A. Site Health and Safety Plan

A.1 Introduction

This health and safety plan (HASP) was prepared by *redacted* to address health and safety concerns related to the field sampling activities detailed in the sampling and analysis plan. The planned field activities include the collection and tissue sampling of yellow perch, brown bullhead, and smallmouth bass from Stillwater Pool above Stillwater Dam, Thompson Island Pool, Feeder Dam, and Oneida Lake. This study is being conducted in support of the Hudson River Natural Resource Damage Assessment in the Upper Hudson River assessment area upstream from Troy, New York.

This section of the site HASP document defines general applicability and general responsibilities with respect to compliance with health and safety programs.

The purpose of this site HASP is to define the requirements and designate protocols to be followed at the site during investigation activities. Applicability extends to all on-site personnel from *redacted*, NYSDEC, USGS, NOAA, USFWS, DOI, and DOJ.

All personnel on site, contractors and subcontractors included, will be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation. Chemical and physical hazards at the site and planned protective measures are presented in Sections A.3, A.5, and A.11 of this appendix.

This plan must be reviewed and an agreement to comply with the requirements must be signed by all personnel before working at the site.

During development of this plan, consideration was given to current safety standards as defined by EPA/OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR 1910.120 and EPA 40 CFR 311
- U.S. EPA, OERR ERT Standard Operating Safety
- NIOSH/OSHA/USCG/EPA Occ. Health and Safety Guidelines.

A.2 Key Personnel

The following personnel and organizations are critical to the planned activities at the site. The organizational structure will be reviewed and updated periodically by the site supervisors.

- *redacted*
- *redacted*
- *redacted*
- *redacted*
- *redacted*
- *redacted*.

Each crew leader has responsibility for ensuring that the provisions of this HASP are adequate and implemented in the field. In addition, the field team leader has responsibility to coordinate with the crew leaders to help maintain proper safety precautions at all times. Changing field conditions may require decisions to be made concerning adequate protection programs.

A.3 Task/Operation Safety and Health Risk Analysis

A.3.1 Historical overview of site

Two capacitor-manufacturing facilities located at Fort Edward (river mile 196) and Hudson Falls (river mile 197) on the Upper Hudson River released large quantities of PCBs to the river between 1947 and 1977. A large fraction of the PCBs discharged before 1973 accumulated behind the Fort Edward dam, located a little over a mile downstream of the Fort Edwards facility. After the deteriorating dam was removed in 1973, subsequent spring floods carried the PCB-contaminated sediments downstream, and many of the PCBs settled in calm areas of the river described as hot spots for their high concentrations of PCBs (TAMS Consultants Inc., 1999).

For a thorough overview of historical information concerning the site, see the following documents:

- Further Site Characterization and Analysis. Data Evaluation and Interpretation Report: Hudson River PCBs Reassessment RI/FS (TAMS Consultants Inc., 1997a).

- Further Site Characterization and Analysis. Low Resolution Sediment Coring Report. Addendum to the Data Evaluation and Interpretation Report: Hudson River PCBs Reassessment RI/FS (TAMS Consultants, 1998).

- PCBs in the Upper Hudson River. Executive Summary (Quantitative Environmental Analysis Inc., 1999).

A.3.2 Task by task risk analysis

The evaluation of hazards is based on the knowledge of site background presented in Section A.3.1 and anticipated risks posed by the specific operation. The following subsections describe each task/operation and specific associated hazards. In addition, protective measures to be implemented during the tasks/operations are also identified.

Planned Activities

Planned activities at the site include:

- electroshocking and trap netting of fish at Stillwater Pool, Thompson Island Pool, Feeder Dam, and Oneida Lake
- processing fish, including measurements, visual examinations, dissection, and collection of tissue samples.

Field sampling will take place in late summer/fall 2001.

Hazard Evaluation

Hazards associated with the field sampling activities detailed in the SAP include physical and chemical hazards.

Physical Hazards. Physical hazards associated with this task include:

- possible drowning hazards from working on and near water
- possible slip, trip, and fall hazards
- possible heat and cold stress
- possible burn hazards associated with using liquid nitrogen and dry ice
- possible hazards associated with using scalpels, scissors, forceps, and other sharp objects used to dissect and process the fish
- possible electrocution hazards associated with collecting fish using electroshocking methods

- possible skin puncture and skin laceration, and associated infection, from handling fish (from fin spines or from teeth), or from handling other animals caught in trapnets (turtles, snakes, birds, and mammals), or from insect bites and stings.

U.S. Coast Guard approved life preservers will be worn by personnel while on any boat or near the water. Care will be used at all times to avoid slip, trip, and fall hazards, and the field team leader will provide for sufficient work breaks to ensure that the field team members are mentally alert and not physically fatigued.

All personnel who handle liquid nitrogen or dry ice will follow proper handling procedures, including the use of cryo-gloves.

Chemical Hazards. Table A.1 lists the chemical compounds of concern for field sampling and sample processing, the advisory levels associated with each compound, and sources and concentrations for the compounds. Table A.2 lists the potential chemical hazards and the first aid procedures required to treat them.

Table A.1. Chemical hazards of concern at the Hudson River assessment area, corresponding standards, sources, and concentrations

Compound		Agency standards			Source or use	Conc.
		OSHA	ACGIH	NIOSH		
Dietrich's fixative	Formaldehyde, ethanol, and glacial acetic acid	0.75 ppm (TWA[a])	0.3 ppm	0.016 ppm recom. TWA[a]; 0.1 ppm recom. 15 min. ceiling	Tissue preservation	100%
Methanol (methyl alcohol)		N/A	N/A	N/A	Disinfectant/ decontamination	>99%[b]
Polychlorinated biphenyls			0.5 mg/m^3 = 500 ng/L for chlorodiphenyl (54% Cl) skin	IDLH[c] not applicable, potential carcinogen	Hudson River surface water	0.02-360 ng/L in the upper Hudson River[d]
Dry ice (frozen carbon dioxide)		10,000 ppm (PEL[e])	5,000 ppm (TLV[f])	NA	Tissue preservation and storage	100%

a. Time weighted average.
b. Source container concentration.
c. Immediately dangerous to life and health.
d. Source: TAMS Consultants Inc., 1997b.
e. Permissible exposure limit.
f. Threshold limit value.

Table A.2. Chemical hazards and first aid procedures

Compound	Hazard	First aid procedures
Formalde-hyde	Inhalation	Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
	Skin contact	Flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing. Get emergency medical assistance.
	Eye contact	Flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Get emergency medical assistance.
	Ingestion	If person is conscious, wash out mouth with water. Get immediate medical attention.
Ethanol	Inhalation	Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
	Skin contact	Wash with soap and copious amounts of water.
	Eye contact	Immediately flush with copious amounts of water for at least 15 minutes.
	Ingestion	If person is conscious, wash out mouth with water. Get immediate medical attention.
Glacial acetic acid	Inhalation	Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
	Skin contact	Flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing. Get emergency medical assistance.
	Eye contact	Flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Get emergency medical assistance.
	Ingestion	If person is conscious, wash out mouth with water. Get immediate medical attention. Do not induce vomiting.
Methanol	Inhalation	Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
	Skin contact	Flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing. Get emergency medical assistance.
	Eye contact	Flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Get emergency medical assistance.
	Ingestion	If person is conscious, immediately give 4 to 8 oz milk or water. Contact a doctor. Do not induce vomiting. Call local poison control for assistance.

Table A.2. Chemical hazards and first aid procedures (cont.)

Compound	Hazard	First aid procedures
Dry ice	Inhalation	If person is conscious, assist to uncontaminated area and inhale fresh air. If unconscious, remove to uncontaminated area and give mouth-to-mouth resuscitation and supplemental oxygen.
	Skin contact	Remove contaminated clothing. Immediately flush for 15 minutes with soap and water. Get emergency medical assistance.
	Eye contact	Immediately flush with copious amounts of water for at least 15 minutes. Get emergency medical assistance.
	Ingestion	N/A

Electroshock Hazards. The following safety requirements will be followed by all personnel involved in collecting fish by electroshocking:

1. The fish collection supervisor is responsible for the safety of all crew members, and each field collection crew leader is responsible for the safety of his or her crew.

2. A minimum of two properly trained people will conduct every electroshocking effort.

3. The crew leader of each boat and at least one additional crew member will have received training in cardiopulmonary resuscitation (CPR) and first aid.

4. All electroshocking personnel will be provided with instructions for the standard operating procedures for using electricity for collecting fish safely.

5. All electroshocking equipment will be checked before each operation to ensure that they are in working order.

6. No field modifications will be made to electroshocking equipment without prior written approval from the manufacturer or a qualified electrical engineer.

7. Only dip nets with insulated handles should be used to collect fish.

8. All personnel on the boat or near the water will wear flotation devices.

9. All personnel on the electroshocking crew will wear linemens' gloves and insulated footwear.

10. A labeled first aid kit and fire extinguisher will be on board the boat at all times.

11. Multiple (3) foot switch will control the output.

12. The generator will be turned off to stop the electrical current during fish transfer operations.

13. All electrical connections will be in watertight junctions boxes; all cables will run through electrical conduit or a heavy duty rubber-covered cord recommended for wet locations will be used.

14. Electroshocking will NOT be conducted during electrical storms, heavy rain or extreme weather conditions.

A.4 Personnel Training Requirements

At a minimum all personnel are required to be trained to recognize the hazards associated with the fieldwork, the provisions of this HASP, and responsible personnel.

The topics in Table A.3 will be discussed by a qualified individual at the periodic site briefings.

Table A.3. Briefing topics and frequency

Training	Frequency
Chemical hazards (Table A.1)	Study orientation/periodic
Physical hazards	Study orientation/periodic
Use of netting equipment	Study orientation
Electrofishing equipment	Study orientation/periodic
Fish handling	Study orientation

A.5 Personal Protective Equipment to Be Used

This section describes the general requirements of the EPA designated Levels of Protection (A-D), and the specific levels of protection required for each task at the site.

A.5.1 Levels of protection

Personnel must wear personal protective equipment (PPE) when response activities involve known or suspected atmospheric contamination vapors or gases, or when particulates may be generated by site activities, or when direct contact with skin-affecting substances may occur. Full

face respirators protect lungs, gastrointestinal tract, and eyes against airborne toxicants. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals.

The four levels of protection and their necessary components are as follows:

Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed.

Level B: Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection is needed. Level B is the primary level of choice when encountering unknown environments.

Level C: Should be worn when the criteria for using air-purifying respirators are met, and a lesser level of skin protection is needed.

Level D: Should be worn only as a work uniform and not in any area with respiratory or skin hazards. It provides minimal protection against chemical hazards.

Modifications of these levels are permitted and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise, the type of chemical protective ensemble (i.e., material, format) will depend on contaminants and degrees of contact.

The level of protection selected is based on the following:

- type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity
- potential for exposure to substances in air liquids, or other direct contact with material due to work being done
- knowledge of chemicals on site along with properties such as toxicity, route of exposure, and contaminant matrix.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be better identified.

A.5.2 Reassessment of protection program

The level of protection provided by PPE selection may be upgraded or downgraded based on a reassessment necessitated by a change in site conditions or findings of investigations. When a significant change occurs, the hazards should be reassessed. Some indicators of the need for reassessment are:

- beginning a new work phase, such as sampling at a new location
- change in job tasks during a work phase
- change of season/weather
- when temperature extremes or individual medical considerations limit the effectiveness of PPE
- contaminants other than those previously identified are encountered
- change in ambient levels of contaminants
- change in work scope that affects the degree of contact with contaminants.

A.5.3 Work mission duration

Before the workers actually begin work in their PPE ensembles, the anticipated duration of the work mission should be established. Several factors limit mission length, including:

- suit/ensemble permeation and penetration rates for chemicals
- ambient temperature and weather conditions (heat, cold stress)
- capacity of personnel to work in PPE.

A.5.4 Specific levels of protection planned for the site

The following levels of protection will be used during activities described in this SOP:

- Level D.

This decision is based on professional judgment of the hazards associated with low PCB concentrations measured in Hudson River surface water (< 360 ng/L) (TAMS Consultants Inc., 1997b).

Level D PPE will be worn during all sampling activities in the Hudson River and Oneida Lake and will include:

- electrically resistant footwear while on boats and while in the river
- electrically-resistant gloves while electroshocking
- outer garment/coveralls — work clothes, flotation device
- chemical resistant gloves during sample preparation
- cut-resistant work gloves while handling live fish with hands
- cryo-gloves for use while handling dry ice.

A.6 Frequency and Types of Air Monitoring/Sampling

This section explains the general concepts of an air monitoring program and specifies the surveillance activities that will take place during project completion at the site.

No air monitoring is required during this field work, because all work will be conducted well off-site where concentrations are quite low. Therefore, no monitoring activities are planned.

A.7 Site Control Measures

The following section defines measures and procedures for maintaining site control. Site control is an essential component in the implementation of the site health and safety program.

A.7.1 Buddy system

During all activities when some conditions present a risk to personnel, the implementation of a buddy system is mandatory. A buddy system requires at least two people who work as a team, each looking out for each other. Teams may also be supplied with marine radios or cell phones so they can communicate with each other and transmit calls for assistance.

A.7.2 Site communications plan

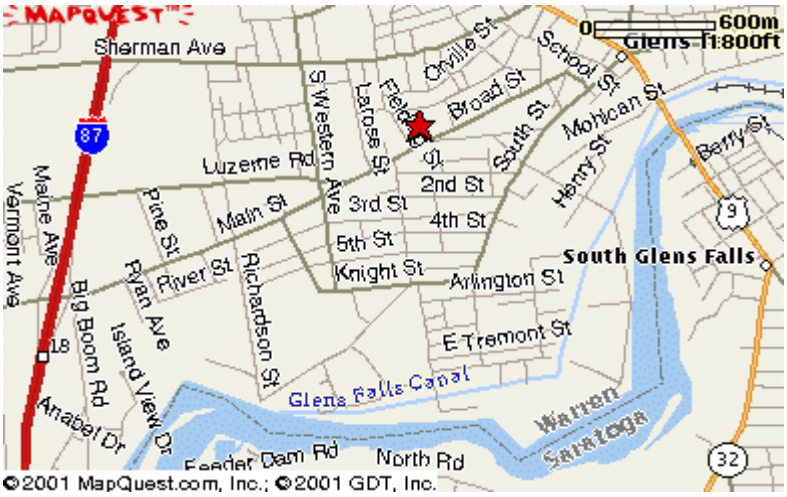
Successful communications between field teams and contact with personnel in the support zone are essential. All teams will be able to communicate using marine radios. The in-person contact communication systems will be used during site activities. Each sampling and processing group will have a cellular telephone (or equivalent) to ensure communication between groups is possible, and to allow each group to contact emergency authorities should the need arise.

A.7.3 Work zone definition

All work will be conducted in areas of the Upper Hudson River above the Dam at Troy and at Oneida Lake near Syracuse, New York.

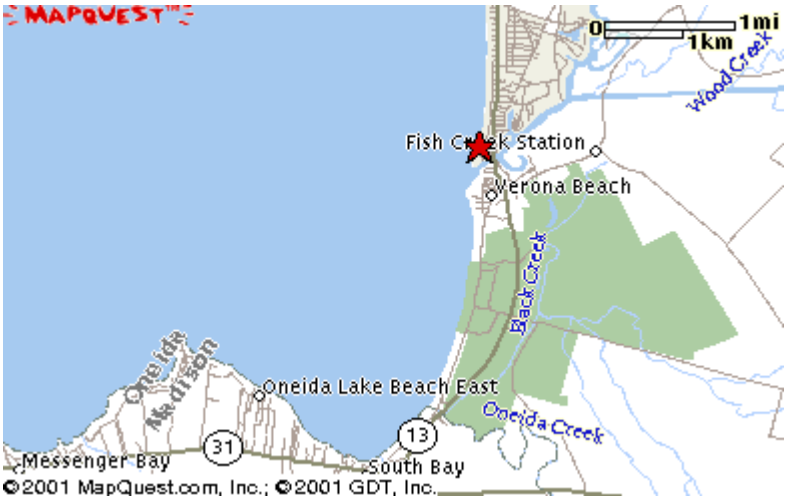
A.7.4 Nearest medical assistance

Figures A.1-A.4 show the route to the nearest medical facility at each sampling location. These facilities can provide emergency care for individuals who may experience an injury or chemical exposure on site. The route to the hospitals should be verified by the Health and Safety Officer, and this route should be familiar to all field personnel.



Irongate Family Practice Assoc.
3 Irongate Ctr. # 2
Glens Falls, NY 12801
(518)793-4409

Figure A.1. Maps depicting locations of medical facilities near Feeder Dam.



East Shore Medical
200 Spencer Ave
Sylvan Beach, NY 13157
(315)761-0507

Figure A.2. Maps depicting locations of medical facilities near Oneida Lake.

Stillwater Family Health
351 Hudson Ave
Stillwater, NY 12170
(518) 664-3242

Figure A.3. Maps depicting locations of medical facilities near Stillwater.

Moreau Family Health
10154 Saratoga Rd
Fort Edward, NY 12828
(518)761-6961

Figure A.4. Maps depicting locations of medical facilities near Thompson Island pool.

A.8 Decontamination Plan

Decontamination involves the orderly, controlled removal of contaminants. All site personnel should minimize contact with contaminants to minimize the need for extensive decontamination.

A.8.1 Levels of decontamination protection required for personnel

The levels of protection required for personnel assisting with decontamination will be Level D.

The Health and Safety Officer (HSO) is responsible for monitoring decontamination procedures and determining their effectiveness.

A.8.2 Equipment decontamination

Sampling equipment will be decontaminated according to the procedures in SOP 4 (Appendix D).

A.8.3 Disposition of decontamination wastes

All equipment and solvents used for decontamination will be decontaminated or disposed of properly. Commercial laundries or cleaning establishments that decontaminate clothing or equipment will be informed of the potentially harmful effects of exposures. Used PPE and other waste will be placed in a trash bag designated for this purpose. At the completion of sampling, the trash will be disposed of at a Class D, nonhazardous landfill.

A.8.4 Level D decontamination steps

Step 1: Remove outer garments (i.e., waders).
Step 2: Remove gloves.
Step 3: Wash hands and face.

A.9 Emergency Response/Contingency Plan

This section describes contingencies and emergency planning procedures to be implemented at the site. This plan is compatible with local, state, and federal disaster and emergency management plans as appropriate.

A.9.1 Pre-emergency planning

During the site briefings held periodically/daily, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes. The plan will be reviewed and revised, if necessary, on a regular basis by the Health and Safety Officer. This will ensure that the plan is adequate and consistent with prevailing site conditions.

A.9.2 Personnel roles and lines of authority

The designated Health and Safety Officers have primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. He is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed.

Health and Safety Officers: *redacted* (fish collection); *redacted* (shore operations)

A.9.3 Emergency recognition/prevention

Section A.3.2 describes the chemical and physical hazards on site. Personnel will be familiar with techniques of hazard recognition from preassignment training and site specific briefings. The HSO is responsible for ensuring that prevention devices or equipment is available to personnel.

A.9.4 Evacuation routes/procedures

If an emergency necessitates an evacuation of the site, the following alarm procedures will be implemented:

- The HSO will ensure that a predetermined location is identified off site in case of an emergency, so that all personnel can be accounted for.

A.9.5 Emergency contact/notification system

Table A.4 provides names and telephone numbers for relevant emergency response/care facilities. Figures A.1 through A.4 show locations of the medical facilities near each of the sampling locations. In the event of a medical emergency, personnel will take direction from the HSO and notify the appropriate emergency organization. In the event of a fire or spill, the field team leader will notify the appropriate local, state, and federal agencies.

A.9.6 Emergency medical treatment procedures

All injuries and illnesses must immediately be reported to the field team leader.

Any person being transported to a clinic or hospital for treatment should take with them information on the chemical(s) they may have been exposed to near the site. This information is included in Table A.1.

Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

A.9.7 Fire or explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the field team leader or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on site.

Table A.4. Emergency contact personnel

Organization	Telephone
Ambulance, local police, state police, fire	911
Emergency care at Stillwater pool sampling site	
Stillwater Family Health 351 Hudson Ave Stillwater, NY 12170	(518) 664-3242
Emergency care at Thompson Island pool sampling site	
Moreau Family Health 10154 Saratoga Rd Fort Edward, NY 12828	(518) 761-6961
Emergency care at Oneida Lake beach sampling site	
East Shore Medical 200 Spencer Ave Sylvan Beach, NY 13157	(315) 761-0507
Emergency care at Feeder Dam sampling site	
Irongate Family Practice Assoc. 3 Irongate Ctr. # 2 Glens Falls, NY 12801	(518) 793-4409
Emergency response teams/contacts	
EPA Emergency Response Team	(908) 321-6660
National Response Center	(800) 424-8802
Center for Disease Control	(518) 473-8389
Chemtrec	(800) 424-9555

If it is safe to do so, site personnel may:

- use fire fighting equipment available on site to control or extinguish the fire
- remove or isolate flammable or other hazardous materials that may contribute to the fire.

A.10 Confined Space Entry Procedures

No confined space entries will be conducted as part of this field work.

A.11 Electrical Hazards

Fish will be collected using electroshocking procedures. Each electroshocking boat will have a foot-activated safety switch that must be pressed to activate the electrical current to the electrodes in the water. If a person loses footing or falls overboard, the electrical current to the electrodes will be stopped. All personnel on board the electroshocking boat will wear electrically insulated footwear. Persons netting fish will wear electrically insulated gloves (5000 V minimum) and use nonconductive nets. All personnel on board the electroshocking boat will receive full orientation on equipment and hazards by the fish collection supervisor.

A.12 Hazard Communication

To comply with 29 CFR 1910.1200, Hazard Communication, the following written Hazard Communication Program has been established. All employees will be briefed on this program, and have a written copy for review.

A.12.1 Container labeling

All containers received on site will be inspected to ensure that:

- the container is clearly labeled as to the contents
- appropriate hazard warnings are noted
- name and address of the manufacturer is listed.

All secondary containers will be labeled either with an extra copy of the original manufacturer's label or with generic labels that have a block for identification and blocks for the hazard warning.

A.12.2 Material safety data sheets

Copies of material safety data sheets (MSDSs) for all hazardous chemicals known or suspected on site will be maintained in the work area. Copies of relevant MSDSs are attached to the end of this HASP. MSDSs will be available to all personnel for review during each work shift.

A.12.3 Personnel training and information

Before starting work, each person will attend a health and safety orientation and will receive information and training on the following: (1) an overview of the requirements contained in the Hazard Communication Standard, 29 CFR 1910.1200, (2) chemicals present in their site

operations, (3) location and availability of a written hazard program, (4) physical and health effects of the hazardous chemicals, (5) methods and observation techniques used to determine the presence or release of hazardous chemicals, (6) how to lessen or prevent exposure to these hazardous chemicals through usage of control/work practices and personal protective equipment, (7) emergency procedures to follow if they are exposed to these chemicals, (8) how to read labels and review MSDSs to obtain appropriate hazard information, and (9) location of MSDS file and location of hazardous chemical list.

References

ACGIH. 1993. Guide to Occupational Exposure Values.

Quantitative Environmental Analysis Inc. 1999. PCBs in the Upper Hudson River. Executive Summary. Prepared for General Electric, Albany, New York. May. Amended July 1999.

TAMS Consultants Inc. 1997a. Further Site Characterization and Analysis: Volume 2C, Book 1 of 3: Data Evaluation and Interpretation Report: Hudson River PCBs Reassessment RI/FS. Phase 2 Report — Review Copy. Prepared by TAMS Consultants, The Cadmus Group, and Gradient Corporation for U.S. EPA Region II and U.S. Army Corps of Engineers, Kansas City District. February.

TAMS Consultants Inc. 1997b. Further Site Characterization and Analysis: Volume 2C, Book 2 of 3: Data Evaluation and Interpretation Report: Hudson River PCBs Reassessment RI/FS. Phase 2 Report — Review Copy. Prepared by TAMS Consultants, The Cadmus Group, and Gradient Corporation for U.S. EPA Region II and U.S. Army Corps of Engineers, Kansas City District. February.

TAMS Consultants Inc. 1998. Further Site Characterization and Analysis: Volume 2C-A, Book 1 of 2: Low Resolution Sediment Coring Report. Addendum to the Data Evaluation and Interpretation Report: Hudson River PCBs Reassessment RI/FS. Phase 2 Report — Review Copy. Prepared by TAMS Consultants, Gradient Corporation and Tetra Tech, Inc. for U.S. EPA Region II and U.S. Army Corps of Engineers, Kansas City District. July.

TAMS Consultants Inc. 1999. Further Site Characterization and Analysis: Volume 2E. Baseline Ecological Risk Assessment: Hudson River PCBs Reassessment RI/FS. Book 1 of 3: Text. Phase 2 Report — Review Copy. Prepared by TAMS Consultants and Menzie-Cura & Associates, Inc. for U.S. EPA Region II and U. S. Army Corps of Engineers, Kansas City District. August.

Material Safety Data Sheets

Riedel-de Haen
3050 Spruce St.
St. Louis, MO 63178 USA
Tel: 314-289-6000

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: 34485
NAME: METHANOL, (PESTANAL) MIN. 99.9% GC
SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 67-56-1
MF: C-H4-O
EC NO: 200-659-6
SYNONYMS
ALCOOL METHYLIQUE (FRENCH) * ALCOOL METILICO (ITALIAN) * BIELESKI'S SOLUTION * CARBINOL * COLONIAL SPIRIT * COLUMBIAN SPIRIT * METANOLO (ITALIAN) * METHANOL (ACGIH) * METHYL ALCOHOL (DOT:OSHA) * METHYLOL * METHYLALKOHOL (GERMAN) * METHYL HYDRATE * METHYL HYDROXIDE * METYLOWY ALKOHOL (POLISH) * MONOHYDROXYMETHANE * PYROXYLIC SPIRIT * RCRA WASTE NUMBER U154 * WOOD ALCOHOL * WOOD NAPHTHA * WOOD SPIRIT *
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
FLAMMABLE (USA)
HIGHLY FLAMMABLE (EU)
TOXIC
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
TOXIC: DANGER OF VERY SERIOUS IRREVERSIBLE EFFECTS THROUGH INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
IRRITATING TO EYES AND SKIN.
TARGET ORGAN(S):
EYES
KIDNEYS
CAUSES EYE AND SKIN IRRITATION.
KEEP CONTAINER TIGHTLY CLOSED.
KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.
TAKE PRECAUTIONARY MEASURES AGAINST STATIC DISCHARGES.
AVOID CONTACT WITH SKIN.
WEAR SUITABLE PROTECTIVE CLOTHING AND GLOVES.
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL

RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF SKIN CONTACT, FLUSH WITH COPIOUS AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND
SHOES. CALL A PHYSICIAN.
IN CASE OF CONTACT WITH EYES, FLUSH WITH COPIOUS AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING
THE EYELIDS WITH FINGERS. CALL A PHYSICIAN.
IF PERSON IS CONSCIOUS AFTER INGESTION OF MATERIAL, IMMEDIATELY GIVE
4 TO 8 OUNCES OF MILK OR WATER.
IF SWALLOWED, DO NOT INDUCE VOMITING; CALL A PHYSICIAN IMMEDIATELY.

SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

FLAMMABLE LIQUID.
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND
FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -

WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
RUBBER GLOVES.
COVER WITH DRY-LIME, SAND, OR SODA ASH. PLACE IN COVERED CONTAINERS
USING NON-SPARKING TOOLS AND TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.

SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -

REFER TO SECTION 8.

SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -

SAFETY SHOWER AND EYE BATH.
USE NONSPARKING TOOLS.
USE ONLY IN A CHEMICAL FUME HOOD.
WASH CONTAMINATED CLOTHING BEFORE REUSE.
WASH THOROUGHLY AFTER HANDLING.
NIOSH/MSHA-APPROVED RESPIRATOR.
COMPATIBLE CHEMICAL-RESISTANT GLOVES.
CHEMICAL SAFETY GOGGLES.
KEEP CONTAINER CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.
DO NOT BREATHE VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
DO NOT USE IF SKIN IS CUT OR SCRATCHED. WASH THOROUGHLY AFTER
HANDLING.

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SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
  APPEARANCE AND ODOR
    LIQUID.
  PHYSICAL PROPERTIES
    BOILING POINT:        64 - 65  C
    MELTING POINT:      -98  C
    FLASHPOINT               52F
                             11.11C
    EXPLOSION LIMITS IN AIR:
      UPPER                                   36.00 %
      LOWER                                   7.3 %
    VAPOR PRESSURE:      97.68 MMHG @ 20  C
    SOLUBILITY:
           WATER -Z1079
    SPECIFIC GRAVITY:     0.791
    EVAPORATION RATE:            5.2
    VAPOR DENSITY:     1.1 G/L
    FREEZING POINT:          -98  C
    SWISS POISON CLASS:      3
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
  STABILITY
    STABLE.
  INCOMPATIBILITIES
    ACIDS
    ACID CHLORIDES
    ACID ANHYDRIDES
    OXIDIZING AGENTS
    ALKALI METALS
    REDUCING AGENTS
  HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
    CARBON MONOXIDE, CARBON DIOXIDE
  HAZARDOUS POLYMERIZATION
    WILL NOT OCCUR.
SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -
  ACUTE EFFECTS
    CAUSES SKIN IRRITATION.
    TOXIC IF ABSORBED THROUGH SKIN.
    CAUSES EYE IRRITATION.
    TOXIC IF INHALED.
    MATERIAL MAY BE IRRITATING TO MUCOUS MEMBRANES AND UPPER
    RESPIRATORY TRACT.
    TOXIC IF SWALLOWED.
    EXPOSURE CAN CAUSE:
    GASTROINTESTINAL DISTURBANCES
    MAY CAUSE CONVULSIONS.
    TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
    TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
    LD
    LC
  CHRONIC EFFECTS
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    TARGET ORGAN(S):
    CENTRAL NERVOUS SYSTEM
  RTECS #: PC1400000
    METHANOL
  IRRITATION DATA
    SKN-RBT 20 MG/24H MOD                          85JCAE -,187,1986
    EYE-RBT 40 MG MOD                              UCDS** 3/24/1970
    EYE-RBT 100 MG/24H MOD                         85JCAE -,187,1986
  TOXICITY DATA
    ORL-MAN LDLO:6422 MG/KG                        CMAJAX 128,14,1983
    ORL-HMN LDLO:428 MG/KG                         NPIRI* 1,74,1974
    ORL-HMN LDLO:143 MG/KG                         34ZIAG -,382,1969
    UNR-MAN LDLO:868 MG/KG                         85DCAI 2,73,1970
    ORL-RAT LD50:5628 MG/KG                        GTPZAB 19(11),27,1975
    IHL-RAT LC50:64000 PPM/4H                      NPIRI* 1,74,1974
    IPR-RAT LD50:7529 MG/KG                        EVHPAZ 61,321,1985
    IVN-RAT LD50:2131 MG/KG                        EVHPAZ 61,321,1985
    ORL-MUS LD50:7300 MG/KG                        TXCYAC 25,271,1982
    IPR-MUS LD50:10765 MG/KG                       EVHPAZ 61,321,1985
    SCU-MUS LD50:9800 MG/KG                        TXAPA9 18,185,1971
    IVN-MUS LD50:4710 MG/KG                        EVHPAZ 61,321,1985
    ORL-MKY LD50:7 GM/KG                           TXAPA9 3,202,1961
    ORL-RBT LD50:14200 MG/KG                       FAONAU 48A,105,1970
    SKN-RBT LD50:15800 MG/KG                       NPIRI* 1,74,1974
    IPR-RBT LD50:1826 MG/KG                        EVHPAZ 61,321,1985
    IVN-RBT LD50:8907 MG/KG                        EVHPAZ 61,321,1985
    IPR-GPG LD50:3556 MG/KG                        EVHPAZ 61,321,1985
    IPR-HAM LD50:8555 MG/KG                        EVHPAZ 61,321,1985
  TARGET ORGAN DATA
    SENSE ORGANS AND SPECIAL SENSES (OPTIC NERVE NEUROPATHY)
    SENSE ORGANS AND SPECIAL SENSES (VISUAL FIELD CHANGES)
    BEHAVIORAL (HEADACHE)
    LUNGS, THORAX OR RESPIRATION (DYSPNAE)
    LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
    GASTROINTESTINAL (NAUSEA OR VOMITING)
    SPECIFIC DEVELOPMENTAL ABNORMALITIES (CENTRAL NERVOUS SYSTEM)
    SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
    ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
    (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
    COMPLETE INFORMATION.
SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - - -
    DATA NOT YET AVAILABLE.
SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - - -
    CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF
    THIS MATERIAL.
    BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND
    SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY
    FLAMMABLE.
    OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.
SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - - -
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    CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.
SECTION 15. - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -
  EUROPEAN INFORMATION
    EC INDEX NO:     603-001-00-X
    HIGHLY FLAMMABLE
    TOXIC
    R 11
    HIGHLY FLAMMABLE.
    R 23/24/25
    TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
    R 39/23/24/25
    TOXIC: DANGER OF VERY SERIOUS IRREVERSIBLE EFFECTS THROUGH
    INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
    S 45
    IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
    IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
  REVIEWS, STANDARDS, AND REGULATIONS
    OEL=MAK
    ACGIH TLV-STEL 250 PPM (SKIN)                 DTLVS* TLV/BEI,1999
    ACGIH TLV-TWA 200 PPM (SKIN)                  DTLVS* TLV/BEI,1999
    EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
     FEREAC 54,7740,1989
    MSHA STANDARD-AIR:TWA 200 PPM (260 MG/M3) (SKIN)
     DTLVS* 3,155,1971
    OSHA PEL (GEN INDU):8H TWA 200 PPM (260 MG/M3)
     CFRGBR 29,1910.1000,1994
    OSHA PEL (CONSTRUC):8H TWA 200 PPM (260 MG/M3)
     CFRGBR 29,1926.55,1994
    OSHA PEL (SHIPYARD):8H TWA 200 PPM (260 MG/M3)
     CFRGBR 29,1915.1000,1993
    OSHA PEL (FED CONT):8H TWA 200 PPM (260 MG/M3)
     CFRGBR 41,50-204.50,1994
    OEL-ARAB REPUBLIC OF EGYPT: TWA 200 PPM (260 MG/M3), SKIN, JAN1993
    OEL-AUSTRALIA: TWA 200 PPM (260 MG/M3), STEL 250 PPM, SKIN, JAN1993
    OEL-AUSTRIA: MAK 200 PPM (260 MG/M3), SKIN, JAN1999
    OEL-BELGIUM: TWA 200 PPM (262 MG/M3), STEL 250 PPM, SKIN, JAN1993
    OEL-DENMARK: TWA 200 PPM (260 MG/M3), SKIN, JAN1999
    OEL-FINLAND: TWA 200 PPM (260 MG/M3), STEL 250 PPM, SKIN, JAN1999
    OEL-FRANCE: VME 200 PPM, VLE 1000 PPM, JAN1999
    OEL-HUNGARY: TWA 50 MG/M3, STEL 100 MG/M3, SKIN, JAN1993
    OEL-JAPAN: OEL 200 PPM (260 MG/M3), SKIN, JAN1999
    OEL-THE NETHERLANDS: MAC-TGG 200 PPM (260 MG/M3), SKIN, JAN1999
    OEL-NORWAY: TWA 100 PPM (130 MG/M3), JAN1999
    OEL-THE PHILIPPINES: TWA 200 PPM (260 MG/M3), JAN1993
    OEL-POLAND: MAC(TWA) 100 MG/M3, MAC(STEL) 300 MG/M3, JAN1999
    OEL-RUSSIA: TWA 200 PPM, STEL 5 MG/M3, SKIN, JAN1993
    OEL-SWEDEN: NGV 200 PPM (250 MG/M3), KTV 250 PPM (350 MG/M3), SKIN,
     JAN1999
    OEL-THAILAND: TWA 200 PPM (260 MG/M3), JAN1993
    OEL-TURKEY: TWA 200 PPM (260 MG/M3), JAN1993
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OEL-UNITED KINGDOM: TWA 200 PPM (255 MG/M3), STEL 250 PPM, SKIN, SEP2000
OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV;
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO METHANOL-AIR:10H TWA 200 PPM (SK);STEL 250 PPM (SK) NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 45930; NIS 344; TNF 78840; NOS 203; TNE 737242
NOES 1983: HZD 45930; NIS 373; TNF 101075; NOS 225; TNE 1620617; TFE 388352
EPA GENETOX PROGRAM 1988, NEGATIVE: SHE-CLONAL ASSAY; CELL TRANSFORM.-SA7/SHE
EPA GENETOX PROGRAM 1988, NEGATIVE: N CRASSA-ANEUPLOIDY; IN VITRO SCE-NONHUMAN
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
EPA TSCA SECTION 8(E) RISK NOTIFICATION, 8EHQ-0892-8989
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001
NIOSH ANALYTICAL METHOD, 1994: METHANOL, 2000
NIOSH ANALYTICAL METHOD, 1996: VOLATILE ORGANIC COMPOUND, 2549
U.S. INFORMATION
THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.
SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -
THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO
BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH,
FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING
OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR
PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Valid 08/2001 - 10/2001

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Tel: 314-771-5765

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: F1635
NAME: FORMALDEHYDE (FORMALIN)
SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 50-00-0
MF: CH2O
EC NO: 200-001-8
ADDITIONAL INFORMATION
CONTAINS METHYL ALCOHOL, CHEMICAL ABSTRACTS REGISTRY NUMBER 67-56-1.
SYNONYMS
ALDEHYDE FORMIQUE (FRENCH) * ALDEHYD MRAVENCI (CZECH) * ALDEIDE FORMICA (ITALIAN) * BFV * FANNOFORM * FORMALDEHYDE (ACGIH:OSHA) * FORMALDEHYD (CZECH, POLISH) * FORMALDEHYDE, GAS * FORMALIN * FORMALIN 40 * FORMALINA (ITALIAN) * FORMALINE (GERMAN) * FORMALIN-LOESUNGEN (GERMAN) * FORMALITH * FORMIC ALDEHYDE * FORMOL * FYDE * LYSOFORM * METHALDEHYDE * METHANAL * METHYL ALDEHYDE * METHYLENE OXIDE * MORBICID * NCI-C02799 * OPLOSSINGEN (DUTCH) * OXOMETHANE * OXYMETHYLENE * PARAFORM * RCRA WASTE NUMBER U122 * SUPERLYSOFORM *
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
TOXIC
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
CAUSES BURNS.
MAY CAUSE SENSITIZATION BY INHALATION AND SKIN CONTACT.
POSSIBLE RISK OF IRREVERSIBLE EFFECTS.
MAY CAUSE HERITABLE GENETIC DAMAGE.
POTENTIAL CANCER HAZARD.
CONTAINS FORMALDEHYDE
READILY ABSORBED THROUGH SKIN.
LACHRYMATOR.
COMBUSTIBLE LIQUID.
TARGET ORGAN(S):
EYES
KIDNEYS
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

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    WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE
    PROTECTION.
    IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
    IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
    USE ONLY IN WELL VENTILATED AREAS.
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - -
    IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
    CALL A PHYSICIAN IMMEDIATELY.
    IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL
    RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
    IN CASE OF SKIN CONTACT, FLUSH WITH COPIOUS AMOUNTS OF WATER
    FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND
    SHOES. CALL A PHYSICIAN.
    IN CASE OF CONTACT WITH EYES, FLUSH WITH COPIOUS AMOUNTS OF WATER
    FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING
    THE EYELIDS WITH FINGERS. CALL A PHYSICIAN.
SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
  EXTINGUISHING MEDIA
    CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
  SPECIAL FIREFIGHTING PROCEDURES
    USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.
    WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
    PREVENT CONTACT WITH SKIN AND EYES.
  UNUSUAL FIRE AND EXPLOSIONS HAZARDS
    EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -
    WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
    RUBBER GLOVES.
    COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER
    AND HOLD FOR WASTE DISPOSAL.
    VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
    EVACUATE AREA.
SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -
    REFER TO SECTION 8.
SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -
    USE ONLY IN A CHEMICAL FUME HOOD.
    SAFETY SHOWER AND EYE BATH.
    WASH CONTAMINATED CLOTHING BEFORE REUSE.
    DISCARD CONTAMINATED SHOES.
    WASH THOROUGHLY AFTER HANDLING.
    DO NOT BREATHE VAPOR.
    DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
    AVOID PROLONGED OR REPEATED EXPOSURE.
    NIOSH/MSHA-APPROVED RESPIRATOR.
    COMPATIBLE CHEMICAL-RESISTANT GLOVES.
    CHEMICAL SAFETY GOGGLES.
    FACESHIELD (8-INCH MINIMUM).
    KEEP TIGHTLY CLOSED.
    STORE IN A COOL DRY PLACE.
SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
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  APPEARANCE AND ODOR
    LIQUID.
  PHYSICAL PROPERTIES
    FLASHPOINT               133F
                             56.11C
    EXPLOSION LIMITS IN AIR:
      UPPER                                  73 %
      LOWER                                  7 %
    VAPOR PRESSURE:      52 MMHG
    SPECIFIC GRAVITY:     1.083
    VAPOR DENSITY:     1.03 G/L
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
  STABILITY
    STABLE.
  INCOMPATIBILITIES
    STRONG OXIDIZING AGENTS
  HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
    CARBON MONOXIDE, CARBON DIOXIDE
  HAZARDOUS POLYMERIZATION
    WILL NOT OCCUR.
SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -
  ACUTE EFFECTS
    MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTIONS.
    CAUSES BURNS.
    TOXIC IF ABSORBED THROUGH SKIN.
    TOXIC IF INHALED.
    MATERIAL IS EXTREMELY DESTRUCTIVE TO THE TISSUE OF THE MUCOUS
MEMBRANES
    AND UPPER RESPIRATORY TRACT.
    TOXIC IF SWALLOWED.
    INHALATION MAY RESULT IN SPASM, INFLAMMATION AND EDEMA OF THE
    LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
    SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING,
    WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND
    VOMITING.
    MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES
    AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
    TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
    TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
  CHRONIC EFFECTS
    THIS PRODUCT IS OR CONTAINS A COMPONENT THAT HAS BEEN REPORTED TO BE
    POSSIBLY CARCINOGENIC BASED ON ITS IARC, ACGIH, NTP OR EPA
    CLASSIFICATION.
    TARGET ORGAN(S):
    EYES
    KIDNEYS
    LIVER
    HEART
    MAY ALTER GENETIC MATERIAL.
    POTENTIAL CANCER HAZARD.
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  RTECS #: LP8925000
    FORMALDEHYDE
  IRRITATION DATA
    SKN-HMN 150 UG/3D-I MLD                        85DKA8 -,127,1977
    EYE-HMN 4 PPM/5M                               IAPWAR 4,79,1961
    EYE-HMN 1 PPM/6M NSE MLD                       AIHAAP 44,463,1983
    SKN-RBT 2 MG/24H SEV                           85JCAE -,264,1986
    SKN-RBT 540 MG OPEN MLD                        UCDS** 4/21/1967
    SKN-RBT 50 MG/24H MOD                          TXAPA9 21,369,1972
    EYE-RBT 750 UG/24H SEV                         85JCAE -,264,1986
    EYE-RBT 750 UG SEV                             AJOPAA 29,1363,1946
    EYE-RBT 10 MG SEV                              TXAPA9 55,501,1980
  TOXICITY DATA
    ORL-WMN LDLO:108 MG/KG                         29ZWAE -,328,1968
    ORL-WMN LDLO:1 ML/KG                           ICMED9 23,708,1997
    UNR-MAN LDLO:477 MG/KG                         85DCAI 2,73,1970
    ORL-RAT LD50:100 MG/KG                         FCTOD7 26,447,1988
    IHL-RAT LC50:203 MG/M3                         GTPZAB 18(2),55,1974
    SCU-RAT LD50:420 MG/KG                         APTOA6 6,299,1950
    IVN-RAT LD50:87 MG/KG                          AEPPAE 221,166,1954
    ORL-MUS LD50:42 MG/KG                          NTIS** AD-A125-539
    IHL-MUS LC50:454 GM/M3/4H                      CUTOEX 1,47,1993
    SCU-MUS LD50:300 MG/KG                         APTOA6 6,299,1950
    SKN-RBT LD50:270 UL/KG                         UCDS** 4/21/1967
    ORL-GPG LD50:260 MG/KG                         JIHTAB 23,259,1941
  TARGET ORGAN DATA
    SENSE ORGANS AND SPECIAL SENSES (OTHER OLFACTION EFFECTS)
    SENSE ORGANS AND SPECIAL SENSES (OLFACTION TUMORS)
    BEHAVIORAL (SOMNOLENCE)
    BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
    BEHAVIORAL (EXCITEMENT)
    BEHAVIORAL (AGGRESSION)
    LUNGS, THORAX OR RESPIRATION (BRONCHIOLAR CONSTRICTION, INCLUDING
ASTHMA)
    LUNGS, THORAX OR RESPIRATION (ACUTE PULMONARY EDEMA)
    LUNGS, THORAX OR RESPIRATION (RESPIRATORY OBSTRUCTION)
    GASTROINTESTINAL (GASTRITIS)
    GASTROINTESTINAL (ULCERATION OR BLEEDING FROM STOMACH)
    GASTROINTESTINAL (NAUSEA OR VOMITING)
    BLOOD (OTHER CHANGES)
    SKIN AND APPENDAGES (TUMORS)
    PATERNAL EFFECTS (SPERMATOGENESIS)
    PATERNAL EFFECTS (TESTES, EPIDIDYMIS, SPERM DUCT)
    PATERNAL EFFECTS (PROSTATE, SEMINAL VESICLE, COWPER'S, ACCESSORY
GLANDS
    PATERNAL EFFECTS (OTHER EFFECTS ON MALE)
    EFFECTS ON FERTILITY (MALE FERTILITY INDEX)
    EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
    EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
    EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
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SPECIFIC DEVELOPMENTAL ABNORMALITIES (CRANIOFACIAL)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (HEPATOBILIARY SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (OTHER DEVELOPMENTAL ABNORMALITIES)
EFFECTS ON NEWBORN (GROWTH STATISTICS)
EFFECTS ON NEWBORN (BIOCHEMICAL AND METABOLIC)
EFFECTS ON NEWBORN (BEHAVIORAL)
EFFECTS ON NEWBORN (OTHER POSTNATAL MEASURES OR EFFECTS)
TUMORIGENIC (CARCINOGENIC BY RTECS CRITERIA)
TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)
TUMORIGENIC (TUMORS AT SITE OF APPLICATION)
BIOCHEMICAL EFFECTS (EFFECT ON INFLAMMATION OR MEDIATION OF INFLAMMATION)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -

CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF THIS MATERIAL.
DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -

CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION

EC INDEX NO: 605-001-00-5
TOXIC
R 23/24/25
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
R 34
CAUSES BURNS.
R 40
POSSIBLE RISK OF IRREVERSIBLE EFFECTS.
R 43
MAY CAUSE SENSITIZATION BY SKIN CONTACT.
S 26
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
S 36/37
WEAR SUITABLE PROTECTIVE CLOTHING AND GLOVES.
S 39
WEAR EYE/FACE PROTECTION.
S 45
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
S 51

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    USE ONLY IN WELL VENTILATED AREAS.
  TLV AND SOURCE
    FOR METHYL ALCOHOL - SKIN:
    ACGIH TLV-TWA: 200 PPM (260 MG/M3); STEL: 250 PPM (310 MG/M3).
    OSHA PEL: 8 H TWA 200 PPM (260 MG/M3); STEL: 250 PPM (310 MG/M3).
  REVIEWS, STANDARDS, AND REGULATIONS
    OEL=MAK
    ACGIH TLV-SUSPECTED HUMAN CARCINOGEN          DTLVS* TLV/BEI,1999
    ACGIH TLV-CL 0.3 PPM                          DTLVS* TLV/BEI,1999
    IARC CANCER REVIEW:ANIMAL SUFFICIENT EVIDENCE IMEMDT 29,345,1982
    IARC CANCER REVIEW: ANIMAL SUFFICIENT EVIDENCEIMEMDT 62,217,1995
    IARC CANCER REVIEW:HUMAN LIMITED EVIDENCE     IMSUDL 7,211,1987
    IARC CANCER REVIEW: HUMAN LIMITED EVIDENCE    IMEMDT 62,217,1995
    IARC CANCER REVIEW:GROUP 2A                   IMSUDL 7,211,1987
    IARC CANCER REVIEW: GROUP 2A                  IMEMDT 62,217,1995
    EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
     FEREAC 54,7740,1989
    MSHA STANDARD:AIR-CL 2 PPM (3 MG/M3)
     DTLWS* 3,19,1973
    OSHA PEL (GEN INDU):SEE 1910.1048
     CFRGBR 29,1910.1000,1994
    OSHA PEL (CONSTRUC):SEE CFR 29,1926.1148
     CFRGBR 29,1926.55,1994
    OSHA PEL (FED CONT):CL 5 PPM (6 MG/M3)
     CFRGBR 41,50-204.50,1994
    OEL-ARAB REPUBLIC OF EGYPT: TWA 2 PPM (3 MG/M3), JAN1993
    OEL-AUSTRALIA: TWA 1 PPM (1.5 MG/M3), STEL 2 PPM, CARCINOGEN, JAN1993
    OEL-AUSTRIA: MAK 0.5 PPM (0.6 MG/M3), SUSPECTED CARCINOGEN, JAN1999
    OEL-BELGIUM: TWA 1 PPM (1.2 MG/M3), STEL 2 PPM, CARCINOGEN, JAN1993
    OEL-DENMARK: TWA 0.3 PPM (0.4 MG/M3), JAN1999
    OEL-FRANCE: VME 0.5 PPM, VLE 1 PPM, C3 CARCINOGEN, JAN1999
    OEL-GERMANY: MAK 0.5 PPM (0.6 MG/M3), CARCINOGEN, JAN1999
    OEL-HUNGARY: STEL 0.6 MG/M3, CARCINOGEN, JAN1993
    OEL-JAPAN: OEL 0.5 PPM (0.61 MG/M3), 2A CARCINOGEN, JAN1999
    OEL-THE NETHERLANDS: MAC-TGG 1 PPM (1.5 MG/M3), MAC-K 2 PPM (3
MG/M3),
     JAN1999
    OEL-NORWAY: TWA 0.5 PPM (0.6 MG/M3), JAN1999
    OEL-THE PHILIPPINES: TWA 5 PPM (6 MG/M3), JAN1993
    OEL-POLAND: MAC(TWA) 0.5 MG/M3, MAC(STEL) 1 MG/M3, JAN1999
    OEL-RUSSIA: TWA 0.5 PPM, STEL 0.5 MG/M3, SKIN, JAN1993
    OEL-SWEDEN: NGV 0.5 PPM (0.6 MG/M3), TGV 1 PPM (1.2 MG/M3), SKIN,
     JAN1999
    OEL-SWITZERLAND: MAK-W 0.5 PPM (0.6 MG/M3), KZG-W 1 PPM (1.2 MG/M3),
     JAN1999
    OEL-THAILAND: TWA 3 PPM, STEL 5 PPM, JAN1993
    OEL-TURKEY: TWA 5 PPM (6 MG/M3), JAN1993
    OEL-UNITED KINGDOM: TWA 2 PPM (2.5MG/M3), CARCINOGEN, SEP2000
    OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV;
    OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
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NIOSH REL TO FORMALDEHYDE-AIR:8H CA TWA 0.016 PPM;CL 0.1 PPM/15M
NIOSH* DHHS #92-100,1992
NOHS 1974: HZD M1529; NIS 72; TNF 10311; NOS 67; TNE 66921
NOHS 1974: HZD 33640; NIS 213; TNF 33243; NOS 155; TNE 394660
NOES 1983: HZD M1529; NIS 87; TNF 11309; NOS 69; TNE 207013; TFE 104994
NOES 1983: HZD 33640; NIS 309; TNF 65738; NOS 193; TNE 1329322; TFE 441902
EPA GENETOX PROGRAM 1988, POSITIVE: CARCINOGENICITY-MOUSE/RAT
EPA GENETOX PROGRAM 1988, POSITIVE: D MELANOGASTER-RECIPROCAL TRANSLOCATION
EPA GENETOX PROGRAM 1988, POSITIVE: N CRASSA-REVERSION; E COLI POLA WITHOUT S9
EPA GENETOX PROGRAM 1988, POSITIVE: D MELANOGASTER SEX-LINKED LETHAL
EPA GENETOX PROGRAM 1988, POSITIVE: S CEREVISIAE GENE CONVERSION; S CEREVISIAE-REVERSION
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: IN VITRO UDS-HUMAN FIBROBLAST
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: CHO GENE MUTATION
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001
NIOSH CURRENT INTELLIGENCE BULLETIN 34, APRIL 1981
NIOSH ANALYTICAL METHOD, 1994: ALDEHYDES, SCREENING, 2539
NIOSH ANALYTICAL METHOD, 1994: FORMALDEHYDE BY ON DUST (TEXTILE OR WOOD), 5700
NIOSH ANALYTICAL METHOD, 1994: FORMALDEHYDE BY GC, 2541; BY VIS, 3500
NTP 9TH REPORT ON CARCINOGENS,2000:REASONABLY ANTICIPATED TO BE HUMAN CARCINOGEN
OSHA ANALYTICAL METHOD #ID-102

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.
THIS PRODUCT IS OR CONTAINS CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Valid 08/2001 - 10/2001

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Tel: 314-771-5765

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: A6283
NAME: ACETIC ACID, GLACIAL
SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 64-19-7
MF: C2H4O2
EC NO: 200-580-7
SYNONYMS
ACETIC ACID (ACGIH:OSHA) * ACETIC ACID, GLACIAL * ACIDE ACETIQUE (FRENCH) * ACIDO ACETICO (ITALIAN) * AZIJNZUUR (DUTCH) * ESSIGSAEURE (GERMAN) * ETHANOIC ACID * ETHYLIC ACID * GLACIAL ACETIC ACID * KYSELINA OCTOVA (CZECH) * METHANECARBOXYLIC ACID * OCTOWY KWAS (POLISH) * VINEGAR ACID *
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
COMBUSTIBLE (USA)
FLAMMABLE (EU)
CORROSIVE
CAUSES SEVERE BURNS.
HARMFUL IN CONTACT WITH SKIN.
LACHRYMATOR.
TARGET ORGAN(S):
TEETH
KIDNEYS
KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.

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    DO NOT INDUCE VOMITING.
    IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL
    RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
    IN CASE OF SKIN CONTACT, FLUSH WITH COPIOUS AMOUNTS OF WATER
    FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND
    SHOES. CALL A PHYSICIAN.
    IN CASE OF CONTACT WITH EYES, FLUSH WITH COPIOUS AMOUNTS OF WATER
    FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING
    THE EYELIDS WITH FINGERS. CALL A PHYSICIAN.
SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
  EXTINGUISHING MEDIA
    CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
  SPECIAL FIREFIGHTING PROCEDURES
    WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
    PREVENT CONTACT WITH SKIN AND EYES.
  UNUSUAL FIRE AND EXPLOSIONS HAZARDS
    EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -
    WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
    RUBBER GLOVES.
    COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER
    AND HOLD FOR WASTE DISPOSAL.
    VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
    EVACUATE AREA.
SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -
    REFER TO SECTION 8.
SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -
    SAFETY SHOWER AND EYE BATH.
    USE ONLY IN A CHEMICAL FUME HOOD.
    WASH CONTAMINATED CLOTHING BEFORE REUSE.
    DISCARD CONTAMINATED SHOES.
    WASH THOROUGHLY AFTER HANDLING.
    DO NOT BREATHE VAPOR.
    DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
    AVOID PROLONGED OR REPEATED EXPOSURE.
    NIOSH/MSHA-APPROVED RESPIRATOR.
    COMPATIBLE CHEMICAL-RESISTANT GLOVES.
    CHEMICAL SAFETY GOGGLES.
    FACESHIELD (8-INCH MINIMUM).
    KEEP TIGHTLY CLOSED.
    STORE IN A COOL DRY PLACE.
SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
  APPEARANCE AND ODOR
    LIQUID.
  PHYSICAL PROPERTIES
    BOILING POINT:        117 - 118  C
    MELTING POINT:      16.2  C
    FLASHPOINT               104F
                             40C
    EXPLOSION LIMITS IN AIR:
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      UPPER                                    19.9 %
      LOWER                                    4 %
    VAPOR PRESSURE:      11.4 MMHG
    SPECIFIC GRAVITY:     1.049
    VAPOR DENSITY:     2.07 G/L
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
  STABILITY
    STABLE.
  INCOMPATIBILITIES
    PROTECT FROM MOISTURE.
    OXIDIZING AGENTS
    SOLUBLE CARBONATES AND PHOSPHATES
    HYDROXIDES
    OXIDES
    METALS
    PEROXIDES
    PERMANGANATES
    AMINES
    ALCOHOLS
  HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
    CARBON MONOXIDE, CARBON DIOXIDE
  HAZARDOUS POLYMERIZATION
    WILL NOT OCCUR.
SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -
  ACUTE EFFECTS
    CAUSES BURNS.
    HARMFUL IF ABSORBED THROUGH SKIN.
    MAY BE HARMFUL IF INHALED.
    MATERIAL IS EXTREMELY DESTRUCTIVE TO THE TISSUE OF THE MUCOUS
MEMBRANES
    AND UPPER RESPIRATORY TRACT.
    MAY BE HARMFUL IF SWALLOWED.
    MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES
    AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
    INHALATION MAY RESULT IN SPASM, INFLAMMATION AND EDEMA OF THE
    LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
    SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING,
    WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND
    VOMITING.
    INGESTION OR INHALATION OF CONCENTRATED ACETIC ACID CAUSES DAMAGE TO
    TISSUES OF THE RESPIRATORY AND DIGESTIVE TRACTS. SYMPTOMS INCLUDE:
    HEMATEMESIS, BLOODY DIARRHEA, EDEMA AND/OR PERFORATION OF THE
ESOPHAGUS
    AND PYLORUS, HEMATURIA, ANURIA, UREMIA, ALBUMINURIA, HEMOLYSIS,
    CONVULSIONS, BRONCHITIS, PULMONARY EDEMA, PNEUMONIA, CARDIOVASCULAR
    COLLAPSE, SHOCK AND DEATH.
    DIRECT CONTACT OR EXPOSURE TO HIGH CONCENTRATIONS OF VAPOR WITH SKIN
OR
    EYES CAN CAUSE: ERYTHEMA, BLISTERS, TISSUE DESTRUCTION WITH SLOW
    HEALING, SKIN BLACKENING, HYPERKERATOSIS, FISSURES, CORNEAL EROSION,
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    OPACIFICATION, IRITIS, CONJUNCTIVITIS AND POSSIBLE BLINDNESS.
    TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
    TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
  CHRONIC EFFECTS
    TARGET ORGAN(S):
    TEETH
    KIDNEYS
  RTECS #: AF1225000
    ACETIC ACID
  IRRITATION DATA
    SKN-HMN 50 MG/24H MLD                        TXAPA9 31,481,1975
    SKN-RBT 525 MG OPEN SEV                      UCDS** 8/7/1963
    SKN-RBT 50 MG/24H MLD                        TXAPA9 31,481,1975
    EYE-RBT 5 MG/30S RINSE MLD                   TXCYAC 23,281,1982
  TOXICITY DATA
    UNR-MAN LDLO:308 MG/KG                       85DCAI 2,73,1970
    ORL-RAT LD50:3310 MG/KG                      DMDJAP 31,276,1959
    IHL-MUS LC50:5620 PPM/1H                     MELAAD 48,559,1957
    IVN-MUS LD50:525 MG/KG                       APTOA6 18,141,1961
    SKN-RBT LD50:1060 UL/KG                      UCDS** 8/7/1963
  TARGET ORGAN DATA
    SENSE ORGANS AND SPECIAL SENSES (OTHER OLFACTION EFFECTS)
    SENSE ORGANS AND SPECIAL SENSES (OTHER EYE EFFECTS)
    BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
    LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
    GASTROINTESTINAL (CHANGES IN STRUCTURE OR FUNCTION OF ESOPHAGUS)
    GASTROINTESTINAL (ULCERATION OR BLEEDING FROM SMALL INTESTINE)
    GASTROINTESTINAL (ULCERATION OR BLEEDING FROM LARGE INTESTINE)
    EFFECTS ON FERTILITY (MALE FERTILITY INDEX)
    EFFECTS ON NEWBORN (BEHAVIORAL)
    ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
    (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
    COMPLETE INFORMATION.
SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - - -
    DATA NOT YET AVAILABLE.
SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - - -
    THIS COMBUSTIBLE MATERIAL MAY BE BURNED IN A CHEMICAL INCINERATOR
    EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
    OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.
SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - - -
    CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.
SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - - -
  EUROPEAN INFORMATION
    EC INDEX NO:     607-002-00-6
    FLAMMABLE
    CORROSIVE
    R 10
    FLAMMABLE.
    R 35
    CAUSES SEVERE BURNS.
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  S 23
  DO NOT BREATHE VAPOR.
  S 26
  IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF
  WATER AND SEEK MEDICAL ADVICE.
  S 45
  IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
  IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
REVIEWS, STANDARDS, AND REGULATIONS
  OEL=MAK
  ACGIH TLV-STEL 15 PPM                        DTLVS* TLV/BEI,1999
  ACGIH TLV-TWA 10 PPM                         DTLVS* TLV/BEI,1999
  EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
   FEREAC 54,7740,1989
  MSHA STANDARD-AIR:TWA 10 PPM (25 MG/M3)
   DTLVS* 3,2,1971
  OSHA PEL (GEN INDU):8H TWA 10 PPM (25 MG/M3)
   CFRGBR 29,1910.1000,1994
  OSHA PEL (CONSTRUC):8H TWA 10 PPM (25 MG/M3)
   CFRGBR 29,1926.55,1994
  OSHA PEL (SHIPYARD):8H TWA 10 PPM (25 MG/M3)
   CFRGBR 29,1915.1000,1993
  OSHA PEL (FED CONT):8H TWA 10 PPM (25 MG/M3)
   CFRGBR 41,50-204.50,1994
  OEL-AUSTRALIA: TWA 10 PPM (25 MG/M3), STEL 15 PPM, JAN1993
  OEL-AUSTRIA: MAK 10 PPM (25 MG/M3), JAN1999
  OEL-BELGIUM: TWA 10 PPM (25 MG/M3), STEL 15 PPM, JAN1993
  OEL-DENMARK: TWA 10 PPM (25 MG/M3), JAN1999
  OEL-FINLAND: TWA 10 PPM (25 MG/M3), STEL 15 PPM (37 MG/M3), SKIN,
   JAN1993
  OEL-FRANCE: VLE 10 PPM (25 MG/M3), JAN1999
  OEL-GERMANY: MAK 10 PPM (25 MG/M3), JAN1999
  OEL-HUNGARY: TWA 10 MG/M3, STEL 20 MG/M3, JAN1993
  OEL-INDIA: TWA 10 PPM (25 MG/M3), STEL 15 PPM (37 MG/M3), JAN1993
  OEL-JAPAN: OEL 10 PPM (25 MG/M3), JAN1999
  OEL-THE NETHERLANDS: MAC-TGG 10 PPM (25 MG/M3), JAN1999
  OEL-NORWAY: TWA 10 PPM (25 MG/M3), JAN1999
  OEL-THE PHILIPPINES: TWA 10 PPM (25 MG/M3), JAN1993
  OEL-POLAND: MAC(TWA) 5 MG/M3, MAC(STEL) 35 MG/M3, JAN1999
  OEL-RUSSIA: TWA 10 PPM, STEL 5 MG/M3, SKIN, JAN1993
  OEL-SWEDEN: NGV 5 PPM (13 MG/M3), KTV 10 PPM (25 MG/M3), JAN1999
  OEL-SWITZERLAND: MAK-W 10 PPM (25 MG/M3), KZG-W 20 PPM (50 MG/M3),
   JAN1999
  OEL-THAILAND: TWA 10 PPM (25 MG/M3), JAN1993
  OEL-TURKEY: TWA 10 PPM (25 MG/M3), JAN1993
  OEL-UNITED KINGDOM: TWA 10 PPM (25 MG/M3), STEL 15 PPM (37 MG/M3),
   SEP2000
  OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV;
  OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
  NIOSH REL TO ACETIC ACID-AIR:10H TWA 10 PPM;STEL 15 PPM
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NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 01568; NIS 264; TNF 51469; NOS 150; TNE 486503
NOES 1983: HZD 01568; NIS 266; TNF 49403; NOS 169; TNE 907205; TFE 322123
EPA GENETOX PROGRAM 1988, NEGATIVE: HISTIDINE REVERSION-AMES TEST
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
EPA TSCA SECTION 8(E) RISK NOTIFICATION, 8EHQ-0892-9237;8EHQ-0892-9238
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001
NIOSH ANALYTICAL METHOD, 1994: ACETIC ACID, 1603
OSHA ANALYTICAL METHOD #ID-118

SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Valid 08/2001 - 10/2001

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M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: 32294
NAME: **ETHANOL** 96 VOL.%, ACS REAGENT MIN. 96%
SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 64-17-5
MF: C2H6O
EC NO: 200-578-6
SYNONYMS
ABSOLUTE ETHANOL * AETHANOL (GERMAN) * AETHYLALKOHOL (GERMAN) * ALCOHOL * ALCOHOL, ANHYDROUS * ALCOHOL DEHYDRATED * ALCOOL ETHYLIQUE (FRENCH) * ALCOOL ETILICO (ITALIAN) * ALGRAIN * ALKOHOL (GERMAN) * ALKOHOLU ETYLOWEGO (POLISH) * ANHYDROL * COLOGNE SPIRIT * ETANOLO (ITALIAN) * ETHANOL (ACGIH:OSHA) * ETHYL ALCOHOL (DOT:OSHA) * ETHYL ALCOHOL ANHYDROUS * ETHYL HYDRATE * ETHYL HYDROXIDE * ETYLOWY ALKOHOL (POLISH) * FERMENTATION ALCOHOL * GRAIN ALCOHOL * JAYSOL * JAYSOL S * METHYLCARBINOL * MOLASSES ALCOHOL * NCI-C03134 * POTATO ALCOHOL * SD ALCOHOL 23-HYDROGEN * SPIRITS OF WINE * SPIRT * TECSOL *
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
FLAMMABLE (USA)
HIGHLY FLAMMABLE (EU)
IRRITANT
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.
TARGET ORGAN(S):
NERVES
LIVER
KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
WEAR SUITABLE PROTECTIVE CLOTHING.
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL

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    RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
    IN CASE OF CONTACT, IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS
    AMOUNTS OF WATER.
    IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF
    WATER FOR AT LEAST 15 MINUTES.
SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
  EXTINGUISHING MEDIA
    WATER SPRAY.
    CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
  SPECIAL FIREFIGHTING PROCEDURES
    WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
    PREVENT CONTACT WITH SKIN AND EYES.
    USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.
  UNUSUAL FIRE AND EXPLOSIONS HAZARDS
    VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND
    FLASH BACK.
    CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.
    FLAMMABLE LIQUID.
    EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -
    WEAR RESPIRATOR, CHEMICAL SAFETY GOGGLES, RUBBER BOOTS AND HEAVY
    RUBBER GLOVES.
    COVER WITH DRY-LIME, SAND, OR SODA ASH. PLACE IN COVERED CONTAINERS
    USING NON-SPARKING TOOLS AND TRANSPORT OUTDOORS.
    VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
    EVACUATE AREA.
    SHUT OFF ALL SOURCES OF IGNITION.
SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -
    REFER TO SECTION 8.
SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -
    SAFETY SHOWER AND EYE BATH.
    USE NONSPARKING TOOLS.
    MECHANICAL EXHAUST REQUIRED.
    WASH THOROUGHLY AFTER HANDLING.
    WASH CONTAMINATED CLOTHING BEFORE REUSE.
    AVOID BREATHING VAPOR.
    AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
    AVOID PROLONGED OR REPEATED EXPOSURE.
    NIOSH/MSHA-APPROVED RESPIRATOR.
    COMPATIBLE CHEMICAL-RESISTANT GLOVES.
    CHEMICAL SAFETY GOGGLES.
    KEEP CONTAINER CLOSED.
    KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
    STORE IN A COOL DRY PLACE.
    HANDLE AND STORE UNDER NITROGEN.
SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
  APPEARANCE AND ODOR
    CLEAR, COLORLESS LIQUID
  PHYSICAL PROPERTIES
    BOILING POINT:        78 C
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    FLASHPOINT               62F
                             16.66C
    SPECIFIC GRAVITY:     0.794
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
  STABILITY
    STABLE.
  INCOMPATIBILITIES
    PROTECT FROM MOISTURE.
    ALKALI METALS
    AMMONIA
    OXIDIZING AGENTS
    PEROXIDES
  HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
    CARBON MONOXIDE, CARBON DIOXIDE
  HAZARDOUS POLYMERIZATION
    WILL NOT OCCUR.
SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -
  ACUTE EFFECTS
    CAUSES SKIN IRRITATION.
    MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN.
    CAUSES EYE IRRITATION.
    MAY BE HARMFUL IF INHALED.
    MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER
    RESPIRATORY TRACT.
    MAY BE HARMFUL IF SWALLOWED.
    CAN CAUSE CNS DEPRESSION.
    NARCOTIC EFFECT
    DAMAGE TO THE HEART
    TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
    TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
  CHRONIC EFFECTS
    TARGET ORGAN(S):
    NERVES
    LIVER
    HEART
    THIS PRODUCT IS OR CONTAINS A COMPONENT THAT IS NOT CLASSIFIABLE AS
    TO ITS CARCINOGENICITY BASED ON ITS IARC, ACGIH, NTP OR EPA
    CLASSIFICATION.
  RTECS #: KQ6300000
    ETHYL ALCOHOL
  IRRITATION DATA
    SKN-RBT 400 MG OPEN MLD                      UCDS** 7/22/1970
    SKN-RBT 20 MG/24H MOD                        85JCAE -,189,1986
    EYE-RBT 500 MG SEV                           AJOPAA 29,1363,1946
    EYE-RBT 500 MG/24H MLD                       85JCAE -,189,1986
    EYE-RBT 100 MG/4S RINSE MOD                  FCTOD7 20,573,1982
  TOXICITY DATA
    ORL-CHD LDLO:2 GM/KG                         ATXKA8 17,183,1958
    ORL-HMN LDLO:1400 MG/KG                      NPIRI* 1,44,1974
    SCU-INF LDLO:19440 MG/KG                     AJCPAI 5,466,1935
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  ORL-RAT LD50:7060 MG/KG                        TXAPA9 16,718,1970
  IHL-RAT LC50:20000 PPM/10H                     NPIRI* 1,44,1974
  IPR-RAT LD50:3600 UG/KG                        PHMGBN 2,27,1969
  IVN-RAT LD50:1440 MG/KG                        TXAPA9 18,60,1971
  IAT-RAT LD50:11 MG/KG                          TXAPA9 18,60,1971
  ORL-MUS LD50:3450 MG/KG                        GISAAA 32(3),31,1967
  IHL-MUS LC50:39 GM/M3/4H                       GTPZAB 26(8),53,1982
  IPR-MUS LD50:528 MG/KG                         STRAAA 127,245,1965
  SCU-MUS LD50:8285 MG/KG                        FAONAU 48A,99,1970
  IVN-MUS LD50:1973 MG/KG                        HBTXAC 1,128,1955
  ORL-RBT LD50:6300 MG/KG                        HBTXAC 1,130,1955
  IPR-RBT LD50:963 MG/KG                         EVHPAZ 61,321,1985
  IVN-RBT LD50:2374 MG/KG                        EVHPAZ 61,321,1985
  ORL-GPG LD50:5560 MG/KG                        JIHTAB 23,259,1941
  IPR-GPG LD50:3414 MG/KG                        EVHPAZ 61,321,1985
  IPR-HAM LD50:5068 MG/KG                        EVHPAZ 61,321,1985
  IPR-MAM LD50:4300 MG/KG                        TXAPA9 13,358,1968
TARGET ORGAN DATA
  BEHAVIORAL (SLEEP)
  BEHAVIORAL (CHANGE IN MOTOR ACTIVITY)
  BEHAVIORAL (ATAXIA)
  BEHAVIORAL (ANTIPSYCHOTIC)
  BEHAVIORAL (HEADACHE)
  BEHAVIORAL (CHANGE IN PSYCHOPHYSIOLOGICAL TESTS)
  LUNGS, THORAX OR RESPIRATION (CHRONIC PULMONARY EDEMA OR CONGESTION)
  LUNGS, THORAX OR RESPIRATION (DYSPNAE)
  LUNGS, THORAX OR RESPIRATION (OTHER CHANGES)
  GASTROINTESTINAL (ALTERATION IN GASTRIC SECRETION)
  GASTROINTESTINAL (HYPERMOTILITY, DIARRHEA)
  GASTROINTESTINAL (NAUSEA OR VOMITING)
  GASTROINTESTINAL (OTHER CHANGES)
  LIVER (FATTY LIVER DEGENERATION)
  LIVER (TUMORS)
  ENDOCRINE (CHANGE IN GONADOTROPINS)
  ENDOCRINE (OTHER CHANGES)
  BLOOD (OTHER CHANGES)
  BLOOD (LYMPHOMA INCLUDING HODGKIN'S DISEASE)
  PATERNAL EFFECTS (TESTES, EPIDIDYMIS, SPERM DUCT)
  EFFECTS ON FERTILITY (FEMALE FERTILITY INDEX)
  EFFECTS ON FERTILITY (MALE FERTILITY INDEX)
  EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
  EFFECTS ON FERTILITY (OTHER MEASURES OF FERTILITY)
  EFFECTS ON EMBRYO OR FETUS (EXTRA EMBRYONIC STRUCTURES)
  EFFECTS ON EMBRYO OR FETUS (CYTOLOGICAL CHANGES)
  EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
  EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
  EFFECTS ON EMBRYO OR FETUS (OTHER EFFECTS TO EMBYRO OR FETUS)
  SPECIFIC DEVELOPMENTAL ABNORMALITIES (EYE, EAR)
  SPECIFIC DEVELOPMENTAL ABNORMALITIES (CRANIOFACIAL)
  SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
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    SPECIFIC DEVELOPMENTAL ABNORMALITIES (RESPIRATORY SYSTEM)
    EFFECTS ON NEWBORN (GROWTH STATISTICS)
    TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)
    ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
    (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
    COMPLETE INFORMATION.
SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -
    DATA NOT YET AVAILABLE.
SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -
    CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF
    THIS MATERIAL.
    BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND
    SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY
    FLAMMABLE.
    OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.
SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -
    CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.
SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -
  EUROPEAN INFORMATION
    EC INDEX NO:     603-002-00-5
    HIGHLY FLAMMABLE
    IRRITANT
    R 11
    HIGHLY FLAMMABLE.
    S 7
    KEEP CONTAINER TIGHTLY CLOSED.
    S 16
    KEEP AWAY FROM SOURCES OF IGNITION - NO SMOKING.
  REVIEWS, STANDARDS, AND REGULATIONS
    OEL=MAK
    ACGIH TLV-NOT CLASSIFIABLE AS A HUMAN CARCINOGEN  DTLVS* TLV/BEI,1999
    ACGIH TLV-TWA 1000 PPM                        DTLVS* TLV/BEI,1999
    IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE IMEMDT 44,35,1988
    EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
     FEREAC 54,7740,1989
    MSHA STANDARD-AIR:TWA 1000 PPM (1900 MG/M3)
     DTLVS* 3,103,1971
    OSHA PEL (GEN INDU):8H TWA 1000 PPM (1900 MG/M3)
     CFRGBR 29,1910.1000,1994
    OSHA PEL (CONSTRUC):8H TWA 1000 PPM (1900 MG/M3)
     CFRGBR 29,1926.55,1994
    OSHA PEL (SHIPYARD):8H TWA 1000 PPM (1900 MG/M3)
     CFRGBR 29,1915.1000,1993
    OSHA PEL (FED CONT):8H TWA 1000 PPM (1900 MG/M3)
     CFRGBR 41,50-204.50,1994
    OEL-AUSTRALIA: TWA 1000 PPM (1900 MG/M3), JAN1993
    OEL-AUSTRIA: MAK 1000 PPM (1900 MG/M3), JAN1999
    OEL-BELGIUM: TWA 1000 PPM (1880 MG/M3), JAN1993
    OEL-DENMARK: TWA 1000 PPM (1900 MG/M3), JAN1999
    OEL-FINLAND: TWA 1000 PPM (1900 MG/M3), STEL 1250 PPM (2400 MG/M3),
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JAN1999
OEL-FRANCE: VME 1000 PPM (1900 MG/M3), VLE 5000 PPM, JAN1999
OEL-GERMANY: MAK 1000 PPM (1900 MG/M3), JAN1999
OEL-HUNGARY: TWA 1000 MG/M3, STEL 3000 MG/M3, JAN1993
OEL-THE NETHERLANDS: MAC-TGG 500 PPM (950 MG/M3), JAN1999
OEL-NORWAY: TWA 500 PPM (950 MG/M3), JAN1999
OEL-THE PHILIPPINES: TWA 1000 PPM (1900 MG/M3), JAN1993
OEL-POLAND: MAC(TWA) 1000 MG/M3, MAC(STEL) 3000 MG/M3, JAN1999
OEL-RUSSIA: STEL 1000 MG/M3, JAN1993
OEL-SWEDEN: NGV 500 PPM (1000 MG/M3), KTV 1000PPM (1900 MG/M3), JAN1999
OEL-SWITZERLAND: MAK-W 1000 PPM (1900 MG/M3), JAN1999
OEL-THAILAND: TWA 1000 PPM (1900 MG/M3), JAN1993
OEL-TURKEY: TWA 1000 PPM (1900 MG/M3), JAN1993
OEL-UNITED KINGDOM: TWA 1000 PPM (1950 MG/M3), SEP2000
OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV;
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO ETHYL ALCOHOL-AIR:10H TWA 1000 PPM
NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 31500; NIS 430; TNF 157709; NOS 242; TNE 2088926
NOES 1983: HZD 31500; NIS 334; TNF 86077; NOS 222; TNE 2069125; TFE 1014002
EPA GENETOX PROGRAM 1988, POSITIVE: RODENT DOMINANT LETHAL
EPA GENETOX PROGRAM 1988, NEGATIVE: ASPERGILLUS-FORWARD MUTATION; SHE-CLONAL ASSAY
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-RLV F344 RAT EMBRYO
EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO CYTOGENETICS-NONHUMAN; MAMMALIAN MICRONUCLEUS
EPA GENETOX PROGRAM 1988, NEGATIVE: N CRASSA-ANEUPLOIDY; HISTIDINE REVERSION-AMES TEST
EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO SCE-HUMAN LYMPHOCYTES; IN VITRO SCE-HUMAN
EPA GENETOX PROGRAM 1988, NEGATIVE: IN VITRO SCE-NONHUMAN; SPERM MORPHOLOGY-MOUSE
EPA GENETOX PROGRAM 1988, NEGATIVE/LIMITED: CARCINOGENICITY-MOUSE/RAT
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001
NIOSH ANALYTICAL METHOD, 1994: ETHANOL IN BLOOD, 8002
NIOSH ANALYTICAL METHOD, 1994: ALCOHOLS I, 1400
NTP CARCINOGENESIS STUDIES; ON TEST (TWO YEAR STUDIES), OCTOBER 2000
SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - -
THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO
BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH,
FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING
OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE

Valid 08/2001 - 10/2001

Riedel-de Haen
3050 Spruce St.
St. Louis, MO 63178 USA
Tel: 314-289-6000

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: 35603
NAME: **2,2',4,5,5'-POLYCHLORINATED BIPHENYL**(OEKANAL)PACKAGE WITH 10MG
SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 37680-73-2
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
TOXIC
MAY CAUSE CANCER.
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.
TARGET ORGAN(S):
LIVER
SKIN
DO NOT BREATHE VAPOR.
KEEP CONTAINER TIGHTLY CLOSED IN A COOL WELL-VENTILATED PLACE.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN IMMEDIATELY.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF SKIN CONTACT, FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING AND SHOES. CALL A PHYSICIAN.
IN CASE OF CONTACT WITH EYES, FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING THE EYELIDS WITH FINGERS. CALL A PHYSICIAN.
SECTION 5. - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
EXTINGUISHING MEDIA

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    WATER SPRAY.
    CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
  SPECIAL FIREFIGHTING PROCEDURES
    WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
    PREVENT CONTACT WITH SKIN AND EYES.
  UNUSUAL FIRE AND EXPLOSIONS HAZARDS
    EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
SECTION 6. - - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -
    WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
    RUBBER GLOVES.
    ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR
    DISPOSAL.
    VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
    EVACUATE AREA.
SECTION 7. - - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -
    REFER TO SECTION 8.
SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -
    USE ONLY IN A CHEMICAL FUME HOOD.
    SAFETY SHOWER AND EYE BATH.
    WASH CONTAMINATED CLOTHING BEFORE REUSE.
    WASH THOROUGHLY AFTER HANDLING.
    DO NOT BREATHE VAPOR.
    DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
    AVOID PROLONGED OR REPEATED EXPOSURE.
    NIOSH/MSHA-APPROVED RESPIRATOR.
    COMPATIBLE CHEMICAL-RESISTANT GLOVES.
    CHEMICAL SAFETY GOGGLES.
    KEEP TIGHTLY CLOSED.
    STORE IN A COOL DRY PLACE.
SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
    DATA NOT AVAILABLE
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
  STABILITY
    STABLE.
  INCOMPATIBILITIES
    STRONG OXIDIZING AGENTS
  HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
    CARBON MONOXIDE, CARBON DIOXIDE
    HYDROGEN CHLORIDE GAS
  HAZARDOUS POLYMERIZATION
    WILL NOT OCCUR.

  ACUTE EFFECTS
    CAUSES SKIN IRRITATION.
    CAUSES EYE IRRITATION.
    MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER
    RESPIRATORY TRACT.
    TOXIC BY INHALATION, INGESTION OR SKIN ABSORPTION.
  CHRONIC EFFECTS
    POSSIBLE CARCINOGEN.
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TARGET ORGAN(S):
LIVER
SKIN

SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -

DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -

CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION
EC INDEX NO: 602--03-9--0
TOXIC
R 45
MAY CAUSE CANCER.
R 23/24/25
TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
R 36/37/38
IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.
S 23
DO NOT BREATHE VAPOR.
S 3/7/9
KEEP CONTAINER TIGHTLY CLOSED IN A COOL WELL-VENTILATED PLACE.
S 36/37/39
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
S 45
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

SUNOX -- DRY ICE - CARBON DIOXIDE, TECHNICAL
MATERIAL SAFETY DATA SHEET
SUNOXNSN: 6830011656174
Manufacturer's CAGE: 6Z872
Part No. Indicator: A
Part Number/Trade Name: DRY ICE
==========
General Information
==========
Item Name: CARBON DIOXIDE, TECHNICAL
Company's Name: SUNOX INC
Company's Street: 4236 STATESVILLE RD
Company's P. O. Box: 33871
Company's City: CHARLOTTE
Company's State: NC
Company's Country: US
Company's Zip Code: 28233
Company's Emerg Ph #: 704-596-6262
Company's Info Ph #: 704-596-6262
Record No. For Safety Entry: 012
Tot Safety Entries This Stk#: 013
Status: SMJ
Date MSDS Prepared: 10OCT88
Safety Data Review Date: 07DEC93
MSDS Serial Number: BVBLZ
Hazard Characteristic Code: NK
==========
Ingredients/Identity Information
==========
Proprietary: NO
Ingredient: CARBON DIOXIDE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: FF6400000
CAS Number: 124-38-9
OSHA PEL: 10000PPM; 30000 STEL
ACGIH TLV: 5000 PPM; 30000 STEL

Proprietary: NO
Ingredient: MATLS TO AVOID:MAGNESIUM, ALUMINUM, TITANIUM/ZIRCONIUM), THEIR HYDRIDES & MATLS LIKE DIETHYL MAGNESIUM, MOIST (ING 3)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 2:CESIUM OXIDE/LITHIUM ACETYLIDE W/AMMONIA CAN IGNITE IN CO*2 ATM. DRY ICE CAN FORM SHOCK SENSITIVE MIX WITH (ING 4)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 9999999ZZ

OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 3:SODIUM, POTASSIUM OR SODIUM-POTASSIUM ALLOY.
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: EFTS OF OVEREXP:COULD RSLT IN FROSTBT/CRYOGENIC (FREEZE)
"BURNS." CNTCT W/LIQ/SOLID CAN PRDCE FROSTBT & FREEZE (ING 5)
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 5:BURNS. EFTS ARE CHANGE IN COLOR OF SKIN TO GRAY/WHITE
POSS FOLLOWED BY BLISTERING. CO*2 IS MOST POWERFUL (ING 7)
Ingredient Sequence Number: 06
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 6:CEREBRAL VASODIALTOR KNOWN. INHAL LG CONC CAUSES RAPID
CIRCULATORY INSUFFICIENCY LEADING TO COMA & DEATH. (ING 8)
Ingredient Sequence Number: 07
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 7:CHRONIC, HARMFUL EFTS ARE NOT KNOWN FROM RPTD INHAL OF
LOW (3-5 MOLAR %) CONC.
Ingredient Sequence Number: 08
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
FROSTBT:FLUSH AFFECTED AREAS W/LUKEWARM WATER. DO (ING 10)
Ingredient Sequence Number: 09
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO

Ingredient: ING 9:NOT USE HOT WATER. MD SHOULD SEE PROMPTLY IF CRYOGENIC "BURN" HAS RSLTD IN BLISTERING OF DERMAL SURF/DEEP (ING 11)
Ingredient Sequence Number: 10
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 10:TISS FREEZING. PROMPT MED ATTN MANDATORY IN ALL CASES OF OVEREXP. RESCUE PERS SHOULD BE EQUIPPED WITH (ING 12)
Ingredient Sequence Number: 11
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 11:NIOSH/MSHA SELF-CONTAINED BREATHING APPARATUS.
Ingredient Sequence Number: 12
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: WASTE DISP METH:HVR/AIR. DO NOT PUT DRY ICE IN CLSD CNTNR WHERE EVOLVED GAS CANNOT ESCAPE! REMOVE SCRAP SOLID (ING 14)
Ingredient Sequence Number: 13
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 13:("SNOW" OR "DRY ICE") TO HOOD W/FORCED VENT OR TO A REMOTE OUTSIDE AREA. ALLOW SOLID TO SUBLIME.
Ingredient Sequence Number: 14
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: HNDLG/STOR PREC:WHICH OPEN FROM TOP HAVING LOOSE-FITTING LIDS SO CO*2 VAPOR FROM SUBLIMATION OF SOLID MAY BE (ING 16)
Ingredient Sequence Number: 15
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 15:ALLOWED TO ESCAPE INTO ATM. FOR ADDNL HNDLG & STOR RECOM SEE CGA PAMPHLETS P-1 & G-6.
Ingredient Sequence Number: 16

NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: OTHER PREC:W/MOST PLASTICS & ELASTOMERS. ALSO SEE CGA PAMPHLET G-6.3.
Ingredient Sequence Number: 17
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: OTHER PROT EQUIP:TEMP) TO PVNT FREEZE BURNS & FROSTBT IF MORE THAN MOMENTARY CNTCT W/CO*2 AT LOW TEMP IS POSS.
Ingredient Sequence Number: 18
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
==========
Physical/Chemical Characteristics
==========
Appearance And Odor: WHITE OPAQUE SOLID; COLORLESS, ODORLESS GAS.
Boiling Point: -109F,-79C
Melting Point: -70F,-57C
Vapor Pressure (MM Hg/70 F): 844.7 PSIA
Vapor Density (Air=1): 0.1144
Solubility In Water: COEFFICIENT = 0.8704
==========
Fire and Explosion Hazard Data
==========
Flash Point: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: NONFLAMMABLE, INERT GAS.
Special Fire Fighting Proc: USE NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP(FP N). USE WATER SPRAY TO COOL FIRE-EXPOS CNTNRS TO PVNT RUPTURE. MATL IS NON-COMBUST. IT CAN BE USED AS (SUPDAT)
Unusual Fire And Expl Hazrds: WATER SPRAY IS NOT EFTIVE FOR USE ON FIRES INVOLVING CHEM THAT HAVE THEIR OWN O*2 SUPPLY (I.E. CELLULOSE NITRATE)/ON FIRES INVOLVING REACTIVE METALS (SUPDAT)
==========
Reactivity Data
==========
Stability: YES
Cond To Avoid (Stability): DECOMPOSES TO CO & O*2 WHEN HEATED ABOVE 1700C. WILL REACT W/ALKALINE MATLS TO FORM CARBONATES & BICARBONATES.
Materials To Avoid: EXPLO CAN OCCUR WHEN CNTCTS MIX OF SODIUM PEROXIDE W/ ALUMINUM/MAGNESIUM. REACTIVE METALS (SUCH AS ALKALI METALS (ING 2)
Hazardous Decomp Products: CARBON MONOXIDE. FORMS CARBONIC ACID IN THE

PRESENCE OF WATER.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT
==========
Health Hazard Data
==========
LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: NERVOUS SYS CONTROL OF RESP IS DEPENDENT ON CO*2 LEVEL BREATHED IN AIR. BY REDUCING O*2 LEVEL IN AIR, CO*2 CAN CAUSE SUFFOCATION. SYMP OF OVEREXP INCL HDCH, DIZZ, SHORTNESS OF BREATH, MUSC WEAK, DROW & RINGING IN EARS. INHAL:LOW CONC (3-5 MOLAR %) CAUSE INCR RESP & HDCH. 8-15 MOLAR % CONC CAUSE HDCH, (EFTS OF OVEREXP)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: HLTH HAZ:NAUS & VOMIT WHICH MAY LEAD TO UNCON IF NOT MOVED TO OPEN AIR/GIVEN O*2. HIGH CONC CAUSE RAPID CIRCULATORY INSUFFICIENCY LEADING TO COMA & DEATH. WHEN REFRIGERATED LIQ CO*2 IS VAPORIZED THRU AN ORIFICE, IT CAN FORM SOLID PARTICLES OF CO*2 ("SNOW"/"DRY ICE" PWDR). CONTINUOUS DERMAL CNTCT W/COLD SNOW (ING 5)
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INGEST:CALL MD IMMED(FP N). EYES:IMMED FLUSH W/POTABLE WATER FOR MIN OF 15 MIN, SEEK ASSISTANCE FROM MD(FP N). INHAL:IF CONSCIOUS, ASSIST TO UNCONTAMD AREA & INHALE FRESH AIR. QUICK REMOVAL FROM AREA IS MOST IMPORTANT. IF UNCON, MOVE TO UNCONTAMD AREA, GIVE MOUTH-TO-MOUTH RESUSCITATION & SUPPLEMENTAL O*2. ASSURE THAT VOMITED MATL DOES NOT OBSTRUCT AIRWAY BY USE OF POSITIONAL DRAINAGE. (ING 9)
==========
Precautions for Safe Handling and Use
==========
Steps If Matl Released/Spill: EVACUATE AREA OF MAJOR SPILL/RELS OF CO*2. NOTIFY SFTY PERS. PROVIDE VENT. CLEAN-UP PERS NEED SPECIAL TRAINING & PROT AGAINST CNTCT W/VERY COLD MATL/EXCESSIVE INHAL OF GASEOUS CO*2.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISP MUST BE I/A/W FED, STATE & LOCAL REGS(FP N). ALLOW GAS TO BLEED OFF AT MOD RATE/SOLID TO SUBLIME TO WELL VENT AREA. INSULATED STOR CNTNR SHOULD BE IN AREA W/ADEQ VENT TO PVNT ACCUM OF CO*2 VAPS ABOVE TWA. CO*2 VAP ARE APPROX 1 1/2 TIMES (ING 13)
Precautions-Handling/Storing: SOLID CO*2 GENERALLY DELIVERED IN KRAFT-PAPER-WRAPPED BLOCKS WEIGHING APPROX 50 LBS & APPROX 1/2 CUBIC FT IN VOL. STORE IN INSULATED CNTNRS (ING 15)
Other Precautions: DRY CO*2 CAN BE HNDL W/MOST COMMON STRUCTURAL MATLS. MOIST CO*2 IS CORR BY ITS FORM OF CARBONIC ACID. FOR APPLICATNS 316,309 & 310 STAINLESS STEELS MAY BE USED AS WELL AS HASTELLOY A, B & C & MONEL. AT NORM TEMP, CO*2 IS COMPATIBLE (ING 17)
==========

Control Measures

==========

Respiratory Protection: PROVIDE NIOSH/MSHA APPRVD SUPPLIED-AIR OR SELF-CONTAINED RESP FOR USE IN NON-ROUTINE/EMER SITUATIONS W/EXPOS ABOVE TLV. FULL FACEPIECE IS REQD FOR CONC > 10%. PROVIDE STANDBY PERSON(S) W/RESCUE EQUIP IF WORK REQD AT > 15% CO*2 IN AIR.
Ventilation: GENERAL AND LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.
Protective Gloves: LOOSE FITTING, INSULATED GLOVES.
Eye Protection: ANSI APPRVD CHEM WORK GOGGLES (SUP DATA)
Other Protective Equipment: SFTY SHOES, SOLID CO*2 HNDLG "TONGS." MAY REQ ADDNL PROT CLTHG (APRON, FSHLD, ETC WHICH ARE RESISTANT TO LOW (ING 18)
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: FIRE FIGHT PROC:FIRE EXTING AGENT PRIMARILY FOR ITS SMOTHERING EFT (REDUCTION OF O*2 CONC TO PT WHERE IMMED ATM CANNOT SUPPORT COMBUST). EXPLO HAZ:(SUCH AS POTASSIUM, SODIUM, MAGNESIUM, ALUMINUM, TITANIUM & ZIRCONIUM) OR THEIR HYDRIDES AS THESE MATLS CAN DECOMPOSE CARBON DIOXIDE. EYE PROT: W/FULL LNGTH FCSHIELD (FP N).

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Transportation Data

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Trans Data Review Date: 93337

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 07DEC93
Label Date: 03DEC93
Label Status: G
Common Name: DRY ICE
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE: NERVOUS SYSTEM CONTROL OF RESP IS DEPENDENT ON CARBON DIOXIDE LEVEL BREATHED IN AIR. BY REDUCING OXYGEN LEVEL IN AIR, CARBON DIOXIDE CAN CAUSE SUFFOCATION. SYMP OF OVEREXP INCLUDE HEADACHE, DIZZINESS, SHORTNESS OF BREATH, MUSCULAR WEAKNESS, DROWSINESS & RINGING IN EARS. INHAL:LOW CONC (3-5 MOLAR %) CAUSE INCR RESP & HEADACHE. 8-15 MOLAR % CONC CAUSE HEADACHE, NAUSEA & VOMIT WHICH MAY LEAD TO UNCONSCIOUSNESS. HIGHER CONC CAUSE RAPID CIRCULATORY INSUFFICIENCY LEADING TO COMA & DEATH. CONTINUOUS DERMAL CONTACT WITH LIQUID/SOLID PARTICLES OF CARBON DIOXIDE COULD RESULT IN FROSTBITE & FREEZE BURNS. CHRONIC: NONE LISTED BY MANUFACTURER.
Protect Eye: Y

```
Protect Skin: Y
Protect Respiratory: Y
Label Name: SUNOX INC
Label Street: 4236 STATESVILLE RD
Label P.O. Box: 33871
Label City: CHARLOTTE
Label State: NC
Label Zip Code: 28233
Label Country: US
Label Emergency Number: 704-596-6262
```

B. Fish Identification

B.1 Brown Bullhead *(Ameiurus nebulosus)*

The brown bullhead is a member of the catfish family (Ictaluridae) that typically ranges from 8 to 14 inches in length at maturity (Smith, 1985). Traits of catfish (family Ictaluridae) include a body that lacks scales, the presence of an adipose fin, four pairs of barbels (whiskers) on the head, and a heavy spine on the leading edge (anterior) of the dorsal and pectoral fins. One pair of barbels are present on the snout, two pairs are present on the chin, and one pair are present on the distal ends of the maxillary. The family Ictaluridae is separated into two or three genera, depending on the reference used. The remaining group of catfish, including several species of madtom and the stonecat is in the genus *Noturus*. There are three species of bullhead in New York, including the yellow bullhead (*Ictalurus natalis*), brown bullhead, and the black bullhead (*Ictalurus melas*).

Brown bullhead are olive to black on the dorsal surfaces and pale white or yellow on the ventral surfaces (Smith, 1985). The fins are dark, and the basal third of the anal fin is as dark as the rest of the fin. The barbels are gray to black, although those on the base of the chin may be pale at the base. The dorsal fin spine is strongly serrated. The caudal fin is square (not forked) with rounded corners. The adipose dorsal fin is flag-like (adnexed) and distinctly separate from the caudal fin.

Key distinguishing features separating the three bullhead species from other catfish species include the following:

- Bullhead have a flag-like (adnexed) adipose fin, whereas madtom and stonecat have a keel-like (adnate) adipose dorsal fin (Smith, 1985).

- Bullhead have a round, square, or slightly forked tail, whereas white and channel catfish have a deeply forked tail (Smith, 1985).

The brown bullhead is differentiated from yellow and black bullhead based on the color of chin barbels, color of fin membranes, amount of serration on the dorsal fin spine, and number of anal fin rays.

Brown bullhead are distinguished from yellow bullhead by the following:

- Brown bullhead have dark chin barbels, although the base of the chin barbels may be light-colored. Yellow bullhead have white or yellow chin barbels (Scott and Crossman, 1973; Smith, 1985).

- Brown bullhead have dark fin membranes, especially the basal third of the anal fin is as dark as the rest of the fin. Yellow bullhead have light fin membranes, but the margins may be darker (Smith, 1985).
- Brown bullhead have 21 to 24 anal fin rays (including the 2 anterior rudimentary fin rays), whereas yellow bullhead have 24 to 27 anal fin rays (Scott and Crossman, 1973; Smith, 1985).

Brown bullhead are distinguished from black bullhead by:

- Brown bullhead have a strong, definitive serration on the posterior margin of the dorsal fin spine, whereas black bullhead have a nearly smooth dorsal fin spine (Scott and Crossman, 1973; Smith, 1985).
- Brown bullhead have 21 to 24 anal fin rays (including the 2 anterior rudimentary fin rays), whereas black bullhead have 17 to 21 anal fin rays (Scott and Crossman, 1973; Smith, 1985).
- Brown bullhead have 13 to 16 gill rakers, whereas black bullhead have 15 to 24 gill rakers (Smith, 1985).

Brown bullhead spawn in late spring to summer when water temperatures reach 21°C (70°F) (Scott and Crossman, 1973). Nests are built in small depressions or burrow under overhanging banks, under docks, or near any other type of protection. Maturity is reached at age 2 and the usual life span is 6 or 7 years (Smith, 1985). Brown bullhead feed at night mainly on food associated with the bottom sediments. Their diet consists of benthic macroinvertebrates, crustaceans, small fish, and some plant material. Brown bullhead are found in pools and sluggish runs over soft substrates in creeks and rivers; they are also found in lakes and ponds.

B.2 Smallmouth Bass *(Micropterus dolomieui)*

Smallmouth bass are a robust species in the sunfish family (Centrarchidae). Sunfish, including smallmouth and largemouth, have scales and a continuous dorsal fin that comprises an anterior section with numerous spines and a posterior section that has fin rays. The longest fin rays of the dorsal fin are in the middle of this fin ray section. There are three or more anal fin spines (Smith, 1985).

Smallmouth bass are distinguished from other sunfish by several features. The body length is 2 to 3 times the length of the greatest depth of the body. The body is completely scaled, with more than 55 scales along the lateral line (Smith, 1985). The dorsal fin has approximately 10 spines anteriorly and 12 to 15 fin rays posteriorly (Scott and Crossman, 1973). The shortest

dorsal fin spine is more than half as long as the longest dorsal fin spine. The most posterior end of the maxillary, with the mouth closed, extends to the middle of the pupil of the eye. The color is generally greenish bronze to brown, with the dorsal surface darker and the sides lighter, and the ventral surface is greyish or brownish white (Smith, 1985). There are usually 8 to 11 narrow vertical bars below the lateral line and fewer, wider vertical bars above the lateral line. Individuals can reach 9 pounds or more, and 20 inches or more in New York (Smith, 1985).

The black bass (smallmouth and largemouth bass) can be distinguished from other sunfish by the following:

- Black bass have small scales, with more than 55 scales along the lateral line, whereas other sunfish have relatively large scales, with fewer than 53 scales along the lateral line (Smith, 1985).
- Black bass have a relatively compressed and elongate body with a length that is 3 to 5 times the maximum depth of the body. Other sunfish are more compressed laterally with a length that is 2 to 3 times the maximum depth of the body (Smith, 1985).

Key distinguishing features separating smallmouth bass from largemouth bass are as follows:

- The posterior end of the maxillary bone (with the mouth closed) of the smallmouth bass reaches to below the middle of the pupil eye, whereas the end of the maxillary of the largemouth bass reaches beyond the posterior border of the eye (Scott and Crossman, 1973; Smith, 1985).
- The shortest dorsal fin spine is more than half as long as the longest dorsal fin spine in smallmouth bass, whereas the shortest dorsal fin spine is less than half as long as the longest fin spine in largemouth bass (Scott and Crossman, 1973; Smith, 1985).
- Smallmouth bass are brown or brassy with a uniform pattern or with one or two series of vertical bars on a lighter background; largemouth bass are greenish with a prominent longitudinal stripe along the middle of the side (Smith, 1985).
- Smallmouth bass have a unified pyloric caeca, whereas largemouth bass have a bifurcated pyloric caeca (Smith, 1985).

The smallmouth bass spawn in the spring when the water temperature reaches 16 to 21°C (60 to 70°F) (Scott and Crossman, 1973). Spawning nests are built in gravel substrate in water 0.6 to 6 meters (2 to 20 feet) deep (Smith, 1985). After the eggs are laid, the male guards the nest until the fry emerge, and then guards the dense school of fry for a short amount of time. Smallmouth bass feed opportunistically on almost any small animal in the water, including insects, crustaceans, tadpoles, frogs, and small fish. Juvenile smallmouth bass feed on zooplankton and

small macroinvertebrates. Smallmouth bass inhabit lakes, ponds, and slow to moderate currents in rivers. They tend to use habitats with clear water and rocky substrate with little vegetation and depositional sediment (Smith, 1985).

B.3 Yellow Perch *(Perca flavescens)*

Similar to walleye, the yellow perch is also a member of the family Percidae (see Section B.4 for characteristics of Percidae). The yellow perch is similar to both walleye and sauger. Yellow perch have uniform-sized teeth arranged in bands, and have 5 to 10 vertical dark bars along the side. The color is yellowish, but darker dorsally and lighter ventrally. The anterior dorsal fin is similar to walleye in that it has a dark patch at the posterior margin. Although the body is scaled, the top of the head lacks scales (Smith, 1985).

Key distinguishing features separating yellow perch from walleye and sauger are as follows:

- Yellow perch have uniform-sized teeth, whereas sauger and walleye have large caniniform teeth (Scott and Crossman, 1973; Smith, 1985).
- Yellow perch have well-defined dark vertical bars, whereas sauger and walleye have irregular dark areas or uniform coloration (Scott and Crossman, 1973; Smith, 1985).
- Yellow perch have 6 to 8 anal fin rays, whereas sauger and walleye have 11 to 13 anal fin rays (Scott and Crossman, 1973; Smith, 1985).

Yellow perch spawn in the spring in water 1.5 to 3 meters (5 to 10 feet) deep when water temperatures reach 7 to 11°C (45 to 52°F). Eggs are laid in sand, gravel, or vegetation and consist of a long gelatinous band. Adults typically reach 25 to 30 cm (10 to 12 inches) and live for 9 years.

Yellow perch feed opportunistically on zooplankton, macroinvertebrates, crayfish, and small fish during the day, and are less active at night. These fish use both lake and river habitats, and are often found in clearer water with vegetation (Smith, 1985).

References

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Canadian Government Publishing Centre, Ministry of Supply and Services Canada, Fisheries Research Board of Canada, Bulletin 184, Ottawa.

Smith, C.L. 1985. *The Inland Fishes of New York State*. New York State Department of Environmental Conservation, Albany, NY.

C. Field Equipment Lists

C.1 Equipment for Collecting Fish by Electroshocking

- Sampling and Analysis Plan
- Fish capture field notebook
- Waterproof ink pens
- Camera wand film
- Detailed maps of each sample location
- Hand-held GPS unit (Garmin GPS 12 or GPS 12XL, Garmin International, Lenexa, Kansas)
- Hand-held compass
- Marine radio for communication with other crews
- Cellular phone
- 60-ft trap nets
- Floy tag gun and tags
- Meter measuring board
- Electrofishing boat and motor (gas and oil), oars (2), boat hook, anchor, rope
- Boat trailer with working lights
- Generator (check gas, oil, and connections)
- Electroshocking voltage converter
- Electrodes (anode and cathode)
- Foot pedal, deadman switches (one for each person netting)
- Insulated, long-handled dip nets (3)
- Insulated, short-handled dip nets (2)
- Holding tank or live well (aerator or water circulator)
- Electrically insulated footwear (all crew members)
- Electrically insulated gloves (5,000 V minimum)
- Personnel flotation devices (all crew members) and safety toss
- Thermometer
- First aid kit
- Fire extinguisher
- Tool box
- Depth sounder.

C.2 Equipment for Dissecting and Collecting Samples from Fish

- Sampling and Analysis Plan
- Fish health assessment field notebook
- Waterproof ink pens
- Camera and film
- Marine radio for communication with fish collection crews
- Cellular phones
- First aid kit
- Fire extinguisher
- Bound copy of Appendix B (species descriptions)
- Portable Canopy
- Tables & Stools
- Short-handled dip net (2) (for handling of all live fish, one per crew)
- 60 to 80 L cooler (2) (fish processing station live well)
- 20 to 40 L cooler (2) (icewater tank, one for each fish health sampling crew)
- Aerator (2)
- Airstones & tubing
- Water bucket (with liter marks on the inside)
- Meter measuring board with 1 mm divisions (2) (for measuring fish, one per fish health crew)
- Ohaus portable electronic balance and 500 g calibration standard (±20 g accuracy) (2) (for fish wet weight, one balance per fish health crew)
- Ohaus portable electronic balance and 10 g calibration standard (±0.01 g accuracy) (2) (for tissue weights, one balance per fish health crew)
- Weigh paper and boats
- Scale knife (2) (for removing scales, one per fish health crew)
- Wire side cutters (2) (for removing dorsal fin spines, one per fish health crew)
- Polycarbonate cutting boards
- Dissecting scissors (1/fish, may be cleaned; for opening body cavity, cutting intestine and gill)
- Probe (1/fish, may be cleaned; for internal necropsy)
- Medium curved-tip forceps (1/fish, may be cleaned; for handling and manipulating tissues)
- Syringe (5 cc) with 22 G needle (1/fish, for collection of bile)
- Sterile bacterial loop (1/fish, for kidney bacteria sample)
- Sterile scalpel blade (1-#11, 1-#22 per fish, for tissue removal)
- Scalpel handles (2/fish, may be cleaned; one for each blade)
- Surgical steel razor blades (4/fish, for cutting tissues)
- Hemostat clamp (1/fish for scalpel blades)

- 1 quart heavy duty Ziploc™ freezer bags (1/fish for clean dissection tools)
- Pesticide grade methanol (for decontamination of tools)
- ASTM Type II reagent water or distilled water (for decontamination of tools)
- Wash bottles, Teflon, prelabeled for methanol and distilled water (for decontamination)
- Wash basin (1/team, for nondisposable used dissection tools)
- Aluminum foil (for clean tools)
- Disposable nitrile gloves (several sizes, 2 pairs per fish)
- Kimwipes® (many boxes)
- Sharps container
- Garbage cans (30 gal with 30-gal heavy duty trash bags)
- Scale envelopes (1/scale or spine sample)
- 4 ml amber vials, with Teflon-lined caps (at least 1/fish for gall bladder bile PAH metabolite samples)
- 20 ml & 40 ml vials, certified clean, with Teflon-lined caps (at least 1/fish for liver contaminant samples)
- 125, 250 & 500 ml jars, certified clean (at least 1/fish for fillet contaminant samples)
- 5.5-mL snap-cap bullet tubes prepared with HBSS (Hank's balanced salt solution) (1/fish, for spleen virology sample)
- BHIA slant culture tubes, prepared (1/fish, for kidney bacteriology sample)
- Sterile loops (for kidney bacteriology)
- Surgipath "super cassettes" (at least 8/fish for histopathological samples)
- Gauze bags for tissues
- TBD ml jars (1/fish for histopathological samples)
- Dietrich's fixative (histopathology fixative)
- Marking pens and histology pencils
- Index cards (for fillet sample and scale/spine sample label)
- Prelabeled self adhesive sample labels (for each sample, including QA/QC)
- Clear packing tape (for securing sample labels and sealing shipping containers)
- Small coolers (6) (for bacterial cultures, viral cultures, and scales and spine samples)
- Large hazardous materials coolers (9) (for residue, parasite, histopathology samples)
- Wet ice (for viral samples)
- Dry ice (for residue samples)
- Hazardous materials shipping labels (fixatives, dry ice, flammable materials)
- Chain of custody forms
- Plastic bags (for protecting chain of custody forms)
- Fed Ex airbills, prepared
- Custody seals (for sealing containers for chain of custody)
- Cryo-gloves (for handling dry-ice frozen materials)
- 9 V and D batteries

- Paper towels
- Parafilm
- Flashlight/lanterns/headlamps.

D. Hudson River Phase I Fish Health Assessment Field Standard Operating Procedures (SOPs)

List of SOPs

SOP 1	Measuring fish length and weight
SOP 2	Applying Floy tags to fish
SOP 3	Setting and operating hand-held Global Positioning System (GPS) units
SOP 4	Decontaminating Re-useable Dissection and Sample Collection Tools
SOP 5	Preparing Sample Preservative Solutions
SOP 6	Using Scales and Spines for Estimating Ages of Yellow Perch, Smallmouth Bass, and Brown Bullhead from the Hudson River and Oneida Lake, NY
SOP 7	Detection and Identification of Bacterial and Viral Fish Pathogens from Yellow Perch, Smallmouth Bass, and Brown Bullhead from the Hudson River, NY

SOP 1: Measuring Fish Length and Weight

Before taking measurements of each fish, the measuring board will be inspected to ensure that the board is in good working order. Any visible water will be removed from the balance, and the calibration checked with at least two standard calibration weights. The weight of the calibration weight will be recorded before and after calibration adjustment of the balance.

Measuring Length

Length will be measured on a measuring board that has a linear scale (mm) with a rigid head piece.

1. Place a fish on the measuring board on its right side, with its head facing the recorder's left.

2. Hold the head of the fish firmly against the head piece before measuring the fish.

3. Measure the total length, fork length, and standard length to the nearest millimeter. Total length is defined as the length from the most anterior part of the fish to the tip of the longest caudal fin ray.

Measuring Weight

Weight will be measured on a portable scale.

1. Calibrate the scale at least two times per sampling day.

2. Clean and dry the scale.

3. Tare the weight of the weighing tub.

4. Wipe any excess water from the fish with a disposable paper towel, and gently place the fish into the weighing tub.

5. Record the balance reading to the nearest gram.

SOP 2: Applying Floy Tags to Fish

Each fish of a target species that is of an acceptable size will be tagged with a unique three-digit identification tag. The procedure for tagging fish is as follows:

1. Load the tag into the tagging gun and record the tag number in the field notebook.

2. Place the fish into the v-trough holding board in the swimming position with the head facing to your left.

3. Hold the fish on both sides just behind the operculum (gill cover) with your left hand.

4. Insert the needle of the tagging gun into the musculature approximately 1 cm below and 2 cm behind the most anterior (most forward) portion of the dorsal fin. Angle the needle so the tip will pass the dorsal-ventral midline (i.e., will pass between the bones that produce the dorsal fin spines and rays).

5. Compress the trigger of the tagging gun. With the trigger compressed, turn the gun 1/8th turn counterclockwise and gently pull the needle out of the musculature. Keep the trigger compressed while removing the needle.

6. Tug on the tag to ensure that the tag will not come out.

7. Remove any scales, tissue, or debris from the needle.

SOP 3: Operating the Hand-Held Global Positioning System (GPS) Units

A Garmin (Garmin International, Lenexa, Kansas) GPS 12 or GPS 12XL hand-held GPS unit will be used to identify fish capture locations during the study. The use and operation of the individual unit is provided in the instruction manual provided by the manufacturer. This SOP provides the settings required for consistency of GPS coordinates between units, and for accuracy of identifying locations on maps and for identification of locations during future sampling activities.

The unit allows for GPS locations to be in several different north-south coordinate systems with several different map datum reference protocols. The units will be set up to record UTM (Universal Transverse Mercator) coordinates using the WGS 84 (World Geodetic System 1984) map datum reference points. With this system, each unit refers to one meter east-west or north-south. Under this protocol, coordinates will be in the form of:

13T 0386797

4134887

where:

"13T" refers to the unique global zone of the coordinates.

The top set of numbers (0386797) is the east-west position within the zone.

The bottom set of numbers (4134887) is the north-south position within the zone.

Record the UTM coordinates directly on the data sheet.

SOP 4: Decontaminating Re-useable Dissection and Sample Collection Tools

Materials

- Clean potable water.
- HPLC (High Performance Liquid Chromatography)-grade or pesticide-grade methanol.
- Analyte-free distilled water, ASTM (American Society for Testing and Materials) Type-II reagent grade water, or HPLC-grade water.
- Phthalate-free plastic or Teflon containers.
- Alconox soap.

Decontamination (for equipment used to obtain samples for contaminant analysis)

1. Wash in Alconox soap solution.
2. Rinse using clean potable water.
3. Rinse thoroughly with methanol.
4. Rinse thoroughly with analyte-free water from a phthalate-free plastic or Teflon wash bottle.

Storage

Decontaminated tools will be stored in aluminum foil wrapping to protect them from exposure to airborne contamination.

SOP 5: Preparing Sample Preservative Solutions

This SOP describes the preparation of HBSS, which is used to preserve tissue samples for analysis of viral infection.

Preparation of HBSS

The HBSS must be prepared using a sterile technique in a laminar flow hood, using appropriate sterile glassware and pipettes. The HBSS will be prepared and placed into the sample containers before their shipment to the field.

1. Combine and mix the following ingredients in a 500 mL sterile glass bottle:

    a. 450 mL sterile water
    b. mL $NaHCO_3$
    c. 10 mL Pen/Strep
    d. mL Mycostatin (= Nystatin)
    e. mL Gentamicin
    f. 50 mL 10X Hanks solution.

2. Dispense 2.7 mL into each sterile snap-cap tube.

SOP 6: Using Scales and Spines for Estimating Ages of Yellow Perch, Smallmouth Bass, and Brown Bullhead from the Hudson River and Oneida Lake, NY

redacted

Introduction

The protocols for preparing scales and spines for use in estimating ages of freshwater fishes taken from North American waters are described below. These protocols are based on standard protocols, professional experience in estimating fish ages, recommendations from the primary literature, and consultation with other experts on age estimation.

Methods

Age Estimation

Two experienced individuals will estimate ages independently for each fish. The individual estimates will then be compared for consensus. If age estimates for individual readers agree, then that age will be recorded as the final estimated age. Structures from those fish for which there is not consensus will be re-examined by both individuals simultaneously and a consensus age estimate reached. If the readers cannot reach a consensus, then no final age is recorded (the individual age estimates are reported).

Scale Preparation

Scales will be cleaned in water or a mild soap solution to remove tissue, mucous, and debris. Permanent impressions of several scales from each fish will be made on clear acetate using a standard scale press. Acetate slides will be uniquely etched with a fish identification number specified by the sample ID on the scale envelope.

Scale impressions will be viewed on a microfiche reader at either 24 or 48 X magnification, depending on the size of the scale and the ability to discern annuli. Generally, higher magnifications will be used for smaller scale impressions. Higher magnification will be used on impressions of large scales when annuli are difficult to discern. Scale annuli will be identified using criteria described in Carlander (1961).

Ictalurid Spines

Remaining skin and connective tissue will be removed from the spine. A high-speed rotary cutting tool will be used to cut 1-3 cross-sections through the articulating process, if present. If

the articulating process is not present, then sections will be cut through the shaft. Both sides of each cross-section will then be polished with 600-grain aluminum oxide paper. Cross sections will be viewed under a variable-magnification, dissecting, light microscope using an independent fiber-optic light source with variable light intensity. Magnification and light intensity will be varied as necessary to generate the clearest image.

General Considerations: Spines

The field processing crews will make every effort to separate ictalurid spines at the articulating process. Previous research on ictalurids suggests age estimates from cross-sections from the shaft of spines are lower than those from the articulating process because of loss of earlier annuli as the central lumen forms (Turner, 1980).

References

Carlander, K. D. 1961. Variations in re-reading walleye scales. *Transactions of the American Fisheries Society* 90:230-231.

Turner, P. R. 1980. Procedures for age determination and growth rate calculations of flathead catfish. *Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies* 34:253-262.

SOP 7: Detection and Identification of Bacterial and Viral Fish Pathogens from Yellow Perch, Smallmouth Bass, and Brown Bullhead from the Hudson River, NY

redacted

Introduction

The protocols for detecting and identifying bacterial and viral fish pathogens from non-salmonid fishes is briefly described below. These protocols are based on standard protocols used by all U.S. Fish and Wildlife Service Fish Health Centers as described in the National Wild Fish Health Survey Laboratory Procedures Manual. The target bacterial pathogens include: *Aeromonas salmonicida, Yersinia ruckeri, Edwardsiella ictaluri*, and *Renibacterium salmoninarum.* Viruses will include channel catfish virus, and Infectious pancreatic necrosis virus.

Methods

Field Samples

Each fish will be aseptically sampled in the field in the following ways: An inoculum is sampled aseptically from the kidney using a sterile 1 Fl loop. It is streaked onto and individual slant containing brain heart infusion agar (BHIA).

1. Kidney and spleen tissues are collected with clean forceps and placed into a culture tube containing HBSS. Both kidney and spleen from a single fish may be placed into each tube.

2. Samples are properly labeled, securely packaged, and shipped on ice overnight to the laboratory.

Laboratory Processing

Samples received will be assigned an individual Case History Number. Tubes will be externally disinfected and all sample data recorded onto the Case History Sheet. Sample racks will be labeled with the case number and transported to the appropriate lab for analysis.

Tissues for virology will be homogenized and centrifuged for 20 minutes at 4°C. The supernatant is diluted to 1:100 and inoculated onto the following cell lines: brown bullhead (BB), catfish ovary (CCO), blue gill fin (BGF), fathead minnow (FHM, chinook salmon embryo (CHSE) and epithelio-papilloma of carp (EPC). Cells will be examined daily for cytopathic effect (CPE). If no CPE is observed by 14 days, the cultures are discarded and recorded as negative.

Bacterial cultures are incubated at 20°C and checked daily for growth. Tubes containing growth within 7 days are striated onto a petri plate containing tryptic soy agar (TSA). Representative colonies are isolated onto TSA and tested for morphological and biochemical characteristics.

All pathogens identified by the above described techniques are verified by either serological techniques or by the polymerase chain reaction (PCR) technique.

References

Thoesen, J. 1994. Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens. American Fisheries Society, Fish Health Section, Bethesda, MD.

National Wild Fish Health Survey, Laboratory Procedures Manual. March 2000. U.S. Fish & Wildlife Service, Division of Fish Hatcheries, Washington, DC.

E. Site Location Maps and GPS Coordinates