

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR ANTU

INTRODUCTION

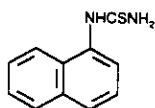
This guideline summarizes pertinent information about ANTU for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

α -Naphthylthiourea, 1-naphthalenylthiourea, 1-(1-naphthyl)-2-thiourea, 1-naphthylthiourea, α -naphthylthiocarbamide, Alrato, Anturat, Bantu, Dirax, Kill Kantz, Krysid, Naphtox, Rattrack, Rat-tu, Smeesana

• Identifiers

1. CAS No.: 86-88-4
2. RTECS No.: YT9275000
3. DOT UN: 1651 53
4. DOT label: Poison

• Appearance and odor

ANTU is a colorless, white, or gray crystalline compound that is odorless. Commercial ANTU preparations are often contaminated with as much as 2% 2-naphthylamine, a recognized human carcinogen. ANTU is no longer manufactured in the United States.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 202.3
2. Boiling point (at 760 mm Hg): Decomposes
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of ANTU): 6.99
5. Melting point: 198°C (388.4°F)
6. Vapor pressure at 20°C (68°F): Nearly zero
7. Solubility: Practically insoluble in water, fairly soluble in hot alcohol, and soluble in acetone and triethylene glycol
8. Evaporation rate: Not applicable

• Reactivity

1. Conditions contributing to instability: None
2. Incompatibilities: Fires and explosions may result from contact of ANTU with strong oxidizers; ANTU also reacts with silver nitrate.
3. Hazardous decomposition products: Toxic gases (such as sulfur dioxide, oxides of nitrogen, and carbon monoxide) may be released in a fire involving ANTU.
4. Special precautions: None

• Flammability

ANTU may burn, but it will not ignite readily.

1. Flash point: Not applicable
2. Autoignition temperature: Not applicable
3. Flammable limits in air: Not applicable
4. Extinguishant: Use dry chemical, carbon dioxide, Halon[®], water spray, or standard foam to fight small fires involving ANTU; use water spray, fog, or standard foam to fight large fires involving ANTU.

Fires involving ANTU should be fought upwind and from the maximum distance possible. Isolate the hazard area and

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deny access to unnecessary personnel. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Dikes should be used to contain fire-control water for later disposal. If a tank car or truck is involved in a fire, personnel should isolate an area of a half mile in all directions. Firefighters should wear a full set of protective clothing (including a self-contained breathing apparatus) when fighting fires involving ANTU. Firefighters' protective clothing may not provide protection against permeation by ANTU.

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for ANTU is 0.3 mg/m³ of air as an 8-hr time-weighted average (TWA) concentration [29 CFR 1910.1000, Table Z-1-A].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for ANTU of 0.3 mg/m³ as an 8-hr TWA [NIOSH 1992].

• ACGIH TLV[®]

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned ANTU a threshold limit value (TLV) of 0.3 mg/m³ as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1991b].

• Rationale for limits

The limits are based on the risk of pulmonary effects associated with exposure to ANTU.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to ANTU can occur through inhalation, ingestion, and eye or skin contact; by analogy with other thiourea products, percutaneous absorption of ANTU is likely.

• Summary of toxicology

1. *Effects on Animals:* ANTU causes pulmonary edema and pleural effusion in exposed animals. The toxicity of ANTU varies widely among different species of animals but is especially high in adult Norway rats [Hayes 1982]. The oral LD₅₀ is 6 mg/kg in rats and 4,250 mg/kg in monkeys [NIOSH 1991]. Sixty percent of rats fed a 35-mg/kg dose of ANTU died; their autopsies revealed interstitial pulmonary edema and pericardial effusions as well as mild liver damage [Proctor et al. 1988]. Rats given lethal doses of ANTU also showed increases in blood sugar, decreases in liver glycogen stores, decreased or absent urine output, and lesions of the kidney at autopsy [Gosselin et al. 1984]. After repeated

doses, animals developed a tolerance to the acute toxicity of ANTU [Proctor et al. 1988]. ANTU may have antithyroid properties when administered to animals in sublethal, chronic doses [Gosselin et al. 1984]. ANTU is mutagenic in several in vitro assay systems [Hayes 1982; NIOSH 1991]. Carcinogenicity bioassays in two strains of mice were negative [Hayes 1982].

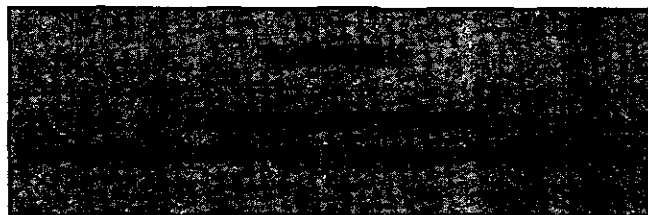
2. *Effects on Humans:* ANTU is believed to have caused bladder cancer in workers exposed during the application of ANTU-containing rodenticides; however, the causative agent in these cancers may have been β-naphthylamine, which was present in ANTU as an impurity [Orjelick 1975]. A total of 14 cases of urothelial tumors were reported [Davies et al. 1982]. When ingested, ANTU is probably not toxic to humans except in relatively large amounts; on the basis of the results of acute toxicity testing in monkeys, the mean lethal oral dose in humans is estimated to be 4 g/kg [Gosselin et al. 1984]. No reported cases have involved the ingestion of pure ANTU, but accidental or suicidal ingestions of ANTU in combination with other rat poisons have been reported. One man ingested 80 g of a rat poison that contained 30% ANTU and then drank a large amount of alcohol; he subsequently showed the following ANTU-related effects: vomiting, difficult breathing, cyanosis, and fluid in the lungs [Gosselin et al. 1984]. ANTU is reported to have caused contact eczema in one occupationally exposed worker [Hayes 1982]. Workers handling products containing thiourea (such as ANTU) have shown dermal absorption and destructive changes of the thyroid gland [ACGIH 1991a].

• Signs and symptoms of exposure

1. *Acute exposure:* Acute inhalation exposure may produce coughing, lung edema, dyspnea, trenchitis, or pneumonitis [NLM 1991]. Ingestion of ANTU can induce vomiting, difficult breathing, blueness of the skin and mucous membranes, and lung edema. Tissue contact can cause eye or skin irritation.

2. *Chronic exposure:* ANTU can cause blood or pus in the urine, pain on urination, and other signs and symptoms of bladder cancer. Hypothyroidism with weight gain, dryness of the skin, eczema, and bradycardia have also been associated with occupational exposure to ANTU.

• Emergency procedures



Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure: Immediately and thoroughly* flush the eyes with large amounts of water for at least 15 min, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* ANTU can be absorbed through the skin in lethal amounts. *Immediately* remove all contaminated clothing and *thoroughly* wash contaminated skin with soap and water for at least 15 min.

3. *Inhalation exposure:* If particulates or vapors, mists, or aerosols of ANTU are inhaled, move the victim to fresh air *immediately*. Have the victim blow his or her nose.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if ANTU or any material containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations involve ANTU and may result in worker exposures to this substance:

—Manufacture of ANTU

—Formulation and use of ANTU as a rodenticide to control the Norway rat

The following methods are effective in controlling worker exposures to ANTU, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.

4. Wadden RA, Scheff PA [1987]. *Engineering design for control of workplace hazards*. New York, NY: McGraw-Hill.

5. Plog BA [1988]. *Fundamentals of industrial hygiene*. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to ANTU, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the thyroid and adrenal glands, respiratory tract, liver, and bladder. Medical monitoring for respiratory disease should

be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to ANTU at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with chronic respiratory disease, hypothyroidism, other endocrine disease, chronic liver disease, or bladder disorders.

- **Periodic medical examinations and biological monitoring**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to ANTU exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of ANTU on the lungs, thyroid, adrenal gland, liver, and bladder. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for ANTU.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population. Because exposure to ANTU may cause diseases with long latencies, medical surveillance may need to be continued long after job termination.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne ANTU is determined by using a 37-mm, 1-micron polytetrafluoroethylene filter. Samples are collected at a maximum flow rate of 2.0 liters/min until a maximum air volume of 480 liters is collected. The samples are desorbed with methanol. Analysis is conducted by high-performance liquid chromatography using an ultraviolet light detector. The limit of detection for this procedure is 5 µg per sample. This method is described in Method No. S276 of the *NIOSH Manual of Analytical Methods* [NIOSH 1978].

PERSONAL HYGIENE

Because ANTU can be absorbed through the skin in toxic amounts, workers should dust off any solid ANTU from their skin, flush the affected areas immediately with plenty of water for 15 min, and then wash the area twice with soap and water.

Clothing and shoes contaminated with ANTU should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering contaminated clothing should be informed of the hazardous properties of ANTU, particularly its potential to be hazardous to the respiratory system, bladder, and endocrine system.

A worker who handles ANTU should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where ANTU or a solution containing ANTU is handled, processed, or stored.

STORAGE

ANTU should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of ANTU should be protected from physical damage and should be separated from strong oxidizers, heat, sparks, and open flame. Because empty containers may contain ANTU residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving ANTU, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete.

The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Ventilate the atmosphere to reduce the concentration of ANTU.
4. For small dry spills, use a clean shovel and place the material into a clean, dry container; cover and remove the container from the spill area.
5. Absorb small liquid spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.
6. For large liquid spills, build dikes far ahead of the spill to contain the ANTU for later disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether these requirements have been changed.

• Emergency planning requirements

If 10,000 lb or more of ANTU is present, the owner or operator must comply with EPA's emergency planning requirements [40 CFR 355.30]. If ANTU is in the form of a finely divided powder or is handled in solution or in molten form, the employer must comply with these requirements if 5,000 lb or more is present at the facility.

• Reportable quantity requirements for hazardous releases

A hazardous substance release is defined by EPA as any spilling, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous substances into the environment (including the abandonment or discarding of contaminated containers). In the event of a release that is greater than the reportable quantity for that chemical, employers are required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the proper Federal, State, and local authorities.

The reportable quantity for ANTU is 100 lb. If an amount equal to or greater than this quantity is released within a 24-hr period in a manner that will expose persons outside the facility, employers are required to do the following:

- Notify the National Response Center *immediately* at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].
- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].
- Notify the community emergency coordinator of the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

• Community right-to-know requirements

Employers are not required by Section 313 of the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of ANTU emitted or released from their facility annually.

• Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. ANTU is listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], and has been assigned EPA Hazardous Waste No. P072. This substance has been banned from land disposal and may be treated by incineration. ANTU may also be disposed of in an organometallic or organic lab pack that meets the requirements of 40 CFR 264.316 or 265.316.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

• Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of ANTU exceeds prescribed exposure limits. Respirators may be used

(1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

• Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective clothing should be worn to prevent any possibility of skin contact with ANTU. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to ANTU permeation; however, one source recommends polyethylene to protect against permeation by ANTU. Since specific test data are not available for ANTU, the information provided here should be considered as a guideline only. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to ANTU.

If ANTU is dissolved in an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which ANTU might contact the eyes (e.g., through dust particles or splashes of ANTU-containing solutions). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with ANTU.

Contact lenses should not be worn if the potential exists for ANTU exposure.

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