Health and Safety Plan for
Well Installation and Subsurface Investigation
And Remediation
of Soils and Groundwater
Tronox LLC
Henderson, Nevada

Updated August 3, 2010

Prepared For:

Tronox LLC
560 West Lake Mead Parkway
Henderson, Nevada 89015

Prepared By:

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Principal

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Corporate Health & Safety

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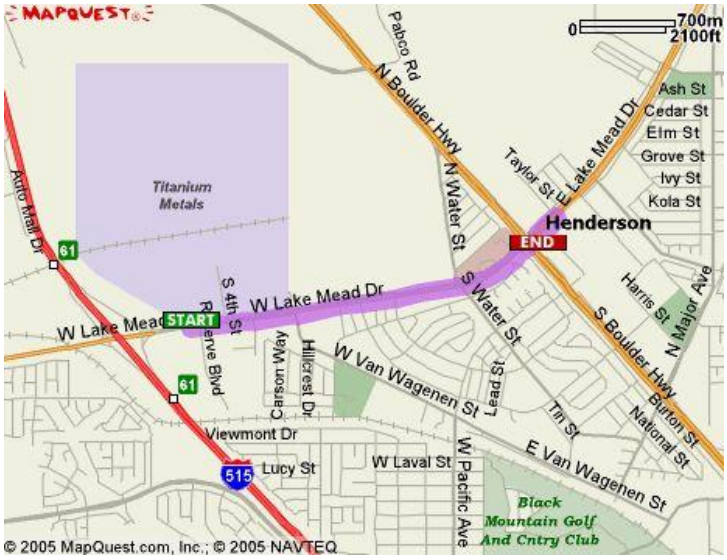
APPENDICES

EXECUTIVE SUMMARY

Emergency References
For Well Installation and Subsurface Investigation, Tronox LLC, Henderson Nevada

Ambulance:	911
Fire:	911
Police:	911
Medical Services:	St Rose Dominican Hospital (702) 564-2622 or (702) 616-4560 102 E Lake Mead Pkwy, Henderson, NV 89015

1	Start out going EAST on **W LAKE MEAD PKWY/NV-146**toward RESERVE BLVD. Continue to follow W LAKE MEAD PKWY.	1.7
2	Turn left into entrance of **St Rose Dominican Hospital**	0.0
3	End at **St Rose Dominican Hospital**	0.0



Tronox Contractor Safety

On-site work shall be performed consistent with the current Tronox Contractor's Safety Handbook and Contractor's Safety Orientation handout. Complete copies of these documents are provided in Appendix F. On-site training is required for each contractor. Safety training is held the first and third Wednesday of each month. For information on training, contact Karen Luna at (702) 651-2308. The contractors' safety checklist shall be completed and signed by Northgate, each contractor and Tronox before commencement of work. A sample of this form is in Appendix F.

Emergency Muster Point

In case of a site/facility emergency, please meet at the closest evacuation meeting place to your location. There are six evacuation meeting places:

1 Back gate,
2 West of the Lab and Change House,
3 South of Unit 6,
4 West of the Administration Building,
5 At the intersection of the plant driveway and Lake Mead Parkway and
6 At the Timet Ball Field.

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

Underground Utility Location Service:
DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

Client Contacts:

Karen Luna, Tronox Safety Officer	(702) 651-2308 (Office)
Rick Stater, Tronox Plant Manager	(702) 651- 2200 (Office)
Keith Bailey, Corporate Contact	(405) 270-2665 (Office), (405) 203-8694 (Cell)

Northgate Project Representatives:

Derrick Willis, Project Manager	(949) 375-7004 (Cell)
Ted Splitter, Corporate Health and Safety	(510) 435-4609 (Cell)
Susan Crowley, Crowley Environmental	(702) 651-2334 (Cell)

Hazard Assessment
Chemical Hazards - Physical Hazards

Dust	Overhead utilities
Falling objects	Rotating equipment
Flying objects	Traffic
Heat	Tripping
Lifting	Underground utilities
Noise	

Personal Protective Equipment

PPE Item	General	Drilling	Sample Collection
Hard Hat	1 & 2	🕘	1 & 2
Traffic Vests	2	2	2
Steel Toed Safety Shoes	1	🕘	🕘
Safety Glasses with Sideshields	1	🕘	🕘
Hearing Protection		🕘	3
PPE Item	**General**	**Drilling**	**Sample Collection**
PVC or Nitrile Gloves		4	🕘
Sun Screen	🕘	🕘	🕘

🕘 Required PPE

1 All employees must comply with Tronox safety requirements.

2 Traffic vests and hardhats are required within twenty feet of any public road or any private road with active traffic.

3 Hearing protection should be worn if normal conversation cannot be understood.

4 Note that chemical resistant gloves are only required of those that are likely to come in direct contact with potentially contaminated soils and/or groundwater.

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1.0 INTRODUCTION

1.1 HASP Applicability

This site-specific Health and Safety Plan (HASP) has been developed to establish the health and safety procedures required to minimize any potential risk to personnel involved in subsurface investigations and remediation for Tronox in Henderson, Nevada.

The provisions of this plan apply to all Northgate personnel and Northgate contract personnel who may potentially be exposed to safety and/or health hazards related to activities described in Section 2 and 3 of this document. The Site contractors have prepared HASPs for their personnel.

This HASP has been written to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Personal Protective Equipment Standard (29 CFR 1910.132) for all activities and the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) for tasks where there are potential exposures to subsurface contaminants. All activities covered by this HASP must be conducted in complete compliance with this HASP and with all applicable federal, state, and local health and safety regulations. Personnel covered by this HASP who cannot or will not comply will be excluded from site activities.

This plan will be distributed to each employee and Northgate subcontract personnel involved with investigation or remedial activities at the Site. Each employee must sign a copy of the attached health and safety plan sign-off sheet (see Appendix A).

This HASP only pertains to the tasks that are listed in Section 3.0. A task specific HASP or addenda to this HASP will be developed at a later date for any other subsequent investigative/remedial activities at the Site.

All subcontractors are required to have in place a Health and Safety Plan for any work conducted on this site, which must be consistent with the requirements of this plan and all Tronox health and safety requirements.

1.2 Organization/Responsibilities

The implementation of health and safety at the Site will be the shared responsibility of the Northgate Project Manager (PM), the Northgate Site Safety Officer (SSO) and other Northgate and contractor personnel.

1.2.1 Project Manager

The Northgate PM (Derrick Willis) is the individual who has the primary responsibility for the overall health and safety of this project. The PM therefore has the primary responsibility for implementing the requirements of this HASP. Some of the PM's specific responsibilities include:

- Providing the Corporate Safety Manager with updated data regarding the types and extent of contamination at the Site;
- Assuring that all personnel to whom this HASP applies have received a copy and have submitted a completed copy of the HASP sign-off form;
- Assuring that all Northgate and contractor personnel submit documentation of the medical surveillance and training requirements specified in Section 10 of this HASP;
- Assuring that all personnel to whom this HASP applies have attended a pre-entry briefing prior to entering an exclusion zone;
- Maintaining a high level of health and safety consciousness among employees at the work site; and
- Maintaining regular communications with the SSO and subcontractors.

1.2.2 Site Safety Officer

The Northgate SSOs will be on-site during all the activities covered by this HASP. The onsite SSO responsible for enforcing the requirements of this HASP for -site investigation activities is Dana Brown, C.E.M.. The onsite Northgate SSO for soil remediation is Jim Carolan. By design, the SSOs have the authority, and the responsibility, to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Procuring and distributing the PPE needed for this project for Northgate employees;
- Verifying that all PPE and health and safety equipment is in good working order;
- Procuring the necessary air monitoring equipment for this project and ensuring that the required monitoring is conducted in accordance with this plan;
- Setting up and maintaining the contamination reduction zone adjacent to the exclusion areas and assuring proper decontamination of all site personnel and equipment;
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Conducting on site Job Hazard Assessments if conditions or tasks change and communicating to the Corporate Health and Safety Manager the results of the Job Hazard Assessment (see appendix D for an assessment form);
- Assisting with accident/incident investigations and preparing accident/incident investigation reports;
- Conducting the pre-entry briefing in accordance with Section 10; and
- Initiating emergency response procedures in accordance with Section 11 of this HASP.

1.2.3 Field Personnel and Covered Contractor Personnel

All Northgate field personnel and contractor personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form and documentation of medical surveillance and training to the PM prior to the start of work;
- Attending the required pre-entry briefing prior to beginning on-site work;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM prior to the start of work;
- Reporting all accidents, injuries, and illnesses, regardless of their severity, to the SSO; and
- Complying with the requirements of this HASP and the requests of the SSO.

In addition to other requirements referenced in this HASP, all contractors are required to:

- Provide appropriate PPE for their employees;
- Ensure, via daily inspections, that their equipment is maintained in good working condition;
- Operate their equipment in a safe manner; and
- Appoint an on-site safety coordinator to interface with the Northgate SSO.

1.3 Modification of the HASP

The procedures in this HASP have been developed based on information obtained prior to commencing work at the project site. Should additional information become available regarding potential on-site hazards, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the Northgate Corporate Safety Manager before such modifications are implemented.

Any significant modifications must be incorporated into the written document and addenda and the HASP must be reissued. The PM will ensure that all personnel covered by this HASP receive copies of all issued addenda. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. Sign-off forms will be submitted to the PM. The HASP addenda should be distributed during the daily safety meeting so that they can be reviewed and discussed. Attendance forms will be collected during the meeting.

2.0 SITE HISTORY

2.1 Site Description

The Site is approximately 452 acres in size and is located 13 miles southeast of Las Vegas in an unincorporated section of Clark County, Nevada. Elevations across the Site range from 1,677 to 1,873 feet above mean sea level. The land surface across the Site slopes toward the north at a gradient of approximately 0.023 foot per foot (ft./ft.). The developed portions of the Site have been modified by grading to accommodate building foundations, surface impoundments, and access roads.

The BMI complex has been the site of industrial operations since 1942 and was originally sited and operated by the U.S. government as a magnesium production plant in support of the World War II effort. Following the war, a portion of the complex was leased by Western Electrochemical Company (WECCO). By August 1952, WECCO had purchased several portions of the complex, including six of the large unit buildings, and produced manganese dioxide, sodium chlorate and various perchlorates. In addition, in the early 1950s, pursuant to a contract with the U.S. Navy, WECCO constructed and operated a plant to produce ammonium perchlorate on land purchased by the Navy. In 1962, AP&CC purchased the ammonium perchlorate plant from the Navy, but continued to supply the Navy. AP&CC merged with Kerr-McGee Corporation (Kerr-McGee) in 1967. This merger included boron production processes in California, which were moved to Henderson and began operation in the early 1970s. These included elemental boron, boron trichloride and boron tribromide. In 1994, the boron tribromide process was shut down and dismantled. In 1997, the sodium chlorate process was shut down and in 1998, production of commercial ammonium perchlorate ended as well. The ammonium perchlorate production equipment was used to reclaim perchlorate from on-site materials until early 2002, when the equipment was permanently shut down. In 2005, Kerr-McGee Chemical LLC's name was changed to Tronox LLC. Processes currently operated by Tronox at the Henderson facility are for production of manganese dioxide, boron trichloride and elemental boron. Additional companies operate within the BMI complex; details regarding ownership and leases within the BMI complex are described in the 1993 Phase I ECA report (Kleinfelder, 1993).

During the 1970s, the USEPA, the State of Nevada, and Clark County investigated potential environmental impacts from the BMI companies' operations including atmospheric emissions, groundwater and surface water discharges and soil impacts (Ecology and Environment, 1982). From 1971 to 1976, Tronox, then Kerr-McGee, modified their manufacturing process and constructed lined surface impoundments to recycle and evaporate industrial wastewater. In 1976, the facility achieved zero discharge status regarding industrial wastewater management.

Soil and/or groundwater have been impacted with ammonium perchlorate (AP), hexavalent chromium, arsenic, asbestos, dioxin, volatile organic compounds (VOC's), total petroleum hydrocarbons (TPH's) and other chemical compounds as a result of current and historic business operations at this facility.

3.0 SCOPE OF WORK

3.1 Scope of Work

The work covered by this HASP consists of environmental site sampling and remediation. This work will generally require Northgate personnel and their subcontractors to handle soil or groundwater.

The activities that may be conducted during the site investigation phase of the project are as follows:

- HydroPunch and cone penetrometer testing (CPT);
- Hollow-stem auger (HAS);
- Mud-rotary, air-rotary and percussion-hammer drilling;
- Geoprobe;
- Temporary piezometer installation;
- Groundwater sampling;
- Soil sampling;
- Water level measurement; and
- Well installation and related pump tests.

The types of activities that may be conducted during the site remediation phase of the project are as follows:

Northgate Activities (covered by this HASP for Northgate personnel and Northgate contract personnel)

- Establish site work zones;
- Observe and document the excavation of soils prior to reuse;
- Observe and document the excavation, loading, and off-hauling of soil for off-site disposal;
- Observe and document the excavation, loading, hauling of soil for on-site stockpile management;
- Inspect, along with NDEP representatives, the decontamination of haul trucks at tack out stations;
- Observe and document the demolition of concrete foundations and slabs, pavement, utility lines and buildings;
- Observe and document the removal of concrete and asphalt materials;
- Observe and document backfilling and compaction;
- Collection of soil samples of excavation sidewalls & floor;
- Collection of stockpile samples;

- Observe and document the drilling and logging of soil borings and the installation of monitoring wells and piezometers;
- Collection of groundwater samples.

Contractor Activities (covered by Contractors HASPs for their own personnel)

- Excavate impacted and unimpacted soils;separate into stockpiles for disposal andonsite reuse;
- Excavate, load, and off-haul soil for off-site disposal at Apex Landfill and US Ecology Landfill, as appropriate;
- Excavate, load, and haul soil for on-site stockpile management;
- Demolish concrete foundations and slabs, pavement, utility lines (where appropriate) and buildings;
- Remove concrete and asphalt materials;
- Backfill and compact soil to Northgate and NDEP specifications;
- Drill soil borings and install monitoring wells and piezometers; and
- Perform other field investigations as specified by Northgate

The scope of work may involve the abatement for lead-based paint and asbestos, demolition of several buildings unused production facilities, block walls, and the removal of above- and underground utilities to provide access for removal of soil in the proposed remedaition areas. Following demolition activities in the proposed remedaition areas, the main scope of work focuses on the phased excavation, potential temporary stockpiling, loading and transport off-Site of approximately 440,000 cubic yards of soils to one or more approved offsite land disposal facilities.

4.0 CHEMICAL HAZARD ASSESSMENT AND CONTROLS

4.1 Potential Chemical Contaminants

Based on extensive soil and groundwater investigations conducted at the Site, the potential chemical contaminants of interest and their general locations of impacted environmental media are:

- Manganese - Manganese tailing area
- Dioxin/Furans - impacted soil in former effluent pond areas
- Hexachlorobenzene - impacted soil in former trade effluent pond areas
- Asbestos - impacted soil in areas of building demolition
- Perchlorate compounds and hexavalent chromium (production facilities and groundwater treatment system)
- Hazardous Waste Landfill - impacted with sodium chlorate filter cakes and potassium perchlorate process waste solids
- Volatile Organic Carbons (VOCs; groundwater treatment system)

4.1.1 Manganese Compounds

Manganese is an essential trace element. In excess, it is of medium toxicity to humans. Manganese and its compounds are usually absorbed into the body by oral and respiratory routes, in the form of dust. Chronic inhalation exposure of humans to high levels may result in a syndrome called manganism and typically begins with feelings of weakness and lethargy. Other chronic effects reported in humans from inhalation exposure to manganese are respiratory effects such as an increased incidence of cough, bronchitis, dyspnea during exercise, and an increased susceptibility to infectious lung disease.

4.1.2 Dioxin

The term "dioxin" is commonly used to refer to a family of toxic chemicals that share a similar chemical structure and induce harm through a similar mechanism. Dioxins have been characterized by the EPA as likely human carcinogens and are anticipated to increase the risk of cancer at background levels of exposure. Dioxins are formed as a result of combustion processes such as commercial or municipal waste incineration and from burning fuels (like wood, coal, or oil). Most of the population has low-level exposure to dioxins. Although dioxins are environmental contaminants, most dioxin exposure occurs through the diet, with over 95% coming through dietary intake of animal fats. Small amounts of exposure occur from breathing air containing trace amounts of dioxins on particles, from inadvertent ingestion of soil containing dioxins, and, to a lesser degree, from absorption through the skin.

4.1.3 Hexachlorobenzene

Hexachlorobenzene is a white crystalline solid. It is formed as a by-product during the manufacture of chemicals used as solvents, other chlorine-containing compounds, and pesticides. Small amounts of hexachlorobenzene can also be produced during combustion processes. Studies in animals suggest that eating this substance for months or years can cause cancer of the liver, kidney, and thyroid, but there is no strong evidence that the substance causes cancer in people. Although hexachlorobenzenes are environmental contaminants, most exposure occurs through the diet. Small amounts of exposure occur from breathing air containing trace amounts of hexachlorobenzene on particles, from inadvertent ingestion of soil containing hexachlorobenzene, and, to a lesser degree, from absorption through the skin.

4.1.4 Asbestos

Asbestos is the name given to a group of six different fibrous minerals. Asbestos fibers do not evaporate into the air or dissolve in water. However, pieces of fibers can enter the air from the wearing down of manufactured asbestos products. Long term and significant exposure to asbestos fibers is associated with having increased chances of getting two principal types of cancer: cancer of the lung tissue itself and mesothelioma, a cancer of the thin membrane that surrounds the lung and other internal organs. Low levels of asbestos that present little, if any, risk to your health can be detected in almost any air sample. You can bring asbestos home in the dust on your hands or clothes if you work with asbestos containing materials.

4.1.5 Perchlorate Compounds

Perchlorates are colorless salts that have no odor. Common salts of perchloric acid are moderately toxic by ingestion. Dilute solutions in water should be considered mildly toxic and a minor skin irritant.

4.1.6 Volatile Organic Compounds

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. The most common symptoms associated with exposure are eye, nose, and throat irritation; headaches; loss of coordination; and nausea. Long-term exposure to VOCs may cause damage to the liver, kidneys, and central nervous system. Some organic compounds are suspected or known to cause cancer in humans.

4.1.7 Sodum chlorate filter cakes and potassium perchlorate process waste solids

Wastes disposed of in the hazardous waste Landfill contained sodium chlorate filter cakes and potassium perchlorate process waste solid mixed with soil. Both sodium chlorate and potassium perchlorate are strong oxidizers. Oxidizers have the capacity to provide excess oxygen at elevated temperatures and these chemicals may pose a fire and explosion hazard when they come in contact with all forms of combustibles (wood, paper, textiles, plastics, liquid fuels, etc.). In

addition, mixtures of oxidizers and combustibles can be ignited by a heat energy originating from a weak ignition source such as friction, physical impact or static electricity. All contact with organic and combustile material must be avoided during drilling and excavation of the landfill material.

4.2 Chemical Exposure Potential/Control

4.2.1 Exposure Guidelines

Exposure guidelines for chemical hazards potentially encountered at the site are listed in Table 1. Air monitoring for dust will be conducted at the site to ensure dust levels are minimized.

Table 1
Exposure Guidelines for Non VOC Site Chemical Hazards [1]

Chemical Name	Odor Threshold	OSHA PEL[a]	ACGIH TLV[b]	Site Action Levels
Respirable Dust	Not applicable	5 mg/m^3	3 mg/m^3	0.1 mg/m^{3d}
Manganese	Not applicable	5 mg/m^3 (C)	0.2 mg/m^3	0.1 mg/m^{3c}
hexachlorobenzene	Not applicable	na	0.002 mg/m^3	0.001 mg/m^{3c}
Asbestos	Not applicable	0.1 f/cc	0.1 f/cc	0.05 f/cc c

Notes:

1. See Section 6 for action level for VOCs

[a] OSHA 8-hour Permissible Exposure Limits

[b] ACGIH 8-hour Recommended Threshold Limit Values for Chemical Substances and Physical Agents American Conference of Governmental Industrial Hygienists. 2009.

[c] Site Action Levels calculated as 50% of threshold limit value or PEL (as measured by NIOSH methods), whichever is lower.

[d] Based on community action level for particulate matter per NDEP standards of quality for ambient air.

ppm parts per million
mg/m^3 milligrams per cubic meter
(C) ceiling concentration

4.2.2 Potential Routes of Exposure

The potential routes of exposure to the contaminants of concern include:

- Dermal contact with contaminated soils during drilling of soil borings, well and piezometer installation, and soil sample collection;
- Dermal contact with contaminated groundwater during well installation and groundwater sampling;
- Incidental ingestion of soil from hand to mouth transfer activities;
- Inhalation of vapors or dusts during soil boring and soil sampling; and
- Inhalation of vapors or dusts during well installation and groundwater sampling.

4.2.3 Exposure Control

As a precaution, Northgate will be conducting real-time air monitoring for VOCs and dust in the worker's breathing zone to determine exposures to chemicals of interest during the subsurface investigations. If exposures exceed the action levels as defined in Section 6, respiratory protection as discussed in Section 7 will be donned.

To avoid direct dermal contact with contaminated media, protective clothing as described in Section 7 will be required when collecting samples and decontaminating sampling equipment.

Although highly unlikely, exposure to all of the chemicals of interest may occur via ingestion (hand-to-mouth transfer). The decontamination procedures described in Section 9 address personal hygiene issues that will limit the potential for chemical ingestion.

4.3 Hazardous Substances Brought On-Site by Northgate or Northgate subcontractors

A material safety data sheet (MSDS) must be available for each hazardous substance brought on the property. This includes solutions/chemicals that will be used to decontaminate sampling equipment. Containers of hazardous materials must be properly labeled in accordance with OSHA's Hazard Communication Standard.

5.0 PHYSICAL HAZARDS AND CONTROLS

5.1 General

The physical hazards of this project are those normally associated with geotechnical field work, including hazards relating to underground utilities, work near drilling or construction equipment and trucks, noise, slip and fall hazards, and back strains from lifting.

Geophysical or utility clearance surveys shall be conducted at each proposed boring/geoprobe or excavation location prior to any drilling or excavation activities. Each location will be marked with flagging, stakes, or marking paint to identify any potential subsurface hazards. Overhead clearance will also be checked for any locations where drilling rig masts or backhoe arms may encounter overhead hazards. The Northgate Field Manager can alter any drilling or sampling locations as necessary to avoid potential hazards.

Hearing protection shall be worn whenever noise levels exceed 85 dBA. Either the PM or the SSO shall review these hazards with field personnel during tailgate safety meetings.

Confined space entry is not anticipated during this project. A confined space is defined as any location that is large enough to enter, that has limited access or egress, and that is not designed for continuous human occupancy. Precautions shall be reviewed with the SSO before entry into either type of location. These precautions include training, confined space air monitoring, and provisions for confined space rescue procedures. Entry into excavations will require provisions for preventing hazards associated with moving ground.

These hazards should be discussed during routine tailgate safety meetings. Either the Project Manager or the SSO shall conduct routine project inspections to eliminate physical hazards to the extent feasible.

5.2 Heat Stress

The work to be conducted at the Tronox facility will be done in an arid climate with high ambient temperatures during a significant part of the year.

Types of Heat Stress

Heat related problems include **heat rash, fainting, heat cramps, heat exhaustion, and heat stroke**. **Heat rash** can occur when sweat isn't allowed to evaporate, leaving the skin wet most of the time and making it subject to irritation. **Fainting** may occur when blood pools to lower parts of the body and, as a result, does not return to the heart to be pumped to the brain. Heat related fainting often occurs during activities that require standing erect and immobile in the heat for long periods of time. **Heat cramps** are painful spasms of the muscles due to excessive salt loss associated with profuse sweating. **Heat**

exhaustion results from the loss of large amounts of fluid and excessive loss of salt from profuse sweating. The skin will be clammy and moist, and the affected individual may exhibit giddiness, nausea, and headache. **Heat stroke** occurs when the body's temperature regulatory system has failed. The skin is hot, dry, red, and spotted. The affected person may be mentally confused and delirious. Convulsions could occur. EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH. A person exhibiting signs of heat stroke should be removed from the work area to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Early Symptoms of Heat-Related Health Problems

- Decline in task performance,
- Excessive fatigue,
- Incoordination,
- Reduced vigilance,
- Decline in alertness,
- Muscle cramps,
- Unsteady walk, and
- Dizziness.

Susceptibility to Heat Stress Increases Due to:

- Lack of physical fitness,
- Obesity,
- Lack of acclimation,
- Drug or alcohol use,
- Increased age,
- Sunburn,
- Dehydration, and
- Infection.

People unaccustomed to heat are particularly susceptible to heat related fatigue. First timers in PPE need to gradually adjust to the heat.

The Effect of Personal Protective Equipment

Sweating normally cools the body as moisture is removed from the skin by evaporation. However, the wearing of certain personal protective equipment (PPE), particularly chemical protective coveralls (e.g., Tyvek), reduces the body's ability to evaporate sweat and thereby regulate heat buildup. The body's efforts to maintain an acceptable temperature can therefore become significantly impaired by the wearing of PPE.

Measures to Avoid Heat Stress

The following guidelines should be adhered to when working in hot environments:

- Establish work-rest cycles (short and frequent are more beneficial than long and seldom).
- A shaded, cool rest area will be provided.
- Rotate personnel, and alternate job functions.
- Water intake should be equal to the sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst. DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK. For an 8-hour work day, 50 ounces of fluids should be drunk. Cool water will be available in the rest area.
- Eat lightly salted foods or drink salted drinks such as Gatorade to replace lost salt.
- Save most strenuous tasks for non-peak heat hours such as the early morning or at night.
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration.
- Avoid double shifts and/or overtime.

The implementation and enforcement of the above mentioned measures will be the joint responsibility of the Project Manager, on-site Field Manager, and SSO. A shaded break area with potable water and fruit juices will be made available each day for the field team.

Heat Stress Monitoring Techniques

Atmospheric temperature should be monitoring by use of a thermometer located in a shaded area.

Site personnel should regularly monitor their heart rate as an indicator of heat strain resulting from heat stress by using the following method:

Radial pulse rates should be checked by applying light pressure to the pulse in the wrist, using the fore- and middle fingers, for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beats/minute, the next work cycle will be shortened by one-third and the rest period will be kept the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, the work cycle will be shortened again by one-third.

If the ambient temperature exceeds 85oF, each field staff member should monitor their heart rate at the beginning of each rest cycle, using the technique described above. If any member of the field team believes they may be experiencing heat stress related symptoms, they are to immediately report this to the site safety officer. This may include general fatigue, dizziness, nausea, vomiting, headache or difficulty in reaching simple decisions.

5.3 Noise Exposure

The use of the drilling rig or construction equipment can generate noise levels that will require the use of hearing protection in the immediate vicinity. Appropriate earmuff or earplugs (i.e., with an NRR greater than 25 dB) should be worn to prevent overexposure. The general rule of thumb is that if you have to raise your voice to be understood by someone who is standing 3 to 5 feet away from you, the noise levels are likely to be above 85 dB and therefore require the use of hearing protection.

5.4 Underground Utility Hazards

Law requires that a utility clearance survey must be performed before any subsurface activities are performed. The utility clearance survey must be requested from:

DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

The survey must be requested at least 72 hours (i.e., 3 full business days) prior to conducting the subsurface activities. The Digsafe ticket should be updated by requesting a remark every 30 days. Remember that digging outside of your originally specified boundaries requires that a new survey be performed.

Be aware that utility companies often cannot identify the exact location of their underground services once they cross onto private property (Note: Utility clearance survey requests are still required on private property). Private property owners may have rerouted these services or installed their own.

5.5 Overhead Utility Hazards

Any vehicle or mechanical equipment, particularly the mast of the drilling rig, that is capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 10 feet is maintained at all times.

5.6 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment, such as drums of investigation-derived wastes, is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects:

- Bend at the knees, not the waist. Let your legs do the lifting.
- Do not twist while lifting.
- Bring the load as close to you as possible before lifting.
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards.
- Use mechanical devices to move heavy objects, such as drums of investigation derived wastes or generators, that are too heavy to be moved manually.
- If mechanical devices are not available, ask another person to assist you.

5.7 Traffic Safety

The following precautions should be followed to draw attention to you and to warn other people of your presence in high traffic areas:

- Notify the property representative of your work location, dates of work and the anticipated work times, and suggest the possibility of a detour around the work area.
- Wear an orange or other appropriately colored safety vest. If work is being performed at dawn, dusk, or evening, the vests must have reflective tape.
- Set up traffic cones 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.
- Use an employee to direct traffic in high traffic areas where the hazard may increase.

5.7.1 Fire/Explosion Safety

During the investigation of the Hazardous Waste Landfill, soil samples will be collected using a hollow-steam auger or Geoprobe drill ™ to determine depth and extent of of landfill material. Due to the potential for contacting oxidizing materials in landfill, the following additional safety measures will be required for investigative and remediation work in the Landfill area:

- All contact with combustible materials (wood, paper, plastics) must be avoided;
- An appropriate source of fire control (i.e., water truck) should be stationed near the Landfill in the event of a fire;
- Notify the Northgate on-site Safety Officer of any potential issues; and

- Soil borings cuttings and/or excavated materials should be separated in a manner to ensure soils are not mixed with other potential combustible materials.

6.0 AIR MONITORING

Personal air sampling will be conducted by Northgate during the activities covered by this HASP, as required. Air sampling during soil sampling events will be conducted on a once-a-week basis. Daily air monitoring will be conducted during potential dust generating activities such as excavating, moving, scraping, and loading of soil. Asbestos air monitoring will be conducted at least two times per week during potential dust generating operations in areas impacted with asbestos.

Airborne exposures to site contaminants are not expected to approach or exceed the current OSHA PELs. Atmospheric monitoring will be conducted by the use of a handheld photoionization detector (e.g. PAE PID or equivalent). These devices have a minimum detection limit of 0.1 ppm. Monitoring of the atmosphere will occur continuously near the well head while drilling or soil handling is underway. The results will be documented. PPE shall be upgraded from modified Level D to modified Level C (same as modified Level D but with respirators required) whenever breathing zone PID readings indicate more than 5 ppm for five consecutive minutes. If the PID values exceed 20 ppm respiratory protection (half-mask with organic vapor cartridges) will be donned immediately. Section 7 of this HASP provides additional details on protective clothing. Respiratory protection use may be discontinued if breathing zone readings fall below this criterion. An alternative response to respirator use shall be to suspend operations until breathing zone concentrations fall below 5 ppm for 5 consecutive minutes.

Airborne HCB and manganese will be monitored by measuring total airborne particulates using a direct reading real-time analyzer. Calculations were made using detected concentrations in Site soils for both HCB and manganese. Maintaining total dust levels below an action level of 0.1 mg/m3 are protective of meeting the action level for HCB and manganese. Total dust concentrations will be monitored during the drilling, soil handling and other tasks where airborne dust can be released. This will be measured using a PDR1000 model real time aerosol monitor that is capable of measuring airborne dust concentrations in the range of 0.001 - 400 mg/m3. These measurements will be documented, indicating the location, time of day, and activity that is being performed. This dust monitoring will be conducted throughout the period of time that soils are being disturbed. Asbestos air samples will be collected if there is reason to believe that asbestos debris or asbestos containing material will be disturbed. These air samples will be collected for a minimum of 100 minutes. Analysis will be conducted by an accredited laboratory using NIOSH method 7400.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Contaminated Area PPE Requirements

The following (EPA level D) PPE minimizes the physical and chemical hazards which may be encountered while working with contaminated materials:

- Hardhat;
- Cotton or disposable coveralls;
- Hearing protection (if sound level measurements exceed 85 dBA);
- Nitrile gloves (when handling contaminated soils, groundwater, and equipment);
- Chemical splash goggles or safety glasses with side shields; and
- Safety footwear with steel toe and shank.

All personnel who may come in direct contact with contaminated materials shall wear the above described PPE clothing. Unnecessary contact with potentially contaminated residues shall be avoided as much as possible.

Should air monitoring results (i.e. PID levels above 20 ppm; total dust concentrations above 0.1 mg/m^3) warrant the use of respirators, protective equipment shall be upgraded to Level C, as appropriate. The Level C ensemble for this project shall consist of the following:

- Hardhat;
- Cotton or disposable coveralls;
- Hearing protection (if sound level measurements exceed 85 dBA);
- Nitrile gloves (when handling contaminated soils, ground water, and equipment);
- Coated Tyvek (e.g. polyethylene or saranex) apron or coveralls (or equivalent);
- Chemical splash goggles or safety glasses with side shields;
- Safety footwear with steel toe and shank; and
- NIOSH approved half-face air-purifying respirator fitted with combination HEPA (either N-100 or P-100) filter and organic vapor cartridges.

7.2 Clean Area PPE Requirements

Work outside contaminated areas shall require the use of EPA level D protective equipment normal in the construction industry. Typically, this consists of hard hats, safety footwear, and normal work clothing.

The following additional safety items shall be available at the site:

- Portable, hand-held eyewash bottles;
- Escape Respirator; and
- First aid kit.

8.0 SITE CONTROL

8.1 Designation of Zones

If it is determined that there is contamination in the subsurface soil or groundwater, Northgate will designate work areas or zones as suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (NIOSH/OSHA/USCG/EPA, November 1985). They recommend the areas surrounding each of the work areas to be divided into three zones:

- Exclusion or "hot" Zone;
- Contamination Reduction Zone (CRZ); and
- Support Zone.

8.1.1 Exclusion Zone

The exclusion zone will include the area that immediately surrounds the drilling and excavation activities. This zone should be sufficiently large in order to protect unprotected personnel from contact with vapors or dusts that may arise from these operations, as well as the physical hazards associated with the operation of heavy equipment. All personnel entering the exclusion zone must be trained in accordance with the requirements defined in Sections 10 and 11 of this HASP and must wear the level of personal protective equipment prescribed in Section 7.

8.1.2 Contamination Reduction Zone

The Contamination Reduction Zone or decontamination area will be established adjacent to the exclusion zone. Personnel will remove contaminated gloves, Tyvek, and other disposable items in this area and place them in a plastic bag until they can be properly disposed of in accordance with the work plan requirements.

8.1.3 Support Zone

At this site the support zone will include the area outside of the exclusion and contamination reduction zones.

8.2 Safety Practices

The following measures are designed to augment the specific health and safety guidelines provided in this plan:

- The "buddy system" will be used at all times by all field personnel. No one is to perform fieldwork alone. Standby team member must be intimately familiar with the procedures for initiating an emergency response.

- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in the immediate work area and the decontamination zone. Drinking is allowed and encouraged during heat stress related conditions in the rest area.
- Smoking is prohibited in all work areas. Matches and lighters are not allowed in these areas.
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activities. Disposable towelettes will be provided in the rest area to accommodate hand and face cleaning prior to taking a break.
- Beards or other facial hair that interfere with respirator fit are prohibited.
- The use of alcohol or illicit drugs is prohibited during the conduct of field operations.
- All equipment must be decontaminated or properly discarded before leaving the site in accordance with the project work plan.
- In accordance with Tronox requirements no photographs shall be taken when on the Tronox Site.

9.0 DECONTAMINATION

9.1 Personal Decontamination

Proper decontamination is required of all personnel before leaving the site. Decontamination will occur within the contamination reduction zone.

Regardless of the type of decontamination system required, a container of potable water and liquid soap should be made available so employees can wash their hands and face before leaving the site for lunch or for the day.

After leaving the work area and before eating, smoking, or drinking, employees must wash their face and hands with soap and water.

9.2 PPE Decontamination

Disposable PPE, such as Tyvek coveralls, gloves, etc. will be removed and placed in garbage bags. Final disposal of contaminated PPE will be in accordance with the work plan.

If worn, respirators will be cleaned after each use with respirator wipe pads and will be stored in plastic bags after cleaning. Respirators will be thoroughly cleaned using disinfectant material within one week following any respirator use. Refer to the cleaning instructions provided with the respirator or specified by the OSHA regulations at 29 CFR 1910.134.

9.3 Equipment Decontamination

Equipment will be decontaminated prior to being moved to other locations. Decontamination procedures will be specified by the Project Manager.

10.0 MEDICAL MONITORING AND TRAINING REQUIREMENTS

10.1 Medical Monitoring

All personnel performing activities covered by this HASP must be active participants in Northgate's Medical Monitoring Program or in a similar program which complies with 29 CFR 1910.120(f). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on the site covered by this HASP. The program is conducted by a medical professional. The purpose of the program is to identify any pre-existing illnesses or problems that would put an employee at unusual risk from certain exposures, or inhibit the use of respirators.

10.2 Health and Safety Training

All personnel performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual must have completed an annual 8-hour refresher-training course within the last year and initial 40-hour training course prior to performing any work on the sites covered by this HASP. All workers will have completed three days of supervised work on hazardous waste sites before being allowed to work unsupervised. Also, on-site managers and supervisors directly responsible for supervising individuals engaged in hazardous waste operations must have completed the specified 8-hour managers training course and 30 OSHA Supervisors Training Course.

Additionally, Tronox requires all personnel working on Site to addend and pass a Tronox safety training class prior to entering the Site.

10.3 Safety Meetings, Briefings, and Documentation

Prior to the commencement of on-site activities, a pre-entry briefing will be conducted by the SSO to review the specific requirements of this HASP. HASP sign-off sheets will be collected at this meeting. Short safety refresher meetings will be conducted, as needed, throughout the duration of the project. Attendance of the pre-entry meeting is mandatory and will be documented by the SSO. An attendance form is presented in Appendix B.

11.0 EMERGENCY RESPONSE

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrolled release of a hazardous substance." Northgate personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). Northgate's response actions will be limited to evacuation and medical/first aid as described within this section below. As such, this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- Employee training,
- Alarm systems,
- Escape routes,
- Escape procedures,
- Critical operations or equipment,
- Rescue and medical duty assignments,
- Designation of responsible parties,
- Emergency reporting procedures, and
- Methods to account for all employees after evacuation.

11.1 Employee Training

Employees must be instructed in the specific aspects of emergency evacuation applicable to the site as part of the site safety meeting prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

11.2 Alarm Systems/Emergency Signals

An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. Each site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (i.e., noise from heavy equipment such as drilling rigs, backhoes, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all personnel because of distance, terrain, or other obstructions.

Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. However, it may be difficult to maintain a clear line-of-sight with employees because of the size and remoteness of the site. Walkie-talkies or an emergency air horn must be carried by employees who are working in out-of-sight locations to enhance their communication with employees working on the site proper. If telephone service is not immediately available upon arrival to the site, a portable phone must be made available to facilitate emergency communications.

11.3 Escape Routes and Procedures

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization and during Tronox safety training.

11.4 Employee Accounting Method

The SSO is responsible for identifying all Northgate personnel on-site at all times. On small, short duration jobs this can be done informally as long as accurate accounting is possible. On all other sites, a formal log-in and log-out procedure must be implemented.

11.5 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and Northgate and Tronox representatives are provided in the emergency reference sheet. This sheet will be posted in the site vehicle and on-site office trailer.

In the event an injury or illness requires more than first aid treatment, the SSO will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury, the person will not be moved and the requirements for decontamination do not apply. The SSO must inform the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this is not feasible, decontamination will be performed after the injured person has been stabilized.

11.6 Designation of Responsible Parties

The SSO is responsible for initiating emergency response. In the event the SSO cannot fulfill this duty, the alternate SSO will take charge. All personnel on-site are responsible for knowing the escape route from the site and where to assemble after evacuation.

11.7 Incident Reporting

All incidents must be reported to the Northgate Project Manager.

11.8 Accident Investigation

Any incident (other than minor first aid treatment) resulting in injury, illness, or property damage requires an accident investigation and report. The investigation should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame, but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An accident investigation form is presented in Appendix C of this HASP. The injured employee's supervisor and the Corporate Safety Manager should be notified immediately of the injury. If a subcontractor employee is injured, they are required to notify the Northgate SSO. Once the incident is under control, the subcontractor will submit a copy of their company's accident investigation report to the SSO.

APPENDIX A
HEALTH AND SAFETY PLAN ACCEPTANCE FORM

Health and Safety Plan Review Form
Well Installation and Subsurface Investigation of Soils and Groundwater
Tronox LLC
Henderson, Nevada

I have reviewed a copy of the Health and Safety Plan prepared for the above-referenced site and activities. I have read and understood its contents and I agree that I will abide by its requirements.

Name: _____

Signature: _____

Date: _____

Representing: _____

APPENDIX B
HEALTH AND SAFETY PRE-ENTRY BRIEFING ATTENDANCE

Health and Safety Pre-Entry Briefing Attendance Form
Well Installation and Subsurface Investigation of Soils and Groundwater
Tronox LLC
Henderson, Nevada

Conducted by:		**Date Performed:**	
Topics Discussed:	1. Review of the content of the HASP (Required)		
	2.		
	3.		
	4.		

Printed Name	Signature	Representing

APPENDIX C
SUPERVISOR'S INCIDENT INVESTIGATION REPORT

Supervisor's Incident Investigation Report

Injured Employee _____ Job Title _____

Home Office _____ Division/Department _____

Date/Time of Incident _____

Location of Incident _____

Witnesses to the Incident _____

Injury Incurred? _____ Nature of Injury _____

_____

Engaged in What Task When Injured? _____

_____

Will Lost Time Occur? _____ How Long? _____ Date Lost Time Began _____

Were Other Persons Involved/Injured? _____

_____

How Did the Incident Occur? _____

_____

_____

_____

_____

What Could Be Done to Prevent Recurrence of the Incident? _____

_____

_____

What Actions Have You Taken Thus Far to Prevent Recurrence? _____

_____

Supervisor's Signature _____ Title _____ Date _____

Reviewer's Signature _____ Title _____ Date _____

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed Incident investigation report must be submitted to the Regional Health and Safety Manager within two days of the occurrence of the Incident.

APPENDIX D
JOB HAZARD ASSESSMENT

JOB SAFETY ANALYSIS

JSA Type: ☐ Investigation ☐ O&M ☐Office ☐ Construction ☐ Other	☐ New ☐ Revised	**Date**:
Work Activity:		
Personal Protective Equipment (PPE):		

Development Team	Position/Title	Reviewed By	Position/Title	Date

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
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APPENDIX E
MATERIAL SAFETY DATA SHEETS

.....Alconox

SPI Supplies Division
Structure Probe, Inc.
P.O. Box 656 West Chester, PA 19381-0656 USA
Phone: *1-(610)-436-5400* ***Fax:*** *1-(610)-436-5755*
E-mail: *spi3spi@2spi.com*
WWW: http://www.2spi.com
Manufacturer's CAGE: 1P573

Material Safety Data Sheet

SPI #01200-AB and #01200A-AB Alconox® Powdered Detergent

Section 1: Identification

```
Date Effective.....  November 14, 2005
                     (most recent revision)

Chemical Name/Synonyms...  On Label:  Alconox®

Chemical Family.....  Anionic powdered detergent

Emergencies
Contacting CHEMTREC:

24 Hour Emergency Use Only #'s...
Worldwide phone: 1-(703)-527-3887
Worldwide FAX:   1-(703)-741-6090
Toll-free phone: 1-(800)-424-9300 USA only

Product or Trade Name....  SPI #01200-AB and #01200A-AB
                           Alconox® Powdered Detergent

CAS #.....................  Not applicable

Chemical Formula.........  Not applicable
```

Section 2 Composition

Component Name	CAS #	OSHA	OSHA	ACGIH	ACGIH

No hazardous ingredients in Alconox Powdered Detergent as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

Hazardous Material Information System USA	**Health**	**0**	**National Fire Protection Association USA**	
	Fire Hazard	**0**		
	Reactivity	**0**		
	Personal Protection			

NFPA (National Fire Protection Association) Rating (Scale 0-4):
HEALTH=0 FLAMMABILITY=0 REACTIVITY=0 OTHER=0 Not known

Section 3: Hazard Identification

Routes of entry
    Inhalation? Yes
    Skin? No
    Ingestion? Yes

Health Hazards (Acute and chronic):
    Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.

Carcinogenicity:
    NTP? No
    IARC Monographs? No
    OSHA Regulated? No

Section 4: First Aid Measures

Signs and Symptoms of Exposure:
    Exposure may irritate mucous membranes. May cause sneezing.

Medical conditions generally aggravated by exposure:
    Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder if air borne.

Emergency and First Aid Procedures:

    Eyes: Immediately flush eyes with copious amounts of water for minimum 15 minutes. Call physician.

    Skin: Flush with plenty of water.

    Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs re-administer fluids. See a physician for discomfort.

Section 5: Fire Fighting Measures

NFPA Rating: Not known

Extinguishing Media

Suitable/Not suitable:

SMALL FIRE: Use DRY chemical powder, water, foam, carbon dioxide

LARGE FIRE: Use extinguishing media suitable for the surrounding materials.

Special firefighting procedures:
Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.

Unusual Fire/Explosion Hazards: None

Hazardous thermal decomposition products: None known.

Protection of fire fighters: No special measures are required.

Flammable Limits:
LEL: No data
UEL: No data

Section 6: Accidental Release Measures

Personal precautions: No special precautions

Environmental Precautions and Clean Up Methods:
Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.

Section 7: Handling and Storage

Material should be stored in a dry area to prevent caking.

Section 8: Exposure Controls and Personal Protection

Engineering controls: Normal ventilation is normally required when handling or using this product. Avoid conditions that could produce dusting.

Personal Protective Equipment

Respiratory system: Dust mask recommended but not required.

Skin and body: Laboratory coat recommended but not required.

Hands: Impervious gloves recommended

Eyes: Goggles are recommended, especially when handling solutions irrespective of what they might be.

Other: Wash hands before eating, drinking, or smoking.

Section 9: Physical and Chemical Properties

Physical State and Appearance: White powder interspersed with cream

colored flakes.

Odor: None

Boiling Point: Not applicable

Melting Point: Not applicable

Density (water = 1): Not applicable

Solubility: Appreciable, to 10% at ambient conditions.

Octanol/water partition coefficient: Not available

pH: Not known

Flash Point: None

Flammability: Non-flammable

Autoignition temperature: Not applicable

Section 10: Stability and Reactivity

Chemical Stability: The product is stable

Hazardous polymerization: Will not occur

Conditions to Avoid: None

Hazardous Products of Deposition: May release CO_2 on burning.

Reactions with Air and Water:
Does not react with air, water or other common materials.

Section 11: Toxicological Information

Summary: Not considered to be toxic to humans or animals.

Skin Effects: Can be locally irritating

Eye Irritation: Can be irritating to the eyes

Inhalation: Dust can be irritating to mucous membranes

Sensitization: Not known

Chronic toxicity: There is no known effect from the chronic exposure to this product.

Section 12: Ecological Information

Exotoxicity: Not know but it is expected to be low because the material is biodegradable.

Environmental Fate: It is biodegradable.

Bioaccumulation: Not expected to occur (because the material is biodegradable).

Section 13: Disposal Considerations

This material is NOT classified as a hazardous material by RCRA. Use only licensed transporters and permitted disposal facilities and conform to all laws.

Recycle to process, if possible.

Germany water class: VCI WGK: No products were found.

Methods of disposal; waste of residues; contaminated packaging:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

Proper Shipping Name: Non-Regulated, No dangerous cargo

DOT Hazard Class: Non-Regulated, No dangerous cargo

UN/NA ID: Non-Regulated, No dangerous cargo

Packing Group: Not Applicable

Labels: Not Regulated

Marine Pollutant: No

NAER Guidebook: Not Regulated

DOT Status: Not Regulated

Land-Road/Railway:
ADR/RID Class: No dangerous cargo

Sea:
IMDG Class: No dangerous cargo

Air:
IATA-DGR Class: No dangerous cargo

Section 15: Regulatory Information

TSCA: All components of this product are listed on the TSCA 8(b) inventory. If identified components of this product are listed under the TSCA 12(b) Export Notification Rule, they will be listed below.

TSCA 12(b) Component	Listed under TSCA Section

SARA Title 3: Section 313 Information/Emissions Reporting (**40 CFR 372**):

Component	Reporting Threshold

SARA-Section 311/312:

No components present in this product are subject to the reporting requirements of this statute.

CERCLA Hazardous Substances and their Reportable Quantities:

Component	Reportable Quantity

EU Regulations: Risk Phrases: This product is not classified according to the EU regulations.

Safety Phrases: Not applicable

Contains: Not applicable

California Prop. 65:
Proposition 65 requires manufacturers or distributors of consumer products into the State of California to provide a warning statement if the product contains ingredients for which the State has found to cause cancer, birth defects or other reproductive harm. If this product contains an ingredient listed by the State of California to cause cancer or reproductive toxicity, it will be listed below:

None found

Section 16: Other Information

Disclaimer of Liability:

Caution! Do not use SPI Supplies products or materials in applications involving implantation within the body; direct or indirect contact with the blood pathway; contact with bone, tissue, tissue fluid, or blood; or prolonged contact with mucous membranes. Products offered by SPI Supplies are not designed or manufactured for use in implantation in the human body or in contact with internal body fluids or tissues. SPI Supplies will not provide to customers making devices for such applications any notice, certification, or information necessary for such medical device use required by US FDA (Food and Drug Administration) regulation or any other statute.

SPI Supplies and Structure Probe, Inc. make no representation, promise, express warranty or implied warranty concerning the suitability of these materials for use in implantation in the human body or in contact with internal body tissues of fluids.

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The information and recommendations set forth above are taken from sources believed to be accurate as of the date hereof, however SPI Supplies and Structure Probe, Inc. make no warranty with respect to the accuracy of the information or the suitability of the recommendations, and assume no liability to any user thereof. The information contained in this sheet does not constitute a hazard assessment and should not be used in place of the user's own assessment of work place risks as required by other health and safety legislation. Be aware of the Structure Probe, Inc. Copyright Policy. Structure Probe, Inc. grants a nonexclusive license to make unlimited copies of this safety sheet for internal use only. Quite obviously, this information would pertain only to this material when purchased from SPI Supplies as product from other sources, with other ingredients and impurity levels could have substantially different properties.

Worldwide Distributors, Representatives, and Agents

….. Bentonite clay, k-10

Material Safety Data Sheet

ACC# 96650

Section 1 - Chemical Product and Company Identification

MSDS Name: Bentonite clay , k-10
Catalog Numbers: AC233170000, AC233170010, AC233170050
Synonyms: None.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
1318-93-0	Mortmorillonite	100.0	215-288-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: off-white powder.
Caution! May cause eye and skin irritation. May cause respiratory and digestive tract irritation. The toxicological properties of this material have not been fully investigated.
Target Organs: None.

Potential Health Effects

Eye: Dust may cause mechanical irritation.

Skin: May cause skin irritation.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. The toxicological properties of this substance have not been fully investigated.
Inhalation: Dust is irritating to the respiratory tract. The toxicological properties of this substance have not been fully investigated.
Chronic: No information found.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Substance is noncombustible.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower:N/A
Upper: N/A
NFPA Rating: (estimated) Health: 1; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Mortmorillonite	none listed	none listed	none listed

OSHA Vacated PELs: Mortmorillonite: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European

Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Powder
Appearance: off-white
Odor: None reported.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point: Not available.
Decomposition Temperature: Not available.
Solubility: Not available.
Specific Gravity/Density: Not available.
Molecular Formula: Not applicable.
Molecular Weight: Not available.

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials: Oxidizing agents.
Hazardous Decomposition Products: Irritating and toxic fumes and gases.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 1318-93-0 unlisted.

LD50/LC50:
Not available.

Carcinogenicity:
CAS# 1318-93-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Mutagenicity: No information available.
Neurotoxicity: No information available.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.
Environmental: No information found.
Physical: No information found.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 1318-93-0 is not listed on the TSCA inventory. It is for research and development use only.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 1318-93-0 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
Not available.
Risk Phrases:

Safety Phrases:
S 24/25 Avoid contact with skin and eyes.
S 37 Wear suitable gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 28A After contact with skin, wash immediately with plenty of water
.

WGK (Water Danger/Protection)
CAS# 1318-93-0: No information available.
Canada - DSL/NDSL
CAS# 1318-93-0 is listed on Canada's DSL List.
Canada - WHMIS
WHMIS: Not available.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List

Section 16 - Additional Information

MSDS Creation Date: 12/15/1998
Revision #4 Date: 3/15/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

APPENDIX F
CONTRACTORS' SAFETY HANDBOOK AND
CONTRACTORS' SAFETY ORIENTATION
(INSERT HERE)