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Dental woes

Amalgam used in tooth fillings is causing great pain in terms of sick days and medical examinations.

A randomly selected group of 1,000 people were surveyed by two Swedish researchers, Per Erik Falk and Paula Liukkonen. 29 per cent of people had sought medical advice for their amalgam complaints. As many people had had their fillings replaced.

Of those who became sick from amalgam, 14 per cent had stayed away from work some time during the past year.

Another study by the Uppsala county council has established that the use of mercury amalgam in dental practices results in pollution of both the work environment inside the practice and the general environment. Short peaks of mercury fumes were detected in the atmosphere during dental work. The peaks measured 171 micrograms per cubic metre. The Swedish exposure limit is 50 micrograms (same as Australia).

Dental personnel complained more of headaches, skin rashes, fatigue and head-colds than a reference group.



Source: Eva Ekelöf, Arbetsmiljö 7/1993 p15



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Before you don the mask...



Wearing a respirator is not your first choice

It's not even the second choice. In fact, there are many measures you can take before having to don a respirator.

Alternative process methods

- Mechanical handling
- Automation

Substitution

- Replace the hazardous chemical with a harmless one

Plant layout and construction

- Isolate the hazard from the workers
- Remote control
- Ducting
- Pipelines
- Enclosures

Local exhaust ventilation

- Chemical fume hoods
- Air duct system
- Air cleaning/filtering system
- Exhaust fans
- Point exhausts
- Floor exhaust/suction

Air replacement ventilation

- High power general ventilation systems

Air dilution ventilation

- Work outdoors (only if safe)

Dust suppression

- Dust control by keeping dust wet (be aware of electrical safety)

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Source: Worksafe Australia Guide to Atmospheric Contaminants, AGPS, Canberra 1989; C E Colton, L R Birkner, L M Brosseau: "Respiratory Protection", AIHA, Fairfax, Virginia 1993

Is asphalt fume hazardous?

Two main types of fumes occur in road paving work: hot bitumen and diesel oil. A further concern is the exhaust from the road machines.

Bitumen is the binding agent in asphalt. When the asphalt is heated, irritating bitumen fumes are released.

Diesel oil is used to make handling easier; it serves to unclog the asphalt so that it doesn't stick to machinery and tools.

The smoke has an irritating effect on the mucous membranes in the body. Eyes become red and itchy, the throat uncomfortable. Road workers often complain of coughing, fatigue, nausea and dizziness. These symptoms disappear when the person is removed from the road fumes.

Several studies have shown a slightly higher occurrence of lung cancer and gastric cancer in road workers, but those affected have usually been exposed to tar-mixes with higher concentrations of polycyclic aromatic hydrocarbons such as benzopyrene, which is a strong carcinogen. These tar-mixes were discontinued in 1970, and are no longer used. Modern asphalt is considered to be of low cancer risk.

The Nynäs company is developing a type of cold asphalt which will eliminate the fumes and smoke (see PPM 1/93 — "Cool Asphalt"). The drawbacks are a weaker road surface, and asphalt that is harder to work with.

The Swedish Government Employees' Union regards the surrounding traffic as the biggest health problem for road workers.

A safety engineer from the construction workers health organisation in Norrköping, Arne Andersson, gives three pieces of advice to minimise irritating fumes during road work:

- **Keep the temperature as low as possible — around 160 degrees. Every 10—15 degrees higher temperature results in a doubling of the fumes.**
- **Use as little diesel as possible, or replace diesel with other unclogging agents. One litre of diesel generates as much smoke as a tonne of asphalt. The**

**Education is good
Understanding is better!**

pollutants in asphalt fume are two-thirds diesel.

- **Rotate workers. Many of the functions create strain or discomfort on a particular body area. By swapping work duties, some repeat strain could be avoided.**



Source: Eva Berlin, Arbetsmiljö 7/1993 p32

Handy Hints



LET'S NOT TWIST AGAIN!

...and save your back.

How to design, fill out and read a Material Safety Data Sheet

SUPPLIER INFORMATION:

Company
Address
Telephone number
Emergency telephone number (preferably 24-hour line)

IDENTIFICATION OF CHEMICAL

Product name as it appears on the label
Trade name(s)
Chemical name
Other names
Manufacturer's product code or any other codes used to identify the chemical
UN number
CAS number
Dangerous goods class
Hazchem code
Poisons schedule

Uses and locations: *Various uses of the chemical and, if applicable, the locations where it is used*

Physical description: *Note: Description should relate to the PRODUCT (mixture etc.), not its individual constituents*
Appearance (liquid/gas/solid/dust/fibres/crystal etc)
Colour
Odour
Volatility

Chemical properties: *Note: Description should relate to the PRODUCT (mixture etc.), not its individual constituents*
Solubility in water
Boiling/melting point in °C
Vapour pressure in mm Hg at 25°C
Per cent volatiles at 25°C
Specific gravity
Flash point in °C (indicate open or closed cup method)
Flammability (or explosion) limit %
Auto-ignition temperature in °C
Incompatibilities (e.g. forms explosive mix with air; releases hydrogen in contact with water etc)
Other properties (e.g. gas heavier than air—gathers in low areas; could ignite when shaken etc.)

Ingredients: *All hazardous chemical ingredients in the product, along with CAS numbers*

Proportions: *Actual proportions, along with high-medium-low values (high >60%; Medium 10%—60%; Low <10%). If the actual proportions are a trade secret, list high-medium-low proportions only.*

HEALTH HAZARDS

Health effects: *Eye contact*
Skin contact (Corrosive damage, skin absorption etc)
Inhalation
Ingestion

A Material Safety Data Sheet (MSDS) should be clear, concise, yet comprehensive. A little forethought will go a long way in designing your own. Below is a suggestion for a standardised MSDS. Use it as a matrix and checklist if you're writing your own data sheets; use it as a guide to reading an MSDS if you're using and handling chemicals.

NOTE: Few chemicals would carry ALL the information contained here.

First aid: Eye contact
Skin contact
Inhalation
Ingestion
Special advice to physician: (Additional emergency information, e.g. Do not administer adrenaline, check kidney function, be aware of delayed effects etc)

EXPOSURE AND PROTECTION

Exposure limits: TWA
Ceiling level
The latest Australian exposure limit levels, if published. Limit values from other countries, if required.

Ventilation: General exhaust, fume hoods, local (point) exhaust, floorexhaust, fans etc.
Floor drains, runoffs, safety showers, eye rinse stations etc

Personal protection: Clothing
Gloves
Boots
Respirators (respirator type and filter type)
Face shields, goggles, visors

Flammability: Spark-free tools, no welding, no open flames, earthed appliances etc.

HANDLING

Storage and transport: Where?
How?
Type of containers?
Under nitrogen?
Under lock & key?
Isolated from other substances?
Other information

Spills and disposal: Spill containment techniques
How to contain
Materials to be used for absorption
Materials to be used for neutralisation
Evacuation procedures
Disposal method (sewer, landfill, incineration etc)

Fire and explosion: Type of extinguisher to use
Hazardous combustion by-products
Personal protection for fire fighters
Evacuation procedures

Other information: Any additional information, e.g. biodegradability, soil residue, water residue etc.
Contact point:
Date of completing the MSDS:



Eight steps to a safer workplace

One: Make a commitment

- Make a commitment to set up a safety policy, and to stick to it.
- Provide the appropriate protective equipment.
- Allocate resources, determine how they should be managed, and by whom.
- Devise ways of conducting safety auditing, hazard analyses, medical monitoring, training and information.

Two: Determine your objectives

- Set goals.
- Devise a record keeping system.
- Work not only to increase safety by providing equipment, but to decrease unsafe behaviour.
- Define who has certain authority and what their responsibilities are.

Three: Monitor the safety status

- Conduct unscheduled and unannounced evaluations, as well as advertised ones.
- Devise a record lodging system, e.g. sampling records, self-inspection reports, hazard notification records and so on.

Four: Identify the hazards

- Only staff with the appropriate knowledge should perform hazard audits — hire specialists or consultants if necessary.
- Identify any existing occupational diseases or potential problems.
- Make sure employees can easily report any real or suspected problems without fear of reprisal.
- Identify the sources and extent of exposure to toxic chemicals.
- Communicate findings to employees.

Five: Identify employees at risk

- Their length of time on the job
- Their location in the plant
- Their job descriptions
- Their use of toxic substances

Six: Improve the workplace

- Develop sign-in/sign-out procedures, monitoring of employees, and evaluation systems for the handling of suspected carcinogens.
- Change processes for increased safety
- Implement wet handling of dusts
- Use personal protection
- Implement ear and eye protection, including good lighting
- Consider ergonomics (not only in offices)
- Replace hazardous chemicals with less harmful ones
- Isolate or enclose hazardous processes away from employees
- Increase clean airflow
- Ensure good housekeeping, cleanliness, waste disposal, meal and break facilities etc.
- Provide skin protection and ensure correct washing techniques and cleaning agents

Seven: Plan and perform training

- Make sure you select the right person for the right job (e.g. conduct medical screening)
- Conduct safety training
- Provide job training
- Implement wellness programs (non-smoking incentive programs, exercise & diet promotions, programs to eliminate drug and alcohol use etc.)

Eight: Assess the entire safety program

- Establish good communication
- Evaluate decrease in incidents, accidents and near-accidents
- Evaluate intangible indirect effects (e.g. staff morale, goodwill, publicity)
- Ensure that an effective feedback system is in place
- Evaluate tangible indirect effects of the program (e.g. downtime, sick leave, lost production)
- Make any changes and start again



Workers in the hot seat

Heat exchange is an important key consideration in the use of breathing protection. Your body temperature is critical. A few degrees above or below the normal can mean death or permanent disability. Breathing protection puts higher demands on the body, and heat exchange is a significant factor in the selection and use of breathing devices.

The human body is designed to operate at +37°C. When you are ill, or when you perform hard physical work, the body temperature rises. If the body temperature rises about six degrees, certain vital body functions deteriorate, and death follows.

Conversely, if the body temperature sinks a few degrees, death could occur.

Many professions subject the body to enormous temperature changes. Take, for instance, firemen and smelter workers. Sometimes, such workers can experience a temperature change of 200 degrees simply by entering a burning apartment or a pot room. But the body temperature can only be allowed to change a few degrees.

Getting used to the heat

Many workers know that the first week back at work after a holiday is a very heavy week, with energy levels at a minimum and discomfort at a maximum.

It is possible for the body to become acclimatised to heat to a certain extent. Within a few weeks, a novice can learn to work harder in high temperatures without much discomfort. Both the body temperature and pulse rate of an acclimatised worker are much lower than a starter.

Example:

	Pulse rate	Body temp
Acclimatised	118	37.8
Non-acclimatised	174	39.3

It's not the chemical that's unsafe: it's the method!

Causes of increased body temperature

• Internal heat generation

Physical work leads to a higher body temperature. The lungs need more oxygen, and the breathing rate increases. Consequently, the heart has to pump faster and harder to transport more blood around the body. The human body is like a car engine; the harder you run it, the more fuel it consumes, the more air it needs, and the hotter it gets.

■ Heat exchange with the surroundings

Heat exchange (or convection) can occur in two ways: if the surroundings are cooler than the body, body heat is lowered (e.g. walking into a coolroom); if the surrounding air is hot, the body absorbs heat (e.g. entering a sauna).

■ Radiating heat

Heat radiating from hot surfaces (walls, floors etc.) can be absorbed by the body.

■ Conducted heat

If you touch or lean against hot walls, appliances etc., your body can absorb heat. Similarly, if you lie down on the ground in winter, your body temperature may drop quickly.

Cooling down

There is only one way for the body to get rid of heat: lose water. Water evaporation consumes a lot of energy, and consequently, the temperature drops. The human body has only two ways of evaporating water: sweating and breathing. Sweating is by far the most efficient cooling method.

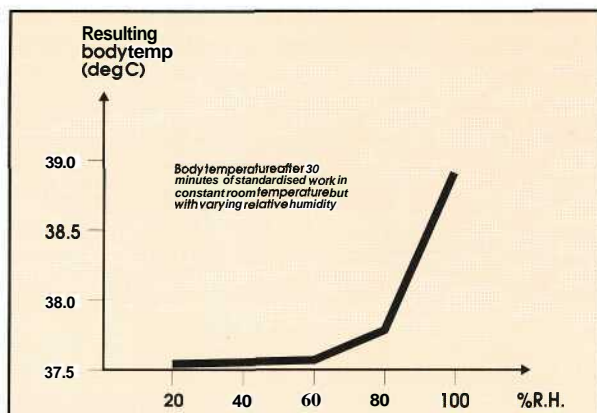
The "normal" amount of sweating varies from person to person. However, by acclimatising to hot conditions, it is possible to increase the basic rate of perspiration, thus increasing work efficiency.

It is not the amount of sweat that cools you down; it is the rate at which the sweat evaporates. The evaporation can be hampered if the surrounding air is humid. Relative humidity is an indication of how much humidity



is already in the air, and how much more it is able to take up. At low relative humidity, water evaporates easily, and is absorbed by the atmosphere. At 100% relative humidity, the air is saturated, and water cannot evaporate.

Here is a graph that illustrates how higher relative humidity reduces sweat evaporation, resulting in a higher body temperature. The graph shows the body temperature after 30 minutes' work in atmospheres of varying humidity:



Respirator selection

Wearing a respirator can greatly affect body temperature, lung function, heart rate, and many other factors that are important to the work performance and comfort of a worker.

• Deadspace

Deadspace is the volume of air that remains in the respiratory system after you breathe out, that is, the volume of the mouth and nose cavities, the air tubes and bronchi. The air within the deadspace has already been used by the lungs, and contains no useful oxygen. It does, however, contain carbon dioxide. This deadspace amounts to about 30 per cent of a normal breath (which means that if you breathe in 500 ml of air, 150 ml is "old" air that has already been in your lungs before).

By donning a respirator, the normal deadspace of the mouth and nose and tubes is increased (usually by around 50 ml). An increased deadspace means an increased amount of CO₂ with every breath. This in turn leads to a higher breathing rate, because you have to bring in more air to the lungs to compensate for the extra deadspace. The increased breathing means an increased work load on the body, and results in a higher body temperature.

In terms of deadspace, it is better to take *SLOWER, DEEPER* breaths than *QUICKER, SHALLOWER* breaths when you are wearing a respirator. The difference is very significant, as

illustrated by this graph, using two workers with identical respirators and deadspace:

	Short, shallow breaths	Slow, deep breaths
Inhaled air (ml)	400	1,000
Deadspace within body	150	150
Respirator deadspace	50	50
Total deadspace	200	200
Fresh air to lungs (ml)	200	800
% useful air	50	80

■ Inhalation resistance

A filter will inevitably sit "in the way" of normal air intake, and the lungs will have to work harder to draw the air through the barrier created by the filter. The combined effect of deadspace and filter resistance may cause great stress on the body. A large respirator with a small filter has a greater detrimental effect than a small mask with a large filter. If you are performing hard work in a hot workplace, the effect is even stronger.

It is a good idea to compare various respirators' breathing resistance. Factors that determine resistance include the **DIAMETER** of the filter(s), the **MATERIAL** used in particle filters and, in the case of gas filters, the **DEPTH** of activated carbon within the filter.

■ Exhalation resistance

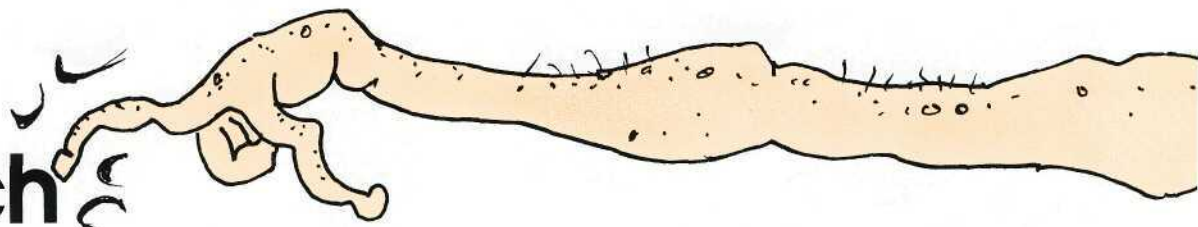
Often overlooked, the exhalation resistance also puts greater strain on the lungs. Two things happen when you breathe out through a respirator: firstly, the lungs have to create enough air pressure to open the exhalation valve (or valves); secondly, the air must be pushed out through the valve apertures. It is important to consider and compare the exhalation resistance of various respirators. Tests have shown that in some respirators available in Australia, it is *even harder* to breathe out than to breathe in! Like inhalation resistance, exhalation resistance results in more work for the body and a consequent increase in body temperature.

An additional concern with high exhalation resistance is that during hard work and heavy breathing, the entire respirator could lift off the face and cause leakage around the rim of the mask.



Source: C Malmsten, M Rosander: "R6k och Kemdykning.", Stockholm 1987

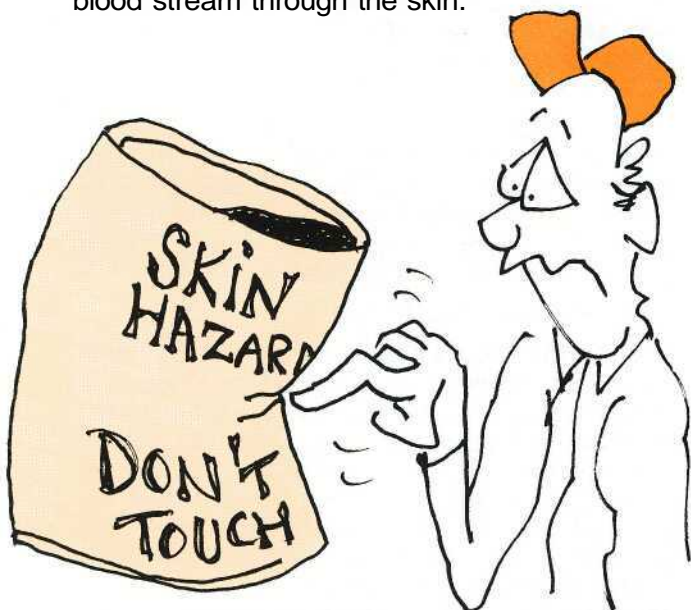
The Evil Touch



Even if you are not exposed to excessive hazardous airborne chemicals, you may still suffer harmful effects. How? In many cases, it's not what you breathe, but what you touch.

Inhalation hazards have always been the biggest concern in the industry, and skin absorption has taken a back seat in the safety discussion. But many chemicals are hazardous only through skin contact.

Dermatitis (skin irritation from chemicals) is the most common occupational disease, and many chemicals can not only produce skin problems, but can be absorbed into the blood stream through the skin.



Researchers are concerned that skin exposure seems to be an underestimated factor. Whereas breathing hazards are expressed in specific quantities, the effects of the skin are usually only expressed as "dermal hazard" without any quantification.

The substances described as dermal hazards in the American list of Threshold Limit Values currently number 33 per cent of all included chemicals. However, if a substance would be considered to be a dermal hazard if it tripled the internal biological level of the substance in contact with 2% of the skin area

(the size of the palms and fingers), as compared with TLV inhalation exposure, many more substances should be designated — in fact, about 58 per cent of all included chemicals.

The 2% skin area criterion can be seen as a conservative one. If a more radical criterion should be applied, for instance that skin absorption would raise the internal biological level of the substance to 30% higher than the inhaled level, nine out of ten substances would have to be labelled as dermal hazards.

*Here is a collection of chemicals listed as **EXTREMELY HAZARDOUS** that can be absorbed through the skin:*

- Trichloroethylsilane
- o-Cresol
- Dimethyl sulphide
- Aniline
- Phenol
- Nicotine
- Methyl Vinyl Ketone
- Mercuric Oxide
- Toluene 2,4-diisocyanate
- Formaldehyde
- Hydrogen peroxide
- Lindane

According to some occupational health professionals, certain substances, such as glycol ethers, should have their exposure levels lowered by up to 99 per cent if skin absorption was taken into consideration (skin absorption of glycol ethers is the primary route of exposure). However, the limit value was set for inhalation exposure, although most workers are not affected by breathing in glycol ethers.

The American Environment Protection Agency is currently looking into quantifying

dermal hazards. But it is a big challenge; there is little research to go by, and it is hard to set the criteria. Testing of chemicals will take between five and ten years.

Hand cleaning with a downside

The EPA is also studying chemical mixtures. This is important in regard to cleaning the hands after work, for instance. Many workers clean their hands with solvents, which contain hydrocarbons. The hydrocarbons can penetrate the skin directly, and could also take other chemicals along with them. This means that a worker who thinks he or she is *washing* off dirt with a solvent could in fact *bring it into* the body by using the solvent as a vehicle.

Solvents also remove natural fats from the skin, making it more vulnerable to contact with chemicals.

Protection

It is extremely important to ensure that the correct protection equipment is used for the right chemicals. Published permeation data cannot always be trusted. For instance, a type of glove could be thought to resist a chemical substance for a week under laboratory test conditions. But in the real workplace, the gloves might be stretched, the temperature could be high, there may be a mixture of chemicals and solvents—all resulting in a permeation time of, say, only twenty minutes.

It is also important to remember that glove use may cause perspiration and enlarged pores, making the skin more vulnerable to chemicals, rashes and infections. It is a good idea to use specialised skin creams for glove and boot wear, and also to wear a thin pair of cotton gloves inside the chemical glove.

Go wash your dirty hands!

Washing your skin (not with solvents) is still one of the most important parts of dermal health. Even though there is a small chance that some chemicals may react with water, washing the chemical off as quickly as possible still is the priority.



Source: S. L. Smith, Occupational Hazards, Cleveland OH, Sep 1993 pp111-114

CHEMICAL FACTS:

Aniline

Other names:	Aminobenzene, Aniline oil, Phenylamine
Characteristics:	Colourless to brown liquid. Oily consistency.
Odour:	Slight sweet, aromatic, amine odour
Aust. TWA:	2 ppm (10 mg/m ³) (Aniline & homologues)
Fire:	Emits flammable vapours when heated. Explosive mix with air.
Inhalation:	Fresh air and rest. Artificial respiration may be required. Oxygen may be required. Transport to hospital.
Skin contact:	Easily absorbed through the skin. Remove soiled clothing immediately. Wash in ample amounts of water for several minutes. Transport to hospital.
Eye splashes:	Rinse immediately with plenty of water. Keep eyelids wide apart while rinsing. Seek medical advice.
Ingestion:	Transport to hospital. If the person is conscious, administer a glass or two of water and active carbon. Induce vomiting if hospital is more than 30 mins away.
Prevention:	Use enclosed systems if possible. Very good ventilation required, including floor level ventilation. Floors should be jointless. Keep workplace clean. Local exhaust may be required. Keep containers tightly closed. Emergency shower and eye rinse stations should be available. Eliminate sparks and open flames. No smoking or welding. Use full face mask with organic vapour filter or breathing apparatus if working with aniline other than in closed systems. Wear gloves and protective suit.



Source: Skyddsblad; NIOSH; Merkblätter

Lower aluminium limits

Swedish authorities have decided that the exposure limits for aluminium need to be lowered, and that exposure below the current limit of 5 mg/m³ can still cause health effects.

alu **MINIMUM**

There is still a risk of asthma, lung disease and damage to the central nervous system, according to the occupational environment institute. The revised exposure limit level should be 1 mg/m³, according to the Swedish Occupational Health Institute's publication, *Forskning Pågår*.

High levels of aluminium occur chiefly in welding processes and in the manufacture of aluminium powder.

The current Australian exposure limit for aluminium is 10 mg/m³ as dust, and 5 mg/m³ as fumes (welding).



Source: Arbetsmiljö 7/1993 p13, quoting *Forskning Pågår*.

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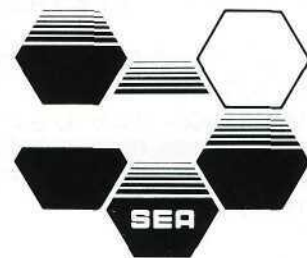
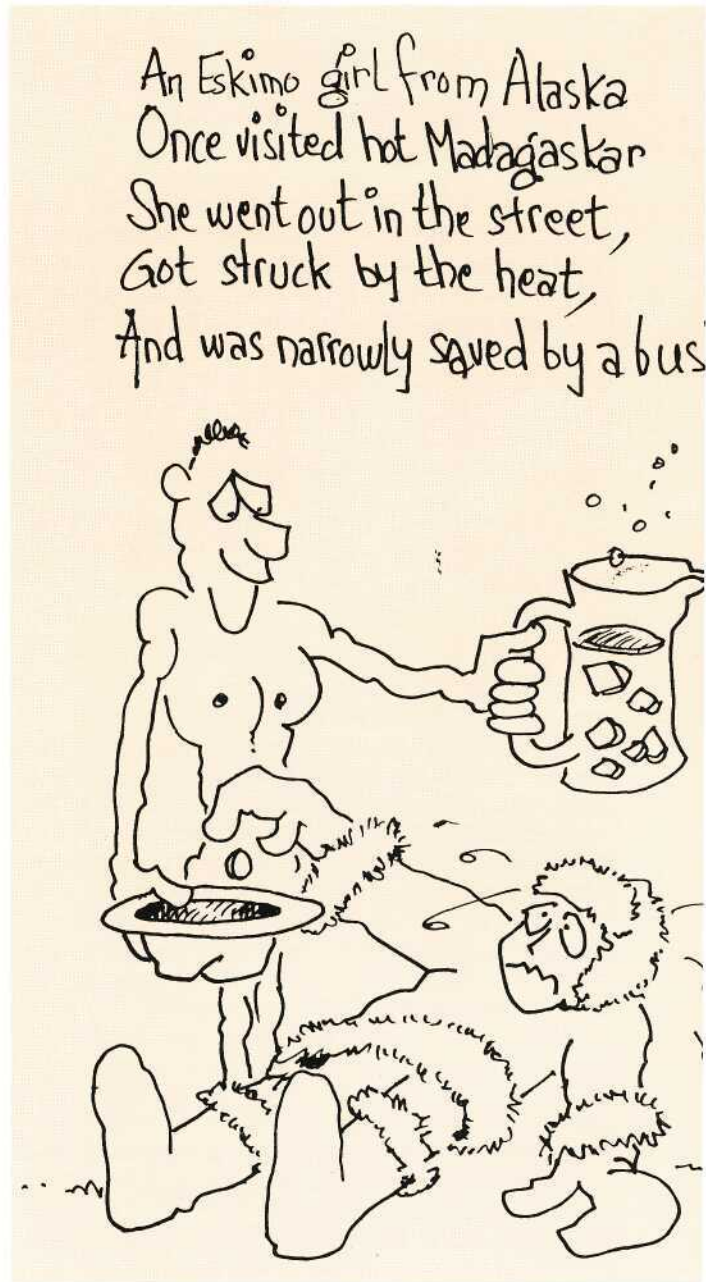
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