IPCS INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Health and Safety Guide No. 103

WHITE SPIRIT (STODDARD SOLVENT) HEALTH AND SAFETY GUIDE

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IPCS

Health and Safety Guide No. 103

WHITE SPIRIT (STODDARD SOLVENT) HEALTH AND SAFETY GUIDE

This is a companion volume to
Environmental Health Criteria 187: White Spirit

Published by the World Health Organization for the International Programme on Chemical Safety (a collaborative programme of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization) and produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals

WORLD HEALTH ORGANIZATION, GENEVA 1996

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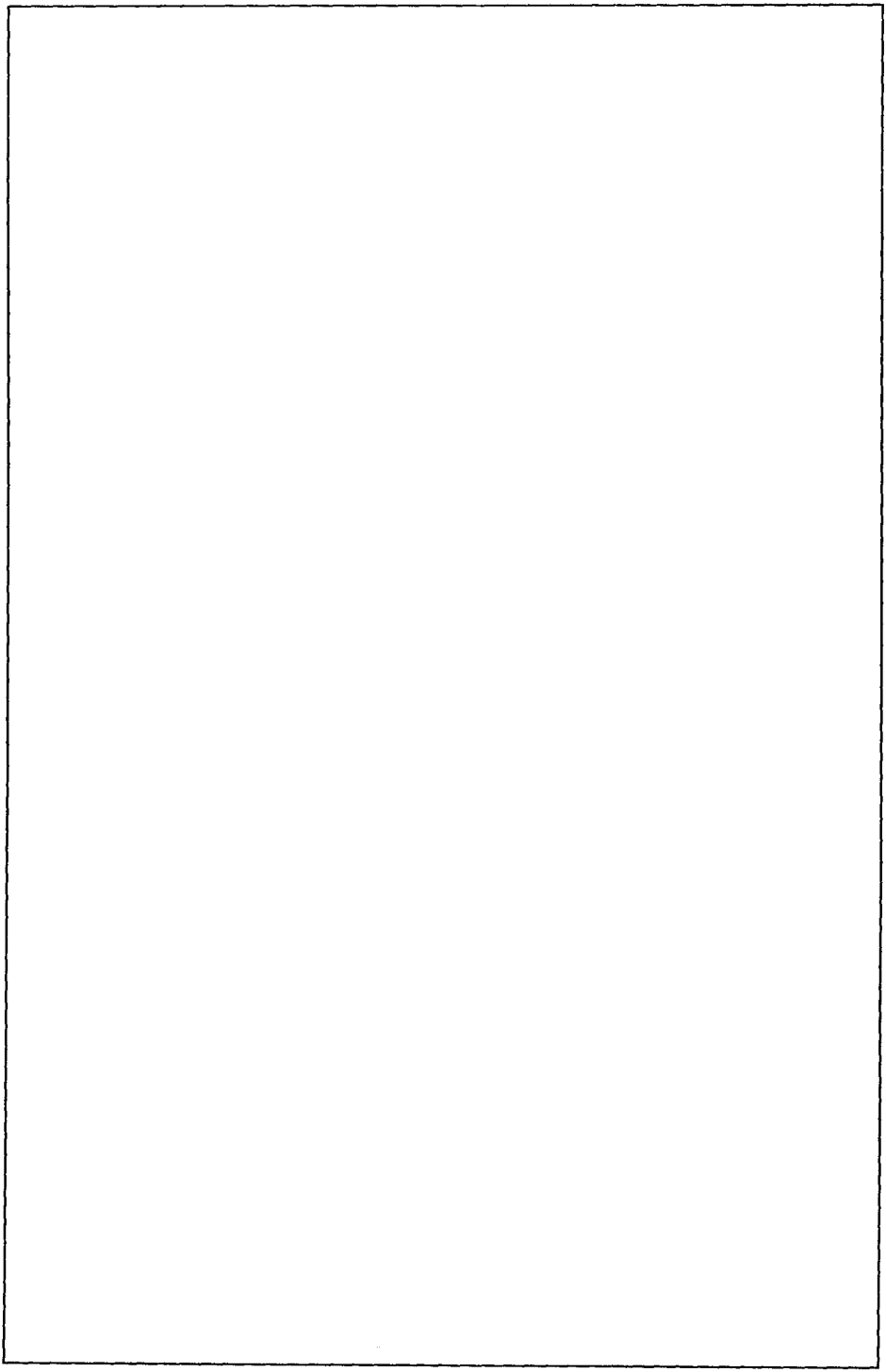

INTRODUCTION

The Environmental Health Criteria (EHC) monographs produced by the International Programme on Chemical Safety include an assessment of the effects on the environment and on human health of exposure to a chemical or combination of chemicals, or physical or biological agents. They also provide guidelines for setting exposure limits.

The purpose of a Health and Safety Guide is to facilitate the application of these guidelines in national chemical safety programmes. The first three sections of a Health and Safety Guide highlight the relevant technical information in the corresponding EHC. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. Within the Guide is a Summary of Chemical Safety Information which should be readily available, and should be clearly explained, to all who could come into contact with the chemical. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms. A bibliography has been included for readers who require further background information.

Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

The Director
International Programme on Chemical Safety
World Health Organization
1211 Geneva 27
Switzerland

THE INFORMATION IN THIS GUIDE SHOULD BE CONSIDERED AS A STARTING POINT TO A COMPREHENSIVE HEALTH AND SAFETY PROGRAMME

1. PRODUCT IDENTITY AND USES

1.1 Identity

Common names: white spirit, Stoddard solvent.

White spirit is a mixture of saturated aliphatic and alicyclic C_7 to C_{12} hydrocarbons with a maximum content of 25% of C_7 to C_{12} alkyl aromatic hydrocarbons.

Molecular formulae:

C_nH_{2n+2}	(*n*-alkanes and isoalkanes)[a]
C_nH_{2n}	(cycloalkanes)[a]
C_nH_{2n-6}	(aromatics), n > 6

Relative molecular mass:

150	(Approximate average value)
92-170	(for single constituents)

Common synonyms:

Lacknafta (Sweden); Lakkibensiini (Finland); Mineral Spirit; Mineral Turpentine; Mineralsk Terpentin (Denmark); Mineralterpentin (Sweden); Petroleum Spirits; Solvent Naphtha; Stoddard solvent; Terpentin (Denmark); Testbenzin (Germany); Turpentine Substitute.

Common trade name:

B.A.S.; C.A.S.; Clairsol; Dilutine; Exxsol; Halpasol; Hydrosol; Indusol; Sane; Kristalloel; Laws; Ragia; Sangajol; Shellsol; Solfina; Solnap; Solvesso; Spezialbenzin; Spirdane; Spraysol; Stoddard Solvent; Supersol; Terpentina; Tetrasol; Thersol; Varnolene; Varsol; W.S.; White Spirit.

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[a] Aliphatic alkanes are also known as "paraffins", while "naphthenes" is a commonly used term for cycloalkanes.

PRODUCT IDENTITY AND USES

CAS registry number:

8052-41-3	(Stoddard solvent);
64742-82-1	(white spirit type 1);
64741-92-0	(white spirit type 2);
64742-48-9	(white spirit type 3);
64742-88-7	(white spirit type 0).

Three different types and three different grades of white spirit exist. The type refers to whether the solvent has been subjected to hydro-desulfurization (removal of sulfur) alone (type 1), solvent extraction (type 2) or hydrogenation (type 3). Each type comprises three different grades: low flash grade, regular grade and high flash grade. The grade is determined by the crude oil used as the starting material and the conditions of distillation.

In addition there is type 0, which is defined as distillation fraction with no further treatment, consisting predominantly of saturated C_9 to C_{12} hydrocarbons with a boiling range of 140-200 °C.

A USA variety of type 1 is called Stoddard solvent. It is a petroleum distillate defined according to its boiling range of 149-204 °C and the absence of rancid or objectionable odours.

1.2 Physical and chemical properties

White spirit is a clear, colourless, non-viscous solvent with a characteristic odour. Other properties are given in Table 1.

Conversion factors (at 25 °C and normal atmospheric pressure):

1 ppm = 5.25 to 6.0 mg/m^3
1 mg/m^3 = 0.17 to 0.19 ppm

1.3 Analytical methods

Sampling of air for white spirit may be performed by the use of gas pipettes or flexible bags. Alternatively, white spirit vapour can be trapped on charcoal tubes.

Table 1. Physical properties of white spirit

	Low flash	Regular	High flash
Initial boiling point (IBP) (°C)	130-144	145-174	175-200
Final boiling point (°C)		IBP + 21, max. 220	
Average relative molecular mass	140	150	160
Relative density (15°C)	0.765	0.780	0.795
Flash point (°C)	21-30	31-54	≥ 55
Vapour pressure (kPa, 20°C)	1.4	0.6	0.1
Volatility (*n*-butyl acetate = 1)	0.47	0.15	0.04
Autoignition temperature (°C)	240	240	230
Explosion limits (% by volume in air)	0.6-6.5	0.6-6.5	0.6-8
Vapour density (air = 1)	4.5-5	4.5-5	4.5-5
Refractive index (at 20 °C)	1.41-1.44	1.41-1.44	1.41-1.44
Viscosity (cps, 25 °C)	0.74-1.65	0.74-1.65	0.74-1.65
Solubility (% by weight in water)	< 0.1	< 0.1	< 0.1
Kauri-butanol value	29-33	29-33	29-33
Aniline point (°C)	60-75	60-75	60-75
Reactivity		reaction with strong oxidizing agents	
Odour threshold (mg/m³)		0.5-5	4

Analytical measurements in air may be conducted by directly reading infrared instruments, which yield quantitative results of total content of hydrocarbons. Qualitative results can be obtained by gas chromatographic separation of the sample and detection by flame ionization or mass spectrometry.

1.4 Production and uses

In 1985 the total amount of the various white spirit solvent produced in the USA was 922 000 tonnes. This was made up of odourless white spirit (236 000 tonnes), Stoddard solvent (324 000 tonnes) and 140 Flash solvent (326 000 tonnes).

White spirit is used as an extraction solvent, as a cleaning solvent, as a degreasing solvent and as a solvent in aerosols, paints, wood preservatives, lacquers, varnishes and asphalt products. In western Europe about 60% of the total white spirit consumption is used in paints, lacquers and varnishes. White spirit is the most widely used solvent in the paint industry.

2. SUMMARY AND EVALUATION

2.1 Environmental transport, distribution and transformation

The environmental transport and transformation of white spirit constituents will depend on the physico-chemical and biological properties of the constituents. The lower molecular weight alkanes and aromatics tend to volatilize and undergo photodegradation in the atmosphere. The higher molecular weight alkanes and cycloalkanes tend to be sorbed to organic matter in soil or water. Biodegradation is expected to be the primary fate of white spirit in soil and water. Biodegradation of C_7 to C_{12} hydrocarbons is expected to be significant under environmental conditions favourable to microbial oxidation. Ready biodegradability has been demonstrated in laboratory tests using sewage sludge. The low water solubility and moderate vapour pressure of white spirit suggest that volatilization and subsequent photooxidation are important for abiotic degradation. Reported octanol/water partition coefficients (log P_{ow}) of 3.5 to 6.4 indicate a moderate potential for bioaccumulation. However, the degradability and lowered bioavailability following sorption would reduce the likelihood of bioconcentration in the field.

2.2 Environmental levels and human exposure

There are few data on white spirit in air, water or soil. Monitoring at a site contaminated with spilt white spirit (Stoddard solvent) revealed soil levels of up to 3600 mg/kg and deep soil water levels of up to 500 mg/litre. Biodegradation led to a 90% reduction in soil concentration over a 4-month period following remediation.

Humans are predominantly exposed to white spirit through the inhalation of vapour. The general population is exposed during the domestic use of paints and lacquers containing white spirit. Mean exposure concentrations during amateur painting have not been estimated but would be expected to be similar to those encountered by professionals. Exposure concentrations for humans in recently painted rooms would be expected to be lower, but no estimated values are available. Occupationally exposed humans would be exposed to similar concentrations during house painting. Spray-painting could lead to higher exposures and exposure to aerosols. An 8-h average exposure level of 150-240 mg/m^3 has been estimated for painters in ventilated rooms. Peak concentrations in closed or poorly ventilated rooms may be as high as 6200 mg/m^3, particularly at high temperatures.

Vehicle washers using products containing white spirit showed measured time-weighted average (TWA) exposures ranging from 5 to 465 mg/m^3 for automobiles and 45 to 805 mg/m^3 for heavy vehicles. TWA measurements of between 90 and 210 mg/m^3 were made in dry cleaning plants using white spirit (Stoddard solvent). The highest reported exposure concentration was for workers in airline hangars, with a short-term value of up to 8860 mg/m^3.

2.3 Kinetics and metabolism

White spirit vapour is readily absorbed by inhalation. In humans 59% of the aliphatic and alicyclic hydrocarbons and 70% of the aromatic hydrocarbons were absorbed at a white spirit vapour level of 1000 mg/m^3. The hydrocarbons are distributed from blood to other tissues, and a human fat:blood partition coefficient of 47 has been calculated. White spirit is widely distributed throughout the body in humans. Experiments performed with single hydrocarbon exposure to rats revealed higher brain:blood partition ratios for aliphatics and alicyclics than for aromatic hydrocarbons.

White spirit is eliminated from the blood in a biphasic manner after exposure. After an initial and very short distribution phase with rapid elimination from the blood, a long phase with a considerably slower elimination (half-life of about 46 h) follows. Thus, white spirit has been detected in blood 66 h after a single inhalation exposure. The half-life in adipose tissue has been estimated to be 46-48 h.

Only sparse data on elimination and metabolism of white spirit exist, but urinary excretion of metabolites and elimination of parent compounds through expiration have been demonstrated in humans.

2.4 Effects on laboratory animals and *in vitro* systems

White spirit possesses low acute toxicity for mammals. Thus an LC_{50} for rats was not achieved with 8-h exposure to 8200 mg/m^3 (1400 ppm). In a group of four cats, all were killed at 10 000 mg/m^3 (vapour and aerosols). The general signs were irritation, loss of coordination, tremor and clonic spasms. No mortality was found after oral administration (gavage) of 5000 mg/kg to rats. In rabbits loss of appetite and hypoactivity followed a single dermal exposure of 2000-3000 mg/kg, and death occurred in 1 out of 16 exposed animals.

SUMMARY AND EVALUATION

In skin irritation tests white spirit was determined to be a slight to moderate irritant.

In short- and long-term toxicity studies on white spirit, the central nervous system (CNS), respiratory system, liver and kidney were generally found to be the target of white spirit toxicity.

Irritation of the respiratory tract has been observed following inhalation exposure, and histopathological signs from irritation have been observed in rats exposed nose-only to 4-h exposures for 4 days at 214 mg/m^3.

Guinea-pigs were the most sensitive of five species tested with long-term exposure. There was increased mortality following 90 days of continuous exposure to levels of 363 mg/m^3 or more. During postmortem examinations pulmonary irritation was found.

Rats exposed to 4800 mg/m^3, 8 h daily, for 26 weeks exhibited reduced nerve conduction velocity in the tail axon. Neurobehavioural tests indicated only mild effects and only immediately after a daily exposure.

Rats exposed to 2290 and 4580 mg/m^3, 6 h daily, for 3 weeks or 6 months were found to develop increases in the levels of catecholamines and serotonin in the brain and reduced protein content in synaptosomes isolated from the animals. No effects were noted in neurobehavioural tests.

Neurophysiological recordings have shown changes in sensory evoked potentials in the brain of rats measured 2 months after a 6-month period of exposure to either 2339 or 4679 mg/m^3 (400 or 800 ppm) of dearomatized white spirit. Three weeks of exposure to this solvent also resulted in increased levels of reactive oxygen species in brain tissue from the rats.

In several inhalation studies, male rats developed the so-called "α_2-microglobulin nephropathy".

Repeated dermal exposure of rabbits caused reduction in weight gain and liver toxicity at dose levels of 2000 mg/kg, given 3 times weekly for 4 weeks.

There have been three developmental toxicity studies, all of which reported essentially negative findings. However, insufficient data are available for a comprehensive assessment.

White spirit was not found to be genotoxic in assays using *Salmonella typhimurium* and *Saccharomyces cerevisiae*, a mouse lymphoma mutation assay, mouse and rat bone marrow cytogenic tests, and rodent (rat and mouse) dominant lethal tests.

No carcinogenicity studies have been performed with experimental animals exposed to white spirit. Related heavier and lighter refinery distillation streams such as kerosene, straight-run and light straight-run naphtha have induced skin tumours in mice after 80 weeks of skin application.

2.5 Effects on humans

The odour threshold of white spirit is quite low, and vapours can be detected at levels of 0.5-5 mg/m^3. Tolerance of the odour may be developed.

Eye irritation has been reported in connection with acute exposure down to a level of 600 mg/m^3 (100 ppm). At higher levels respiratory irritation and more pronounced eye irritation occur. Acute CNS symptoms such as headache, drunkenness, dizziness and fatigue have been reported in several cases of occupational exposure.

Controlled 7-h exposure to levels of 600 mg/m^3 or more resulted in impaired balance during walking and to an increased reaction time. Exposure to 4000 mg/m^3 for 50 min resulted in impaired performance in tests for perceptual speed and short-term memory.

One case of cyanosis, apnoea and cardiac arrest after excessive inhalation exposure during painting has been reported.

Ingestion of white spirit has been reported to produce gastrointestinal irritation with pain, vomiting and diarrhoea. Lesions of the mucous membranes in the oesophagus and the gastrointestinal tract followed the oral exposure.

Due to its low viscosity and low surface tension, white spirit poses a risk of aspiration into the lungs following oral exposure. A few ml of solvent aspirated into the lungs is able to produce serious bronchopneumonia and 10-30 ml may be fatal.

SUMMARY AND EVALUATION

Prolonged dermal exposure to white spirit, e.g., resulting from wearing clothes that have been soaked or moistened by white spirit for hours, may produce irritation and dermatitis.

Single cases of acute toxicity to the kidney, liver and bone marrow have been reported following exposure to white spirit at high levels. However, owing to lack of details and the sporadic nature of the reportings, the relevance of these findings is unclear.

There have been few reports concerning the haematological or biochemical effects of white spirit. However, clinical studies reveal decreased erythrocyte, leukocyte and platelet counts, and increased mean corpuscular volume in exposed workers. Similar haematological changes have been observed in animal studies. There are no consistent serum biochemical changes; reduced aspartate aminotransferase and lactate dehydrogenase activity and elevated creatinine kinase activity have been observed.

Numerous epidemiological studies have been performed involving painters with long-term exposure to white spirit. Increased incidence of complaints of memory impairment, fatigue, impaired concentration, irritability, dizziness, headache, anxiety and apathy have been demonstrated in several cross-sectional studies. Studies including neuropsychological tests have shown impaired ability in performing some of the tests. In some studies an overall reduction in cognitive functioning was noted to a degree that corresponded to a diagnosis of chronic toxic encephalopathy. In a few studies a dose-response relationship was established. This was the case in a comprehensive study in which painters predominantly exposed to white spirit were compared with non-exposed bricklayers. Painters with low solvent exposure were comparable to non-exposed bricklayers with regard to neuropsychological test results. However, the prevalence of impaired functioning increased with increasing exposure in the groups of painters with medium and high exposure.

Similar complaints and neuropsychological test results, although more severe, were reported from clinical studies in which painters predominantly exposed to white spirit had been referred to occupational medical clinics for detailed examinations because of health complaints and suspected chronic toxic encephalopathy due to the long-term solvent exposure.

In case-control studies, increased odds ratios for the award of disability pension because of mental disturbances were found for painters compared to other occupational groups not exposed to white spirit or other solvents.

Several case-control studies have shown a high risk of glomerulonephritis among painters. Even though cross-sectional studies using early markers of nephropathy were inconclusive, they are consistent with the hypothesis that painters have an increased risk of glomerulonephritis and renal dysfunction.

Several minor studies concerning reproductive effects in humans have been undertaken. In one of the most extensive studies, reproductive parameters were compared between members of a union for painters and members of a union for electricians. No firm conclusion in this or in the other studies could be drawn as no significant differences occurred. Nevertheless, there is a suggestion that parental exposure to solvents may have an untoward effect on the offspring. However, there is no adequately reported information directly related to white spirit.

Few epidemiological studies of cancer in humans exposed solely to white spirit are available. Increased risks of respiratory, pancreatic and kidney cancer have been reported in three studies on dry cleaners where white spirit was the predominant cleaning solvent. For painters, an occupational group widely exposed to white spirit, evidence has been found of increased cancer risks, particularly in the lung and bladder.

There was no increase in sister-chromatid exchange in a group of painters with long-term solvent exposure. However, there were some small increases in cytogenetic damage in a small number of humans exposed mainly to petroleum vapours.

2.6 Effects on other organisms in the laboratory and field

Few studies on the toxicity of white spirit to organisms other than laboratory mammals have been reported.

Reports of inhibitory effects on growth of the fungus *Aspergillus niger* have been made, although concentrations of the white spirit in the growth medium were difficult to assess. No effects were found on mycorrhizal fungi

in a single study. Increased oxygen uptake by excised plant root tips has been reported; the significance of this finding is doubtful for actual exposure in the field.

The few studies on the aquatic toxicity of white spirit and related hydrocarbon mixtures indicate moderate toxicity to freshwater and marine organisms. The toxicity is probably due to the dissolved fraction and leads to 96-h LC_{50} values of the order of 0.5 to 5.0 mg/litre.

These results are likely to overestimate the effects of white spirit in the field, given its volatility and lowered bioavailability following sorption to soil/sediment.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

White spirit has low acute toxicity by inhalation, dermal and oral routes. However, acute exposure can lead to central nervous system (CNS) depression resulting in lack of coordination and slowed reactions. Exposure to very high concentrations in enclosed spaces can lead to narcotic effects and loss of consciousness. Oral ingestion presents a high aspiration hazard. Prolonged or repeated skin exposure can result in severe irritant dermatitis.

Exposure to an average white spirit concentration of 240 mg/m^3 (40 ppm) for more than 13 years could lead to chronic CNS effects. White spirit is implicated in the development of "chronic toxic encephalopathy" among house painters.

Owing to the volatility and low bioavailability of its constituents, white spirit, although it is moderately toxic to aquatic organisms, is unlikely to present significant hazards to the environment.

3.2 Recommendations

a) In order to reduce exposure concentrations for the general public and the occupationally exposed, paints based on white spirit should only be used in adequately ventilated areas.

b) All practicable methods should be used to minimize exposure of indoor painters to white spirit. Greater use should be made of water-based and other paints.

4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1 Human health hazards, prevention and protection, first aid

The human health effects associated with exposure to white spirit are summarized in section 2.5. They are also listed in the Summary of Chemical Safety Information (section 6), along with preventive and protective measures and first-aid recommendations.

4.1.1 *Advice to physicians*

Exposure to high vapour concentrations can lead to headache, dizziness and fatigue. CNS depression may result in lack of coordination and extended response time. Chest pain, cyanosis, apnoea and cardiac arrest have been reported.

If white spirit is swallowed, droplets can enter the lungs and cause pneumonitis. Symptoms usually take several hours to become apparent and are aggravated by physical effort. Rest and observation are therefore essential.

Following ingestion, vomiting should not be induced, because of the danger of aspiration into the lungs. Gastric lavage should only be given when aspiration into the lungs can be avoided by the use of a cuffed endotracheal tube.

4.1.2 *Health surveillance advice*

Depending on the extent of exposure, regular medical check-ups are advisable. Emphasis should be placed on examination of the central nervous system function. However the skin should also be examined since white spirit is a defatting agent and can cause dermatitis on prolonged exposure.

Since white spirit may cause liver damage, a profile of liver function should be obtained. Urinalysis should also be undertaken as the kidneys may be affected by white spirit. A complete blood count should be performed.

4.2 Explosion and fire hazards

White spirit is flammable and presents a moderate fire and explosion risk, especially when exposed to heat or flame. Depending on the grade, the flashpoint can lie between 21 and 55°C or higher. Combustion results in the formation of carbon monoxide. White spirit forms explosive air-vapour mixtures above 21°C.

Adequate ventilation should be provided and smoking prohibited. Sealed machinery and explosion-proof electrical equipment should be used.

Fire extinguishers containing powder, foam or carbon dioxide are recommended. Containers should be kept cool by spraying with water.

4.3 Storage

White spirit should be stored in a well-ventilated cool area in tightly closed fire-resistant clearly labelled containers. It should be kept away from strong oxidants. No smoking should be allowed within the storage area.

4.4 Transport

Containers should be in good condition and properly labelled, and should be kept in a well-ventilated place, away from sources of ignition. Transport should comply with national and international requirements regarding the transport of flammable material.

4.5 Spillage and disposal

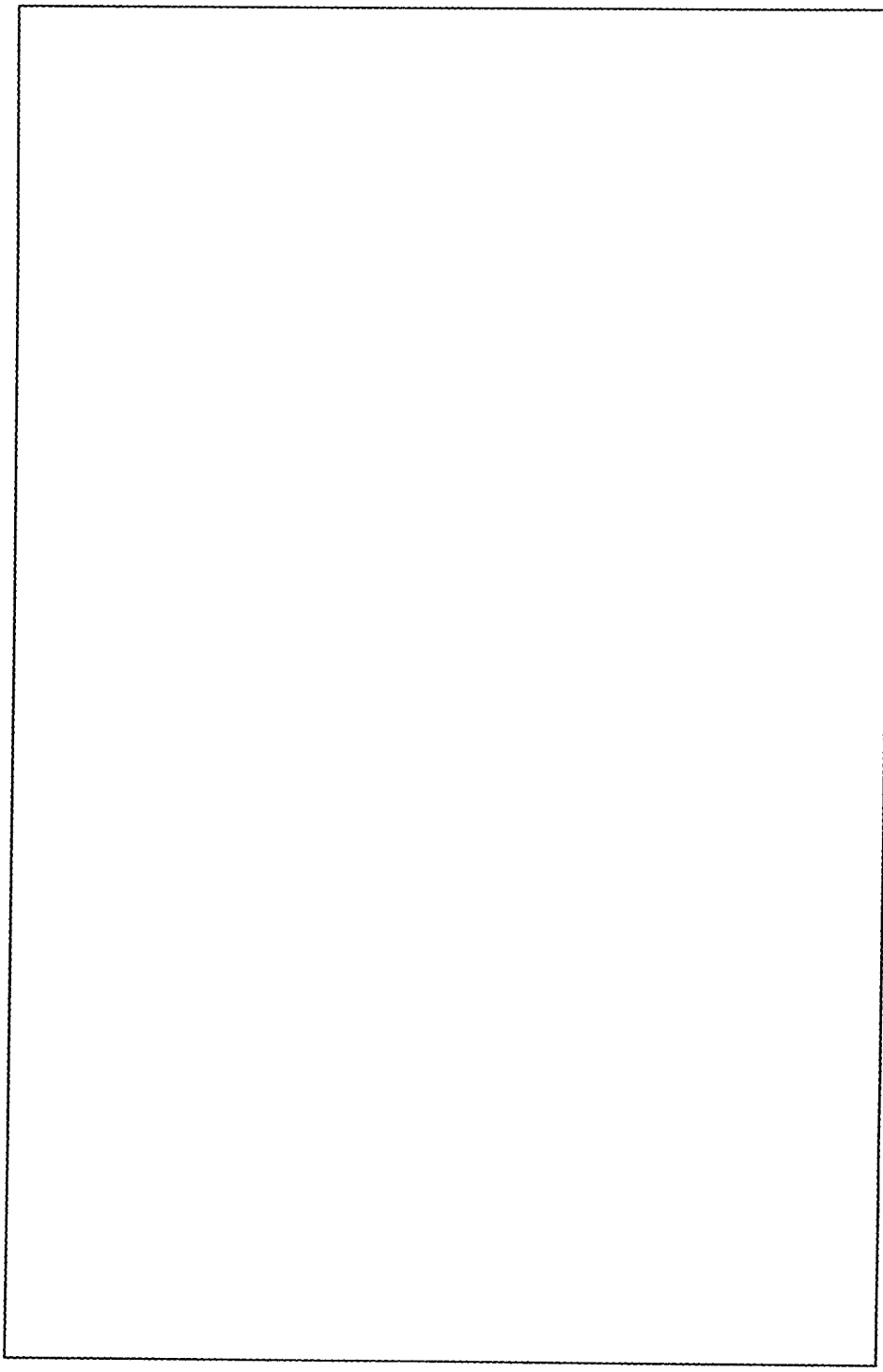
In the event of spillage, naked flames, sparks and heat should be avoided. Protective clothing should be worn. Leaking liquid should be collected in a sealable container. Spilled liquid should be absorbed in sand or other inert absorbent and removed to a safe place. White spirit should not be allowed to enter a sewer because of the possibility of an explosion. If it has entered drains, the local authorities should be informed.

The International Register of Potentially Toxic Chemicals recommends disposal of turpentine as follows: "Spray into a furnace. Incineration will become easier by mixing with a more flammable solvent".

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

Only as a result of spillage are substantial amounts of white spirit likely to be found in the environment. However, most of the constituent compounds evaporate fairly rapidly. The less volatile constituents partition to soil and sediment; this lowers the bioavailability and reduces the uptake by organisms.

White spirit is moderately toxic to aquatic organisms. There is moderate potential for bioaccumulation but the tendency for bioconcentration is probably low.



6. SUMMARY OF CHEMICAL SAFETY INFORMATION

This summary should be easily available to all health workers concerned with, and users of, white spirit. It should be displayed at, or near, entrances to areas where there is potential exposure to white spirit and on processing equipment and containers. The summary should be translated into the appropriate language(s). All persons potentially exposed to the chemical should also have the instructions in the summary clearly explained.

Space is available for insertion of the National Occupational Exposure Limit, the address and telephone number of the National Poison Control Centre, and local trade names.

SUMMARY OF CHEMICAL SAFETY INFORMATION

WHITE SPIRIT (STODDARD SOLVENT)

CAS registry numbers:
64742-82-1 (white spirit type 1)
64741-92-0 (white spirit type 2)
64742-48-9 (white spirit type 3)
64742-88-7 (white spirit type 0)
8052-41-3 (stoddard solvent)

PHYSICAL PROPERTIES	(Regular grade)	OTHER CHARACTERISTICS
Relative molecular mass	150	Clear colourless liquid with a characteristic odour (odour threshold=0.5-5 mg/m^3); reacts with strong oxidants causing fire and explosion hazards; attacks some forms of plastics, rubber and coatings
Initial boiling point (°C)	145-174	
Flash point (°C)	31-54	
Autoignition temperature (°C)	240	
Explosive limits (% volume in air)	0.6-6.5	
Relative density (15 °C)	0.78	
Relative vapour density	4.5-5	
Vapour pressure (Pa at 20°C)	600	
Volatility (*n*-butyl acetate=1)	0.15	
Refractive index (20°C)	1.41-1.44	
Viscosity (cps at 25°C)	0.74-1.65	
Solubility in water (% by weight)	< 0.1	

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
EYES: Redness, irritation	Wear safety goggles	Rinse with plenty of water for at least 15 minutes (remove contact lenses if possible); obtain medical attention
SKIN: Dry rough skin with small cracks; defatting; possibility of severe irritant dermatitis	Avoid skin contact; wear protective clothing and gloves	Remove contaminated clothes; wash skin with soap and plenty of water
INHALATION: Headache, nausea, fatigue, pulmonary irritation, dizziness, confusion, slowed reactions, unconsciousness	Ventilation, local exhaust or breathing protection	Fresh air, rest, artificial respiration if necessary; obtain medical attention
INGESTION: Sore throat, cough, headache, nausea, vomiting, dizziness, drowsiness, gastrointestinal irritation, diarrhoea; aspiration in lungs can cause chemical pneumonitis and be fatal	Do not eat, drink or smoke during work	Rinse mouth; do NOT induce vomiting; obtain medical attention immediately

SPILLAGE	STORAGE	FIRE AND EXPLOSION
Ventilate area; collect leaking and spilled liquid in sealable containers as far as possible, absorb remaining liquid in sand or other inert absorbent and remove to safe place	Keep in fire-proof place, separate from strong oxidants	Flammable; explosive vapour/air mixtures may be formed; in case of fire, keep containers cool by spraying with water; use powder, foam or carbon dioxide to extinguish fire

WASTE DISPOSAL	NATIONAL INFORMATION	LABELLING
Incinerate	National occupational exposure limit: National Poison Control Centre: Local trade names:	United Nations Hazard Class: 3

7. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The information given in this section has been extracted from the International Register of Potentially Toxic Chemicals (IRPTC) legal file. A full reference to the original national document from which the information was extracted can be obtained from IRPTC. When no effective date appears in the IRPTC legal file, the year of the reference from which the data are taken is indicated by (r).

The reader should be aware that regulatory decisions about chemicals taken in a certain country can only be fully understood in the framework of the legislation of the country. Furthermore, the regulations and guidelines of all countries are subject to change and should always be verified with appropriate regulatory authorities before application.

7.1 Previous evaluations by international bodies

IPCS (1982) evaluated petroleum solvents, including white spirit, and drew attention to acute CNS effects (narcosis) resulting from accidental inhalation of very high vapour concentrations and to feelings of ill health resulting from excessive chronic exposure.

In 1986 the Nordic Expert Group for Documentation of Occupational Exposure Limits concluded that the critical effects of white spirit are irritation of the eyes and mucous membranes, and acute and chronic CNS effects. It also noted that the risk of developing chronic toxic encephalopathy following long-term exposure should be considered.

The International Agency for Research on Cancer evaluated certain petroleum solvents, including white spirit, in 1989 and found these solvents not classifiable with respect to their carcinogenicity to humans (Group 3). There was inadequate evidence for carcinogenicity in humans and no experimental animal data on white spirit were available (IARC 1989).

In 1994 the European Union classified white spirit, owing to the aspiration risk, as harmful (Xn) and attached the risk phrase R22 (harmful if swallowed). This phrase may soon be replaced by phrase R65 (harmful, it may cause lung damage if swallowed).

7.2 Exposure limit values

Some exposure limit values are given in the table on page 28.

7.3 Labelling, packaging and transport

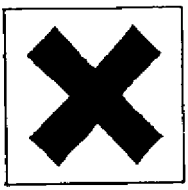
The International Maritime Organization classified white spirit as a category B substance, "a substance which is bioaccumulated with a short retention time of the order of one week or less, or which is liable to produce a tainting of sea food, or which is moderately toxic to aquatic life. Discharge into the sea of white spirit, of ballast water, tank washings or other residues or mixtures containing white spirit shall be prohibited except where specific conditions are satisfied".

The United Nations Committee of Experts on the Transport of Dangerous Goods classified white spirit (turpentine substitute) as a flammable liquid (Hazard Class 3). It adds the following special provision:

"Packing Group according to grouping criteria for flammable liquids. Substances not meeting the criteria of Packing Group I, II or III are considered non-dangerous provided they do not meet the definition of any other class or division".

European Economic Community legislation requires white spirit (Stoddard solvent) to be labelled as a harmful substance, using the symbol Xn.

Xn



Harmful

The following label statements are required:

R 10 Flammable
R 22 Harmful if swallowed
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
S 53 Avoid exposure - obtain special instructions before use

CURRENT REGULATIONS, GUIDELINES AND STANDARDS

EXPOSURE LIMIT VALUES

Medium	Specification	Country	Exposure limit description	Value	Effective date
AIR	Occupational	Argentina	Maximum permissible concentration (MPC) - Time-weighted average (TWA)	 525 mg/m^3	1991
		Australia	Threshold limit value (TLV) - Time-weighted average (TWA)	 790 mg/m^3	1991(r)
		Belgium	Threshold limit value (TLV) - Time-weighted average (TWA)	 525 mg/m^3	1991(r)
		Canada	Threshold limit value (TLV) - Time-weighted average (TWA) - Short-term exposure limit (STEL)	 525 mg/m^3 1050 mg/m^3	1991
		Denmark	Threshold limit value (TLV) - Time-weighted average (TWA)	 145 mg/m^3	1994
		Mexico	Threshold limit value - Time-weighted average (TWA)	 525 mg/m^3	1991
		USA (ACGIH)	Threshold limit value (TLV) - Time-weighted average (TWA)	 525 mg/m^3	1991
		USA (OSHA)	Permissible exposure limit (PEL) - Time-weighted average (TWA)	 525 mg/m^3	1989
		USA (NIOSH)	Recommended exposure limit (REL) - Time-weighted average (TWA) - Ceiling value (15 min.)	 350 mg/m^3 1800 mg/m^3	1977

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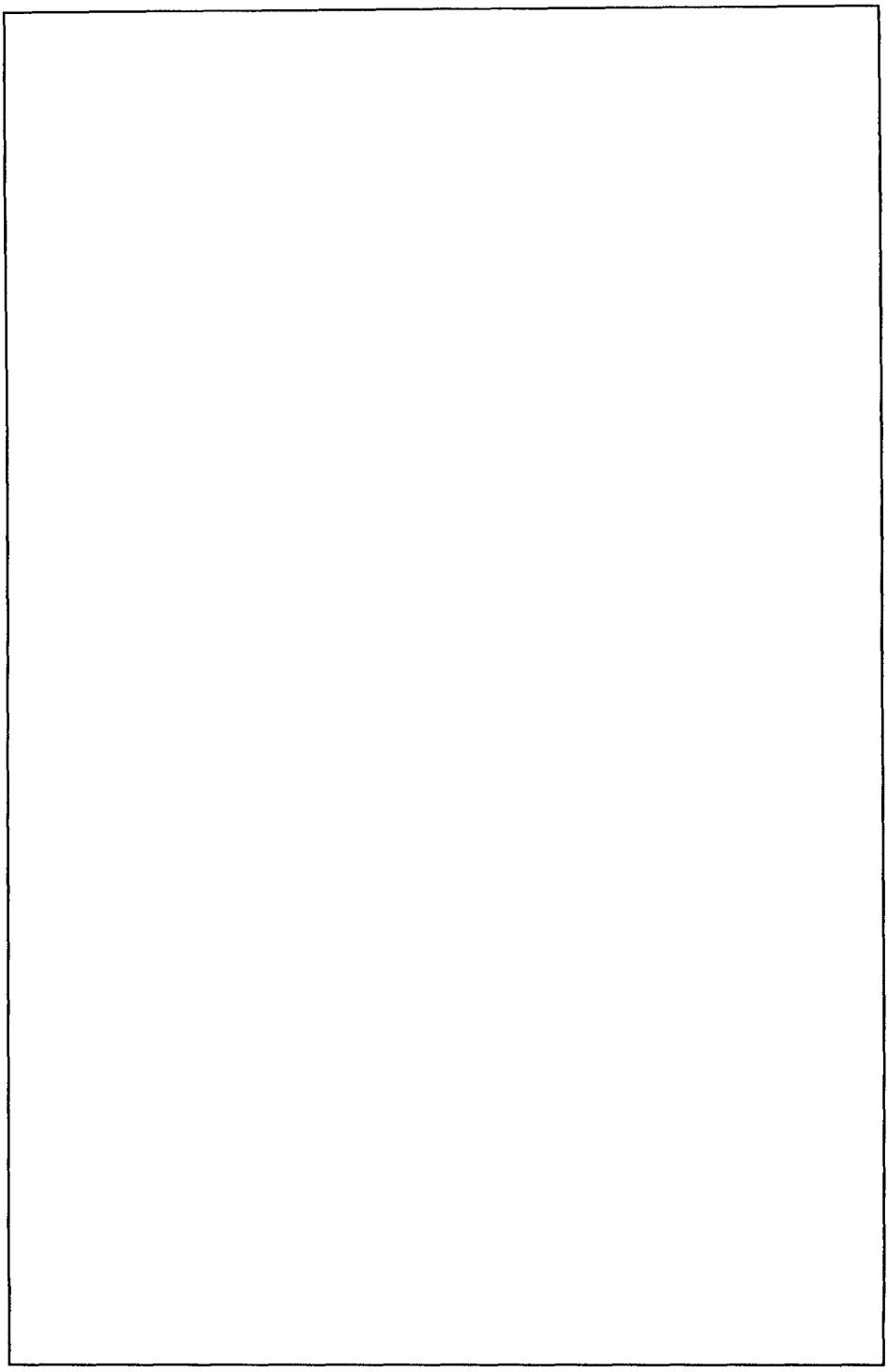

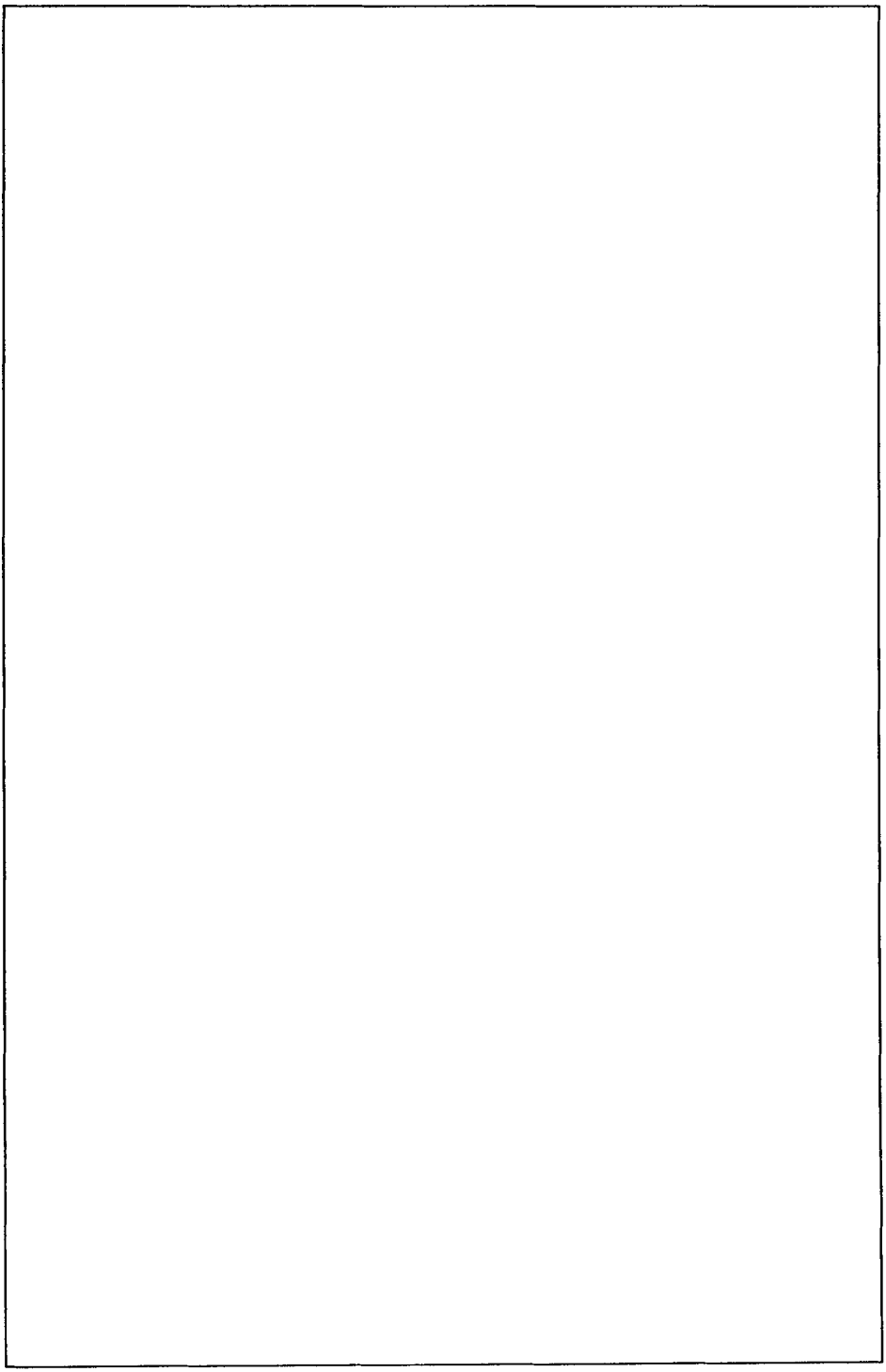

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