## Environmental Assessment Information

# Feed Shellfish Chitin Processing Plant
# Old Perlican, NL.

**Quinlan Brothers Limited**
**Atlantic Place, 302 – 215**
**Water St., St. John's,**
**NL A1C 6C9**

**Date: April 24, 2008**

**Contact**

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**SIGNING OFFICER:**

_____ _____

Date Signature

**NAME OF UNDERTAKING: Quinlan Brothers Chitin Production Facility**

**PROPONENT: Quinlan Brothers Ltd.**

(i) Name of Corporate Body: Quinlan Brothers Ltd.
(ii) Address: Quinlan Brothers Limited
Atlantic Place, 302 – 215
Water St., St. John's,
NL A1C 6C9

(iii) Chief Executive Officer:

Name: Pat Quinlan
Address: as above
Telephone No.: 709-739-6960

(iv) Principal Contact Person for purposes of environmental assessment:

Name: Robin Quinlan
Address: as above
Telephone No.: 709-739-6960

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**THE UNDERTAKING:**

***(i) Nature of the Undertaking:***

Quinlan Brothers propose to build a full scale chitin/chitosan production facility in Old Perlican, through partnerships with industry, the Marine Institute, and Memorial University of Newfoundland. This facility will be a fully functioning laboratory as well, with researchers, technicians and production analysts carrying out research over a three year period. This research work will help turn this facility into one of the most efficient and technologically advanced chitin plants built to date.

***(ii) Purpose/Rationale/Need for the Undertaking:***

Waste management has become an important issue for seafood processors from both an environmental and financial perspective. Quinlan Brothers Ltd., part of the Quinlan Group of Companies, is Newfoundland and Labrador's largest processor of snow crab and shrimp, processing over 20 million lbs of snow crab and 40 million lbs of shrimp annually. Their processing facilities in Old Perlican and Bay de Verde produce over 13 million tones of shrimp byproduct waste each year.

The primary commercial application derived from this byproduct is the biopolymer chitin. Recognizing the global market opportunities for a high quality chitin supply, Quinlan Brothers has been working aggressively over the past year to assemble a development team and plan and secured access to market. As well, Quinlan Brothers has an R&D technology plan that will allow the maximum harvesting gains needed to capitalize on this market potential while resolving a waste disposal dilemma.

**DESCRIPTION OF THE UNDERTAKING:**

**(i) Geographical Location:**

Initially two locations were under consideration in the community of Old Perlican on the Bay de Verde Peninsula:
1) an existing building originally occupied by Riff's Department Store on Route 80
2) a new construction on the waterfront, adjacent to the existing Quinlan Brothers Plant facility.

The existing building on Route 80 has been identified as the optimal site for the location of the facility. The following issues were considered in making the decision:

- Accessibility to existing municipal waste disposal/outfall systems
- Lead time required for construction/site preparation

Please refer to the attached aerial photograph (Appendix A) for site location and surrounding structures. The building is located approximately 100m from the nearest structure, a gas station/restaurant. The general area is unpopulated, heavily treed and outside the town centre and residential population.

**(ii) Physical Features:**

The proposed operation will occupy less than 929 square meters (10,000 square feet) of space and requires limited storage space for finished product. Raw product will not require storage and will be pumped directly from a transport truck into the primary stage processing unit. Please refer to the Operations Plan for process details.

The Riffs building is a one story structure with dimensions of 24.4m (80)' x 36.6m (120'). The site has access to town water and sewer services. It is located approximately one kilometer from the Quinlan's Old Perlican processing plant. The proposed transportation route of the waste shells to the new processing facility is identified on the map. The plant facility is not located near any rivers or streams and all effluent would be neutralized.

Please refer to the attached map (Appendix A) for location, transportation route and other pertinent information.

**(iii) Construction**:

The plant's initial design has been completed with a start date for equipment assembly by late Fall 2008 with a 6 month completion period.

**Construction Schedule**

| | |
|---|---|
| Building Preparation | November, 2008 |
| Equipment Delivery | November, 2008 |
| Installation Completion | December, 2008 |
| Pilot Operation | January, 2009 |
| Production Start | May, 2009 |

The building preparation is expected to start in late fall 2008. Modifications are required to accommodate secured chemical holding tanks and storage areas; no sources of pollutants are expected during this construction phase, aside from those typically produced during construction.

**(iv) Operation:**

*Process Description*

Quinlan Brothers is proposing construction of a full scale chitin production facility in Old Perlican. the facility will be operating 24 hours a day for approximately eight months of the year (closed from November through February). The plant will be a fully functioning laboratory facility as well, with researchers, technicians and production analysts carrying out research activities over a three year period. This research work will help turn this facility into one of the most efficient and technologically advanced chitin plants built to date in North America.

The project will initially draw on the 5.9 million kilograms (13 million lbs) of shrimp byproduct from Quinlan's Bay de Verde and Old Perlican processing plants, as these

plants are located in close enough proximity to one another to make transportation viable. The byproduct, primarily shrimp shell, will be transported to the processing facility in trucks and will then be pumped directly into the primary continuous feed processing unit. Each load should provide up to twelve hours of processing time. As the science develops and new technologies are established, it is hopeful that local crab shell may be utilized as well. It is Quinlan's goal to be processing its entire shellfish waste to chitin when the plant reaches full capacity.

The process to be implemented in the Quinlan Brothers' plant will exploit the structure of the shrimp shell, so that most of the mineral and protein can be removed under mild conditions, producing a higher quality and higher valued end product while minimizing waste. To achieve this, it will utilize a series of special mechanical processing, mild chemical treatments and wash steps. This process will also allow for the controlled recovery of valuable protein fractions, allowing for the greatest level possible of waste product utilization.

An overview of the process follows.

1. A truck collects from Bay de Verde and Old Perlican locations and delivers to receiving tank in factory.
2. Shell transferred to receiving storage tank
3. Shell continuously pumped to mascerator and washed on a screen.
4. Effluent flows to Protein Recovery and Water Recycling Units
5. Shell subjected to emulsification (small amount of dilute base added), and washed on a screen
6. Effluent sent to Protein Recovery and Water Recycling Units
7. Washed shell treated with dilute HCl to yield chitin.
8. Small amount of fumes exhausted and neutralized.
9. Dilute acid effluent captured and neutralized prior to sewer discharge.
10. Chitin pumped to drying system.
11. Effluent is discharged; pH adjusted if necessary.
12. Drying system produces dry finished chitin.

13. Chitin is compacted and baled in 50 kg sacks.
14. Protein Recovery Unit produces a concentrate, stored in vault.
15. Protein stabilized as a powder by spray drying, stored in 50 kg sacks
16. Any effluent from unit not recycled is filtered to remove TSS prior to sewer discharge.

A key feature of the proposed process is the Protein Recovery Unit. At least 90% of the protein from the shrimp shell feed will be found in wash streams from both maceration/screening and emulsification/ screening steps. The Protein Recovery Unit will contain Dissolved Air Flotation (DAF)[1] and Hydroclone[2] units, allowing these streams to be combined and the protein concentrated. The process water will be recycled to the first wash station.

To maximize waste product conversion, scientists from MUN and Marine Institute will also be working to identify advanced processes for separation and removal of protein, as well as the utilization of this by-product. Quinlan Brothers' intent is to have a full scale working production plant laboratory in which the company and its collaborators can produce product while continuously running a series of research activities both onsite and at collaborator locations.

*Chemical Usage*

Traditional shellfish chitin production facilities require large volumes of concentrated acid and strong alkali solutions. With the new technology proposed by Quinlan's chemical usage will be reduced.

[1] **Dissolved air flotation** (DAF) is a water treatment process that clarifies wastewaters (or other waters) by the removal of suspended matter such as oil or solids. The removal is achieved by dissolving air in the water or wastewater under pressure and then releasing the air at atmospheric pressure in a flotation tank or basin. The released air forms tiny bubbles which adhere to the suspended matter causing the suspended matter to float to the surface of the water where it may then be removed by a skimming device. Dissolved air flotation is very widely used in treating the industrial wastewater effluents from oil refineries, petrochemical and chemical plants, natural gas processing plants and similar industrial facilities.

[2] A Hydroclone is a static device that applies centrifugal force to a liquid mixture so as to promote the separation of heavy from light components which are suspended in solution

The chemicals used in the process are:

- 5% aqueous potassium hydroxide ( “dilute base”), prepared from solid potassium hydroxide supplied in pre-weighed and secured containers
- 1.5 % aqueous hydrochloric acid ( “dilute acid”), diluted from concentrated (35%) hydrochloric acid (Please refer to Appendix B for chemical data sheets.)

The dilute base will be added to the crude product after shrimp shell maceration screening/ wash and before emulsification. The separate maceration and emulsification steps are called the mechanical de-proteination processes. The addition of small amount of dilute base will assist, chemically, in enhancing the second de-proteination.

The dilute acid will be added after the second de-proteination/ screening/ wash step described above. At this stage about 30-40 % of the minerals (chiefly calcium carbonate) have been mechanically removed. The remaining carbonate present in chitin will be effectively removed by this acid treatment.

*Chemical Storage and Handling*

The dilute acid and dilute base (prepared on site) will be stored in 20,000 liter Poly tanks separated by greater than 20 metres. Each tank will be surrounded with an acid or base resistant retaining wall of 3.66m x 3.66m x 1.83m(h) (12’x 12’ x 6’). The dilute acid tanks will be fitted with a neutralizing vent for filling. The tanks will be placed inside the plant but away from the processing line. Proper signage and safety/ spillage response protocols will be in place.

The dilute acid will be prepared from concentrated (35%) hydrochloric acid by simple dilution. Concentrated acid will stored in 100L sealed heavy-duty Poly barrels specially ordered from the supplier for ease of handling and safety. Barrels will be carefully stored in a dedicated secured shed constructed with acid-resistant material and equipped with proper ventilation and neutralization vents in case of leakage. The shed will be secured under lock and key and will be an attached structure to the main plant. Proper industrial training and safeguards will be implemented.

The dilute base will be prepared from supplied pre-weighed solid potassium hydroxide for ease of handling and safety. Because the potassium hydroxide is hydroscopic it will be stored in a dry separate storage area inside the plant. Proper safety protocols will be implemented.

Reusable plastic containers will be used to ship the concentrated acid and solid base. These containers will be shipped back to the suppliers for reuse.

Safety of the workers will be of prime importance and all regulatory safety/ handling protocols will be followed. The facility will contain appropriate spill response equipment and specified procedures will be developed and strictly adhered.

*Effluent Treatment System*

All effluent from the processing facility will be routinely monitored and treated prior to discharge, in accordance with the Sewage Discharge Compliance requirements as per the Environmental Control Water and Sewer Regulations 2003.

Wash water from the acid and base treatment process will be neutralized before being discharged in the municipal sewage. The excess dilute base will be neutralized by dilute acid to neutral pH. The excess dilute acid will be neutralized by dilute base to neutral pH. As a result of the treatment, effluent and wash water will consist of less than 1% aqueous potassium chloride and trace amounts of residual protein.

The neutralized effluent will be diluted with fresh water, if necessary, to a TDS value of less than 700 mg per liter. Approximately 15 000 litres/ day will be discharged to the municipal sewer.

Of concern to ECW&S regulations is the effluent coming from the Protein Recovery Unit. At least 90% of the protein from the shrimp shell feed will be found in wash streams from both maceration/screening and emulsification/ screening steps. Extracting the protein as a viable byproduct drastically reduces the waste created by the chitin extraction process. The effluent will consist mainly of dissolved proteins

In-line filters will be used to lower the total suspended solids (TSS) to 10 mg per litre. Treatment with DAF units in combination with flocculation towers will result in wastewater having 5 day biochemical oxygen demand (BOD) of less than 200 mg per litre and total dissolved solids (TDS) values of less than 500 mg per litre.

Regular effluent monitoring will be carried out and approximately 19 000 litres / day of protein recovery unit waste water will be sent to the municipal sewer system. Apart from treated effluent no other waste materials will be generated by the process.

*Environmental Contingency Emergency Plan*

An Environmental Safety and Emergency Contingency Plan will be developed, prior to start of operations to ensure environmental emergency and safety procedures are established and all personnel/stakeholders receive the appropriate training.

A Health, Safety and Regulatory Policy will be developed and a team member assigned specifically to its management and enforcement. As well, an Emergency Response and Safety Policy will be developed, again with a team member dedicated to its management and enforcement. Key topics to be covered by the policies include:

- Hazard Awareness
- Employees
- Firefighting
- Medical Facility and Personnel
- Incident Command
- Off-site Responders Coordination
- Community Notification
- Spill Preparedness, Prevention and Response

Quinlan's will work with NEIA (Newfoundland Environmental Industry Assoc.) members, environmental engineers, other team members, Occupational Health and Safety Representatives, Municipal Council and local Fire Protection and Health Services to ensure comprehensive and effective policies are developed, with appropriate measures in

place for adherence prior to commencement of operations. Ongoing training and safety awareness will be a high priority at the facility.

**(v) Occupations**

It is anticipated that upon full production start six employees will work at the facility in a full time capacity, with an additional 1-2 supplemental staff as needed. There will be a trained chemical technician, who will be the only person to handle the preparation of acid and the base solutions. Chemists or chemical technicians are not classifieds as a hazardous occupation according to the National Occupational Classification 2006.

A Safety Officer will also be hired, trained in the following: proper handling of the chemicals with associated labeling and signage, MSDS and WIMIS documents, easily accessible to all workers, training of workers for emergency response protocols, etc.

**(vi) Project-Related Documents**

No other environmental work has been completed for the project. Project-related documents submitted with this proposal are listed below:

- Aerial view of site location
- 1:50,000 Map of area

**APPROVAL OF THE UNDERTAKING:**

It is anticipated that further permits, licenses, approvals and authorizations may be required from the following:

- Town of Old Perlican Municipal Council
- DFO
- Government Services – OHS
- Dept Fisheries and Aquaculture

**SCHEDULE:**

The plant's initial design has been completed with a start date for equipment assembly by late Fall 2008 with a 6 month completion period. This schedule coincides with the operation of the annual shrimp fishery.

**Construction Schedule**

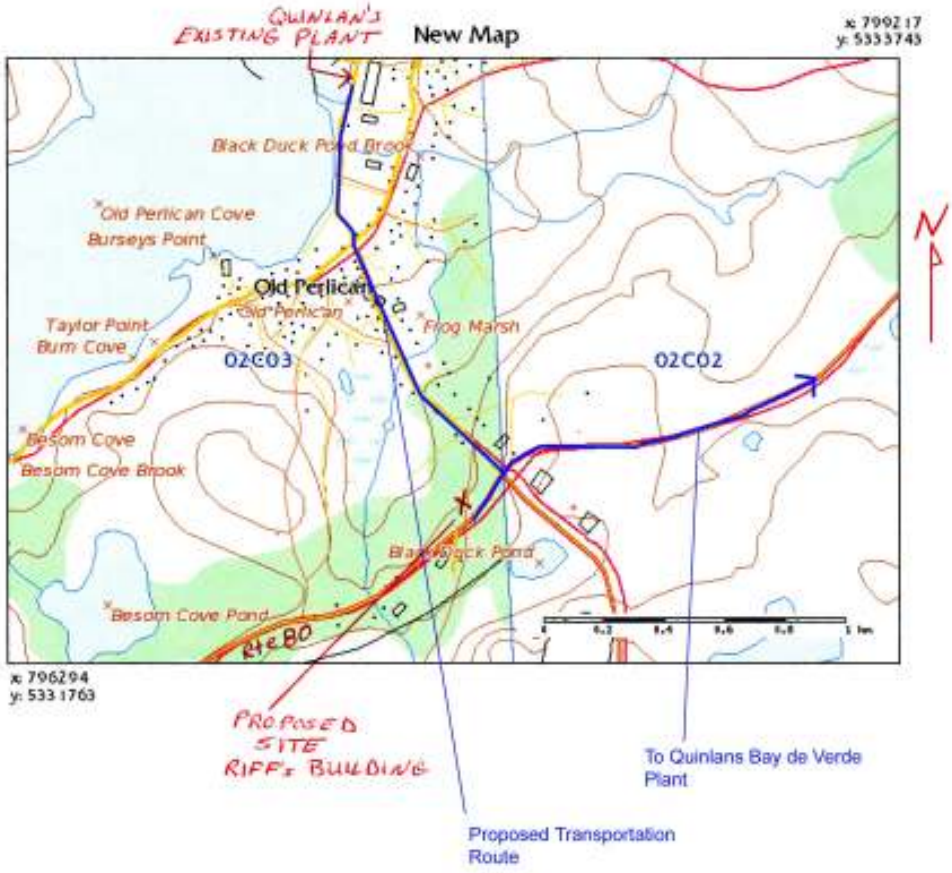
| | |
|---|---|
| Building Preparation | November, 2008 |
| Equipment Delivery | November, 2008 |
| Installation Completion | December, 2008 |
| Pilot Operation | January, 2009 |
| Production Start | May, 2009 |

**FUNDING:**

Quinlan Brothers has been selected to receive investment from ACOA's Atlantic Innovation Fund for a portion of the project costs. With Quinlan Brothers' investments in the project the company will also attempt to leverage additional financing from NSERC, NRC, CCFI (confirmed), DFA (confirmed), and DITRD. The overall costs of the plant facility and the 3-year R&D initiative with MUN and MI will be just over $5 Million dollars.

# Appendix A

## Map and Aerial Photo of Proposed Location


QUINLAN'S EXISTING PLANT
New Map
x: 799217
y: 5333743
Black Duck Pond Brook
Old Pelican Cove
Burseys Point
Old Pelican
Old Pelican
Taylor Point
Burn Cove
Frog Marsh
02C03
02C02
Besom Cove
Besom Cove Brook
Black Duck Pond
Besom Cove Pond
Rte 80
x: 796294
y: 533 1763
PROPOSED SITE RIFF'S BUILDING
To Quinlans Bay de Verde Plant
Proposed Transportation Route

# Appendix B

# Chemical Data Sheets

# Material Safety Data Sheet
# HYDROCHLORIC ACID

Print Date: March 2007

## SECTION 1 – Chemical Product and Company Identification

**MSDS Name:** HYDROCHLORIC ACID MSDS Preparation Date: 02-2007, Supersedes 02-2004, 02-2001 & 02-98

**Synonyms or Generic ID:** Muriatic acid, Chlorohydric acid, hydrogen chloride, spirits of salt.

**Seastar Product Codes:** IQ-04-0500, IQ-04-1000, IQ-04-1000HDPE, IQ-04-1000R, IQ-04-2500, IQ-04-2500-6, IQ-04-2500-S, IQ-04-
25SK, IQ-04-25SK6, IQ-04-25SKS, IQ-04-4000, IQ-04-DRUM, IQ-04-200L, BA-04-0250, BA-04-0500, BA-04-1000, BA-04-1000-02N,
BA-04-1000-2N, BA-04-1000-4N, BA-04-1000-6N, BA-04-1000-10N, BA-04-2000, CP-04-1000P400, CP04-1000P400, OVERFLOW-04

**Canadian TDG Classification**: 8 PKG Gr II **Formula:** HCl

**PIN (UN# / NA#):** UN1789 **Molecular Wt:** 36.46

**Canadian WHMIS Class:** Class E; Class D Div 1 Sub A.

**Supplier:** Seastar Chemicals Inc, 10005 McDonald Park Road, Sidney, BC V8L 5Y2 CANADA

**Tel:** (250) 655-5880, **Fax:** (250) 655-5888

**CANUTEC (CAN): (613)-996-6666**

## SECTION 2 – Composition/Information on Ingredients

CAS # Chemical Name Percent EINECS/ELINCS TLV Hazard
7647-01-0 Hydrogen
chloride
30-38% 231-595-7 (Ceiling) 5 ppm (7 mg/$m_3$)
(ACGIH)
Corrosive/Poison
7732-18-5 Water Balance 231-791-2 Not established N/ap
Hazard Symbols: C Risk Phrases: 34 37

## SECTION 3 – Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colourless to slight yellow clear liquid. Danger! Causes eye and skin burns. Causes severe digestive tract irritation with
possible burns. Repeated or prolonged exposure may cause erosion of exposed teeth. Corrosive to metal. May be fatal if inhaled or
swallowed. Causes severe respiratory tract irritation with possible burns.
Target Organs: Respiratory system, gastrointestinal system, teeth, eyes, skin.

### Potential Health Effects

**Primary Route(s) of Entry**: Inhalation and ingestion. Skin contact. Eye contact.

**Effects of Acute Exposure**: Harmful by ingestion, inhalation or skin absorption. May cause permanent damage.

**LD50/LC50**: CAS# 7332-18-5: Oral, rat: LD50 – >90 mL/kg.
CAS# 7647-01-0: Inhalation, mouse: LC50 = 1108 ppm/1H, Inhalation, rat: LC50 = 3124 ppm/1H, Oral, rabbit: LD50 = 900 mk/kg

**Eyes**: May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes
and causes severe burns. May cause painful sensitisation to light. May cause conjunctivitis May cause permanent damage.

**Skin**: May be absorbed through the skin in harmful amounts. Contact with liquid is corrosive and causes severe burns and ulceration.
May cause photosensitization in certain individuals.

**Ingestion**: May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death.
May cause corrosion and permanent tissue destruction of the esophagus and digestive tract.

**Inhalation**: Causes severe respiratory tract inflammation. Destructive to tissues of mucous membranes. Coughing, difficulty breathing,
pulmonary edema, collapse, respiratory system and lung damage, possible coma and possibly death.
**Effects of Chronic Exposure**: Erosion of the teeth, ulceration of the nose, mouth and gums, bronchitis. Target organs: skin, eyes,
lungs, respiratory system. To the best of our knowledge the chronic toxicity of this substance has not been fully investigated.

## SECTION 4 – First Aid Measures

**Eyes**: Immediately flush eyes with large amounts of water for at least 30 minutes, holding lids apart to ensure flushing of the entire
surface. Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed.

**Skin**: Get medical aid immediately. Immediately flush skin with copious quantities of water for at least 30 minutes while removing
contaminated clothing and shoes. Call a physician. Wash clothing before re-use.
**Ingestion**: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Consult a physician immediately.
Never give anything by mouth to an unconscious person.
**Inhalation**: Remove patient to fresh air. Administer approved oxygen supply if breathing is difficult. Administer artificial respiration or
CPR if breathing has ceased. Call a physician.
**Notes to Physician**: Treat symptomatically and supportively. **Antidote**: No specific antidote exists.

## 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. Not flammable, but reacts with most metals to form flammable hydrogen gas. Use water spray to
keep fire-exposed containers cool. Contact with metals may cause generation of flammable concentrations of hydrogen gas. Emits toxic
fumes under fire conditions. Hazardous Combustion Products: Hydrogen chloride gas.
**Extinguishing Media**: Substance is non-flammable; use agent most appropriate to extinguish surrounding fire. Water spray. Carbon
dioxide.
**Auto-ignition Temperature**: Not applicable.
**Flash Point**: Does not burn.
**NFPA Rating**: Health 3; Flammability 0; Instability 1
**Explosion Limits**: Lower: Not applicable. Upper: Not applicable.

## SECTION 6 – Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks**: Large spills may be neutralised with dilute alkaline solutions of soda ash, or lime. Absorb spill using an absorbent, noncombustible
material such as earth, sand, or vermiculite.
**Steps to be taken in case material is released or spilled:** Evacuate and ventilate the area. Wear self-contained breathing apparatus,
rubber boots and heavy rubber gloves. Cover with soda ash or lime. Place in a suitable container and mark for disposal. Wash spill site
after material pick-up is complete.
**Waste disposal method:** According to all applicable regulations. Avoid run-off.

## SECTION 7 – Handling and Storage

**Handling**: Wash thoroughly after handling. Remove contaminated clothing and wash before re-use. Use with adequate ventilation. Do
not get on skin or in eyes. Do not ingest or inhale. Do not wash down the drain. Wash well after use. In according with good storage and

handling practices. Do not allow smoking or food consumption while handling.
**Storage**: Keep away from heat and flame. Do not store in direct sunlight. Store in a cool, dry, well-ventilated area away from
incompatible substances. Keep tightly closed. Do not add any other material to the container.
**Storage Code**: White.

## SECTION 8 – Exposure Control/Personal Protection

**Engineering Controls**: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible
exposure limits.
**Exposure Limits**:
***Chemical Name ACGH NIOSH OSHA***
Hydrogen chloride None listed. C5 ppm; C 7 mg/$m^3$ C5 ppm; C 7 mg/$m^3$
Water None listed. None listed. None listed.
**OSHA Vacated PELs**
Personal Protective Equipment
**Eyes**: Wear appropriate protective face shield and eyeglasses or chemical safety goggles as described by OSHA's eye and face
protection regulations in 29 CFR 1910.133.
**Skin**: Wear appropriate protective neoprene gloves to prevent skin exposure. Neoprene apron or clothing sufficient to protect skin.
**Clothing**: Wear appropriate protective clothing to prevent skin exposure.
**Respiratory Protection**: Follow the OSHA respirator regulations found in 29CFR 1910.134. Always use a NIOSH-approved respirator
when necessary. If more than TLV, do not breathe vapour. Wear self-contained breathing apparatus.
Use only in a chemical fume hood. Adequate ventilation to maintain vapour/dust below TLV.
**Ventilation**: Use only in a chemical fume hood. Adequate ventilation to maintain vapour/dust below TLV.
**Other Protective Equipment**: Make eye bath and emergency shower available.

# NIOSH Pocket Guide to Chemical Hazards

September 2005

## Potassium hydroxide

CAS
1310-58-3

KOH

RTECS
TT2100000

### Synonyms & Trade Names

Caustic potash, Lye, Potassium hydrate

### DOT ID & Guide

1813 154 (dry, solid)
1814 154 (solution)

### Exposure Limits

**NIOSH REL**: C 2 mg/m$^3$

**OSHA PEL**†: none

### IDLH

N.D. See: IDLH INDEX

### Conversion

### Physical Description

Odorless, white or slightly yellow lumps, rods, flakes, sticks, or pellets. [Note: May be used as an aqueous solution.]

| | | | |
|---|---|---|---|
| MW: 56.1 | BP: 2415°F | MLT: 716°F | Sol(59°F): 107% |
| VP(1317°F): 1 mmHg | IP: ? | | Sp.Gr: 2.04 |
| Fl.P: NA | UEL: NA | LEL: NA | |

Noncombustible Solid; however, may react with $H_2O$ & other substances and generate sufficient heat to ignite combustible materials.

### Incompatibilities & Reactivities

Acids, water, metals (when wet), halogenated hydrocarbons, maleic anhydride [Note: Heat is generated if KOH comes in contact with $H_2O$ & $CO_2$ from the air.]

### Measurement Methods

NIOSH 7401
See: NMAM or OSHA Methods

### Personal Protection & Sanitation

(See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

### First Aid

(See procedures)
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

### Respirator Recommendations

Not available.
Important additional information about respirator selection

### Exposure Routes

inhalation, ingestion, skin and/or eye contact

### Symptoms

Irritation eyes, skin, respiratory system; cough, sneezing; eye, skin burns; vomiting, diarrhea

### Target Organs

Eyes, skin, respiratory system