mals. Contact the CDC at 404-639-3670 from 8 AM-4:30 PM Eastern Time, Monday-Friday for more information or go to their website: www.cdc.gov/ncidod/srp/drugs/drug-service.html

Pentostam® is available commercially in several countries.

SODIUM SULFATE
GLAUBER'S SALT

(soe-*dee*-um sul-*fayte*; *glow*-bers *salt*)

SALINE CATHARTIC

Prescriber Highlights

- Used primarily in food animals
- Contraindications: Dehydration
- Caution in patients with severe CHF or in patients otherwise susceptible to sodium retention
- Adverse Effects: Diarrhea, cramping, & flatulence may result; electrolyte abnormalities may occur with chronic use

Uses/Indications
Sodium sulfate is used as a saline cathartic, primarily in food animals.

Pharmacology/Actions
When given orally, sodium sulfate acts as a saline cathartic (draws water into small intestine). Sodium sulfate is considered the most effective saline cathartic on a molar basis. Sulfates also react with a variety of cations to form non-absorbable compounds, which may explain their efficacy in reducing copper loads and reduce gut calcium.

Pharmacokinetics
Sodium sulfate is not appreciably absorbed from the GI tract and thereby acts a saline cathartic. Sodium may be absorbed however, after exchanging with other cations.

Contraindications/Precautions/Warnings
Saline cathartics should not be used in dehydrated animals. Because of the drug's high sodium content, it should be used with caution in patients with severe CHF or otherwise susceptible to sodium retention.

Adverse Effects
Diarrhea, cramping, and flatulence may result. Electrolyte abnormalities may occur with chronic use.

Drug Interactions/Laboratory Considerations
No specific drug or laboratory interactions or considerations were noted.

Doses
Note: When used in food animals, FARAD states that this salt is rapidly excreted and is not considered a residue concern in animal tissues; therefore, a 24 hour preslaughter withdrawal interval (WDI) would be sufficient. (Haskell, Payne et al. 2005)

CATTLE:

a) As a cathartic: 500–750 g PO as a 6% solution via stomach tube (Davis 1993)

SHEEP & GOATS:

a) As a cathartic: 60 g PO as a 6% solution via stomach tube (Davis 1993)

SWINE:

a) As a cathartic: 30–60 g PO as a 6% solution via stomach tube (Davis 1993)

Chemistry/Synonyms
Sodium sulfate (hexahydrate form) occurs as large, colorless, odorless, crystals or white crystalline powder. It will effloresce in dry air and partially dissolve in its own water of crystallization at about 33°C. 1 gram is soluble in about 2.5 mL of water.

Sodium sulfate may also be known as E514, Glauber's Salt, natrii sulphas, natrio sulfata, or natrium sulfuricum.

Storage/Stability
Store in tight containers at temperatures not exceeding 30°C.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS: None

HUMAN-LABELED PRODUCTS: None

Sodium sulfate (hexahydrate) is available from chemical supply houses.

SODIUM THIOSULFATE

(soe-*dee*-um thye-oh-*sul*-fayte) Sodium Hyposulfite

ANTIDOTE (ARSENIC, CYANIDE)

Prescriber Highlights

- Used for cyanide or arsenic poisoning
- Contraindications: None
- Adverse Effects: Large doses by mouth may cause profuse diarrhea
- Injectable forms should be given slowly IV

Uses/Indications
Sodium thiosulfate (alone or in combination with sodium nitrite) is useful in the treatment of cyanide toxicity. It has been touted for use in treating arsenic or other heavy metal poisonings, but its efficacy is in question for these purposes. However, because sodium thiosulfate is relatively non-toxic and inexpensive, it may be tried to treat arsenic poisoning. When used in combination with sodium molybdate, sodium thiosulfate may be useful for the treatment of copper poisoning.

Sodium thiosulfate may be useful for the topical treatment for some fungal infections (Tinea). In humans, sodium thiosulfate has been used to reduce the nephrotoxicity of cisplatin therapy. A 3 or 4% solution has been used to infiltrate the site of extravasations of cisplatin, carboplatin, or dactinomycin. In combination with steroids, sodium thiosulfate may reduce the healing time associated with doxorubicin extravasation.

Pharmacology/Actions
By administering thiosulfate, an exogenous source of sulfur is available to the body, thereby hastening the detoxification of cyanide using the enzyme rhodanese. Rhodanese (*thiosulfate cyanide sulfurtransferase*) converts cyanide to the relatively nontoxic thiocyanate ion; thiocyanate is then excreted in the urine.

Sodium thiosulfate has been used in humans to treat extravasation injuries secondary to carboplatin or cisplatin, for prophylaxis to prevent nephrotoxicity after cisplatin overdoses and ototoxicity with carboplatin overdoses.

Sodium thiosulfate's topical antifungal activity is probably due to its slow release of colloidal sulfur.

While sodium thiosulfate has been recommended for treating arsenic (and some other heavy metal) poisoning, the proposed mechanism of action is not known and its efficacy is in question. Presumably, the sulfate moiety may react with and chelate the metal allowing its removal.

Pharmacokinetics

Sodium thiosulfate is relatively poorly absorbed from the GI tract. When substantial doses are given PO, it acts a saline cathartic. When administered intravenously, it is distributed in the extracellular fluid and then rapidly excreted via the urine.

Contraindications/Precautions/Warnings

There are no absolute contraindications to the use of the drug.

Adverse Effects

The drug is relatively non-toxic. Large doses by mouth may cause profuse diarrhea. Injectable forms should be given slowly IV.

Reproductive/Nursing Safety

Safe use during pregnancy has not been established; use when benefits outweigh the potential risks. In humans, the FDA categorizes this drug as category ***C*** for use during pregnancy (*Animal studies have shown an adverse effect on the fetus, but there are no adequate studies in humans; or there are no animal reproduction studies and no adequate studies in humans.*)

No lactation information was found.

Drug Interactions/Laboratory Considerations

No specific drug or laboratory interactions or considerations were noted.

Doses

▪ DOGS, CATS:

a) For cyanide toxicity: Contact an animal poison control center for guidance.

b) For treating extravasation injuries secondary to doxorubicin, carboplatin, cisplatin infusions: **Note:** These are recommendations for human patients.

Doxorubicin: Subcutaneous sodium thiosulfate 2% added to therapy with subcutaneous hydrocortisone and topical betamethasone decreased the healing time by half for cytotoxic drug extravasation (including doxorubicin and epirubicin) when compared to therapy without sodium thiosulfate.

Carboplatin: Prepare a 0.17 moles/L solution by mixing 4 mL sodium thiosulfate 10% w/v with 6 mL sterile water for injection. Inject 5 mL into extravasation site.

Cisplatin: For extravasation of large amounts (greater than 20 mL) of highly concentrated (greater than 0.5 mg/mL) solutions: Prepare a 0.17 moles/L solution by mixing 4 mL sodium thiosulfate 10% w/v with 6 mL sterile water for injection. Inject into extravasation site. (DRUGDEX® Evaluations. Micromedex Healthcare Series; Thompson, 2007)

▪ HORSES:

a) For cyanide toxicity: First give sodium nitrite at a dose of 16 mg/kg IV followed with a 20% solution of sodium thiosulfate given at a dose of 30–40 mg/kg IV. If repeating treatment, use sodium thiosulfate only. (Bailey and Garland 1992)

b) For cyanide toxicity: First give sodium nitrite in a 20% solution at a dose of 10–20 mg/kg IV followed with a 20% solution of sodium thiosulfate given at a dose of 30–40 mg/kg IV (Osweiler 2003)

c) For arsenic toxicity: Sodium thiosulfate at 20–30 grams in 300 mL of water orally with dimercaprol (BAL) 3 mg/kg IM q4h (Jones 2004c)

▪ RUMINANTS:

Note: When used in food animals, FARAD states that this salt is rapidly excreted and is not considered a residue concern in animal tissues; therefore, a 24 hour preslaughter withdrawal interval (WDI) would be sufficient. (Haskell, Payne et al. 2005)

a) In combination with sodium molybdate for the treatment of copper poisoning: In conjunction with fluid replacement therapy, 500 mg sodium thiosulfate in combination with 200 mg ammonium or sodium molybdate PO daily for up to 3 weeks will help decrease total body burden of copper (Thompson and Buck 1993)

b) For treatment of cyanide toxicity secondary to cyanogenic plants: 660 mg/kg IV sodium thiosulfate in a 30% solution given rapidly using a 12 or 14 gauge needle (Nicholson 1993), (Post and Keller 2000)

c) For treatment of arsenic poisoning: 30–60 grams PO every 6 hours for 3–4 days and 30–60 grams as a 10–20% solution IV may be potentially useful in binding arsenic. Adjunctive fluid and electrolyte replacement is necessary. (Galey 1993)

Chemistry/Synonyms

Sodium thiosulfate occurs as large, colorless crystals or coarse, crystalline powder. It is very soluble in water, deliquescent in moist air and effloresces in dry air at temperatures >33°C.

Sodium thiosulfate may also be known as: natrii thiosulfas, natrium thiosulfuricum, sodium hyposulphite, sodium thiosulphate, *Consept Step 2®*, *Hiposul®*, *Hyposulfene®*, or *S-hydril®*.

Storage/Stability/Compatibility

Unless otherwise stated by the manufacturer, store at room temperature. Crystals should be stored in tight containers.

Sodium thiosulfate is **not compatible** mixed with cyanocobalamin.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS: None

HUMAN-LABELED PRODUCTS:

Sodium Thiosulfate for Injection: 10% (100 mg/mL, as pentahydrate) & 25% (250 mg/mL) preservative-free in 10 mL & 50 mL single-use vials; generic, (American Regent); (Rx)

SOMATOTROPIN (GROWTH HORMONE)

(soe-ma-toe-***troe***-pin)

HORMONE

Prescriber Highlights

- Used for canine hypopituitary dwarfism or growth hormone-responsive dermatosis (in adult dogs).
- May cause diabetes mellitus
- Availability & expense issues