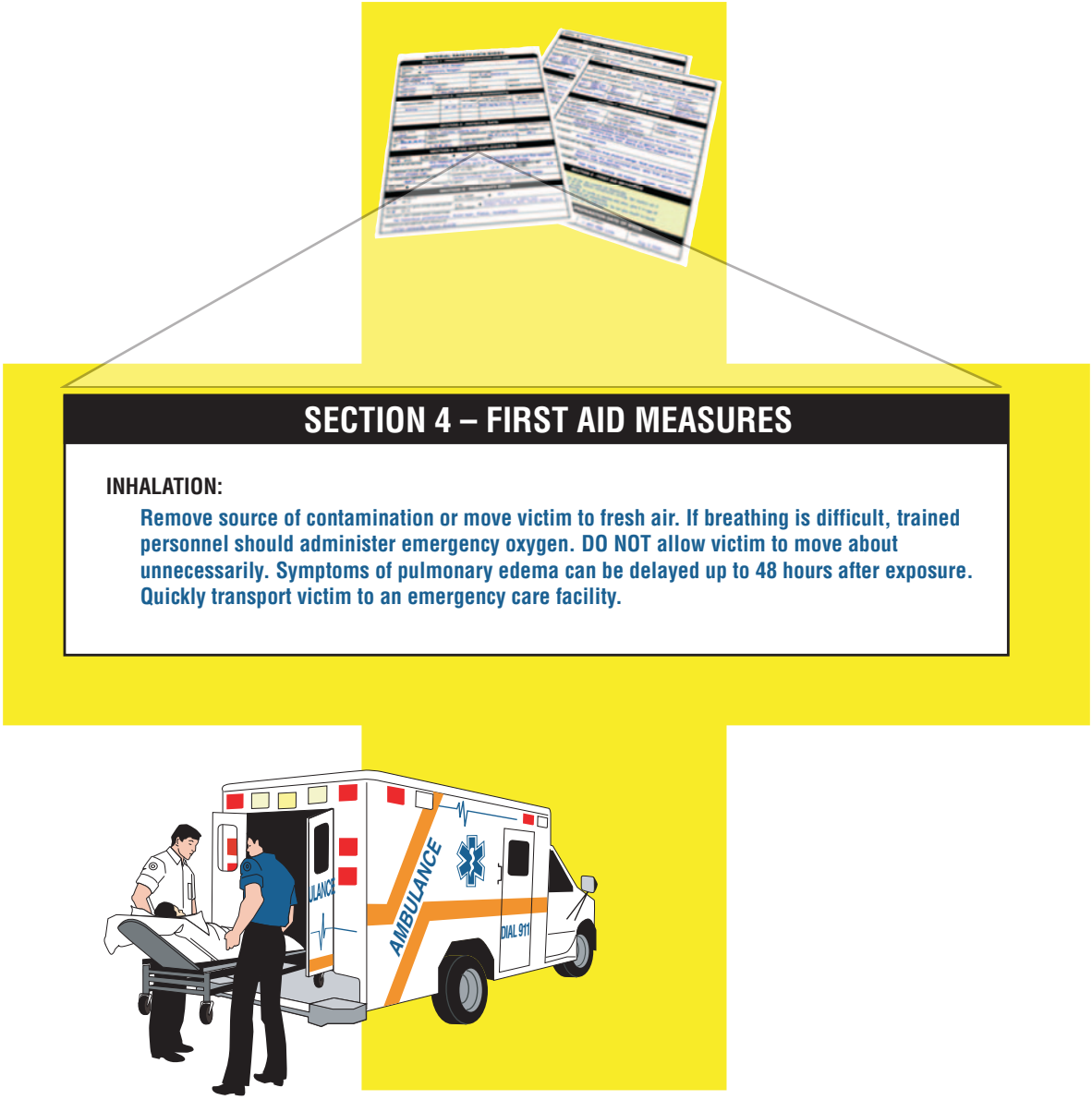
- The Material Safety Data Sheet - A Practical Guide to First Aid



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- The Material Safety Data Sheet - A Practical Guide to First Aid

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1. Introduction

The purpose of first aid is to minimize injury and disability. In serious cases, first aid is necessary to sustain life. The First Aid Measures section on a Material Safety Data Sheet (MSDS) provides recommendations on how to minimize the effects of an accidental exposure to a chemical product. The recommendations describe measures that trained first aid providers are able to safely use at the scene of a chemical exposure before obtaining medical assistance.

Provision of first aid information on an MSDS is only one component of establishing an effective first aid program for the workplace. The people responsible for this program must also ensure that:

- the necessary emergency equipment and facilities are available at the worksite,
- everyone working with the product is trained and equipped to administer the appropriate first aid, and
- they are knowledgeable about local emergency services available including how to contact the regional Poison Center.

This publication presents a system for preparing and/or evaluating first aid recommendations for chemical exposures in the workplace. It is not intended to provide specific advice on how to respond to the effects of particular chemicals, nor is it a first aid training manual. Rather, it is to be used by people who have a basic understanding of chemicals and their hazards and who write or evaluate first aid recommendations for Material Safety Data Sheets.

Significant effort has been invested in identifying the scientific basis for first aid procedures recommended in this document. However, it must be recognized that many first aid practices rest on uncertain scientific foundations. Most of the evidence supporting the value of first aid assessment and management is based on clinical observations, extrapolations from other data sources, consensus statements and historical approaches.(2,7,9) In an evidence-based review, these types of evidence are considered relatively weak, but it is the best evidence currently available.

For some topics (e.g., use of syrup of ipecac or single dose activated charcoal), the reader is referred to published evidence-based reviews for detailed information supporting recommendations. In other cases, the best or most appropriate first aid practices continue to be the subject of debate (e.g., duration of water flushing following skin or eye contact). For these issues, a review of the available evidence is presented in this document.

This document first describes a basic approach to preparing the first aid section of an MSDS. Next, the logic and scientific evidence behind the specific recommendations are discussed. Finally, a step-by-step system for selecting the appropriate recommendations for each route of exposure is presented.

2. A Basic Approach to First Aid for the MSDS

This section examines assumptions that can be made and factors that must be considered when writing first aid recommendations for an MSDS. The principles stated in this section are used to develop the specific recommendations and the step-by-step system presented in Section 4.

The MSDS writer can assume that the person who provides first aid to the victim has basic first aid training. Therefore, MSDSs do not need to recommend or explain how to execute procedures to be followed in every emergency. For example, trained first aid providers know they should initially check the airways, look for bleeding and assess the level of consciousness (ABCs).

Generally, the MSDS writer can assume that medical assistance can be obtained within a reasonably short period of time (60 minutes or less). If medical assistance is not readily available, a doctor familiar with the product and the facilities available at the location should review the first aid recommendations and make appropriate changes, as required.

The MSDS should provide instructions that direct the first aid provider to respond to the specific health effects of the product. Any procedures recommended in the First Aid Measures section must correspond to specific health effects and routes of exposure in the "Potential Health Effects" section of the MSDS. The MSDS should not introduce any new health effects in the First Aid Measures section. The MSDS should not include first aid procedures that are not applicable to the product.

The MSDS should not exclusively describe first aid recommendations written for the "worst case" exposure imaginable. Usually, first aid is given for mild to moderate exposures. If the MSDS places too much emphasis on extreme exposures, which rarely occur, the first aid procedures will be overstated. Inappropriate first aid could further harm the victim. The best approach is to write first aid procedures for situations most likely to occur based upon knowledge of the product's use and properties and/or on actual case reports.

In general, the MSDS should keep recommendations simple and advise the use of materials that are readily available in most workplaces. For example, first aid providers should usually use potable water to remove a chemical from the eye rather than saline (a neutral salt solution). Delays of even seconds can dramatically affect the outcome following contact with a corrosive chemical. There is no justification for waiting for another solution if water is the first available agent.

The MSDS should not recommend procedures that could cause additional harm or may complicate subsequent medical care. For example, the use of special creams or ointments must be carefully considered. The cream or ointment may have to be removed before a medical professional can assess the injury and begin treatment and its removal could worsen the injury. Nevertheless, in some cases the benefits do outweigh any risks. For example, there is good evidence that certain topical preparations are very beneficial in the first aid treatment of hydrofluoric acid burns.

The "First Aid Measures" section of an MSDS should not include procedures that fall outside the definition of first aid. It is sometimes difficult to determine where first aid stops and medical intervention starts. Typically, first aid does not include procedures like the administration of intravenous or oral medications. However, under certain circumstances, it may be appropriate to recommend more advanced procedures (e.g., the administration of amyl nitrite for cyanide toxicity). Protocols for undertaking advanced procedures must be developed in

consultation with a doctor and must be regularly reviewed. In these situations, advanced, specialized training is required for first aid providers. There are two criteria for including these procedures:

- The benefits of the procedure must outweigh any risks associated with it, i.e. the intervention must be essential to sustain life or prevent other serious consequences and must not introduce significant new risks.
- It must be legally acceptable for the first aid provider to perform the intervention. This legality can be determined by contacting local first aid training organizations (e.g., the Red Cross) or your governing medical authority (e.g., the Royal College of Physicians, the State Board of Medical Examiners or the State Health Division).

The first aid measures sections of an MSDS should not contain information directed toward medical professionals. Inclusion of this information could be confusing to the first aid provider. The MSDS should direct comments to medical professionals under the heading "Note to Physicians". For a brief discussion regarding "Note to Physicians", refer to Appendix 4.

Writers and reviewers of first aid recommendations may find the following basic outline useful. An MSDS should:

- Provide recommendations for each potential route of occupational exposure.
- Present recommendations in the order in which the first aid measures are to be carried out, taking care of the most urgent problems first, as follows:
  - Protect the first aid provider. Specify any special protective equipment and clothing or procedures necessary to protect the first aid provider, if necessary. For example, if the product is flammable, all sources of ignition must be eliminated or avoided. If a toxicity hazard exists, first aid providers must NOT enter the hazardous area or attempt rescue without putting on appropriate personal protective equipment.
  - Remove or reduce the source of exposure, either by removing the source from the victim or the victim from the source.
  - Recommend well-established first aid procedures.
  - Describe the need and urgency for medical follow-up.
  - Indicate if contaminated clothing, shoes or leather goods can be decontaminated or if they should be discarded. Indicate safe storage procedures for contaminated clothing, when necessary.

3. A Background Discussion of the Recommendations

This section discusses issues that affect the selection of appropriate first aid recommendations for an MSDS. This background discussion addresses topics such as the use of oxygen and whether or not to induce vomiting for chemical exposures. Appendix 3 explains the reasons for wording of recommendations where specific wording has particular significance and is not self-explanatory.

3.1 Emergency Oxygen Administration

In the past, the use of emergency oxygen was commonly recommended as a first aid procedure for any inhalation exposure. This practice was adopted because oxygen was thought to be helpful in any case where the victim became short of breath or unconscious. Administering oxygen may have been perceived as giving the victim "fresh air" or a "boost" to help get over the effects of an exposure.

Subsequently, concern was expressed that the administration of oxygen itself may be harmful if carried out improperly or in the wrong circumstances. In particular, there was a concern that administering oxygen to victims with chronic obstructive lung diseases, such as chronic bronchitis or emphysema, could cause the victim to stop breathing. Recent reviews have concluded that, during an emergency situation, the lack of oxygen is the most critical issue and there should be little concern over worsening the condition of victims with chronic obstructive pulmonary disease (COPD).(6,11,12)

The presence of oxygen cylinders in the workplace can introduce additional hazards. For example, since oxygen supports combustion, the presence of oxygen cylinders could contribute to a fire hazard in the workplace. Also, since oxygen is stored under high pressure, the cylinder can behave like a missile if the valve breaks or the tank is punctured.

Therefore, the risks and benefits of storing and maintaining an emergency oxygen supply in the workplace must be weighed.

There are some situations where the benefits of emergency oxygen outweigh the potential risks associated with maintaining and storing oxygen cylinders in the workplace. Emergency oxygen may be beneficial for exposure to chemicals that interfere with the body getting the necessary levels of oxygen to sustain life and health including chemicals that can:

- displace oxygen in the air and reduce the amount available for breathing (e.g., helium, argon, methane, carbon dioxide, nitrogen);
- impair the oxygen-carrying capacity of the blood (e.g., carbon monoxide, nitrates/nitrites that cause methemoglobinemia) or impair oxygen use at the cellular level (e.g., cyanides, hydrogen sulfide, azides);
- interfere with the ability of oxygen to cross through the lungs to the blood stream, as occurs with pulmonary edema, a potentially life-threatening accumulation of fluid in the lungs (e.g., chlorine, ammonia); or
- provoke a severe asthma attack (e.g., toluene diisocyanate), thus interfering with oxygen and carbon dioxide exchange.(6,14)

Since basic first aid training courses do not include oxygen administration, additional training is required. First aid providers who have been properly instructed in the use of oxygen can use supplemental oxygen for victims of serious illness or injury.(9,13) First aid providers must be familiar with laws that govern the use of oxygen equipment in their jurisdiction.

Emergency oxygen may be beneficial in circumstances where a chemical exposure interferes with oxygenation. Special training of first aid providers is required.

3.2 Neutralization Following Skin Contact

It seems logical to neutralize exposure to an acid with a base or vice versa. However, there are concerns that attempts to neutralize chemical contamination of the skin or eyes could increase injury by causing:

- a delay in starting irrigation while first aid providers search for special irrigating fluids (17,21);
- thermal burns from the heat given off when the two chemicals react (17,21); and
- additional injury due to contact with the neutralizing agent.

Recent research has examined the science behind these concerns.

In two studies (22,23), rat skin was damaged by a 1-minute exposure to a strong alkali (2N (8%) sodium hydroxide). Treatment consisted of continuous irrigation with water or a neutralizing agent (0.35M (9%) sodium citrate solution; pH 5.90) starting at 1, 10 or 30 minutes after injury. The first study demonstrated that water flushing must begin as soon as possible after the injury occurs (ideally within 1 minute) and should continue until the pH returns to normal (60 minutes, if flushing begins within 1 minute). In the experiment using sodium citrate, the tissue damage was deeper following citrate treatment when compared to water treatment. The authors believed that thermal injury occurred when the concentrated alkali was neutralized with the weakly acidic sodium citrate.

In another study (15), rat skin was damaged by a 1-minute exposure to a strong alkali (2N (8%) sodium hydroxide). Irrigation with tap water (pH 7.8) or 5% acetic acid (pH approximately 3) was started at 1 minute following exposure and continued until a near normal subcutaneous pH of 7.8 was reached. There were no significant differences between peak skin temperature or peak pH between the two groups. Flushing with 5% acetic acid was associated with a shorter flushing time (15 vs 32 minutes), less severe tissue injury at 24 hours and somewhat improved wound healing (as measured by one aspect) at 14 days. Overall, both treatments led to complete healing at 14 days.

In an early, less well-conducted study, alkali or acid burns were induced in rats. Animals that were vigorously washed with water survived longer and showed less evidence of injury than animals treated with chemical neutralizers.(17)

Clearly, it is critical that flushing a chemical burn commence as quickly as possible. Water is readily available in almost all circumstances.

There is no clear benefit to using neutralizing agents instead of water following skin contact with basic or acidic chemicals.

3.3 Duration of Flushing with Water

Most standard first aid resources recommend that water flushing following skin or eye contact with a chemical product should continue for 15 or 20 minutes. The following section discusses the research behind this recommendation.

Skin Contact

In the Yano study (22) reviewed in Section 3.2, the subcutaneous pH returned to normal after 60 minutes of water flushing following a 1-minute skin contact with 8% sodium hydroxide, even when flushing started 1 minute after the injury. When flushing was delayed 10 minutes, the pH did not return to normal, even with 90 minutes of flushing. In the Andrews study (15), the subcutaneous pH returned to normal after 32 minutes of water flushing following a 1-minute exposure to 8% sodium hydroxide.

In a related study (24), rat skin was damaged by application of 0.05 mL of 1N (3.65%) hydrochloric acid. When flushing started at 1 minute after exposure, the pH returned to normal at 10 minutes. When flushing was delayed 3 or 10 minutes, the pH did not rise above 7.52 (return to normal), even with 60 minutes of flushing, but a statistically significant difference in pH (compared to the untreated group) was observed from 8-25 minutes.

Earlier studies (16,18) show that the severity of skin injury increases with a longer delay between chemical exposure and the start of water flushing. Bromberg (16) exposed mice to 50% sodium hydroxide or 36% hydrochloric acid. The skin pH did not approach pre-burn levels until well after 1 hour of continuous irrigation. Gruber et al. (18) exposed mice to 50% sodium hydroxide. Water treatment comprised of a 10-15 second wash, with some receiving an additional 8-hour wash. Treatment started at one minute, two minutes, or three minutes post-injury. Mice with an 8-hour wash had better outcomes than those with the brief washing alone. Mice with earlier washing had better outcomes than mice with delayed washing.

A Regional Burn Center followed up on 35 cases of skin burns, half of which were work-related. Appropriate first aid was defined as starting water flushing within 10 minutes, using a large volume of water and continuing treatment for at least 15 minutes. Appropriate first aid led to a 5-times decrease in third degree burns and an almost 3 times shorter hospital stay.(19) A report on ten years experience with 83 chemical burns showed that effective first aid (copious water lavage within 3 minutes of injury) statistically reduced the incidence of third degree burns, length of hospital stay and delayed complications.(20)

Eye Contact

The appropriate duration of water flushing for chemical eye injuries should vary with the type of chemical exposure.(6,26,28) It is common practice to recommend 20-30 minutes of water flushing. However, prolonged irrigation (1-2 hours or more) is important with severe alkali or acid burns. Prompt, brief irrigation (duration not specified) is thought to be sufficient for chemicals that are not reactive with tissues.(28)

In the only relevant animal study located (30), sodium hydroxide (unspecified concentration) was applied to rabbit eyes. The pH increased abruptly for 6 seconds, reaching a maximum of 11.17 in 3.5 minutes, dropping to 9.08 at 90 minutes. When flushing started within 1 minute (with Ringer solution for 4 minutes), maximum pH attained was 10.84, with recovery to normal at 90 minutes. When flushing started at 5 minutes, the change in pH was the same as non-flushed eyes.

Kuckelhorn (32) reviewed the histories of 101 patients with eyes severely injured by a chemical exposure. In patients receiving immediate rinsing, fewer operations were required, there was a significantly shorter length of hospital stay and there was significantly better visual outcome. However, even eyes with immediate first aid showed severe damage. Kuckelhorn states that this may have been due to inappropriate first aid, because even though initial irrigation was carried out, it was not continued for at least 30 minutes in any of the cases.

Saari et al. (36) reviewed the histories of 172 patients with chemical eye injuries. In all cases, treatment consisted of immediate flushing of the eye with water at the place of the accident followed by further irrigation at the hospital. The outcome of patients receiving prolonged irrigation (1-2 hours) was compared to those receiving conventional treatment (first aid irrigation and "standard" hospital irrigation with saline). With prolonged irrigation, the extent of damage was less, visual outcome was better and the duration of hospital treatment and absence from work were shorter.

In their review of the science behind first aid practices, the American Heart Association advises flushing chemical burns with large amounts of cool running water and to continue flushing until EMS personnel arrive.(2) This recommendation does not address the question of how long flushing should continue. However, it makes sense to tailor the duration of flushing to the known effects of the chemical or product.

It is imperative that water flushing starts immediately following skin or eye contact with a chemical.

Longer flushing is required for corrosive chemicals: 60 minutes for strong alkalis and 30 minutes for other corrosives.

The commonly accepted standard of 15-20 minutes is suitable for moderate to severe irritants.

A 5-minute water flush is sufficient to remove chemicals that are not irritating or are mildly irritating.

It is preferable that complete decontamination of the skin or eyes occur on-site.(5,10) With a severe corrosive injury, it may be necessary to delay transport to an emergency care facility to ensure a complete, uninterrupted 30 or 60 minute of flushing. However, transporting the victim earlier may be necessary depending on the condition of the victim (compromised ABCs) or the availability of a water supply. If necessary, flushing the affected area should continue during emergency transport, taking proper precautions to protect emergency services personnel.

Note: Refer to page 34 ("lukewarm water") for information regarding water temperature.

3.4 Using pH Paper to Evaluate Flushing Duration

Sometimes, it is recommended that pH paper be used to determine the duration of flushing time in a first aid situation. The rationale is that water flushing should continue until a neutral or near neutral pH is measured. However, some chemicals (e.g., sodium hydroxide) will continue to leach out of the eye and skin for some time after injury. If the pH is tested during or shortly after ending irrigation (e.g., within 7-10 minutes), it may be the pH of the irrigation fluid that is being measured rather than pH of the eye or skin surface. Testing the pH too early could lead to stopping irrigation prematurely. On the other hand, if an abnormal pH is measured after time is allowed to elapse, the interruption in irrigation will have led to further damage. Ultimately, the use of pH paper is no substitute for prompt, adequate and thorough irrigation.(33)

An evidence-based review (34) concluded that pH paper may have utility in monitoring the treatment of chemical exposure, but there is insufficient evidence to make a strong recommendation for or against its routine use.

pH paper should NOT be used to determine the duration of water flushing in a first aid situation.

3.5 Using Flushing Solutions Other Than Water

Four eye-irrigating solutions were evaluated for comfort as flushing solutions: normal saline, lactated Ringer's, normal saline with bicarbonate, and Balanced Saline Solution Plus. All four solutions were used on patients in random order and the patients (11 patients/12 affected eyes) were asked to comment on comfort. The patients preferred Balanced Saline Solution Plus. However, this solution needs to be reconstituted and discarded within 6 hours, thus it is not considered practical for first aid use. No significant differences were noted between the other solutions.(29)

Diphoterine® is an eye/skin chemical splash decontamination solution. Most research on the efficacy of this solution is only available in abstract or poster format and cannot be objectively evaluated. In one published study, immediate 5-minute irrigation with Diphoterine® was compared to the same treatment with 0.9% saline in rabbits eyes burned with 3 mL 1N (4%) sodium hydroxide for 30 seconds. Diphoterine® was more effective in lowering pH of the corneal surface (at 5 minutes, pH 12 for saline and pH 7.5 for Diphoterine®). In a second experiment, the same Diphoterine® and saline treatments were applied following eye burns with sodium hydroxide. Treatment then continued with 160 mL, 3 times daily, of 0.9% saline. While there may have been some early beneficial effects of Diphoterine®, it was

concluded that there was no overall difference in outcome in either treatment group at 16 days.(37)

Overall, water is effective and universally available. It has been experimentally established that delays of even minutes in starting water flushing can dramatically affect the outcome, making the ready availability of water a key consideration in its selection as a flushing solution.

The importance of time between exposure and treatment outweighs all other considerations in selecting a flushing solution. There is no justification for waiting for any flushing solution other than water, which is typically readily available.

3.6 Inducing Vomiting

How to respond to accidental ingestion of a chemical has been, and continues to be, the subject of much debate. What is clear is that the recommendation to induce vomiting CANNOT be made without careful consideration of many factors, including:

- a high degree of risk or evidence of toxicity,
- time since ingestion (less than 1-2 hours),
- amount ingested,
- whether or not vomiting has already occurred, and
- contraindications to inducing vomiting (e.g., ingestion of a corrosive or risk of aspiration (ingestion of a petroleum distillate or the victim's level of consciousness)).(6)

Although it is a difficult issue to study, some researchers have shown clinical benefit from gastric emptying in patients with serious overdoses when gastric emptying is accomplished within 1 hour after ingestion. Other researchers are unable to describe any benefit at all. Detailed review of these studies can be found in references 6 and 40.

Thus, inducing vomiting after a chemical ingestion is a selective rather than a routine procedure – the benefit of which is largely unproven.

MSDSs should NOT recommend inducing vomiting, but should refer the first aid provider to a Poison Center or a doctor for advice.

3.7 Syrup of Ipecac

The American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists have issued a position statement on the use of Syrup of Ipecac. The position statement is a systematically developed clinical guideline based on high-quality research evidence. This position statement is accepted by other organizations, including the Canadian Association of Poison Control Centres and the American Board of Applied Toxicology. The Position Statement on Ipecac Syrup concludes that:

"Syrup of ipecac should not be administered routinely in the management of poisoned patients. In experimental studies the amount of marker removed by ipecac was highly variable and diminished with time. There is no evidence from clinical studies that ipecac improves the outcome of poisoned patients and its routine administration in the emergency department should be abandoned. There are insufficient data to support or exclude ipecac administration soon after poison ingestion. Ipecac may delay the administration or reduce the effectiveness of activated charcoal, oral antidotes, and whole bowel irrigation. Ipecac should not be administered to a patient who has a decreased level or impending loss of consciousness or who has ingested a corrosive substance or hydrocarbon with high aspiration potential."(40)

The American Association of Poison Control Centers also conducted an evidence-based review of the use of ipecac syrup for the out-of-hospital management of ingested poisons.(55) This review is supported by a detailed review of the literature and concludes that:

"the use of ipecac syrup might have an acceptable benefit-to-risk ratio in rare situations in which:

- *there is no contraindication to the use of ipecac syrup; and*
- *there is substantial risk of serious toxicity to the victim; and*
- *there is no alternative therapy available or effective to decrease gastrointestinal absorption (e.g., activated charcoal); and*
- *there will be a delay of greater than 1 hour before the patient will arrive at an emergency medical facility and ipecac syrup can be administered within 30-90 minutes of the ingestion; and*
- *ipecac syrup administration will not adversely affect more definitive treatment that might be provided at a hospital.*

In such circumstances, the administration of ipecac syrup should occur only in response to a specific recommendation from a poison center, emergency department physician, or other qualified medical personnel."

In June 2003, an Advisory Committee recommended to the US Food and Drug Administration (FDA) that the over-the-counter status of syrup of ipecac be rescinded, making it available only by prescription. The FDA acceptance of this recommendation will likely end the use of ipecac as a treatment for toxic ingestions.(61)

The use of syrup of ipecac should NOT be recommended on MSDSs.

3.8 Oral Dilution with Water, Milk or a Neutralizing Agent

Much of what we know about the benefits of diluting an ingested chemical with water, milk or a neutralizing agent is based on in vitro (test tube) and ex vivo (using harvested rat esophagi) studies.

In vitro studies suggest that neutralizing or buffering an alkali or acid will lead to a dramatic rise in temperature, possibly leading to thermal burns.(56,58,59)

Dilution with water is not considered effective or practical to bring the pH closer to normal due to the large volume of water required.(56)

Ex vivo studies using harvested rat esophagi examined the cellular effects of dilution with saline, water or milk, or neutralization with orange juice (pH 4.0) or cola (pH 3.2) at 0, 5 or 30 minutes after injuring the esophagus with a strong alkali (50% sodium hydroxide) or strong acid (0.5N (1.82%) hydrochloric acid). All treatments decreased esophageal injury, with less injury occurring with early therapy. Temperature changes due to neutralization were minimal. (48,49,50,51) These studies were not designed to compare the therapeutic benefits of the individual treatments (e.g., cola versus water).

In an in vivo study, dogs had their stomachs surgically altered and were then exposed to 50% sodium hydroxide or 0.5N (3.65%) hydrochloric acid. The sodium hydroxide injury was treated with orange juice or water. The hydrochloric acid injury was treated with 8% sodium bicarbonate or water. In all cases, significant temperature decreases were observed following treatment.(52,53) The effects of these treatments on injury outcome and pH were not assessed.

The design of these ex vivo and in vivo studies makes extrapolation of the results to real-life situations difficult. The authors conclude that there is a strong body of evidence that neutralization of caustic ingestions does not result in a clinically significant exothermic reaction and may provide therapeutic benefit. However, further clinical studies are needed before this treatment can be widely advocated.(53)

The American Heart Association observes that the results of some studies suggest that dilution or neutralization of a caustic agent by water or milk after ingestion reduces tissue injury, but no human studies have demonstrated the clinical benefit of this practice. Administration of water or milk may be considered if a large amount of an industrial-strength caustic or a solid caustic has been ingested, but a Poison Centre should be called first.(2)

It used to be common practice to recommend oral dilution with a large volume of water. However, studies using live animals demonstrate that dilution with large amounts of water increases the toxicity of certain drugs.(43,45,46,47) In 1982, the American Association of Poison Control Centers published a policy statement that:

> *"gastrointestinal dilution with water is potentially harmful and is inappropriate as a first aid measure to prevent gastrointestinal absorption of drugs. The oral administration of water is applicable only when the toxin ingested produces local irritation or corrosion, although milk is preferable if immediately available."(45)*

At the present time, the American Association of Poison Control Centers recommends for chemical or household products: *"If the person is awake and able to swallow, quickly give a glass of water (2 to 8 ounces). DO NOT make the person vomit unless told to do so by the Poison Control Center or a doctor."(42)*

Oral dilution with a neutralizing agent or large volumes of water is NOT recommended. Oral dilution with a small amount (2-8 ounces) of water may be beneficial.

3.9 Universal Antidote/Burnt Toast

Commercial preparations of the universal antidote consisted of one part magnesium oxide, one part tannic acid and two parts activated charcoal. This preparation is no longer available. Activated charcoal alone is superior in decreasing absorption.(6)

Burnt toast had been advocated as an activated charcoal substitute in the home. However, its use was abandoned because of lack of significant adsorbent activity.(6)

Burnt toast and the universal antidote are useless and should NOT be recommended as first aid measures.

3.10 Activated Charcoal

Single-dose activated charcoal treatment involves the oral administration or instillation by nasogastric tube of an activated charcoal water solution. The activated charcoal adsorbs toxic chemicals in the gastrointestinal tract, decreasing the absorption of the chemical and reducing or preventing systemic toxicity.

The American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists have issued a position statement on the use of single-dose activated charcoal.(39) The position statement is a systematically developed clinical guideline based on high-quality research evidence. The position statement on single-dose activated charcoal is accepted by other organizations, including the Canadian Association of Poison Control Centres and the American Board of Applied Toxicology and concludes that:

> *"Single-dose activated charcoal should not be administered routinely in the management of poisoned patients. Based on volunteer studies, the effectiveness of activated charcoal decreases with time; the greatest benefit is within 1 hour of ingestion. The administration of activated charcoal may be considered if a patient has ingested a potentially toxic amount of a poison (which is known to be adsorbed to charcoal) up to 1 hour previously; there are insufficient data to support or exclude its use after 1 hour of ingestion. There is no evidence that administration of activated charcoal improves clinical outcomes. Unless a patient has an intact or protected airway, the administration of charcoal is contraindicated."(39)*

The current consensus is that activated charcoal should NOT be administered as a first aid procedure, for the following reasons.

- There are no definitive studies showing that activated charcoal actually improves the outcome of human poisonings.
- Giving a full dose of activated charcoal is difficult due to palatability issues.
- There is a risk of vomiting and aspirating the activated charcoal, which can cause life-threatening pulmonary complications.
- In most cases where activated charcoal may have some benefit, the victim should be monitored in an emergency department.
- The potential benefits of activated charcoal are outweighed by risks associated with its use.(2,41,54,57,60)

Activated charcoal should NOT be recommended as a first aid measure on MSDSs.

4. A Step-by-Step Guide to Making Recommendations

This section presents a system to help make appropriate, consistent, easy-to-apply first aid recommendations for MSDSs. First, the properties and potential hazards of products that allow the selection of first aid recommendations are identified. Then, a decision-making process is presented in flowcharts (decision trees), one for each route of exposure. Finally, use of the decision trees allows determination or evaluation of first aid recommendations for a specific product.

4.1 Information Needed to Make Recommendations

Before using this system, certain information about the chemical or product must be gathered. This information can be derived from the Physical and Chemical Properties, Fire Fighting Measures, Stability and Reactivity, and Potential Health Effects sections of the MSDS. The specific information needed from each of these four areas and the reason for its inclusion is described in this section. Evaluation of a product's properties against criteria, such as those established in the OSHA Hazard Communication Standard or the Canadian Controlled Products (WHMIS) Regulations, can help answer some questions.

If certain information for the product is not available, and a professional judgement cannot be made using information available for related products, it is prudent to make an assumption that will result in the most conservative first aid procedures. For example, if the flammability of a product is unknown, assume the product is flammable. If the water solubility of a product is unknown, assume it is not water-soluble. Both of these decisions will result in first aid recommendations conservative enough to alleviate any potential hazard.

(On page 15, a worksheet is provided to assist you in gathering the information required for making first aid decisions).

Physical Properties

Is the product used as a solid, liquid or a gas?

This information helps determine which exposure routes and first aid measures are relevant for a particular product. For example, first aid for a solid particle in the eye may not be the same as first aid for a liquid in the eye.

Is the product soluble in water?

Products are water-soluble if at least 1 gram of the product can dissolve in 1 liter of water (1 g/L). To make their removal easier, products that are not water-soluble should be quickly blotted or brushed from the skin, before flushing with water. In addition, mild, non-abrasive soap may facilitate the removal of products that are not water-soluble.

Reactivity Data

Does the product react with water to produce heat or a more toxic chemical?

This information allows modification of the recommendation to reduce contact of the chemical with water, by quickly blotting or brushing the chemical away, prior to flushing.

Is the product an oxidizer?

Oxidizers create a fire hazard by producing oxygen or another oxidizing substance. This information is needed so recommendations can advise that contaminated clothing can be removed and submersed in water so that it does not become a fire hazard.

Fire and Explosion Data

Is the product a flammable liquid or gas?

The product could be a significant fire hazard in an emergency situation. Recommendations should include warning the first aid provider to take appropriate precautions, such as removing all sources of ignition. Also, the product must be removed from the exposed person.

Human Health

Is the product capable of posing an immediate and serious threat to the first aid provider?

A chemical can pose an immediate and serious threat to the first aid provider if it is a simple asphyxiant, very acutely toxic by any route of exposure, or corrosive. In these cases, it is essential that the first aid provider be protected when responding to incidents involving these chemicals. (Note: Advise the use of specific protective equipment, for example, butyl rubber gloves rather than "impervious" gloves).

Is the product capable of posing a significant long-term health concern for the first aid provider?

Although the chemical may not pose an immediate health risk, exposure may affect the long-term health of the first aid provider. This category includes chemicals that can cause cancer, birth defects or any other significant long-term health effects. Again, in these cases, it is imperative to protect the first aid provider before they respond to incidents involving these chemicals.

Does the product have low toxicity?

The first aid provider can be advised that no health effects are expected and minimal precautionary measures can be taken. A chemical with low toxicity must be judged to cause neither significant short-term nor long-term effects.

Is the product non-irritating, or a mild, moderate or severe irritant?

The degree of irritancy determines the amount of flushing required for skin or eye contact. For example, a mild irritant will only need 5 minutes of flushing with water. A moderate or severe irritant requires 15-20 minutes of flushing to ensure complete removal of the product. (Note: Corrosives require special first aid procedures).

Is the product corrosive?

Corrosives require longer flushing with water than irritants to ensure their complete removal. The evidence suggests that strong alkalis, like sodium hydroxide, require prolonged flushing with water–60 minutes. Corrosives like hydrochloric acid require flushing for 30 minutes.

Is the product capable of causing frostbite or freezing tissue?

The first aid provider should be directed to follow special procedures such as not attempting to re-warm the affected area on site. Chemicals can cause frostbite or freeze tissue if they have a low boiling point (below 0 deg C (32 deg F)).

Is the product capable of causing pulmonary edema?

Pulmonary edema is a life-threatening accumulation of fluid in the lungs. It interferes with the ability of oxygen to cross through the lungs into the body. Oxygen, as a first aid measure, may help victims who develop symptoms of pulmonary edema. Symptoms of pulmonary edema may not appear for up to 48 hours after exposure. Anyone with a significant exposure to a chemical that can cause pulmonary edema must be made aware of this delay. Chlorine and ammonia are examples of chemicals that can cause rapid pulmonary edema. Phosgene and nitrogen dioxides can cause delayed pulmonary edema.

Is the product capable of interfering with the body's ability to use oxygen?

Oxygen may be helpful as a first aid measure for chemicals that can interfere with the body's use of oxygen by:

- impairing oxygen transport in the blood, as with carbon monoxide,
- affecting use of oxygen in the cells, as with cyanide, or
- causing a severe asthmatic attack, thus interfering with the exchange of oxygen and carbon dioxide, as with toluene diisocyanate.

Is the product capable of causing severe short-term toxicity affecting breathing or heart function?

If the product is expected to be highly toxic by any route of exposure, the MSDS should advise first aid providers to administer artificial respiration (AR) if breathing has stopped, and cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED) if the heart has stopped. CPR and AED require advanced first aid training.

Is the product likely to be aspirated or is the product capable of causing serious health effects if aspirated?

Some chemicals, for example hydrocarbons that have low surface tension and low viscosity, can easily get into the lungs (aspirated) during ingestion or vomiting and attack lung tissue. If a corrosive is accidentally inhaled into the lungs during vomiting, it could cause severe lung damage. In both cases, specific first aid procedures should be recommended to reduce the risk of aspiration.

Is the product capable of causing toxicity to the first aid provider through mouth-to-mouth contact?

Chemicals that are highly toxic if absorbed through the skin (e.g., cyanide compounds) could harm the first aid provider during artificial respiration (AR) or cardiopulmonary resuscitation (CPR). Therefore, mouth-to-mouth contact should be avoided, unless appropriate mouth guards or shields are available.

4.2 Decision Trees

Before using the decision trees, the information identified in Section 4.1 should be collected and summarized on the worksheet found below. The worksheet can then be used to answer questions posed in the decision trees. This process will produce appropriate, consistent first aid recommendations for most workplace chemical products.

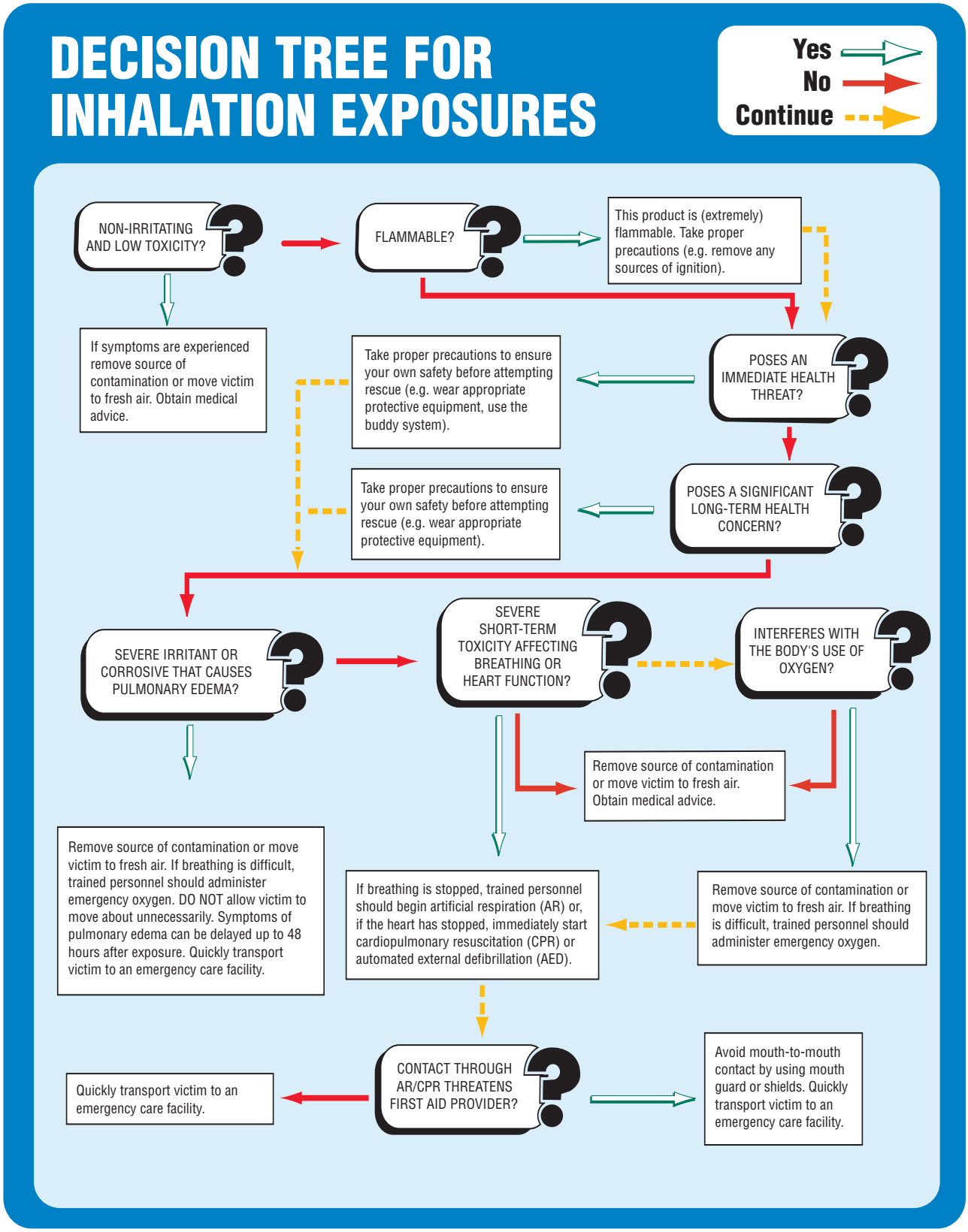
Note: Several special situations have been identified. These exceptions are listed in Appendix 2 and should be reviewed before using the decision trees.

Decision Tree Worksheet

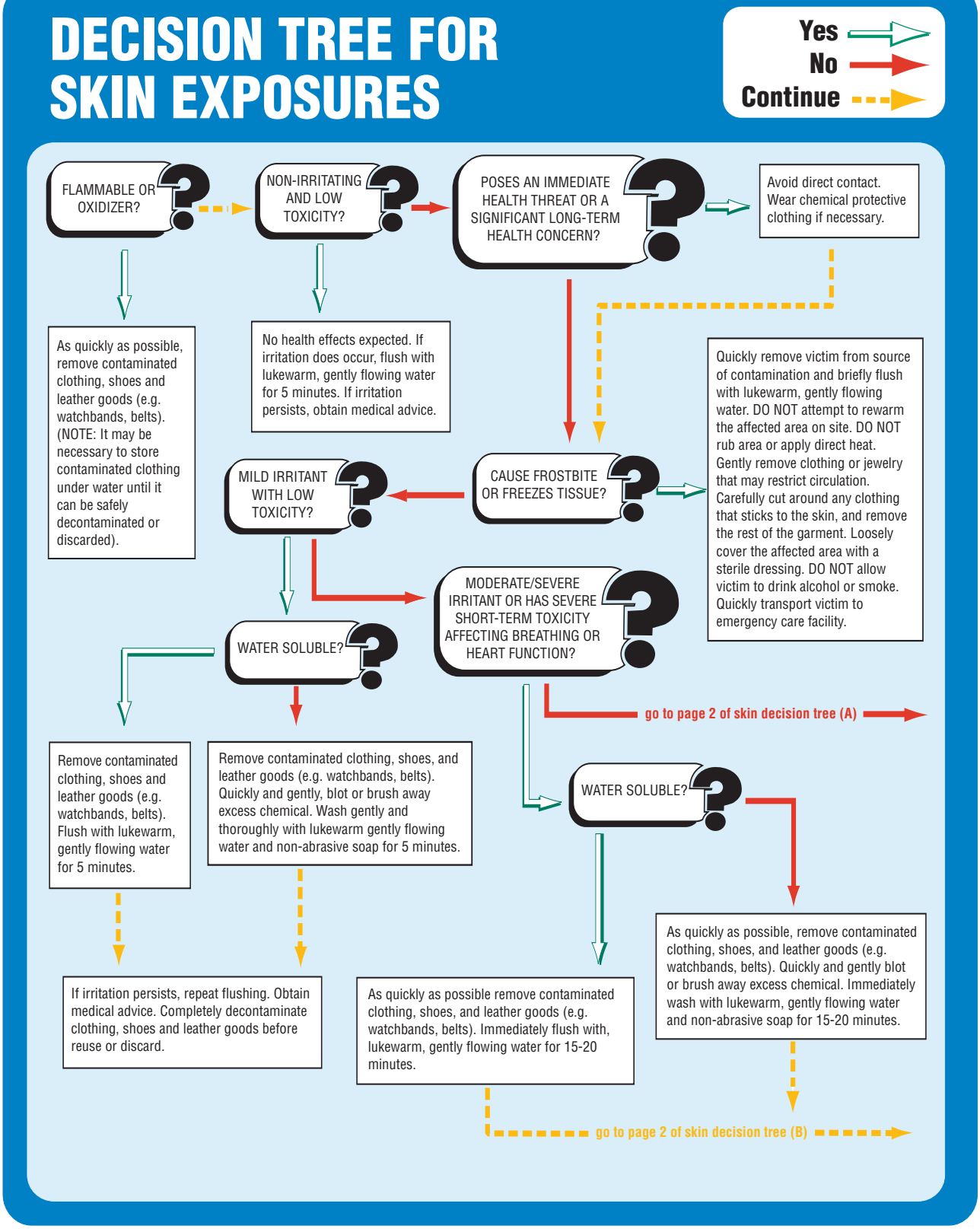
Physical State	☐ Gas ☐ Liquid ☐ Solid
Water Soluble	☐ Yes ☐ No*
Reacts with Water to Produce Heat or a More Toxic Chemical	☐ Yes* ☐ No
Oxidizer	☐ Yes* ☐ No
Flammable	☐ Yes* ☐ No
Poses an Immediate Health Threat to First Aid Provider	☐ Yes* ☐ No
Poses a Long-Term Health Concern to First Aid Provider	☐ Yes* ☐ No
Risk of Toxicity to First Aid Provider Through AR/CPR	☐ Yes* ☐ No
Low Short-Term and Long-Term Toxicity	☐ Yes ☐ No*
Degree of Irritation	☐ Non-irritating ☐ Mild ☐ Moderate ☐ Severe*
Corrosive	☐ Yes* ☐ No
Causes Frostbite or Freezing of Tissue	☐ Yes* ☐ No
Causes Pulmonary Edema	☐ Yes* ☐ No
Interferes with Body's Use of Oxygen	☐ Yes* ☐ No
Severe Short-Term Toxicity Affecting Breathing or Heart Function	☐ Yes* ☐ No
Significant Aspiration Threat	☐ Yes* ☐ No

* indicates the assumption which will result in the most conservative first aid recommendations

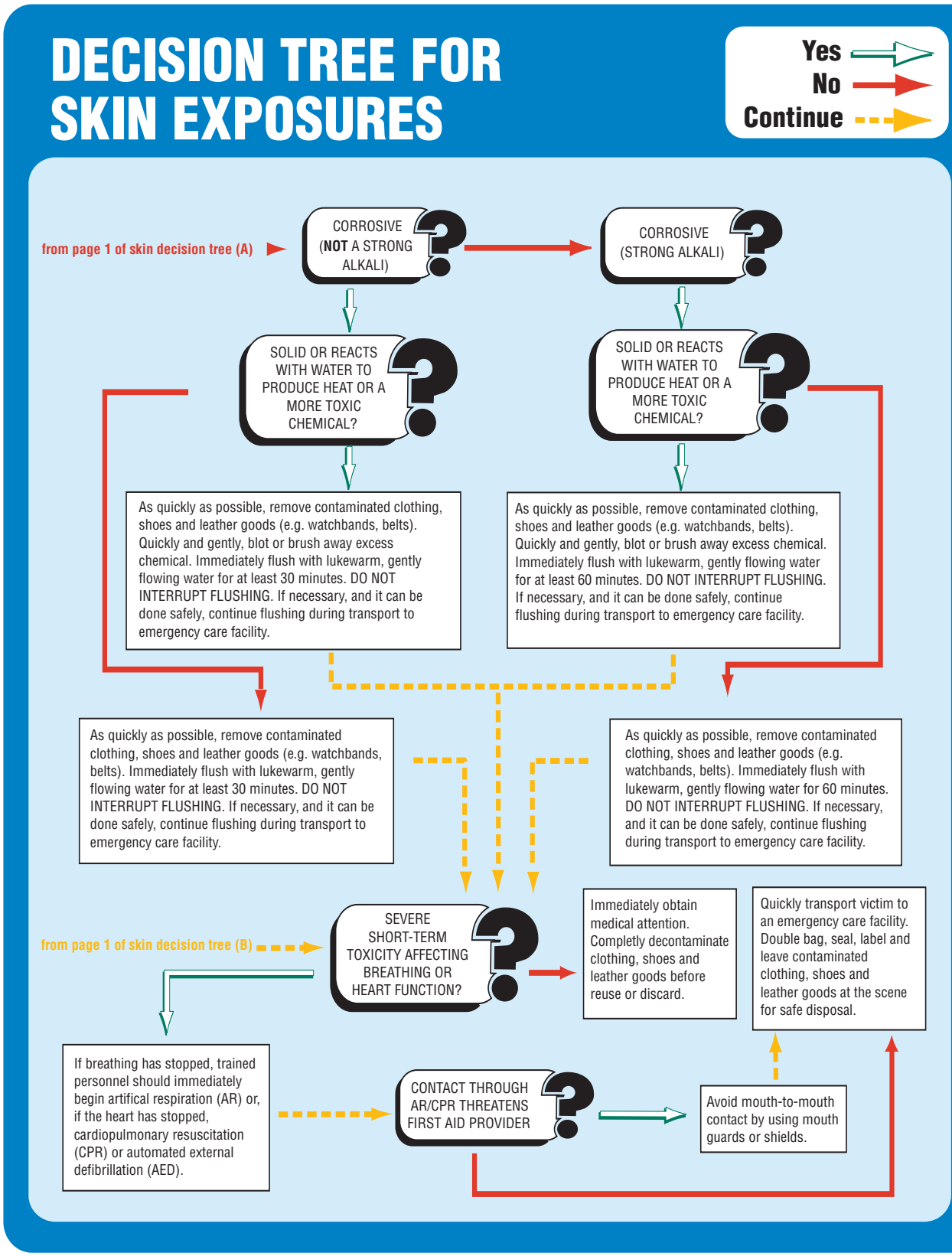
DECISION TREE FOR INHALATION EXPOSURES



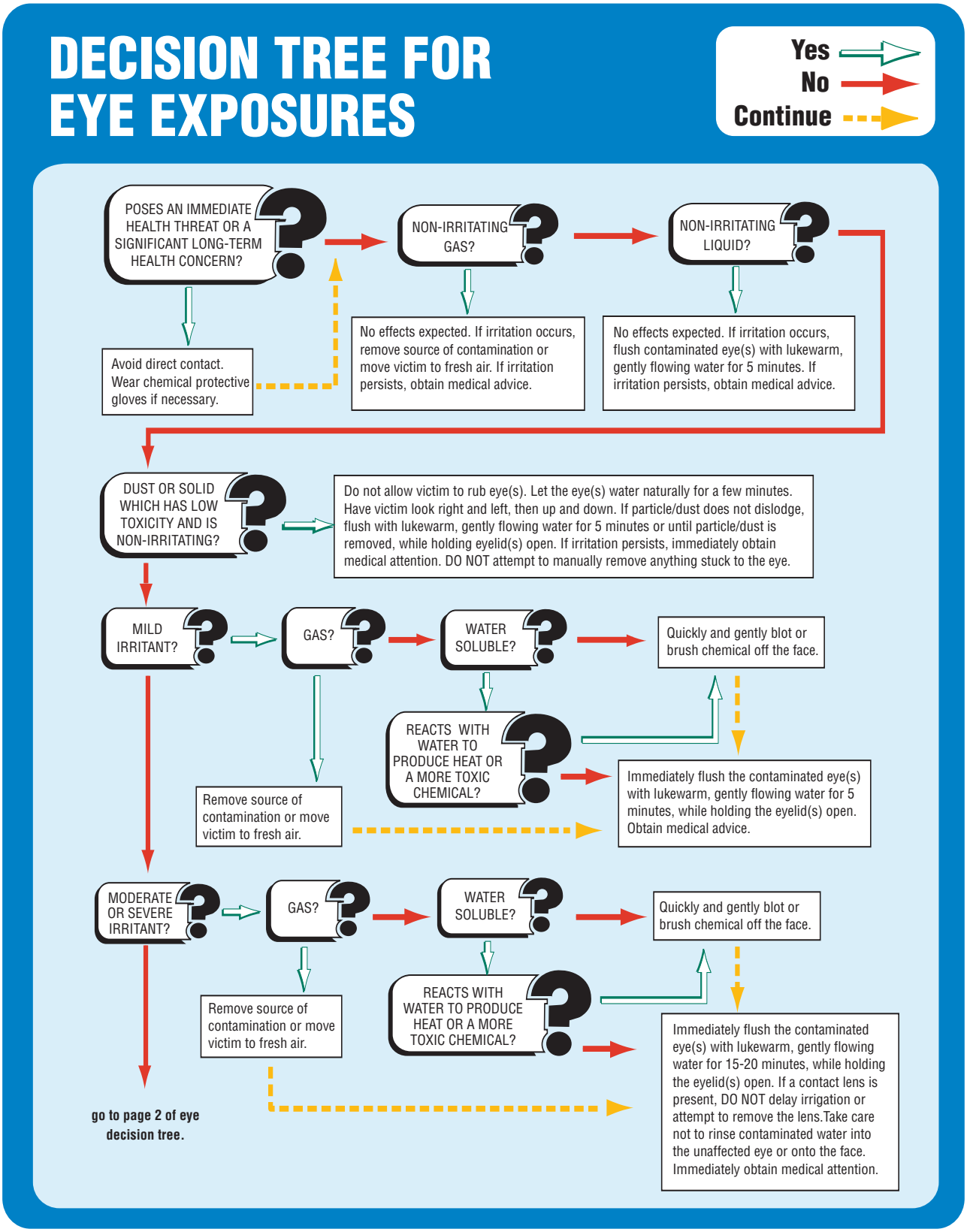
DECISION TREE FOR SKIN EXPOSURES



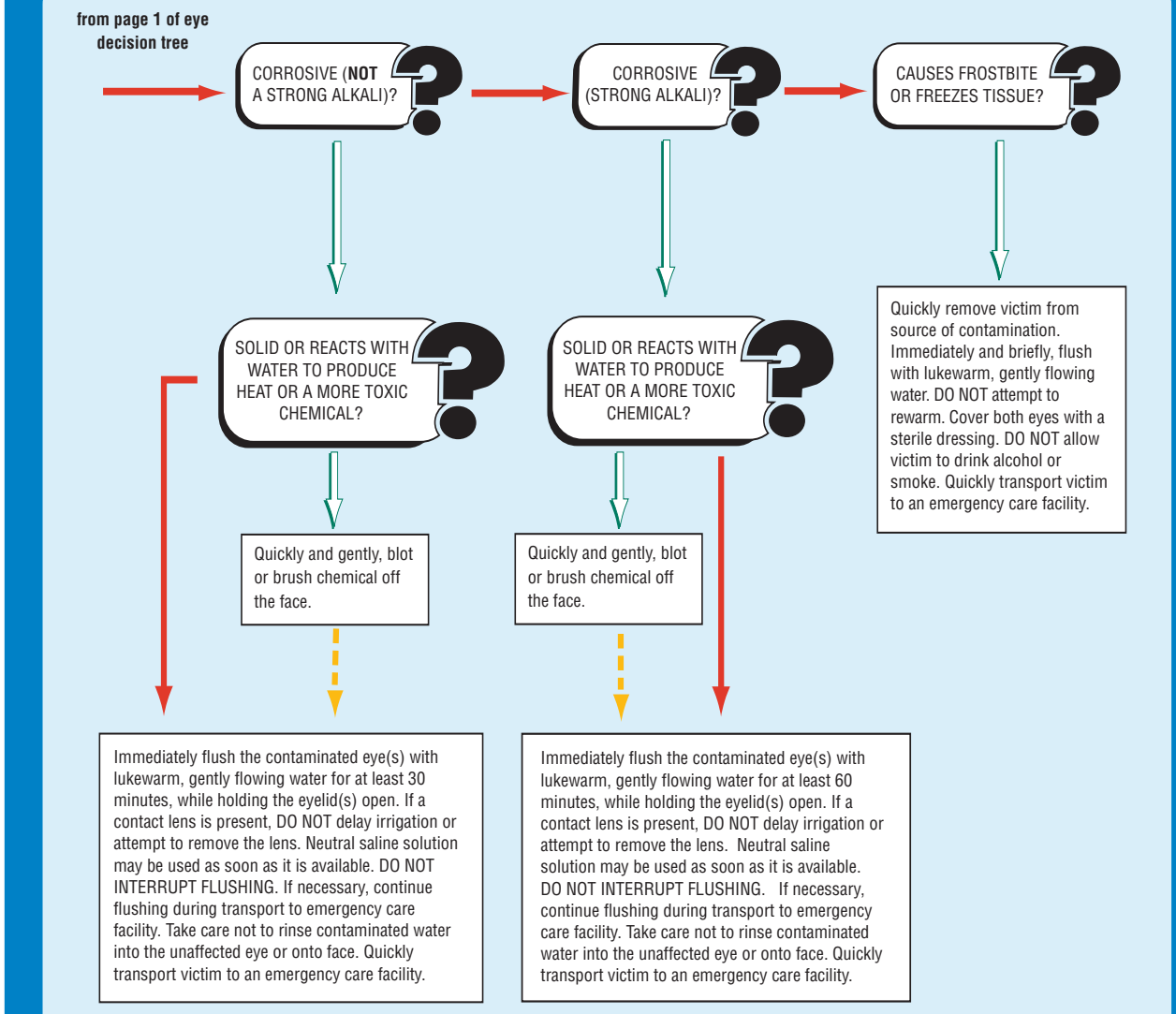
DECISION TREE FOR SKIN EXPOSURES



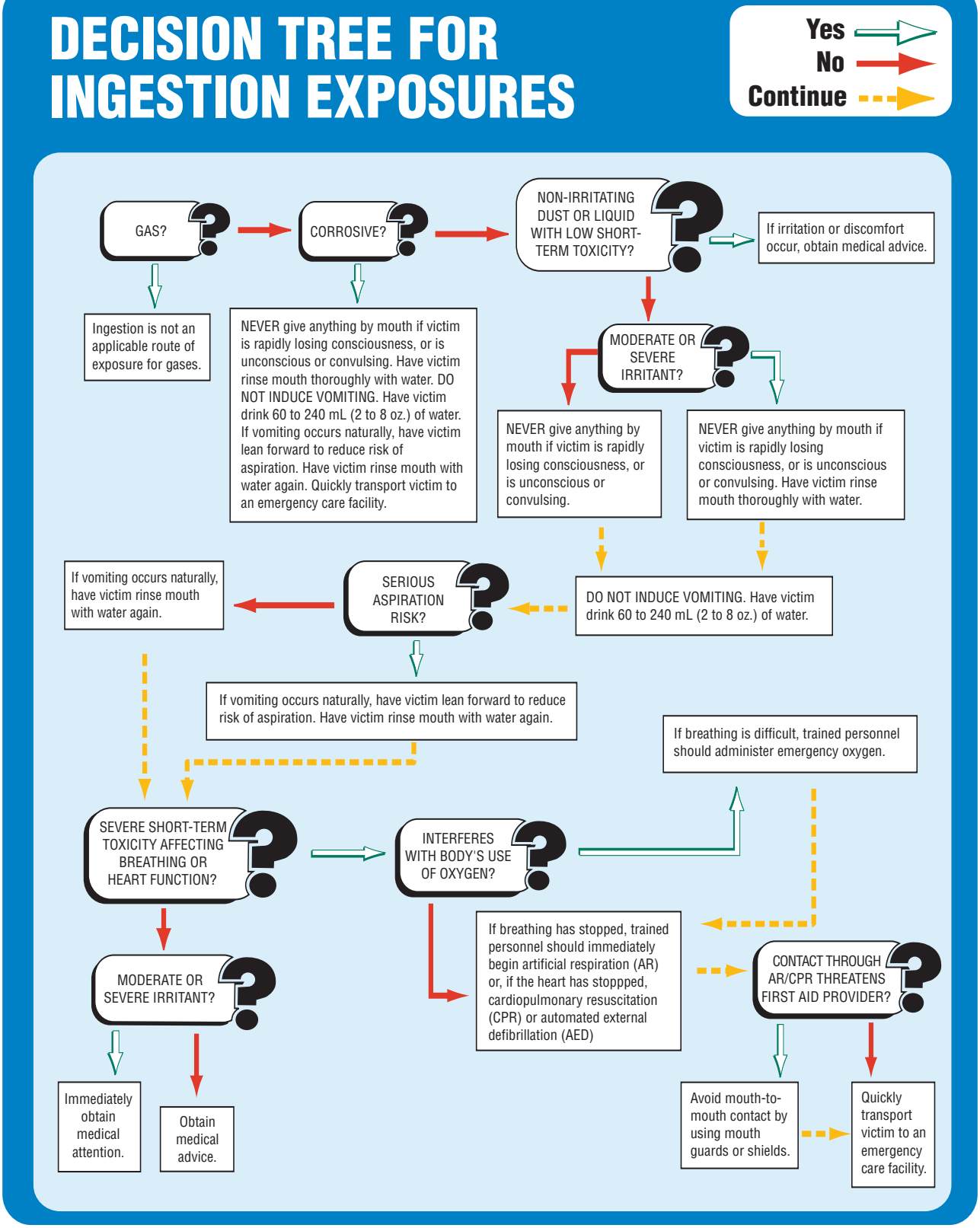
DECISION TREE FOR EYE EXPOSURES



DECISION TREE FOR EYE EXPOSURES



DECISION TREE FOR INGESTION EXPOSURES



5. Conclusion

This document provides a framework for preparing appropriate and consistent first aid recommendations for Material Safety Data Sheets. Examples of recommendations resulting from application of this system are presented in Appendix 1. Once the decision trees have been used for a specific product, the resulting recommendations should be carefully evaluated. This evaluation should be based on the MSDS writer or reviewer's specific knowledge of the chemical and how it is used, and the first aid principles described in Section 2. This process will help ensure the development of well-balanced, appropriate recommendations.

It may be necessary to customize first aid recommendations based on situational factors. The MSDS is only a starting point for developing a comprehensive, worksite-specific first aid program. A doctor familiar with the product, its use, toxicity and potential routes of exposure, the work environment and local community medical facilities should evaluate all first aid procedures. Each emergency situation is unique and it is imperative that the first aid provider be trained to exercise good judgement before carrying out any first aid procedure.

Anyone who might be called upon to give first aid in an emergency should become familiar with the recommended first aid measures before working with the product. It is impossible to overemphasize the importance of being prepared. Within different jurisdictions, first aid training requirements vary. However, every first aid provider should have the training, including applicable advanced training, necessary to use any first aid procedures required for an exposure to products present in the workplace. First aid providers should never try to perform a procedure that is beyond their own expertise. If there is any doubt about the appropriateness of any first aid procedure during an emergency, the nearest Poison Centre should be called and their advice followed.

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Appendix 1 – Examples of applications

Inhalation of Methylamine

Information Needed to Make Recommendations	Suggested Phrasing
Poses an immediate health threat to the first aid provider. Flammable	Take proper precautions to ensure your own safety before attempting rescue (e.g., remove any sources of ignition, wear appropriate protective equipment, use the buddy system).
Gas Corrosive Causes pulmonary edema	Remove source of contamination or move victim to fresh air. If breathing is difficult, trained personnel should administer emergency oxygen. DO NOT allow the victim to move about unnecessarily. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Quickly transport victim to an emergency care facility.

Eye Contact with Sugar

Information Needed to Make Recommendations	Suggested Phrasing
Solid Low toxicity Non-irritating	Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. Have victim look right and left, and then up and down. If particle/dust does not dislodge, flush with luke-warm, gently flowing water for five minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, obtain medical attention. DO NOT attempt to manually remove anything stuck to eye.

Skin Contact with Sodium Cyanide

Information Needed to Make Recommendations	Suggested Phrasing
Poses an immediate health threat to the first aid provider	Avoid direct contact. Wear chemical protective clothing, if necessary.
Liquid (solution) Water-soluble Corrosive	As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Flush contaminated area with lukewarm, gently flowing water for at least 30 minutes. DO NOT INTERRUPT FLUSHING. If necessary and it can be done safely, continue flushing during transport to an emergency care facility.
Interferes with body's use of oxygen.	If breathing is difficult, trained personnel should administer emergency oxygen.
Has severe short-term toxicity affecting breathing or heart function.	If breathing has stopped, trained personnel should immediately begin artificial respiration (AR) or, if the heart has stopped, cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED).
Contact through AR/CPR can threaten first aid provider.	Avoid mouth-to-mouth contact by using mouth guards or shields. Quickly transport victim to an emergency care facility. Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal.
Special situation	Amyl nitrite, which can be used as a first aid measure, may be antidotal to cyanide toxicity. Consult with a doctor knowledgeable about cyanide toxicity and treatment to determine the appropriateness of using amyl nitrite as first aid measure in your workplace, to develop protocols and to arrange for specialized, advanced training for first aid providers who may be required to administer amyl nitrite. **See Appendix 4 – Note to Physicians** – Cyanide Compounds.

Appendix 2 – Special Situations

Chemical	Route of Exposure	Suggested Recommendations
Cyanide compounds with cyanide ion toxicity.	Inhalation Skin contact (for skin-absorbed compounds) Eye Contact (for eye-absorbed compounds) Ingestion	Amyl nitrite, which can be used as a first aid measure, may be antidotal to cyanide toxicity. Consult with a doctor knowledgeable about cyanide toxicity and treatment to determine the appropriateness of using amyl nitrite as first aid measure in your workplace and to develop protocols and arrange for specialized, advanced training for first aid providers who may be required to administer amyl nitrite.(62,63,64,65) See Appendix 4 - Note to Physicians
Elemental sodium and potassium.	Skin contact	*These metals can ignite spontaneously on contact with moisture and react with water to form very corrosive sodium and potassium hydroxides.* Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible remove contaminated clothing and store it in a non-combustible container under mineral oil. DO NOT flush with water. Using forceps, carefully remove any metal fragments embedded in the skin and submerse them in mineral oil. If all particles cannot be removed, cover affected area with non-toxic mineral oil or cooking oil (sodium) / tert-butyl alcohol (potassium) and transport victim to an emergency care facility. If all particles have been removed, flush the affected area with lukewarm, gently flowing water for at least 30 minutes. Then, immediately transport victim to an emergency care facility.(66)
Highly volatile chemicals that quickly form high local vapour concentrations and pose a significant inhalation hazard (e.g., carbon disulfide, isocyanates).	Skin contact	*Standard recommendations for skin contact, plus the following statement:* Any skin contact will also involve significant inhalation exposure. Refer to the inhalation first aid recommendations.

Hydrofluoric acid	Skin Contact Eye contact Ingestion Inhalation	**Inhalation:** In addition to standard first aid, trained personnel should administer a nebulized solution of 2.5% calcium gluconate with oxygen. **Skin Contact:** Avoid direct contact. Wear chemical protective clothing if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). As quickly as possible, flush with lukewarm, gently flowing water for 5 minutes. Immediately after washing, use one of the following measures: **a.** Begin soaking the affects areas in iced 0.13% benzalkonium chloride (Zephiran®) solution. Use ice cubes, not shaved ice, to prevent frostbite. If immersion is not practical, towels should be soaked with iced 0.13% benzalkonium chloride (Zephiran®) solutions and used compresses for the burned area. Compresses should be changed every two-four minutes. Benzalkonium chloride (Zephiran®) soaks or compresses should be continued until pain is relieved or until medical treatment is available. **b.** Wearing chemical protective gloves, start massaging 2.5% calcium gluconate gel into the burn site. Apply gel frequently and massage continuously until pain and/or redness disappear or medical attention is available. If benzalkonium chloride (Zephiran®) or calcium gluconate gel is not available, water rinsing must continue until medical treatment is available. Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal. **Eye Contact:** Avoid direct contact. Wear chemical protective gloves if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. If a contact lens is present, DO NOT delay irrigation or attempt to remove the lens. Take care not to rinse contaminated water into the unaffected eye or onto the face.

		DO NOT use benzalkonium chloride (Zephiran®) for eye contact. If sterile 1% calcium gluconate solution is available, limit flushing with water to 5 minutes. Then, repeatedly irrigate the eye using a syringe filled with 1% calcium gluconate solution. **Ingestion:** No special procedures are recommended.(67) Quickly transport victim to an emergency care facility. *Note: Specific procedures for using benzalkonium chloride (Zephiran®) and calcium gluconate gel are described in references 69 and 70. Consult with a doctor to develop protocols and to arrange for specialized, advanced training for first aid providers who may be required to treat hydrofluoric acid exposures. **See Appendix 4 – Note to Physicians**
Hydrogen sulfide	Inhalation	NOTE: Victims who have been exposed to 500 ppm or higher may pose a threat to responders due to hydrogen sulfide being released from their clothing, skin and exhaled air.(74) Amyl nitrite has been recommended as an antidote to hydrogen sulfide toxicity. However, its use is controversial. Consult with a doctor knowledgeable about sulfide toxicity and treatment to determine the appropriateness of using amyl nitrite as a first aid measure in your workplace and to develop protocols and arrange for specialized, advanced training for first aid providers who may be required to administer amyl nitrite.(71,72,73)
Metals that can cause metal fume fever. Plastic polymers that can cause polymer fume fever.	Inhalation	*These chemicals can cause a reversible flu-like illness up to 24 hours after exposure.* **Inhalation**: Obtain medical attention if flu-like symptoms develop within 24 hours after exposure.
Molten materials	Skin contact	As quickly as possible, flush contaminated area with lukewarm, gently flowing water for 15-30 minutes or until the chemical has cooled and solidified. DO NOT remove solidified material. Immediately obtain medical attention.(2,75,76,77)

Phenol Phenol derivatives that have phenol toxicity.	Skin contact	*Dilution of phenol with water may enhance skin absorption. Phenols are not water-soluble and are difficult to remove with water alone.* Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g. watchbands and belts). If available, immediately and repeatedly wipe the affected area with a 50% water solution of PEG 300 or PEG 400 (polyethylene glycol of average molecular weight 300 or 400). If PEG is not available, quickly blot or brush away excess chemical. Then flush affected area with lukewarm water at a high flow rate for at least 30 minutes. Quickly transport victim to an emergency care facility.(78,79,80,81,82) Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal.
White phosphorus	Skin contact	*White phosphorus spontaneously ignites in air at 30 deg C (86 deg F).* Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, remove all contaminated clothing, shoes and leather goods and gently brush phosphorus particles off of the skin. Flush with lukewarm, gently flowing water for at least 30 minutes. If irritation persists, repeat flushing. Visible particles of white phosphorus should be removed and placed in cold water to prevent re-ignition. Cover burned skin with wet towels during transport.(83,84,85,86) Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal.

Appendix 3 – Explanation of Specific Wording used in First Aid Recommendations

"automated external defibrillation (AED)" The International Liaison Committee on Resuscitation (ILCOR) recommends that resuscitation personnel be authorized, trained, equipped, and directed to operate a defibrillator if their professional responsibilities require them to respond to persons in cardiac arrest. This recommendation includes those assigned to provide first aid at their workplace and who are trained in the use of an AED. (8) For information on establishing an automated external defibrillation program in the workplace, refer to the American College of Occupational and Environmental Medicine (ACOEM) guideline available at: www.acoem.org/guidelines/article.asp?ID=41

"blot or brush" The removal of solid particles or thick, non-water soluble liquids from the skin can be facilitated by blotting or brushing them off before flushing the contaminated area with water.

"DO NOT allow victim to drink alcohol or smoke." The supply of blood to frozen tissue is already constricted. Consumption of alcohol or smoking may further constrict the blood supply and intensify damage.

"DO NOT allow victim to move about unnecessarily." Unnecessary physical exertion could aggravate the effects of pulmonary edema.

"DO NOT allow victim to rub the affected eye(s)." This reaction is a natural response to an eye irritant but it could cause additional abrasion of the eye.

"DO NOT attempt to manually remove anything stuck to eye." Efforts to remove a foreign body adhering to the eye could cause penetration or abrasion.

"DO NOT attempt to re-warm the affected area on site." Re-warming frozen tissue is a complex process, which requires experienced medical care. The speed of re-warming must be carefully controlled, as should the temperature. There is also a high risk of infection and medical control of intense pain may be necessary.(1,5)

"DO NOT interrupt flushing." This statement stresses the importance of prolonged flushing with water.

"DO NOT rub area or apply direct heat." Frozen tissue is very sensitive and rubbing or application of direct heat could intensify damage.(1,4)

"gently flowing" A fast stream of water could cause the product to splash, harming the first aid provider. In addition, a force of water could add mechanical damage to injured skin or eye(s).

"holding the eyelid(s) open" Pain causes forced closing of the eyelids. Therefore, help is necessary to keep the eyelid(s) open to ensure a thorough flushing of the eye and eyelid.

"If a contact lens is present, DO NOT delay irrigation or attempt to remove the lens." Nothing should delay starting water flushing. Water flushing will likely wash away the contact lens. If not, it can be manually removed by the victim or medical personnel after flushing is complete.(25,26,27,35)

"immediately" The speed with which first aid should begin cannot be stressed enough. For example, beginning water flushing within one minute is more effective in reducing injury than beginning water flushing within three minutes.(22,23,24)

"lukewarm water" The water temperature should be under 38 deg C (100 deg F) and above 15.5 deg C (60 deg F). Temperatures of more than 38 deg C (100 deg F) are harmful to the eyes and can enhance chemical interaction with the skin and eyes. Prolonged flushing with cold water (less than 15.5 deg C (60 deg F) can cause hypothermia and may

result in premature cessation of flushing.(3) With thermal burns, optimal healing and lowest mortality rates are noted with water temperatures of 20-25 deg C (68-77 deg F).(2)

"medical advice" The victim does not necessarily need medical attention. However, a medical professional should be verbally consulted to determine if follow-up is required.

"medical attention" A medical professional must see the victim to determine if medical treatment is necessary.

"NEVER give anything by mouth to a victim who is rapidly losing consciousness, is unconscious or convulsing." These conditions increase the risk of aspiration

"non-abrasive soap" A mild soap can facilitate the removal of non-water soluble chemicals.

"Quickly transport victim to an emergency care facility." It is urgent to transport the victim to an emergency care facility after performing any first aid measures needed to stabilize his/her condition.

“remove contaminated clothing” Some authorities estimate that exposure can be reduced by an estimated 75-90% by removing contaminated clothing. Of course, the amount will vary depending on the degree of contact and saturation of the clothing, but common sense suggests that quick removal of contaminated clothing will quickly reduce exposure.

"trained personnel" Training beyond basic first aid may be required to perform the procedure safely and effectively. Requirements for advanced training vary between jurisdictions.

"water" The use of water is presumed to serve the following purposes:

- diluting the chemical,
- washing away the chemical,
- decreasing the rate of any chemical reaction with tissue,
- cooling any heat generated by reaction of the chemical with water or tissue,
- decreasing tissue metabolism thus reducing inflammation,
- minimizing hygroscopic activity of hygroscopic chemicals, and
- normalizing pH levels.(16,24)

Appendix 4 – Note to Physicians

In its position statement on MSDSs, the American College of Medical Toxicology (ACMT) states:

"It is the position of ACMT that the format of the MSDS should not be expanded to serve as a mechanism to communicate to practitioners of medicine advice on treatment of health effects of chemical exposure other than first aid measures. As an alternative the MSDS should include a referral mechanism through which advice on treatment is available from an organization under the supervision of a physician with Board certification in medical toxicology or a physician with Board certification in occupational medicine with recognized expertise in medical toxicology."(87)

Essentially, this position statement recommends that the treating physician should contact a Poison Centre to obtain expert advice on the treatment of chemical exposures, rather than consulting an MSDS. However, it is important to note that not all countries or states have Poison Centres or access to ACMT trained toxicologists or poison specialists 24 hours a day.

The American National Standard for Hazardous Industrial Chemicals – Material Safety Data Sheets – Preparation indicates that the Note to Physicians sub-section on an MSDS should convey *"additional information on antidotes, specific treatments and diagnostic procedures outside of usual and customary practices administered by healthcare professionals".(88)*

According to the ANSI standard, the information included can relate to both immediate and delayed effects and can address both treatment/therapy and diagnostic procedures. Some considerations include the following:

- Clinical testing and medical monitoring for delayed effects.
- Specific procedures for treatment (including emesis, lavage or antidotes).
- Treatment/therapy and diagnostic procedures which may be affected by pre-existing medical conditions and involve a medical judgement.
- An indication when usual and customary procedures should not be performed due to contraindications.(88)

Thus, the MSDS should include a recommendation to contact the regional Poison Centre for more information as well as provide some details on specific issues as described above. Examples of the type of information that would be appropriate in the Note to Physicians subsection of an MSDS are as follows:

- methylene chloride is metabolized to carbo monoxide and can cause carbon monoxide toxicity;
- phosgene can cause delayed pulmonary edema;
- liver and kidney function should be monitored following exposure to carbon tetrachloride; and
- 4-methylpyrazole is antidotal to ethylene glycol (the MSDS should not indicate specific doses of antidotes).(89)

While it is beyond the scope of this publication to provide detailed information on the "Note to Physicians" subsection of an MSDS, the following chart provides a partial list of chemicals for which Note to Physicians are appropriate, with a partial list of resources. It is strongly recommended that the content for the Note to Physicians be developed and approved by a doctor with expertise in the clinical or occupational toxicology and experience with the chemical in question.

Partial List of Useful Resources

Aluminum	IPCS/CEC Evaluation of Antidotes Series. Antidotes for poisoning by metals and metalloids. Monograph on deferoxamine. Revised and updated by N. Bates. World Health Organization, 2004. Available at: www.inchem.org/pages/antidote.html. Accessed Mar. 2005
Anticholinesterase agents	IPCS/CEC Evaluation of Antidotes Series. Antidotes for poisoning by organophosphorus pesticides. Monograph on atropine. Revised and updated by R. McKeown. World Health Organization, 2002. Available at: www.inchem.org/pages/antidote.html. Accessed Mar. 2005 IPCS/CEC Evaluation of Antidotes Series. Antidotes for poisoning by organophosphorus pesticides. Monograph on diazepam. Edited by by N. Bates. World Health Organization, 2004. Available at: www.inchem.org/pages/antidote.html. Accessed Mar. 2005
Cyanide compounds with cyanide ion toxicity.	IPCS/CEC Evaluation of Antidotes Series. Vol. 2. Antidotes for poisoning by cyanide. Edited by T.J. Meredith, et al. Published by Cambridge University Press on behalf of the World Health Organization and of the Commission of European Communities. Cambridge University Press, 1993. Also available at: www.inchem.org/pages/antidote.html. Accessed Mar. 2005 Health and Safety Executive. Cyanide poisoning. New recommendations on first aid treatment. Available at: www.hse.gov.uk/pubns/misc076.htm. Accessed Jan. 2005 Cummings, T.F., et al. The treatment of cyanide poisoning. Occupational Medicine. Vol. 54 (2004). p. 82-85
Ethylene glycol	Barceloux, D.G., et al. American Academy of Clinical Toxicology practice guide lines on the treatment of ethylene glycol poisoning. Journal of Toxicology. Clinical Toxicology. Vol. 37, no. 5 (1999). p. 537-560
Hydrofluoric acid	Recommended medical treatment for hydrofluoric acid exposure. Honeywell (2000). Available at: www.honeywell.com/sites/sm/chemicals/hfacid/ Accessed: Jan. 2005 Kirkpatrick, J.J.R., et al. An algorithmic approach to the treatment of hydrofluoric acid burns. Burns. Vol. 21, no. 7 (1995). p. 495-499
Hydrogen sulfide	Guidotti, T.L. Hydrogen sulphide. Occupational Medicine. Vol. 46, no. 5 (Oct. 1996). p. 367-371 Milby, T.H., et al. Health hazards of hydrogen sulfide: current status and future directions. Environmental Epidemiology and Toxicology. Vol. 1, nos. 3-4 (1999). p. 262-269

Iron	IPCS/CEC Evaluation of Antidotes Series. Antidotes for poisoning by metals and metalloids. Monograph on deferoxamine. Revised and updated by N. Bates. World Health Organization, 2004. Available at: www.inchem.org/pages/antidote.html. Accessed Mar. 2005
Methanol	Barceloux, D.G., et al. American Academy of Clinical Toxicology practice guidelines on the treatment of methanol poisoning. Journal of Toxicology. Clinical Toxicology. Vol. 40, no. 4 (2002). p. 415-446
Methemoglobinemia inducers (e.g., aniline, o-toluidine, sodium nitrate)	Bradberry, S.M. Occupational methaemoglobinaemia–mechanisms of production, features, diagnosis and management including the use of methylene blue. Toxicological Review. Vol. 22, no. 1 (2003). p. 13-27
Various Medical Management Guidelines (MMGs)	The Medical Management Guidelines (MMGs) for Acute Chemical Exposures were developed by ATSDR to aid emergency department physicians and other emergency healthcare professionals who manage acute exposures resulting from chemical incidents.The MMGs are intended to aid healthcare professionals involved in emergency response to effectively decontaminate patients, protect themselves and others from contamination, communicate with other involved personnel, efficiently transport patients to a medical facility, and provide competent medical evaluation and treatment to exposed persons. Managing Hazardous Material Incidents (MHMI). Volume III. Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Atlanta, GA: US Department of Health and Human Services, Public Health Service. Also available at: www.atsdr.cdc.gov/mmg.html#bookmark03 Accessed: Mar. 2005
Various Poison Information Monographs (PIMS)	Poison Information Monographs (PIMS) are dynamic documents which represent an international consensus on the diagnosis, management and prevention of poisonings. PIMs are prepared by collaborating poisons information centres and other experts throughout the world and are subjected to individual and peer review. PIMs summarize the physico-chemical and toxicological properties of the substance, the medical features of the effects produced by various routes of exposure to the substance, the patient management and the supporting laboratory investigations. International Programme on Chemical Safety (IPCS). Poison information monographs (PIMS). Available at: www.inchem.org/pages/pims.html