.2 CHRONIC EXPOSURE
A) Common skin findings may include flushing, diaphoresis, palmar hyperkeratosis, peripheral edema, hyperpigmentation, brawny desquamation, and exfoliative dermatitis.
B) Basal cell and squamous cell cancers of the skin may
also be seen years after exposure.

C) Chronic occupational exposure to arsenic dust can result in painful irritation or ulceration of the skin, especially on the wrists and scrotum.

0.2.15 MUSCULOSKELETAL

0.2.15.2 CHRONIC EXPOSURE

A) Muscle cramping may occur.

0.2.16 ENDOCRINE

0.2.16.2 CHRONIC EXPOSURE

A) Diabetes has been associated with chronic arsenic exposure in industry and in regions of endemic arsenic water contamination.

0.2.20 REPRODUCTIVE HAZARDS

A) Arsenic compounds have caused teratogenic and embryotoxic effects in the offspring of pregnant mice, rats, and hamsters. Feto toxicity and fetal death are possible, but arsenic is NOT likely to be a significant risk to human reproduction at permissible occupational exposure limits.

B) Arsenic is excreted in the breast milk in both experimental animals and humans.

C) Systemic toxicity was present before any effects were noted on the testes. Arsenic pentoxide caused adverse parental effects when injected subcutaneously in mice and affected spermatogenesis when injected into the testes in rats.

0.2.21 CARCINOGENICITY

0.2.21.1 IARC CATEGORY

A) IARC Carcinogenicity Ratings for CAS1303-28-2 (IARC, 2004):

1) IARC Classification
   a) Listed as: Arsenic pentoxide
   b) Carcinogen Rating: 1

   1) The agent (mixture) is carcinogenic to humans. The exposure circumstance entails exposures that are carcinogenic to humans. This category is used when there is sufficient evidence of carcinogenicity in humans. Exceptionally, an agent (mixture) may be placed in this category when evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed humans that the agent (mixture) acts through a relevant mechanism of carcinogenicity.

0.2.21.2 HUMAN OVERVIEW

A) Arsenic pentoxide is considered to be a human carcinogen. An IARC review linked arsenic to skin cancer and a greater risk of lung cancer. OSHA has linked arsenic to cancer of the skin, lungs, lymph glands, and bone marrow. Bladder, kidney, prostate, liver, breast and colon cancer have also been linked with arsenic exposure.

0.2.22 GENOTOXICITY

A) Potassium arsenite is a possible mutagen. DNA repair, DNA inhibition, and sister chromatid exchanges have occurred. Human chromosomal aberrations have been reported to be increased following environmental arsenic exposure.

0.2.23 OTHER

0.2.23.1 ACUTE EXPOSURE

A) Malaise and easy bruising were noted in one case of
arsenic pentoxide exposure.

LABORATORY:
A) Quantitative 24 hour urine collections are the most reliable laboratory measure of arsenic poisoning. Urinary concentrations between 700 and 1000 mcg/L (0.7 to 1.0 mg/L) may indicate potentially harmful exposure.
B) This agent may cause nephrotoxicity. Monitor renal function tests and urinalysis in patients with significant exposure.
C) Arsenic is radiopaque and an abdominal film should be obtained whenever arsenic ingestion is suspected.
D) This agent may produce abnormalities of the hematopoietic system. Monitor the complete blood count in patients with significant exposure.
E) This agent may cause hepatotoxicity. Monitor liver function tests in patients with significant exposure.
F) Monitor arterial blood gases and chest x-ray in patients who develop pulmonary edema.
G) Monitor serum electrolytes in patients with significant vomiting, diarrhea, or hypotension from fluid "third spacing."

TREATMENT OVERVIEW:

0.4.2 ORAL EXPOSURE
A) GASTRIC DECONTAMINATION - Aggressive decontamination with gastric lavage is recommended. If X-ray demonstrates arsenic in the lower GI tract, whole bowel irrigation should be considered. Activated charcoal may not bind significant amounts, but is recommended until definitive quantitative data are available. Fluid repletion should be begun as soon as possible.
B) EMESIS: Use is controversial. May be indicated in the prehospital setting if administered soon (within 30 minutes) after substantial ingestion. CONTRAINDICATIONS: loss of airway protective reflexes; CNS depression; seizures; ingestion of a substance that might impair airway protective reflexes or require advanced life support within 60 minutes; ingestion of a corrosive substance or hydrocarbon with high aspiration potential; debilitated patient. (Dose of Ipecac Syrup: ADULT: 15 – 30 mL; CHILD 1 to 12 years: 15 mL; CHILD 6 to 12 months of age: 5 – 10 mL; CHILD under 6 months of age: Not recommended for prehospital use.).
C) GASTRIC LAVAGE: Consider after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation. Control any seizures first.
1) CONTRAINDICATIONS: Loss of airway protective reflexes or decreased level of consciousness in unintubated patients; following ingestion of corrosives; hydrocarbons (high aspiration potential); patients at risk of hemorrhage or gastrointestinal perforation; and trivial or non-toxic ingestion.
D) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.
E) MONITOR LIVER, RENAL, AND CARDIAC FUNCTIONS.
1) Maintain high urine output.
F) ALKALINIZATION OF THE URINE -
1) May prevent the deposition of red cell breakdown products from hemolysis in the renal tubules.

G) URINE ALKALINIZATION
1) Administer 1 to 2 mEq/kg sodium bicarbonate bolus. Add 132 milliequivalents (3 ampules) sodium bicarbonate and 20 to 40 milliequivalents potassium chloride (as needed) to one liter of dextrose 5 percent in water and infuse at approximately 1.5 times the maintenance fluid rate. Adjust as needed to achieve a urine pH of at least 7.5 and a urine output of 1 to 3 mL/kg/hr.


H) CHELATION -
1) BAL - Symptomatic patients should be treated with BAL 3 to 5 mg/kg/dose IM every 4 to 12 hours. The dose and frequency depend on the degree of toxicity seen. Higher doses of BAL invariably cause adverse effects.

2) PENICILLAMINE -
   a) As symptoms and signs subside, change to oral D-penicillamine 100 mg/kg/day up to 2 g daily in four divided doses. If allergic to penicillamine, administer BAL for 5 days with tapering of the dose. In severely ill patients, combined therapy with both BAL and D-penicillamine should be considered.

3) ENDPOINT -
   a) Chelation therapy should be stopped when the urinary arsenic level falls below 50 mcg per 24 hours. If renal failure exists, dose of either chelator should be adjusted downward after loading dose.

4) DMSA -
   a) Dimercaptosuccinic acid (DMSA) is a chelator currently approved for the treatment of pediatric lead poisoning in the United States. It may be more effective and cause fewer side effects than BAL.

I) FLUID/ELECTROLYTES - Monitor volume status; establish adequate urine flow of at least 1 to 2 mL/kg/hr.

J) X-RAY - Arsenic is radiopaque. Obtain abdominal film and repeat as necessary to insure that gastric emptying maneuvers have been effective. A chest radiograph should also be obtained, as pulmonary edema may occur.

1) SEIZURES: Administer a benzodiazepine IV; DIAZEPAM (ADULT: 5 to 10 mg, repeat every 10 to 15 min as needed. CHILD: 0.2 to 0.5 mg/kg, repeat every 5 min as needed) or LORAZEPAM (ADULT: 2 to 4 mg; CHILD: 0.05 to 0.1 mg/kg).
   a) Consider phenobarbital if seizures recur after diazepam 30 mg (adults) or 10 mg (children > 5 years).
   b) Monitor for hypotension, dysrhythmias, respiratory depression, and need for endotracheal intubation. Evaluate for hypoglycemia, electrolyte disturbances, hypoxia.

0.4.3 INHALATION EXPOSURE
A) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

B) Alkalization of the urine may prevent deposition of red cell breakdown products from hemolysis in renal
tubular cells.

1) URINE ALKALINIZATION
   a) Administer 1 to 2 mEq/kg sodium bicarbonate bolus. Add 132 milliequivalents (3 ampules) sodium bicarbonate and 20 to 40 milliequivalents potassium chloride (as needed) to one liter of dextrose 5 percent in water and infuse at approximately 1.5 times the maintenance fluid rate. Adjust as needed to achieve a urine pH of at least 7.5 and a urine output of 1 to 3 mL/kg/hr.
   b) Assure adequate hydration and renal function. Monitor fluid balance, serum electrolytes, and blood pH. Obtain hourly intake/output and urine pH.

C) Chelation therapy may be indicated at a urine arsenic level of 200 mcg/liter or higher. Dimercaprol (BAL), D-PENICILLAMINE and DMSA are effective arsenic chelators.
   1) DIMERCAPROL (BAL) - Usual dosage range is 3 to 5 milligrams/kilogram intramuscularly every 4 to 12 hours until symptoms resolve or another chelator is substituted. The dose and frequency used depend on the degree of toxicity seen. Dose dependent side effects include hypertension, tachycardia, anorexia, restlessness, vomiting, pain, salivation, fever, convulsions, "leukotoxic effect," and reducing substances in the urine. Early administration (within 18 hours of acute exposure) of BAL may be effective in preventing arsenical neuropathy in some cases.
   2) D-PENICILLAMINE - The usual dose is 25 milligrams/kilogram/dose given four times daily up to one gram per day, adults may require larger doses (i.e., up to 2 grams/day).
   3) DMSA - 2,3-Dimercaptosuccinic acid (DMSA) is an investigational drug. It has the advantage of being an oral agent as well as being relatively non-toxic.
   4) N-acetylcysteine (NAC) cannot presently be recommended for the treatment of arsenic poisoning.
   5) THERAPEUTIC END-POINT - Repeat five-day courses of chelation therapy should be prescribed in severe poisonings until the 24-hour urine arsenic level falls below 50 micrograms/liter.

D) A MOBILIZATION TEST - has been suggested to aid the diagnosis of mild or chronic exposure. Its usefulness has been questioned because of the relatively rapid excretion of absorbed arsenic. Refer to TREATMENT/INHALATION EXPOSURE section in the main body of this document for more information.

E) Physical therapy may be helpful for patients with established arsenical neuropathies.

F) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

G) HEMODIALYSIS - should be performed in the presence of any degree of renal failure.

H) HYPOTENSION: Infuse 10 to 20 mL/kg isotonic fluid. If hypotension persists, administer dopamine (5 to 20 mcg/kg/min) or norepinephrine (ADULT: begin infusion at 0.5 to 1 mcg/min; CHILD: begin infusion at 0.1 mcg/kg/min); titrate to desired response.

0.4.4 EYE EXPOSURE
   A) DECONTAMINATION: Irrigate exposed eyes with copious
amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

B) No cases of systemic arsenic poisoning following only eye exposure have been reported.

C) If significant eye irritation is present, prolonged initial flushing and early ophthalmologic consultation are advisable.

0.4.5 DERMAL EXPOSURE

A) OVERVIEW

1) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.

2) Alkalinization of the urine may prevent deposition of red cell breakdown products from hemolysis in renal tubular cells.

   a) URINE ALKALINIZATION

      1) Administer 1 to 2 mEq/kg sodium bicarbonate bolus. Add 132 milliequivalents (3 ampules) sodium bicarbonate and 20 to 40 milliequivalents potassium chloride (as needed) to one liter of dextrose 5 percent in water and infuse at approximately 1.5 times the maintenance fluid rate. Adjust as needed to achieve a urine pH of at least 7.5 and a urine output of 1 to 3 mL/kg/hr.


      3) Chelation therapy may be indicated at a urine arsenic level of 200 mcg/liter or higher. Dimercaprol (BAL), D-PENICILLAMINE and DMSA are effective arsenic chelators.

         a) DIMERCAPROL (BAL) - Usual dosage range is 3 to 5 milligrams/kilogram intramuscularly every 4 to 12 hours until symptoms resolve or another chelator is substituted. The dose and frequency used depend on the degree of toxicity seen. Dose dependent side effects include hypertension, tachycardia, anorexia, restlessness, vomiting, pain, salivation, fever, convulsions, "leukotoxic effect," and reducing substances in the urine. Early administration (within 18 hours of acute exposure) of BAL may be effective in preventing arsenical neuropathy in some cases.

         b) D-PENICILLAMINE - The usual dose is 25 milligrams/kilogram/dose given four times daily up to one gram per day, adults may require larger doses (i.e., up to 2 grams/day).

         c) DMSA - 2,3-Dimercaptosuccinic acid (DMSA) is an investigational drug. It has the advantage of being an oral agent as well as being relatively non-toxic.

         d) N-acetylcysteine (NAC) cannot presently be recommended for the treatment of arsenic poisoning.

         e) THERAPEUTIC END-POINT - Repeat five-day courses of chelation therapy should be prescribed in severe poisonings until the 24-hour urine arsenic level falls below 50 micrograms/liter.

4) A MOBILIZATION TEST - has been suggested to aid the diagnosis of mild or chronic exposure. Its usefulness has been questioned because of the relatively rapid
excretion of absorbed arsenic. Refer to TREATMENT/DERMAL EXPOSURE section in the main body of this document for more information.

5) Physical therapy may be helpful for patients with established arsenical neuropathies.

6) **ACUTE LUNG INJURY**: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

7) **HEMODIALYSIS** - should be performed in the presence of any degree of renal failure.

8) Treat dermal irritation or burns with standard topical therapy. Patients developing dermal hypersensitivity reactions may require treatment with systemic or topical corticosteroids or antihistamines.

9) Restriction from further exposure may be necessary for workers with significant arsenical dermatitis, ulcerations, or dermatoses.

10) **HYPOTENSION**: Infuse 10 to 20 mL/kg isotonic fluid. If hypotension persists, administer dopamine (5 to 20 mcg/kg/min) or norepinephrine (ADULT: begin infusion at 0.5 to 1 mcg/min; CHILD: begin infusion at 0.1 mcg/kg/min); titrate to desired response.

**RANGE OF TOXICITY:**

A) A concentration of 10 ppm of arsenic pentoxide in water presents an acute hazard; an oral dose of 120 mg of arsenic trioxide may be fatal.

B) Trivalent arsenic is more toxic in animals than the pentavalent form. However, significant toxicity may occur with large amounts of pentavalent salts in humans. Pentavalent arsenic may be converted in vivo to trivalent arsenic.

**ANIMAL TOXICITY STUDIES:**

**EVIDENCE FOR CARCINOGENICITY:**


CLASSIFICATION: A; human carcinogen. BASIS FOR CLASSIFICATION: Based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic. HUMAN CARCINOGENICITY DATA: Sufficient. ANIMAL CARCINOGENICITY DATA: Inadequate. /Inorganic Arsenic/ [U.S. Environmental Protection Agency’s Integrated Risk Information System (IRIS) on Arsenic, inorganic (7440-38-2) Available from: http://www.epa.gov/ngispgrm3/iris on the Substance File List as of March 15, 2000]**PEER REVIEWED**

**NON-HUMAN TOXICITY VALUES:**


ECOTOXICITY VALUES:
LD50 Grasshopper oral 0.9-25.6 ppm/7 days; 1.0-5.5 ppm/14 days. [Nat'l Research Council Canada; The Effects of Arsenic in the Canadian Environment p.216 (1978) NRCC No.15391]**PEER REVIEWED**

METABOLISM/PHARMACOKINETICS:

ABSORPTION, DISTRIBUTION & EXCRETION:
Experiments with grazing cows and cows kept indoors were performed to study the transfer of toxic elements from their ration into milk and edible tissues. First experiment was carried out with dairy cows. The toxic elements were administered, via wafers of concentrates which contained a mixture of cadmium, lead and mercury acetate and arsenic pentoxide. The dosing period was three months in which the daily intake for each cow was 152, 200, 1.7, and 33 mg for cadmium, lead, mercury, and arsenic, respectively. The daily intake of these elements for the control cows was 2, 50, 0.2, and 3.4 mg, respectively. The second experiment was carried out with dairy cows which were kept indoors and fed on concentrates and roughage. One group received cadmium, lead and mercury acetate, and arsenic trioxide. The dosing period lasted 28 months or 3 consecutive complete lactations. Liver and in particular kidney were the primary sites of element accumulation. Only for cadmium the proposed tolerance levels in liver and kidney were exceeded. Increased dietary concentrations of elements did not result in significantly higher concentrations in milk, blood and muscle tissue. Only soluble arsenic resulted in higher levels of this element in muscle tissue. Regarding the character of the pathological changes, no essential differences were observed between the control and experimental groups. [Vreman K et al; Neth J Agric Sci 34 (2): 129-44 (1986)]**PEER REVIEWED**

PHARMACOLOGY:

ENVIRONMENTAL FATE & EXPOSURE:

ENVIRONMENTAL BIOACCUMULATION:
Stagnicola emarginata (snail) exposed to arsenic pentoxide for 28 days exhibited a bioaccumulation factor of 3; Helisoma campanualtum (snail) exposed to arsenic pentoxide for 28 days exhibited a bioaccumulation factor of 6; Daphnia magna (cladoceran) exposed to arsenic acid for 4 days exhibited a bioaccumulation factor of 21; Gammarus pseudolimnaeus (amphipod) exposed to arsenic pentoxide for 28 days exhibited a bioaccumulation factor of 0; Pteronarcys dorsata (stonefly) exposed to arsenic pentoxide for 28 days exhibited a bioaccumulation factor of 7; Salmo gairdneri (rainbow trout) exposed to arsenic pentoxide for 28 days exhibited a bioaccumulation factor of 0; Pimephales (fathead minnow) exposed to arsenic pentoxide for 30 days exhibited a bioaccumulation factor of 3. [USEPA; Ambient Water Quality Criteria Doc: Arsenic p.33
FOOD SURVEY VALUES:
The pentavalent state appears to predominate in foods, particularly seafood. [48 FR 45512 (10/5/83)]

ENVIRONMENTAL STANDARDS & REGULATIONS:

FIFRA REQUIREMENTS:
As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Arsenic pentoxide is found on List A, which contains most food use pesticides and consists of the 194 chemical cases (or 350 individual active ingredients) for which EPA issued registration standards prior to FIFRA '88. Case No: 0132; Pesticide type: fungicide (wood preservative); Registration Standard Date: 6/1/88, 9/10/86; Case Status: OPP is reviewing data from the pesticide's producers regarding its human health and/or environmental effects, or OPP is determining the pesticide's eligibility for reregistration and developing the RED document.; Active ingredient (AI): arsenic pentoxide; Data Call-in (DCI) Date(s): 1/31/94; AI Status: The producers of the pesticide has made commitments to conduct the studies and pay the fees required for reregistration, and are meeting those commitments in a timely manner. [USEPA/OPP; Status of Pesticides in Registration, Reregistration and Special Review p.100 (Spring, 1998) EPA 738-R-98-002]


ACCEPTABLE DAILY INTAKES:
WHO= 0.002 mg/kg /Inorganic arsenic cmpd, as As; from table/ [Seiler, H.G., H. Sigel and A. Sigel (eds.). Handbook on the Toxicity of Inorganic Compounds. New York, NY: Marcel Dekker, Inc. 1988.843]

CERCLA REPORTABLE QUANTITIES:
Releases of CERCLA hazardous substances are subject to the release reporting requirement of CERCLA section 103, codified at 40 CFR part 302, in addition to the requirements of 40 CFR part 355. Arsenic pentoxide is an extremely hazardous substance (EHS) subject to reporting requirements when stored in amounts in excess of its threshold planning quantity (TPQ) of 100 or 10,000 lbs. Extremely hazardous substances that are solids are
subject to either of two threshold planning quantities ... The lower quantity applies only if the solid exists in powdered form and has a particle size less than 100 microns; or is handled in solution or in molten form; or meets the criteria for a National Fire Protection Association (NFPA) rating of 2, 3 or 4 for reactivity. If the solid does not meet any of these criteria, it is subject to the upper ... threshold planning quantity ... . [40 CFR 355 (7/1/2000)]**PEER REVIEWED**

Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 1 lb or 0.454 kg. The toll free number of the NRC is (800) 424-8802; In the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b). [40 CFR 302.4 (7/1/2000)]**PEER REVIEWED**

**RCRA REQUIREMENTS:**

P011; As stipulated in 40 CFR 261.33, when arsenic pentoxide, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to federal and/or state hazardous waste regulations. Also defined as a hazardous waste is any container or inner liner used to hold this waste or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may qualify for partial exclusion from hazardous waste regulations (40 CFR 261.5(e)). [40 CFR 261.33 (7/1/2000)]**PEER REVIEWED**

**ATMOSPHERIC STANDARDS:**

Listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Arsenic pentoxide is included on this list. [Clean Air Act as amended in 1990, Sect. 112 (b) (1) Public Law 101-549 Nov. 15, 1990]**PEER REVIEWED**

(a) The owner or operator of an existing glass melting furnace subject to the provisions of this subpart shall comply with either paragraph (a)(1) or (a)(2) of this section ... (1) Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 2.5 Mg (2.7 ton) per year, or ... (2) Total arsenic emissions from glass melting furnace shall be conveyed to a control device and reduced by at least 85%. /Total arsenic/ [40 CFR 61.162(a) (7/1/2001)]**PEER REVIEWED**

(b) The owner or operator of a new or modified glass melting furnace subject to the provisions of this subpart shall comply with either paragraph (b)(1) or (b)(2) of this section ... (1) Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 0.4 Mg (0.44 ton) per year, or ... (2) Total arsenic emissions from glass melting furnace shall be conveyed to a control device and reduced by at least 85%. /Total arsenic/ [40 CFR 61.162(b) (7/1/2001)]**PEER REVIEWED**

The owner or operator of each copper converter subject to the provisions of this subpart shall reduce inorganic arsenic emissions to the atmosphere by meeting the following design, equipment, work practice, and operational requirements: (1) Install, operate, and maintain a secondary hood system on each copper converter. Each secondary hood system shall consist of a
hood enclosure, air curtain fan(s), exhaust system fan(s), and ductwork that conveys the captured emission to a control device ... (2) Optimize the capture of secondary inorganic arsenic emission by operating the copper converter and secondary hood systems at all times ... /Inorganic arsenic/ [40 CFR 61.172(b) (7/1/2001)]**PEER REVIEWED**

National Emission Standards for Inorganic Arsenic Emissions From Arsenic Trioxide and Metallic Arsenic Production Facilities. (a) Within 30 days after the effective date of this subpart, the owner or operator of each source to which this subpart applies shall identify and submit to the Administrator a list of potential sources (equipment and operations) of inorganic arsenic emissions. /Inorganic arsenic/ [40 CFR 61.182(a) (7/1/2001)]**PEER REVIEWED**

National Emission Standards for Inorganic Arsenic Emissions From Arsenic Trioxide and Metallic Arsenic Production Facilities. (b) The owner or operator shall submit a description of an inspection, maintenance, and housekeeping plan for control of inorganic arsenic emissions ... (c) The owner or operator shall implement the plan ... (d) At all times ... the owner or operator ... shall operate and maintain the source incl associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent possible ... /Inorganic Arsenic/ [40 CFR 61.182(b) (7/1/2001)]**PEER REVIEWED**

CLEAN WATER ACT REQUIREMENTS:
Designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance.[40 CFR 116.4 (7/1/2000)]**QC REVIEWED**

Toxic pollutant designated pursuant to section 307(a)(1) of the Federal Water Pollution Control Act and is subject to effluent limitations. /Arsenic & cmpd/[40 CFR 401.15 (7/1/2001)]**QC REVIEWED**

For the maximum protection of human health from the potential carcinogenic effects due to exposure of arsenic through ingestion of contaminated water &amp; contaminated aquatic organisms, the ambient water concn should be zero based on the nonthreshold assumption for this chemical. However, zero level may not be attainable at the present time. Therefore, the levels which may result in incremental increase of cancer risk over the lifetime are estimated at 1X10^-5, 1X10^-6, &amp; 1X10^-7. The corresponding criteria are 22 ng/l, 2.2 ng/l, &amp; .22 ng/l, respectively .... For consumption of aquatic organisms only, excluding consumption of water, the levels are 175 ng/ml, 17.5 ng/l, &amp; 1.75 ng/l, respectively. /Arsenic/[USEPA; Quality Criteria for Water 1986: Arsenic: Human Health Criteria (May 1, 1986) EPA 440/5-86-001]**QC REVIEWED**

D004; A solid waste containing arsenic may or may not become characterized as a hazardous waste when subjected to the Toxicity Characteristic Leaching Procedure listed in 40 CFR 261.24, and if so characterized, must be managed as a hazardous waste.[40 CFR 261.24 (7/1/2001)]**QC REVIEWED**

FEDERAL DRINKING WATER STANDARDS:
10 ug/l /Arsenic/[USEPA/Office of Water; Federal-State Toxicology and Risk Analysis Committee (FSTRAC). Summary of State and Federal Drinking Water Standards and Guidelines (11/93)]**QC REVIEWED**

ALLOWABLE TOLERANCES:
Tolerances for total residues of combined arsenic (calculated as As) in food are established as follows: (a) In edible tissues &amp; in eggs of
chickens & turkeys: 0.5 ppm in uncooked muscle tissue; 2 ppm in uncooked edible by-products; & 0.5 ppm in eggs. (b) In edible tissues of swine: 2 ppm in uncooked liver & kidney; 0.5 ppm in uncooked muscle tissue & by-products other than liver & kidney. /Arsenic/ [21 CFR 556.60 (4/1/2001)]**PEER REVIEWED**

CHEMICAL/PHYSICAL PROPERTIES:

MOLECULAR FORMULA:
As2-O5 **PEER REVIEWED**

MOLECULAR WEIGHT:

COLOR/FORM:


MELTING POINT:

CORROSIVITY:

DENSITY/SPECIFIC GRAVITY:

SOLUBILITIES:


OTHER CHEMICAL/PHYSICAL PROPERTIES:
Combines very slowly with water to form H3AsSO4; gradually deliquesces on exposure to air. [Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996.135]**PEER REVIEWED**
CHEMICAL SAFETY & HANDLING:

DOT EMERGENCY GUIDELINES:

Health: Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin. Avoid any skin contact. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution. [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-151]**QC REVIEWED**


Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations. [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-151]**QC REVIEWED**


Fire: Small fires: Dry chemical, CO2 or water spray. Large fires: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk. Dike fire control water for later disposal; do not scatter the material. Use water spray or fog; do not use straight streams. Fire involving tanks or car/trailer loads: Fight fire from maximum distance or use unmanned hose holders 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. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-151]**QC REVIEWED**

Spill or leak: Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Cover with plastic sheet to prevent spreading. Absorb or cover with

First aid: Move victim to fresh air. Call 911 or emergency medical service. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. For minor skin contact, avoid spreading material on unaffected skin. Keep victim warm and quiet. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000, p. G-151]**QC REVIEWED**

SKIN, EYE AND RESPIRATORY IRRITATIONS:
ARSENICAL DUSTS ... ARE IRRITATING TO UPPER RESP TRACT & EYES. CONJUNCTIVITIS PRODUCED BY ... THESE SUBSTANCES ARE CHARACTERIZED BY ITCHING, BURNING, & WATERING OF EYES. ... /INORGANIC ARSENIC DUSTS/ [Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986.115]**PEER REVIEWED**

FIRE POTENTIAL:

FIRE FIGHTING PROCEDURES:


TOXIC COMBUSTION PRODUCTS:

HAZARDOUS REACTIVITIES & INCOMPATIBILITIES:
With bromine pentafluoride: Contact with arsenic pentoxide at ambient or slightly elevated temperatures is violent, ignition often occurring. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1999093]**PEER REVIEWED**


HAZARDOUS DECOMPOSITION:


IMMEDIATELY DANGEROUS TO LIFE OR HEALTH:
5 mg/cu m (as AS); NIOSH considers arsenic (inorganic cmpd, as As) to be a potential occupational carcinogen. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

PROTECTIVE EQUIPMENT & CLOTHING:
Workers should be supplied with suitable protective clothing, protective boots and when there is a risk that the exposure limit for airborne arsenic will be exceeded, respiratory protective equipment. /Arsenic cmpd/ [International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&amp;II. Geneva, Switzerland: International Labour Office, 1983.182]**PEER REVIEWED**

Where there is occupational exposure to inorganic arsenic compounds, protective clothing shall be provided by the employers. This may include underwear, gloves, coveralls, and a hood over the head and neck. /Inorganic arsenic/ [NIOSH; Criteria Document: Inorganic Arsenic p.5 (1975) DHEW Pub. NIOSH 75-149]**PEER REVIEWED**

Wear appropriate personal protective clothing to prevent skin contact. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S.

Recommendations for respirator selection: At concn above the NIOSH REL, or where there is no REL, at any detectable concn. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive pressure-mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**


PREVENTIVE MEASURES:

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers. All contaminated clothing should not be taken home at end of shift, but should remain at employee's place of work for cleaning. **PEER REVIEWED**

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place. **PEER REVIEWED**

WELL VENTILATED & ALL POISONOUS FUME ... CONDENSED & DUST CONTENT REMOVED. ... EXHAUST HOODS ... WORKTABLES ... EQUIPPED WITH DOWN-DRAUGHT ... VENTILATION. /ARSENIC CMPD/ [Budavari, S. (ed.). The Merck Index - Encyclopedia of Chemicals, Drugs and Biologicals. Rahway, NJ: Merck and Co., Inc., 1989.117]**PEER REVIEWED**

IN ... /FACTORIES/ WITH ARSENIC HAZARD, FLOORS ... SHOULD BE ...


Employees exposed to arsenic shall wash their hands and exposed skin before eating or smoking during the work shift. No food shall be permitted in areas where arsenic is handled, processed, or stored. Employees shall not smoke in areas where arsenic is handled, processed, or stored. /Inorganic arsenic/ [NIOSH; Criteria Document: Inorganic Arsenic p.9 (1975) DHEW Pub. NIOSH 75-149]**PEER REVIEWED**

Clean work clothes should be supplied daily and the workers should shower prior to changing to street clothes. /Arsenic and arsenic cmpd/ [Sittig, M. Handbook of Toxic and Hazardous Chemicals and Carcinogens, 1985. 2nd ed. Park Ridge, NJ: Noyes Data Corporation, 1985.89]**PEER REVIEWED**

Contact lenses should not be worn when working with this chemical. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers. Contaminated clothing should not be taken home at end of shift, but should remain at employee's place of work for cleaning. **PEER REVIEWED**


The worker should immediately wash the skin when it becomes contaminated. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**


Work clothing that becomes wet or significantly contaminated should be removed and replaced. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

Workers whose clothing may have become contaminated should change into


Personnel protection: Avoid breathing vapors. Keep upwind. ... Avoid bodily contact with the material. ... Do not handle broken packages unless wearing appropriate personal protective equipment. Wash away any material which may have contacted the body with copious amounts of water or soap and water. /Arsenical cmpd, liquid, NOS/ [Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994.104]**PEER REVIEWED**


Personnel protection: Avoid breathing dusts, and fumes from burning material. Keep upwind. Avoid bodily contact with the material. ... Do not handle broken packages unless wearing appropriate personal protective equipment. Wash away any material which may have contacted the body with copious amounts of water or soap and water. /Arsenical cmpd, solid, NOS/ [Association of American Railroads. Emergency Handling of Hazardous Materials in Surface Transportation. Washington, DC: Association of American Railroads, Bureau of Explosives, 1994.105]**PEER REVIEWED**

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. (Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.) /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

**STABILITY/SHELF LIFE:**
GRADUALLY DELIQUESCES ON EXPOSURE TO AIR [The Merck Index. 10th ed. Rahway, New Jersey: Merck Co., Inc., 1983.117]**PEER REVIEWED**

The pH of aqueous solutions appears to be a major factor in the relative stability. ... Pentavalent inorganic arsenic ... is relatively stable at
neutral or alkaline pH but undergoes reduction with decreasing pH.


SHIPMENT METHODS AND REGULATIONS:

No person may /transport;/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./ [49 CFR 171.2 (7/1/2000)]**PEER REVIEWED**

The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials. [IATA. Dangerous Goods Regulations. 42nd Ed. Montreal, Canada and Geneva, Switzerland: International Air Transport Association, Dangerous Goods Regulations, 2001.118]**PEER REVIEWED**

The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article. [IMDG; International Maritime Dangerous Goods Code; International Maritime Organization p.6076 (1998)]**PEER REVIEWED**

STORAGE CONDITIONS:


Protect container against physical damage. Store in well ventilated area away from food or food products and combustible materials. /Inorganic arsenic cmpd/ [ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982.51]**PEER REVIEWED**

CLEANUP METHODS:


Floors and other accessible surfaces contaminated with inorganic arsenic may not be cleaned by the use of compressed air, and shoveling and brushing may be used only where vacuuming or other relevant methods have been tried and found not to be effective. /Inorganic arsenic compounds/ [29 CFR 1910.1000 (7/1/87)]**PEER REVIEWED**

DISPOSAL METHODS:

SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices. **PEER REVIEWED**

Recycling: To convert the gas-cleaning residues obtained during the
metallurgical processing of arsenic-containing ores into a portable and less water-soluble form, the metals are precipitated as hydroxides by using an excess of lime water and the arsenic is precipitated as calcium arsenate and calcium arsenite. This "arsenic sludge" is recycled, on the one hand, in order not to lose the valuable metals, and on the other, in order to reduce the problem of arsenic sludge disposal. The following storage possibilities are available today for arsenic residues that cannot be recycled immediately or at all: 1) special dumps sealed against the penetration of ground water, surface water and rain water; 2) galleries in abandoned salt mines; 3) concrete silos. In any case the sludge must be dewatered beforehand until it is compact. Recommendable methods: Precipitation, solidification /hazardous waste/, landfill. Not recommendable methods: Thermal destruction, discharge to sewer. [United Nations. Treatment and Disposal Methods for Waste Chemicals (IRPTC File). Data Profile Series No. 5. Geneva, Switzerland: United Nations Environmental Programme, Dec. 1985.94]**PEER REVIEWED**

Arsenic pentoxide is a poor candidate for incineration. [USEPA; Engineering Handbook for Hazardous Waste Incineration p.3-8 (1981) EPA 68-03-3025]**PEER REVIEWED**

Chemical Treatability of Arsenic; Concentration Process: Chemical Precipitation; Chemical Classification: Metal; Scale of Study: Pilot Scale; Type of Wastewater Used: Domestic Wastewater + Pure Compound; Results of Study: 5ppm @ 4gpm @ pH= 7.0. Iron system-90% reduction; low lime system-80% reduction; high lime system-76% reduction; (3 coagulant systems were used; Iron system used 45 ppm as Fe of Fe2(SO4)3 @ pH= 6.0. Low lime system used 20 ppm Fe of Fe2(SO4)3 and 260 ppm of CaO @ pH= 10.0. High lime system used 600 ppm of CaO @ pH= 11.5. Chemical coagulation was followed by multimedia filtration). /Arsenic cmpd/ [USEPA; Management of Hazardous Waste Leachate, EPA Contract No. 68-03-2766 p.E-68 (1982)]**PEER REVIEWED**

Chemical Treatability of Arsenic; Concentration Process: Chemical Precipitation; Chemical Classification: Metal; Scale of Study: Full Scale Continuous Flow; Type of Wastewater Used: Domestic Wastewater; Results of Study: Effluent character (ppb): 2.5, 56% reduction with lime; 3.3, 24% reduction with lime; (lime dose of 350-400 ppm as calcium oxide @ pH= 11.3). /Arsenic cmpd/ [USEPA; Management of Hazardous Waste Leachate, EPA Contract No. 68-03-2766 p.E-68 (1982)]**PEER REVIEWED**

OCCUPATIONAL EXPOSURE STANDARDS:

OSHA STANDARDS:
8 hr Time-Weighted avg: 10 ug/cu m./Arsenic, inorganic cmpd (as As)/ [29 CFR 1910.1018 (7/1/2001)]**PEER REVIEWED**

Permissible Exposure Limit: Table Z-1 8-Hr Time Weighted Avg: 0.5 mg/cu m. /Arsenic, organic cmpd (as As)/ [29 CFR 1910.1000 (7/1/2001)]**PEER REVIEWED**

THRESHOLD LIMIT VALUES:
8 hr Time weighted Avg (TWA) 0.01 mg/cu m /Arsenic and inorganic cmpd, as As/ [American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001. 15]**PEER REVIEWED**

A1: Confirmed human carcinogen. /Arsenic and inorganic cmpd, as As/
Excursion Limit Recommendation: Excursions in worker exposure levels may exceed three times the TLV-TWA for no more than a total of 30 min during a work day, and under no circumstances should they exceed five times the TLV-TWA, provided that the TLV-TWA is not exceeded. /Arsenic and inorganic compounds, as As/ [American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001. 6]**PEER REVIEWED**

BEI (Biological Exposure Index): Determinant: Inorganic arsenic plus methylated metabolites in urine; Sampling Time: end of workweek; BEI: 35 ug As/l. The determinant may be present in biological specimens collected from subjects who have not been occupationally exposed, at a concentration which could affect interpretation of the result. Such background concentrations are incorporated in the BEI value. /Arsenic, elemental and soluble inorganic cmpd/ [American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001. 86]**PEER REVIEWED**

NIOSH RECOMMENDATIONS:
5 mg/cu m (as As); NIOSH considers arsenic (inorganic cmpd, as As) to be a potential occupational carcinogen. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**


NIOSH usually recommends that occupational exposures to carcinogens be limited to the lowest feasible concentration. /Arsenic (inorganic compounds, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH:
5 mg/cu m (as As); NIOSH considers arsenic (inorganic cmpd, as As) to be a potential occupational carcinogen. /Arsenic (inorganic cmpd, as As)/ [NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997.20]**PEER REVIEWED**

OTHER OCCUPATIONAL PERMISSIBLE LEVELS:

MANUFACTURING/USE INFORMATION:

MAJOR USES:
For Arsenic Pentoxide (USEPA/OPP Pesticide Code: 006802) ACTIVE products
with label matches. /SRP: Registered for use in the U.S. but approved 
pesticide uses may change periodically and so federal, state and local 
authorities must be consulted for currently approved uses. / [U.S. 
Environmental Protection Agency/Organization's Chemical 
Ingredients Database on Arsenic Pentoxide (1303-28-2). Available from the 
Database Query page at http://www.cdpr.ca.gov/docs/epa/epamenu.htm as of 
May 24, 2001.] **PEER REVIEWED**

CHEMICAL INTERMEDIATE; CHEM INT FOR METAL ARSENATES—EG, LEAD ARSENATE; 
HERBICIDE—ESP PREHARVEST COTTON DEFOLIANT; INGREDIENT IN FORMULATED WOOD 
PRESERVATIVES; INSECTICIDE (POSSIBLE USE); SOIL STERILANT (POSSIBLE USE); 
GLASS INGREDIENT [SRI]**PEER REVIEWED**

Arsenates; insecticides; dyeing and printing; weed killer; colored glass; 
metal adhesives [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical 

METHODS OF MANUFACTURING:
REACTION OF ARSENIC TRIOXIDE & NITRIC ACID FOLLOWED BY DEHYDRATION OF 
THE INT ORTHOARSENIC ACID HYDRATE [SRI]**PEER REVIEWED**

The Merck Index – An Encyclopedia of Chemicals, Drugs, and Biologicals. 
Whitehouse Station, NJ: Merck and Co., Inc., 1996.135]**PEER REVIEWED**

By action of oxidizing agent such as nitric acid on arsenious oxide. 

(1) Arsenic trioxide (air oxidation); (2) arsenic acid (dehydration) 
[Ashford, R.D. Ashford's Dictionary of Industrial Chemicals. London, 

GENERAL MANUFACTURING INFORMATION:
Arsenic pentoxide is also sometimes called arsenic acid [Lewis, R.J., Sr 
John Wiley & Sons, Inc. 1997. 93]**PEER REVIEWED**

Arsenic pentoxide is an oxidizing agent capable of liberating chlorine 
from hydrogen chloride. [Kirk-Othmer Encyclopedia of Chemical Technology. 
(1978) 255]**PEER REVIEWED**

LABORATORY METHODS:

SPECIAL REFERENCES:

SYNONYMS AND IDENTIFIERS:

RELATED HSDB RECORDS:
6994 [ARSENIC COMPOUNDS]
509 [ARSENIC; 7440-38-2]
SYNONYMS:
- Anhydride arsenique (French) **PEER REVIEWED**
- ARSENIC ACID ANHYDRIDE **PEER REVIEWED**
- ARSENIC ANHYDRIDE **PEER REVIEWED**
- ARSENIC OXIDE **PEER REVIEWED**
- ARSENIC (V) OXIDE **PEER REVIEWED**
- ARSENIC OXIDE (AS2O5) **PEER REVIEWED**
- ARSENIC PENTAOXIDE **PEER REVIEWED**
- Caswell no 057 **PEER REVIEWED**
- DIARSENIC PENTOXIDE **PEER REVIEWED**


SHIPPING NAME/ NUMBER DOT/UN/NA/IMO:
- IMO 6.1; Arsenic pentoxide
- UN 1559; Arsenic pentoxide, solid

STANDARD TRANSPORTATION NUMBER:
- 49 231 12; Arsenic pentoxide, solid

EPA HAZARDOUS WASTE NUMBER:
- D004; A waste containing arsenic may or may not be characterized as a hazardous waste following testing by the Toxicity Characteristic Leaching Procedure as prescribed by the Resource Conservation and Recovery Act (RCRA) regulations. /Arsenic/
- P011; An acute hazardous waste when a discarded commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate.
- D004; A waste containing arsenic may or may not be characterized as a hazardous waste following testing by the Toxicity Characteristic Leaching Procedure as prescribed by the Resource Conservation and Recovery Act (RCRA) regulations. /Arsenic/

ADMINISTRATIVE INFORMATION:

HAZARDOUS SUBSTANCES DATABANK NUMBER: 429

LAST REVISION DATE: 20021108

LAST REVIEW DATE: Reviewed by SRP on 9/15/2001
UPDATE HISTORY:
Complete Update on 11/08/2002, 1 field added/edited/deleted.
Complete Update on 10/16/2002, 1 field added/edited/deleted.
Complete Update on 06/11/2002, 2 fields added/edited/deleted.
Complete Update on 03/26/2002, 78 fields added/edited/deleted.
Field Update on 01/14/2002, 1 field added/edited/deleted.
Field Update on 08/08/2001, 1 field added/edited/deleted.
Field Update on 05/16/2001, 1 field added/edited/deleted.
Complete Update on 06/12/2000, 1 field added/edited/deleted.
Complete Update on 03/24/2000, 1 field added/edited/deleted.
Complete Update on 02/11/2000, 1 field added/edited/deleted.
Complete Update on 02/08/2000, 1 field added/edited/deleted.
Complete Update on 02/02/2000, 1 field added/edited/deleted.
Complete Update on 11/18/1999, 1 field added/edited/deleted.
Complete Update on 09/21/1999, 1 field added/edited/deleted.
Complete Update on 07/20/1999, 5 fields added/edited/deleted.
Complete Update on 05/04/1999, 1 field added/edited/deleted.
Complete Update on 03/29/1999, 1 field added/edited/deleted.
Complete Update on 02/11/1999, 1 field added/edited/deleted.
Complete Update on 11/12/1998, 1 field added/edited/deleted.
Complete Update on 06/02/1998, 1 field added/edited/deleted.
Complete Update on 02/25/1998, 1 field added/edited/deleted.
Complete Update on 10/17/1997, 1 field added/edited/deleted.
Complete Update on 08/11/1997, 1 field added/edited/deleted.
Complete Update on 05/08/1997, 1 field added/edited/deleted.
Complete Update on 04/01/1997, 2 fields added/edited/deleted.
Complete Update on 02/26/1997, 1 field added/edited/deleted.
Complete Update on 01/24/1997, 1 field added/edited/deleted.
Complete Update on 10/12/1996, 1 field added/edited/deleted.
Complete Update on 06/21/1996, 2 fields added/edited/deleted.
Complete Update on 05/10/1996, 1 field added/edited/deleted.
Complete Update on 01/19/1996, 1 field added/edited/deleted.
Complete Update on 07/17/1995, 1 field added/edited/deleted.
Complete Update on 05/26/1995, 1 field added/edited/deleted.
Complete Update on 03/16/1995, 3 fields added/edited/deleted.
Complete Update on 03/10/1995, 1 field added/edited/deleted.
Complete Update on 01/25/1995, 1 field added/edited/deleted.
Complete Update on 12/21/1994, 1 field added/edited/deleted.
Complete Update on 09/23/1994, 1 field added/edited/deleted.
Complete Update on 08/17/1994, 1 field added/edited/deleted.
Complete Update on 05/05/1994, 1 field added/edited/deleted.
Complete Update on 03/25/1994, 1 field added/edited/deleted.
Complete Update on 11/05/1993, 1 field added/edited/deleted.
Complete Update on 10/28/1993, 1 field added/edited/deleted.
Complete Update on 08/07/1993, 1 field added/edited/deleted.
Field update on 12/12/1992, 1 field added/edited/deleted.
Complete Update on 04/29/1992, 1 field added/edited/deleted.
Complete Update on 04/27/1992, 1 field added/edited/deleted.
Complete Update on 04/01/1992, 1 field added/edited/deleted.
Complete Update on 01/23/1992, 1 field added/edited/deleted.
Complete Update on 12/07/1990, 1 field added/edited/deleted.
Field update on 08/13/1990, 1 field added/edited/deleted.
Complete Update on 05/21/1990, 2 fields added/edited/deleted.
Field update on 05/18/1990, 1 field added/edited/deleted.
Complete Update on 07/13/1989, 91 fields added/edited/deleted.

Complete Update on 01/27/1986