Environmental Assessment Information

Shellfish Chitin Processing Plant
Bay de Verde, NL.

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

Date: April 15, 2011

Contact

Robin Quinlan
Ph: 709-739-6960
Fax: 709-739-0586
Email: rquinlan@quinlanbros.ca

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1.0 NAME OF UNDERTAKING:

Shellfish Chitin Processing Plant

Bay de Verde NL

2.0 PROPONENT:

Quinlan Brothers Ltd.

(i) Name of Corporate Body: Quinlan Brothers Ltd.

(ii) Mailing Address: Atlantic Place, 302 – 215
Water St., St. John's,
NL A1C 6C9

(iii) Chief Executive Officer: Pat Quinlan
Address: as above
Telephone No.: 709-739-6960

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

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

3.0 THE UNDERTAKING:

(i) Nature of the Undertaking:

In 2008 Quinlan Brothers Ltd submitted the Environmental Assessment for the development of a chitin production facility in Old Perlican, NL. Project Registration #1382 was approved on March 20, 2009. As a result of further analysis, research and consultation, it was determined that the only viable site for the facility would be adjacent to the Quinlan Brothers crab and shrimp processing plant in Bay de Verde. The project will be completed in conjunction with partnerships from industry and the Marine Institute/Memorial University of Newfoundland. This facility will include 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, technologically advanced and environmentally sound chitin plants built to date.

In anticipation of the location change requirements, Quinlan Brothers met with the Town of Bay de Verde in February 2011, and upon request of the Town Council, held a town meeting later that month. The purpose of the meeting was to present information on the project to the residents and addresses any concerns or questions they might have. Following the meeting, Quinlan Brothers provided a detailed letter to council addressing areas of concern highlighted during the meeting. The project, town hall meeting and subsequent letter were discussed at the regular Council Meeting on March 10th. Approval to move forward with the project was put to motion and approved by the Council of Bay de Verde at that meeting. A copy of the letter is provided in Appendix C.

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

Quinlan Brothers, Ltd. is a major shellfish processor in Newfoundland. The Company's processing facilities account for a significant portion of both the snow crab and shrimp harvests. The processing of shellfish generates a waste stream of shell. There is minimal value in raw shell and it has become an important issue for seafood processors from both

an environmental and financial perspective. The company has long studied an alternative use for the by-products of shell. This interest is shared by the provincial government, expressed in past RFP's on the matter, however prohibitively high costs of production have traditionally discouraged past efforts to utilize this resource. Quinlan Group processing facilities in Old Perlican and Bay de Verde produce over 13 million tones of shrimp byproduct waste each year alone.

The greatest value of the shell is the chitin content. Chitin is a naturally occurring biopolymer; further processing of chitin yields chitosan or glucosamine. China dominates production, where cheap labor, inexpensive chemicals, and disregard for effluent discharges have made the Chinese factories tough competitors. Recognizing the global market opportunities for a high quality chitin supply, Quinlan Brothers has been working aggressively over the past three years 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.

4.0 DESCRIPTION OF THE UNDERTAKING:

(i) Geographical Location:

Originally, the Old Perlican site was evaluated against the existing Processing Plant site in Bay de Verde. The Old Perlican site was selected due primarily to the short lead time for site preparation in order to allow setup of the plant in fall 2009 – an existing building could be utilized and the existing water supply was sufficient. As a result of concerns and delays with the fishery, construction and setup of the plant did not happen according to the proposed schedule. Quinlan Brothers used this time instead to conduct further research and testing on shell preparation and processing analysis.

With the original plan, timely transport of the shell from the Bay de Verde plant to the Old Perlican site created an additional cost factor but was justified in the interest of

project scheduling. Further research indicated that shell freshness is a key factor in producing a quality grade chitin product with maximum yield. In spring and fall of 2010 representatives from the company Biolog Heppe visited Quinlan's and the two potential sites for the chitin operation. Biolog Heppe is a German company that specializes in the production and marketing of chitin/chitosan. After viewing both sites, they recommended that the ideal location for the facility is closest to the raw material supply – the Bay de Verde Processing Plant site. Besides the access to fresh shell, the chitin process uses large quantities of salt water and the existing plant has easy access to the salt water supply. An additional benefit of this location is that it will stop the transport of the waste shell out of the town to a nearby landfill site. Considering the quality, cost and human resource factors, it has been determined that the Bay de Verde site is the only viable location to operate the chitin processing facility.

Consultations have been made with plant management, staff, the local town council and residents. Quinlan's has proposed the construction of an extension to the current facility; land is available as needed, as well as required infrastructure support. Waste effluent neutrality and environmental standards will remain the same as with the Old Perlican location and meet all the requirements of the Department of Environment, the Department of Fisheries on Oceans.

Please refer to the attached drawing (Appendix A) for site location and measurements.

(ii) Physical Features:

The building expansion will be approximately 12m x 40m and two stories high. It will maintain close to the same look and height as the existing processing facility. The new construction proposed will be attached to the existing structure extending the length of the building into the asphalt area now used for shrimp holding tank storage. Less than 50% of this new space will be used for chitin processing activities. A portion of space will be used for storage of finished product in a dry powder form. There will be no storage of raw materials as the waste shells will be routed direct from the processing line into the buffer/processing tanks. As with the previous facility, chemical holding tanks and

storage areas will be located inside the building, in a secure facility with approved storage containers and appropriate ventilation.

The processing plant is located within a semi-closed harbour, with waste discharge directly to the ocean. Processes for neutralization and monitoring of waste effluent, and safety in storage and handling of chemical, are presented within this document. The described processes and protocols have been developed to ensure protection of the harbour and to meet the standards of Environment and Fisheries. All effluent would be neutralized to meet Dept of Environment standards prior to discharge. The plant facility is not located near any rivers or streams.

Access to the processing facility is via a steep curved, paved road, with the plant located at the base amidst a residential area. Several houses are located along the road and in close proximity to the plant. The road is used regularly by tandem dumps and tractor trailers making regular delivers to and from the existing plant, including tankers of diesel. Safety protocols have been put in place to address concerns with the site location brought forwarded by the town residents and are provided for review within this document. As noted previously, the town has given approval for the project based on the safety and due diligence commitments made.

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

(iii) Construction:

A new schedule has been developed for development of the Chitin facility. Prototype processing equipment has been specified with suitable manufacturers identified. Construction of the specialty components will take approximately four months. Design and layout details for the building have also been finalized, with a start date for on-site equipment assembly by January 2012. It is anticipated building construction will start in Fall 2011 with a 3 month completion time frame. The new construction will be an extension to the existing building with similar exterior features and will meet current

construction code regulations and Health and Safety, WHIMIS, and HAZMAT design criteria for chemical storage and usage.

Construction Schedule

Extension Construction	Fall 2011
Equipment Delivery	January 2012
Installation Completion	March 2012
Commissioning	May 2012
Pilot Production Start	June 2011

The building construction is expected to start in Fall 2011. 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 Bay de Verde. If successful, the facility will operate 2 shifts per day during peak production for eight months of the year, similar to the crab and shrimp processing cycles (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 draw on the 4.5 million kilograms (10 million lbs) of shrimp processed from Quinlan's Bay de Verde processing plant. The byproduct will be pumped directly into the chitin facility located in an adjacent building, with no exposure to the external environment. It is Quinlan's goal to be processing its entire shellfish waste to chitin/chitosan within the next five years, as 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. Waste shell is re-directed from the dump truck loading area a crusher system for protein removal
2. Protein Waste is collected and frozen for use as a feed by-product
3. Crushed shell is pumped to a buffer/processing salt water wash tank
4. Waste Water is reused multiple times, accumulated waste in the tank is directed to the Neutralization Tank
5. Washed shell is treated with dilute HCl
6. Treated Shell is washed with the recycled salt water
7. Washed shell is treated with dilute NaOH
8. HCl and NaOH are recycled and reused. Waste Chemical is directed to the Neutralization Tank
9. Treated Shell/Chitin is washed and sent to drying system or further processed with HCl for chitosan production .
10. All Waste material is directed to Neutralization Tank, using flocculent for sediment removal
11. Neutralized Effluent is discharged to ocean
12. Drying system produces dry finished chitosan.
13. Chitosan is compacted for shipping.

An important feature of the proposed process is the Protein Recovery Process. At least 90% of the protein from the shrimp shell feed will be found in the early crushing and wash stream processes. This protein will be collected and frozen using a plate freezing

system for use in the aquaculture industry. As the plant and markets for protein by-product usage are developing, in the short term the protein waste will be collected and returned to landfill as is the current process. 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 greatly reduced.

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
- 5 % aqueous hydrochloric acid ("dilute acid"), diluted from concentrated (32%) hydrochloric acid (Please refer to Appendix B for chemical data sheets.)

Liquid HCl at a concentration of 32% will be used for preparation of the dilute acid. Dry flaked NaOH at 98% concentration will be used for the dilute base. Approximately 1.4kg of NaOH and 3.4kg HCl will be used for each kg of finished chitosan produced. All chemicals used are diluted to 5% aqueous solutions in separate storage tanks prior to being used in the process via a closed loop piping process. The diluted chemicals are added to the chitin process also via a closed loop piping system with appropriate shutoff and emergency valves along the pipes.

Chemical Storage and Handling

The dilute acid and dilute base (prepared on site) will be stored in 10,000 liter specially constructed Poly tanks, meeting industry and governmental requirements for Hazardous Materials storage. 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 directed through a water scrubbing system for effective exhaust neutralization. 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 as per WHIMIS and HAZMAT requirements.

It is anticipated that the concentrated acid will be shipped to the plant by tanker from the production facility in Montreal. The chemical will be stored onsite in a 30,000 liter specially constructed Poly tank, meeting industry and governmental requirements for Hazardous Materials storage. 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 acid tank will be fitted with a neutralizing vent for filling directed through a water scrubbing system for effective exhaust neutralization.

Discussions with the Town of Bay de Verde and Town Hall meeting with the residents resulted in concerns brought forward regarding the safety and handling of the concentrated acid and the use of a tanker truck to deliver the acid to the processing plant site. The following excerpt is taken from a follow-up document prepared and distributed to the council in response to these concerns. As noted previously, the Council of Bay de Verde has given approval for the project based on the plan and commitments made by Quinlan Brothers in this document, contained in Appendix C.

> *Transport, handling and storage of chemicals (Hazardous Materials) is highly regulated by Transport Canada, Environment Canada and Workers Health Safety Compensation Commission. Regulations concerning storage devices and employee handling or exposure are covered under legislation such as the Hazardous Products Act, Controlled Products Regulations and the Workplace Hazardous Materials Information System (WHMIS).*
>
> *Any employees working in the chitosan plant will be required to have HAZMAT and WHIMIS training, and Quinlan Brothers Ltd is required to have a safety and*

emergency procedures plan in place in the event of exposure to the acid. The concentrated acid will be stored in a secure area, and only accessible by trained designated employees. ***'Resident' suggested the local fire department receive the appropriate HAZMAT training and emergency equipment from Quinlan's. This was a great suggestion and we will start work with the Fire Department to determine their needs and development of an action plan.***

32% concentrated HCl will be shipped from the plant in Montreal to Quinlan's plant by tanker truck, similar to how diesel is brought in. The HCl will be transferred from the tanker by a closed loop system to a storage tank located inside the building. A scrubber cleaning system is used for neutralizing fumes from transfer of the chemical and ensures no acid fumes are vented outside. The on-site storage tank will be constructed of reinforced fibreglass or stainless steel with acid resistant lining and will be completely surrounded by an acid resistant retaining wall, capable of holding the entire contents of the storage tank, meeting federal safety and compliance standards. Once the 32% HCl is on site, the acid will be diluted with water to a concentration of 5% in a separate storage tank for use in the chitin process. At 5% concentration, the acid is classified as an irritant. Again, all acid will be transferred in a closed loop and be taken from the 5% tank as needed for the process. There is no connection of either the 32% or 5% HCL storage tanks to the waste stream of the plant, eliminating the chance of any accidental spill into the harbour.

'Resident' requested further information on the type of truck and shipping of the HCl into the community. Quality Distribution (QDI) is the transport company that will be responsible for the shipping and offloading of the Hydrochloric Acid from the plant in Montreal to Quinlan's facility. They are the largest bulk carrier company in Canada, with a fleet of 7,000 trailers and 3,000 trucks. Quality's core competency is in the transport of chemicals and hazardous materials; they do not handle bulk goods or general shipping. QDI is a publicly traded company, and their reputation is based on safe, reliable and consistent delivery of hazardous materials across the continent. The cargo vessels are specially designed for transport of these types of materials, and QDI ships multiple loads of HCl alone on a daily basis from the supply plant in Montreal. It is not being handled by local trucking companies or inexperienced drivers. In addition to the government regulations that must be met, the company is audited on a regular basis for compliance by both government and independent firms.
Drivers handling the HCL and other hazardous materials are required to have a special license and training. Driver's licenses must be renewed every three years which requires re-training, not just a reissuing of the license. Drivers are responsible for the loading, transport and offloading of the chemical with a zero breech tolerance (no escape of chemical). In addition to government regulated training, Quality Distribution also has its own in-house training program and their drivers are dedicated to chemical shipping only.

Bay de Verde has a unique geographic characteristics, specifically the hills leading to the plant, which is the source of some of the concerns raised. ***Quinlan's commits to having a discussion and onsite inspection with shipping company representatives to ensure drivers are adequately trained and prepared for entrance into the community.*** *Further information on the shipping company may be found at www.qualitydistribution.com*

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

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 as per Health & Safety, WHIMIS and Hazmat regulations.

5.0 ENVIRONMENT

(i) Effluent Treatment System

The mixing of shell with the chemicals occurs in a series of tanks. Water and chemical solutions are re-circulated through the system for reuse, with final waste liquid and chemical residue pumped to a neutralization holding tank. All waste liquid from the HCL mixing tank, the NaOH mixing tank and the water wash tank is pumped to this neutralization tank through a closed system. There is no other discharge point for the waste until it reaches the holding tank. The fluids are then held in this tank until they are neutralized and safe to discharge, meeting all environmental standards. Solid matter and particles are settled and removed from the tank for disposal prior to discharge.

A pH meter will be located inside the neutralization tank to monitor neutralization activity. A computer controlled monitoring system will keep track of these pH readings, and add additional acid (HCL) or base (NaOH) as needed to ensure neutralization occurs.

The waste effluent in the neutralization holding tank is also monitored for other contaminants, including BOD, Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) to ensure particle waste matter is within allowable limits, and that waste effluent being discharged meets all requirements within the Sewage Discharge Compliance of the Environmental Control Water and Sewer Regulations 2003 Schedule A and the Fisheries Act for non-acutely lethal discharge.

Unlike the shrimp plant, there is no continual stream of waste water draining into the harbour. Contents of the neutralization tank are released as needed and only once neutralization is at the appropriate level and other constituents are at appropriate levels as per Environmental Control Water and Sewer Regulations 2003 and the Fisheries Act.

Two water treatment and purification companies have been consulted on the treatment and safe disposal of effluent from this process, ensuring all regulations and requirements under the Sewage Discharge Compliance of the Environmental Control Water and Sewer Regulations 2003 Schedule A and the Fisheries Act are being met.

Biolog Heppe GmbH

BioLog GmbH has been developing environmental technologies and products for water and waste water treatment, the application of biopolymers in the textile, paper and plastics industry as well as in agriculture and bio-plastics since 1992. As a result they have extensive expertise in the production of biopolymers, such as chitin, chitosan and their derivatives, the development of products containing chitin and chitosan, and customized project management for waste-free and environmental friendly biopolymer production facilities (chitin, chitosan, glucosamine). Technical development activities focus on satisfying three main criteria – environmental situation, production quality and economy of production.

Biolog Heppe has conducted analysis of the waste streams at various quality checks points in the process. The sources of waste have been identified and further characterized with strategies targeted for effective treatment or usage:

Protein Paste from the Shell/Protein Separation

The protein paste will be produced at a maximum flow of 1.5t/h under peak processing capacities. A plate freezer process can be used for freezing the paste at 30 m^3/d to be sold as feed. This protein paste (solid particulate) will not be part of the waste effluent stream.

NaOH De-Proteinization Wash Water

The NaOH chemical is used several times in the reaction as the NaOH consumption is balanced by adding concentrated NaOH to reach desired concentration levels. Any Protein that is precipitating from the shells appears as a paste/water-mix and is pumped out from the reactor into the neutralization tank2, every 2-3 cycles depending on the quantity of shells processed

HCl De-Mineralization Wash Water

Calcium chloride and sodium chloride paste are produced from the HCl-reaction and will be pumped out of the reactor into the neutralization tank every 2-3 cycles depending on the quantity of shells processed. The remaining acid and alkaline, which was not chemically used or bound to the protein, is converting into sodium chloride – salt

$$HCl + NaOH \rightarrow NaCl + H_2O$$

Caused by the change of the pH $CaCl_2$ and $CaCO_3$ as well as NaCl and protein are precipitating as a paste. The calcium containing paste can be mixed with the protein paste from the mincer and used as feed blend. The mix relation from protein paste to the neutralization paste is about 10-15 to 1

Sea and Fresh Wash Water

Sea and fresh water for washing the shells between the chemical processes is used in a relation of ten to twenty water to one shells. As a result of the natural chemical reaction in the neutralization tank, the pH of the water will change slightly with a 5-10% rise in the salinity. This waste wash water produced after the HCl/NaOH reaction in the

Neutralization tank meets all environmental effluent standards for discharge directly into the ocean.

Ongoing research and testing is providing significant improvements and refinements to the chitin production process. Through the work conducted by Biolog Heppe, it is no longer anticipated that waste water effluent will require further biologic effluent treatment, as in the earlier project and environmental proposal. In the event that final analysis of the effluent does require further treatment, the biologic treatment process originally proposed by Biologic H2O will be employed. Details on that process are provided below and in Appendix B.

BioProcessH2O

In November 2008 Quinlan Brothers contracted the Marine Institute Centre for Seafood Development to carry out a pilot project in order to characterize the effluent from the proposed plant. This effluent was floc'ed and sent to Maxxam Analytics in Bedford Nova Scotia. Maxxam produced a complete characterization analysis of the effluent sample (Appendix B). The BOD level of the sample was found to be 660mg/L confirmed the requirement for biologic effluent treatment equipment. Quinlan Brothers and their partners have been dealing with BioProcessH20 as an effluent treatment equipment supplier for the project.

BioProcessH2O provides full service pre-treatment systems for wastewater management that uses microbes to clean water prior to its release into municipal water treatment systems. From conducting an initial waste analysis to the design, build and installation, and then maintenance of a complete water-treatment system, bioprocessH2O puts a high on ensuring that each customer is outfitted with a solution that meets their needs.
As the project nears the latter stages of design, BioProcessH2O offers customers a pilot program where clients can test a unit before moving ahead with a full-scale project.

Quinlan's has worked with BioProcess on early stage system design based on the effluent profile; Schedule "A" of the *Environmental Control Water and Sewer Regulations* was

provided to BioProcessH2O to help determine the treatability using their equipment. They have provided a letter confirming that their equipment can effectively treat the effluent to the desired specification, as well as some case studies demonstrating other similar successful projects (Appendix B).

(ii) Water Supply

The process requires both fresh and salt water for its operation. The Town of Bay de Verde has recently committed to install a dedicated pipe to the processing facility, based on Quinlan Brothers projections for additional water needs at the existing shrimp plant and to alleviate low flow and water quality issues experienced by the town with the shared pipe. The engineers have designed the new pipeline based on a future projected anticipated flow by Quinlan Brothers. Quinlan's current usage is approximately 55 million gallons and our projected total increase from the chitin facility is 15 million gallons. For improved environmental and operational savings, part of our ongoing research is to refine water reuse options, and to use salt instead of fresh wherever possible. Salt water will be drawn from the existing salt water wells installed at the shrimp processing plant.

(iii) Odors from Transportation and Operation

Chitosan is produced through a process of purifying the shell until all that's left is a translucent white material. All odour causing agents are removed through the pre-treatment and chemical processes, leaving only a small white odour-free flake for drying. It is important to note that this is not like a fish meal plant, where the protein itself is being dried. There is no residual smell from the chitin or chitosan flakes and no odour is created through the process. The technology process does not require ventilation stacks or specialty exhaust towers. It is also important to note that workers in the chitosan plant are not required to wear specialty air filtration masks or protective equipment on a daily basis moving about the facility. Protective goggles and clothing are to be worn when handling

the solution in the mixing tanks for testing and analysis or conducting visual inspection inside the mixing tanks but not for normal operations.

The requested change in location for the facility has eliminated the need to transport any waste shell material from the processing site. Waste shell generated from the crab and shrimp processing activities will be redirected from the current waste removal process directly into the chitin processing facility, contained within the building.

The proposed process will not add any further foul smells but will actually reduce the severity of the current odour problems experienced outside the plant. Much of the existing odour at the plant is concentrated at the paved lot in front of the shrimp plant. Unloaded shrimp is stored in insulated containers in this area, dispersing shrimp 'juice' and materials onto the parking lot during lifting and transport. During hotter summer months, his spillage dehydrates and bakes in the sun on the parking lot, creating the odour. The building extension proposed to house the chitosan plant has been sized larger than needed, to accommodate the storage of the fresh raw shrimp inside. This will significantly reduce the smell emanating from that area and help provide improvements to the existing operation.

(iv) Wildlife Management

As noted in the previous section, the removal of the exterior stored shrimp for the shrimp processing facility will greatly reduce the amount of material and waste located outside. This removal of shell is expected to have a significant reduction in the amount of seabirds in the area, also reducing sources of odour as well as improving food safety for the company.

(v) 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. As part of the

discussion and commitments made to the town regarding environmental and emergency planning, Quinlan Brothers will work cooperatively with the local Fire Department on the development of an action plan and to ensure proper training and equipment are in place.

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.

(vi) 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.

6.0 PROJECT RELATED DOCUMENTS

The project has successfully undergone a previous environmental review, based on the site location of Old Perlican, under project registration #1382 approved on March 20, 2009. Further project-related documents submitted with this current proposal are listed below:

- Aerial view of site location
- Map of area
- Letter From BioProcessH2O
- Letter to the Town of Bay de Verde in response to questions from the Public Meeting

7.0 APPROVAL OF THE UNDERTAKING:

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

- Development Permit, Town of Bay de Verde Municipal Council
- Government Services – OHS

8.0 FUNDING:

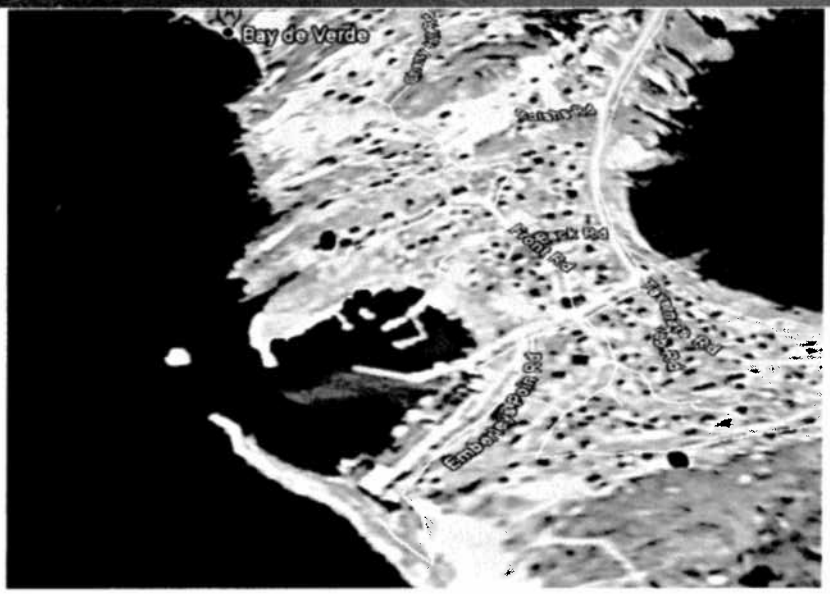
Quinlan Brothers has been selected to receive investment from ACOA's Atlantic Innovation Fund for a portion of the project costs. The overall costs of the plant facility and the 3-year R&D initiative with MUN and MI will be just over $5 Million dollars.

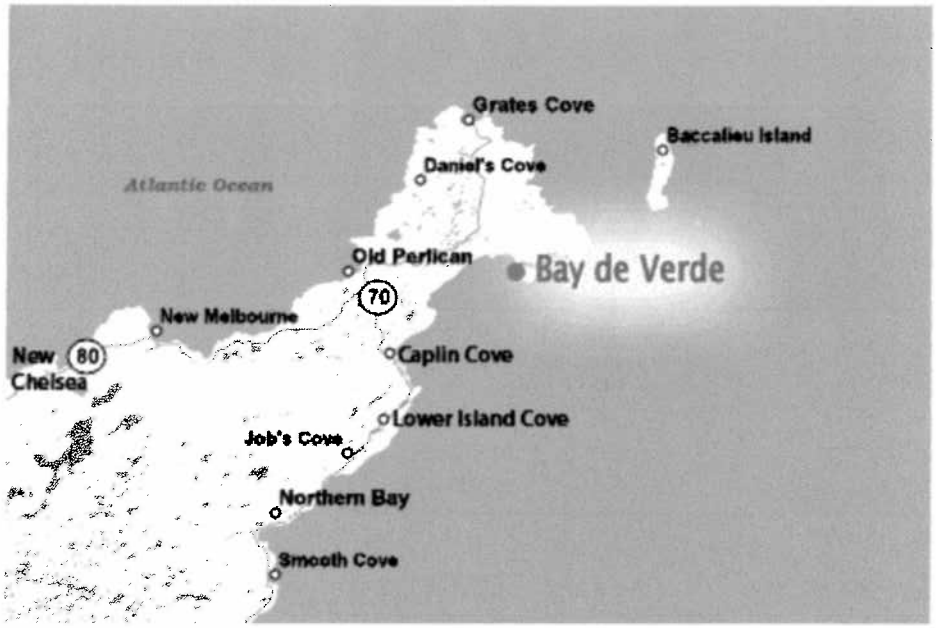
It is important to note that the project with ACOA cannot move forward until the site location change request has been finalized and the Environmental Review has been completed with a permit in place to proceed.

Appendix A: Aerial Photo and Map of Proposed Location


SETTLED 1662 INCORPORATED 1950


19/05/2003


Bay de Verde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Northern Bay
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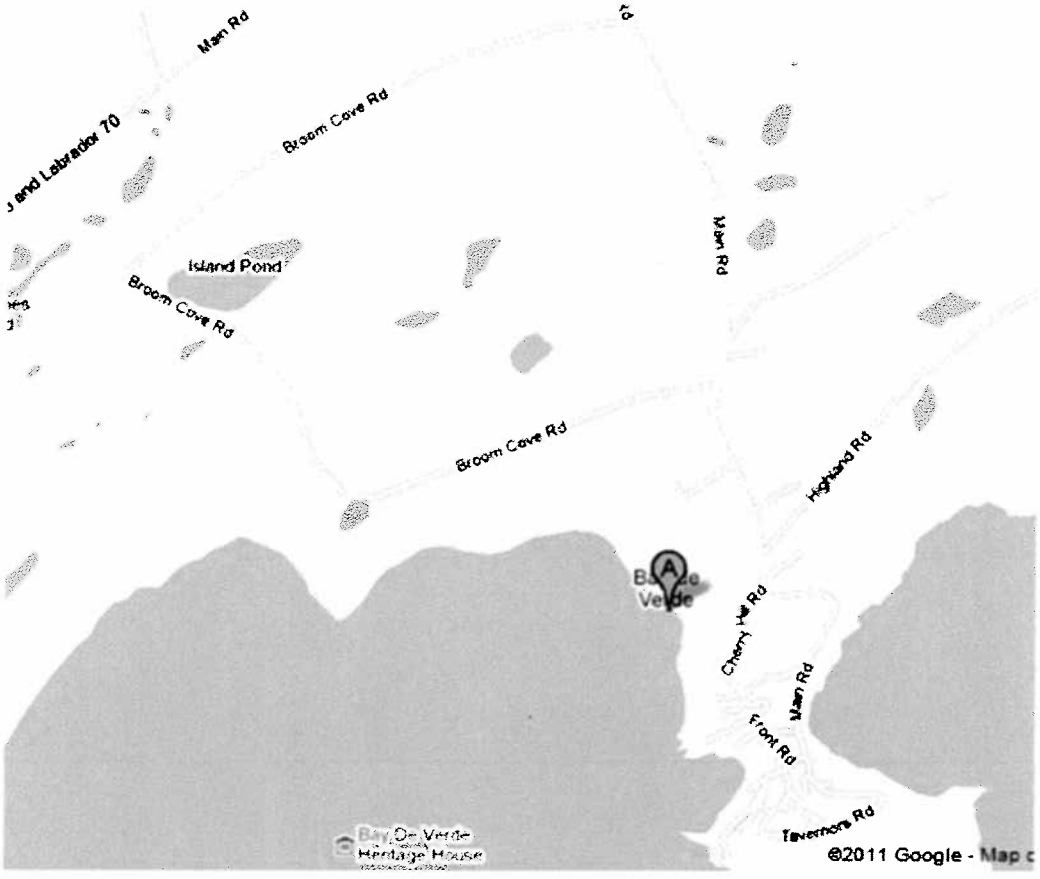
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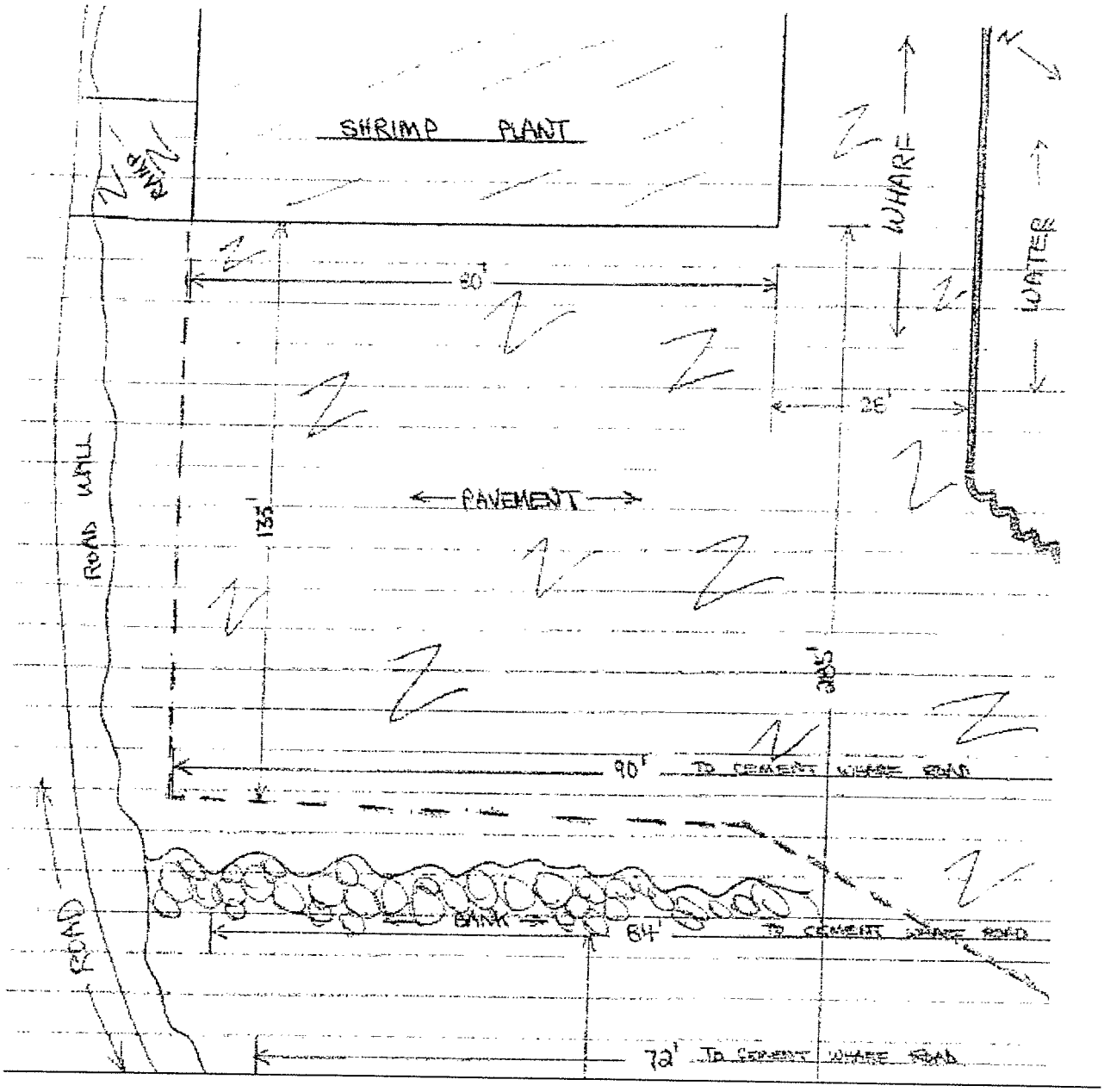
Broom Cove Rd
Island Pond
Broom Cove Rd
Main Rd
Broom Cove Rd
Highland Rd
A
Cherry Hill Rd
Main Rd
Front Rd
Tavernors Rd
©2011 Google - Map d


SHRIMP PLANT
WHARF
WATER
80'
25'
PAVEMENT
135'
ROAD WALL
ROAD
90' To cement wharf road
BANK
64' To cement wharf road
72' To cement wharf road

Appendix B: BioProcessH2O

bioprocessH2O

Chitin Works America, LLC
306 Mill St
Cambridge, MD 21613

January 6, 2009

Attention: Pat Condon & Steve Mercer

Regarding Request for Treatment of wastewater from Shrimp processing operation in Newfoundland, Canada

Gentlemen,

Based solely on the information that Chitin Works America provided to BioprocessH2O in the lab report from Maxxam Analytics dated 11/19/2009 and the Consolidated Newfoundland Regulation 1996 Schedule A, the waste water can be treated. The treatment required will need to be a combination of physical/chemical treatment for the metals present in the wastewater and biological treatment for the BOD present in the wastewater. Based on the lab report we see no significant challenges to treating the waste stream biologically.

Regards,

John Durant
207 Highpoint Avenue
Suite 6
Portsmouth, Rhode Island 02871
Phone: 401.683.5400
Fax: 401.683.5449
Mobile: 401.499.5392
www.bioprocessh2o.com

bioprocessH2O

About BioProcessH2O

Mission

Our mission: to design, develop, produce and install wastewater purification products and systems that allow our customers to reliably and affordably protect our world's most precious natural resource-clean water.

Objectives

Our objective is to simplify wastewater treatment. Our specialty is identifying complete solutions, including Membrane Bioreactor (MBR) systems for water reuse or high-concentrate wastewater streams that can be segregated and treated at a lower cost than a facility designed to treat total flow at all times. bioprocessH2O's technology also lends itself well to retrofitting existing systems or components.

About Us

bioprocessH2O was founded on the belief that better methods for purifying commercial and agricultural wastewater were within reach.

In 2003, bioprocessH2O founders Tim Burns and John Haley recognized that farms and businesses needed a pre-treatment system that was practical and affordable, always reliable and convenient to install and use.

Burns and Haley used their combined expertise in wastewater management to develop a new pre-treatment method that uses microbes to clean water prior to its release into municipal water treatment systems.

But bioprocessH2O didn't stop there. Aware of the challenges organizations face when implementing any major change, bioprocessH2O made a commitment to stay with their customers from start to finish.

From conducting an initial waste analysis to the design, build and installation, and then maintenance of a complete water-treatment system, **bioprocessH2O puts a high priority on ensuring that each customer is outfitted with a solution that meets their needs.** bioprocessH2O even offers customers a pilot program where clients can test a unit before moving ahead with a full-scale project.

Our technology produces nutrient reductions that are rapidly becoming benchmarks in their field.

Customers are happy with the cost savings in power consumption and low-solids production and reductions in the cost of compliance and regulatory oversight.

Communities are happy because together we are protecting our water supplies for generations to come.

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Management Team

The bioprocessH2Omanagement team has critical on the-ground technical, manufacturing, regulatory and operations expertise and 70 combined years of experience building environmental systems and organizations that work.

Tim Burns is an alumnus of Providence College and Brown University with more than 20 years of applied environmental, marketing and general management experience in the environmental industry.

Mr. Burns earned his relevant experience with as a founder in three successful companies:

- Eco Resources - a developer, licensee and manufacturer of onsite membrane filtration equipment for inorganic applications
- 21st EMI - a state-of-the-art technology company for recycling of inorganic and organic waste streams in the fields of electronics, printed circuits and photo imaging
- BurnsProperties LLC - a company that purchases industrial properties to initiate long-term commitments to retain manufacturing and employment at these facilities.

Mr. Burns is past president of the Board of Save the Bay, a nationally recognized environmental advocacy organization.
timburns@bioprocessh2o.com

John Haley III is a co-founder of bioprocessH2O and inventor of the High Rate BioFilter (HRBF). Prior to forming the company, Mr. Haley was employed in various research and development positions at the New England Aquarium in Boston.

Mr. Haley is a graduate of Harvard University and a leading biologist in the areas of microbial mats and bacterial holdfast processes. While at Harvard he was involved with research and development of innovative, cost-effective technologies for nitrogen recovery and efficient treatment of polluted waste streams. He served as technical assistant in Dr. Harold Edgerton's laboratory at the Massachusetts Institute of Technology where he developed first-hand knowledge of experimental procedures and development of innovative processes. His later work for the World Wildlife Foundation included investigating the impact of nutrient loading on Sudan's White Nile Swamp.

Mr. Haley designed and produced the first biofilm-based filtration system, or BioFilter, and also achieved national recognition by the National Oceanographic and Atmospheric Administration for his BioFilter design. Most recently, Mr. Haley received the Innovative Technology Award for his nitrogen removal system.
johnhaley@bioprocessh2o.com

Jeff Marshall is responsible for the planning and execution of waste-stream treatment projects utilizing Membrane Bioreactors (MBR) and BioProcess patented high rate BioFilter technology (HRBF) technology at customer sites worldwide.

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Mr. Marshall is an engineer and construction manager with more than 20 years of experience in the construction of wastewater, advanced technology, manufacturing and commercial facilities around the world. Projects he has worked on include:

- New England's largest water reuse project, Gillette Stadium
- Package regional systems
- Construction management consulting to owners
- Building third-party designed projects
- Building fast-track facilities designed in-house

Prior to joining BioProcess, he was vice president and New England regional manager for the Applied Water group at American Water.

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Case Study: **Pretreatment at Seafood Processing Facilities**

Client: Blount Seafood Corporation
Industry: Food & Beverage
Location: Warren, Rhode Island, and Fall River, Massachusetts

Customer Need

Blount Seafood Corporation has processed clams and other shellfish since 1890. It serves the U.S. market for clams, mussels, calamari, crab cakes, seafood dips, chowders, soups and sauces. Blount operates production facilities in Warren, RI, and Fall River, MA, as well as a distribution center in East Providence, RI.

Wastewater is generated by eviscerating processes as well as cleaning of soup kettles and breading/freezing equipment, thawing of frozen ingredients, rinsing floors and sanitizing ancillary equipment and workspaces. Wastewater is discharged directly to the Warren River and to municipal sewer systems in Fall River. Significant reduction of nutrients and TSS in these discharges is required to comply with local and state regulations.

Solution

BioProcess installed two Biotowers at the Warren plant to demonstrate cost-effectiveness for nutrient reduction in the wastewater. The pilot project was designed to operate for six months but has been operating for over five years, during which its performance has been monitored regularly. Reductions in BOD/COD and TSS are significant and consistent.

Based on the impressive results of the pilot, BioProcess installed a full-scale pretreatment system for a new state-of-the-art gourmet soup plant in Fall River, designed for BOD and TSS discharges below 250 mg/l an average annual flow of over eight million gallons. The design needed to accommodate a possible future expansion to 50,000 gpd. The system includes prescreening and equalization, dissolved air flotation, biological treatment in four Biotowers and effluent clarification. Continuous controls for air, temperature and pH are incorporated into the system.

Status/Results

The treatment system in Fall River has been operating for three years. Data indicates that reductions for BOD, TSS and FOG remain have kept the company in compliance. For the Warren facility, BioProcess technology was included in the Basis of Design developed for regulatory review.

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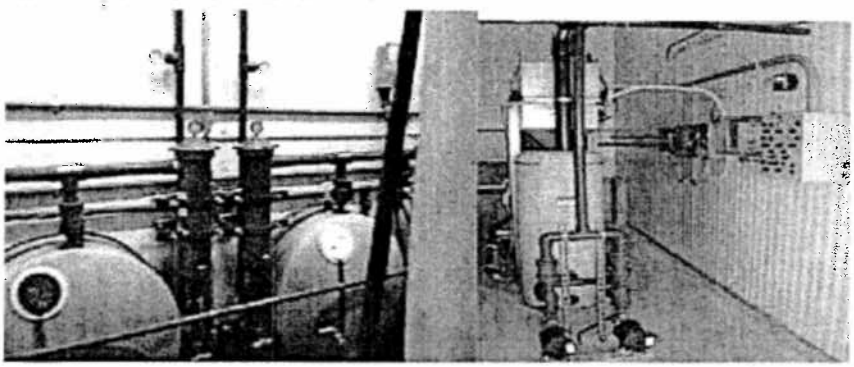

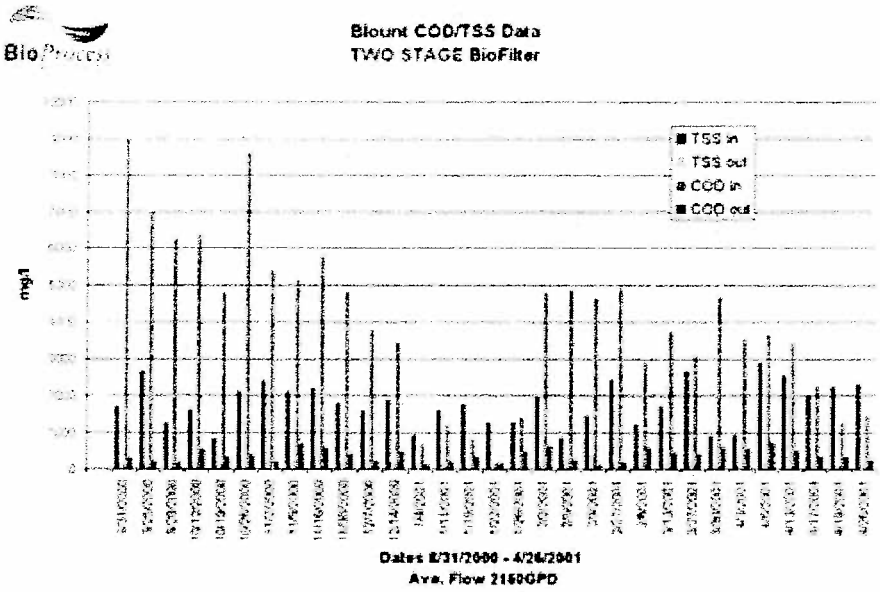

Case Study: Odor Removal at Seafood Company

Odor Removal at Seafood Company
Client: Blount Seafood Company
Industry: Food & Beverage
Location: Warren, Rhode Island

Customer Need
Blount Seafood's supplied restaurants with squid processed in a facility located within an industrial park. While allowing the new processing facility to be constructed, the wastewater treatment authority for the park required reduction in odors associated with wastewater discharged into underground tanks for equalization prior to discharge into the sewer system. The authority also indicated it would impose limits on flow, solids and BOD/COD. The company sought a cost-efficient pretreatment solution that utilized its existing underground capacity and could be implemented quickly.

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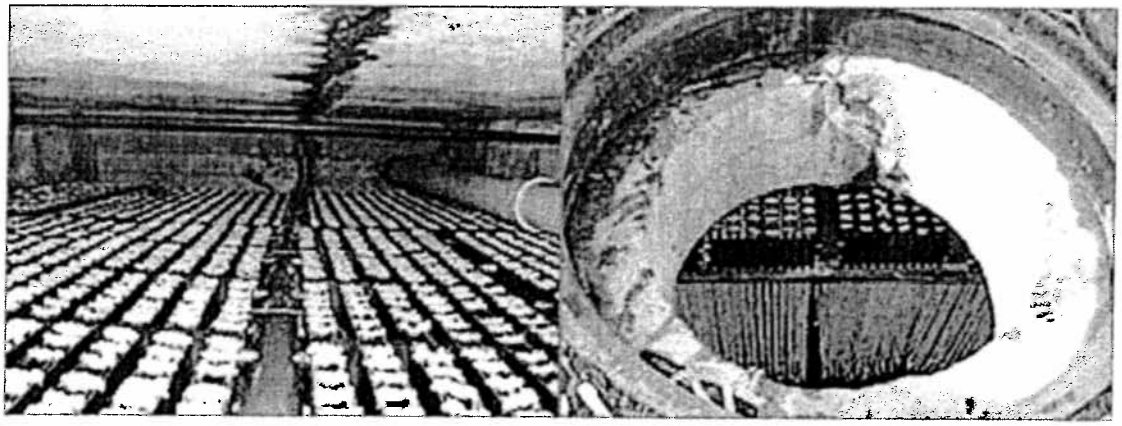
Solution

Having determined that the odor is associated with BOD in the process wastewater, BioProcess Technologies conducted a treatability analysis and designed a preliminary treatment system that includes a retrofit of existing underground tanks with submerged BioFilter frames. The system provides for settling and equalization, preheating, aeration to improve circulation and biological activity, ventilation and a custom-designed wet scrubber. The system is extremely simple to operate and maintain.

Status/Result

The pretreatment system was installed in Spring 2005. After some fine-tuning during start-up, the odor problem was eliminated. Preliminary performance data also show significant reductions in BOD/COD. This became important since the sewer authority added limits for BOD/COD, as well as solids, in its draft permit. Based on initial performance, the authority agreed to postpone the effective date of these limits and allow the company to propose system enhancements based on further baseline testing. BioProcess Technologies is assisting with data collection and analysis. Treatment capacity can be easily expanded by adding more BioFilters in aboveground towers.

Parameter	Effluent Limit
BOD monthly average	
TSS monthly average	160/mg/l
Oil and grease	100mg/l
pH	5-10
Flow	16,000 gpd av/mo
	20,000 gpd max/day
Temperature	104°F



Appendix C: Letter from Quinlan Brothers to the Town of Bay de Verde

QUINLAN BRAND

QUINLAN BROS. LTD.

March 8, 2011

Dear Mayor Gerard Murphy,

I was pleased to hear of such a strong turnout to our information session last Wednesday. The session was held to give details on the proposed Chitin/chitosan development project in Bay de Verde and to have an open discussion on the process. Throughout the evening, several people in the community had questions or expressed concerns about the development. We felt the meeting was very productive and it was good to have this feedback from the community. The purpose of this letter is to provide further information needed and to make commitments that will bring a level of comfort to Council in moving forward that these concerns have been resolved.

The information contained in this document will also be included in a detailed application being submitted to the Department of Environment. The Department will conduct a review of the project to identify environmental impacts and concerns and to ensure that the process submitted by Quinlan's meets required environmental standards. **Council should be aware that a previously submitted assessment for this process has been approved by both provincial and federal government groups for meeting the thresholds for environmental safety and ensuring that the best interests of the population are met.**

Most importantly, we want to confirm our commitment to providing better management of our waste shell. Quinlan's began the chitin/chitosan project as a way to reduce and eventually eliminate the great amount of shell waste landfilled every year from our shellfish processing activities. Very few options for a management solution of the waste shell exist. However, the production of chitosan is a viable solution that has been used around the world since the 1970's. Moving forward with this project will allow Quinlan's to stop the use of the dumpsite and the transport of waste shell through the town. **It is Quinlan's intention within three to five years to completely eliminate all shell waste from the Bay de Verde processing facility. This will be the first such initiative in North America.**

Concerns were expressed about the odour coming from the dump site throughout the processing season and the lack of coverage on the material on a regular basis. **Quinlan's has committed to ensuring dumped waste shell will be covered on a daily basis, and has already met with plant staff to ensure this will be carried out at the start of the upcoming season.** Plant Manager, Barry Hatch, will be responsible for working with our employees to ensure regular and suitable coverage of the waste material. This is a temporary solution to an ongoing problem and does not provide an effective long term strategy. The chitosan plant is a safe and proven method for the reduction of waste created from shell fish processing.

There was a lot of discussion over the course of the evening, however most questions and concerns related back to six main issues:

(i) Transport, handling and control of the Hydrochloric Acid

(ii) Control and monitoring of the waste water discharged to the harbour (effluent)

(iii) Water Usage

(iv) Odour from the process

(v) Economic impact on the community

(vi) Other chitosan processing operations

The following pages contain detailed information to help provide you with a better understanding of the process we are proposing, in response to issues raised. Please take your time to read through the material, and if you have any further questions or concerns, please do not hesitate to contact us.

Sincerely,

_____

Pat Quinlan

President

Quinlan Brothers Ltd.

Transport, handling and control of the Hydrochloric Acid

Chitin is produced by alternately soaking waste shell in the chemicals hydrochloric acid (HCl) and sodium hydroxide (NaOH). This is an established process that has been used in North America and Europe for over thirty years. Brian Walsh and Valda AuCoin both had concerns regarding the use of HCL in this process and safety procedures and protocols.

Transport, handling and storage of chemicals (Hazardous Materials) is highly regulated by Transport Canada, Environment Canada and Workers Health and Compensation. Regulations concerning storage devices and employee handling or exposure are covered under legislation such as the Hazardous Products Act, Controlled Products Regulations and the Workplace Hazardous Materials Information System (WHMIS).

Any employees working in the chitosan plant will be required to have HAZMAT and WHIMIS training, and Quinlan Brothers Ltd is required to have a safety and emergency procedures plan in place in the event of exposure to the acid. The concentrated acid will be stored in s secure area, and only accessible by trained designated employees. **Brian suggested the local fire department receive the appropriate HAZMAT training and emergency equipment from Quinlan's. This was a great suggestion and we will start work with the Fire Department to determine their needs and development of an action plan.**

32% concentrated HCl will be shipped from the plant in Montreal to Quinlan's plant by tanker truck, similar to how diesel is brought in. The HCl will be transferred from the tanker by a closed loop system to a storage tank located inside the building. A scrubber cleaning system is used for neutralizing fumes from transfer of the chemical and ensures no acid fumes are vented outside. The on-site storage tank will be constructed of reinforced fibreglass or stainless steel with acid resistant lining and will be completely surrounded by an acid resistant retaining wall, capable of holding the entire contents of the storage tank, meeting federal safety and compliance standards. Once the 32% HCl is on site, the acid will be diluted with water to a concentration of 5% in a separate storage tank for use in the chitin process. At 5% concentration, the acid is classified as an irritant. Again, all acid will be transferred in a closed loop and be taken from the 5% tank as needed for the process. There is no connection of either the 32% or 5% HCL storage tanks to the waste stream of the plant, eliminating the chance of any accidental spill into the harbour.

Valda AuCoin requested further information on the type of truck and shipping of the HCl into the community. Quality Distribution (QDI) is the transport company that will be responsible for the shipping and offloading of the Hydrochloric Acid from the plant in Montreal to Quinlan's facility. They are the largest bulk carrier company in Canada, with a fleet of 7,000 trailers and 3,000 trucks. Quality's core competency is in the transport of chemicals and hazardous materials; they do not handle bulk goods or general shipping. QDI is a publicly traded company, and their reputation is based on safe, reliable and consistent delivery of hazardous materials across the continent. The cargo vessels are specially designed for transport of these types of materials, and QDI ships multiple loads of HCl alone on a daily basis from the supply plant in Montreal. It is not being handled by local trucking companies or inexperienced drivers. In addition to the government regulations that must be met, the company is audited on a regular basis for compliance by both government and independent firms.

Drivers handling the HCL and other hazardous materials are required to have a special license and training. Driver's licenses must be renewed every three years which requires re-training, not just a reissuing of the license. Drivers are responsible for the loading, transport and offloading of the chemical with a zero breech tolerance (no escape of chemical). In addition to government regulated training, Quality Distribution also has its own in-house training program and their drivers are dedicated to chemical shipping only.

Bay de Verde has unique geographic characteristics, specifically the hills leading to the plant, which is the source of some of the concerns raised. **Quinlan's commits to having a discussion and onsite inspection with shipping company representatives to ensure drivers are adequately trained and prepared for entrance into the community.** Further information on the shipping company may be found at www.qualitydistribution.com

Control and monitoring of the waste water discharged to the harbour (effluent)

The mixing of shell with the chemicals occurs in a series of tanks. Water and chemical solutions are re-circulated through the system for reuse, with final waste water and chemical residue pumped to a neutralization holding tank. All waste effluent from the HCL mixing tank, the NaOH mixing tank and the water wash tank is pumped to this neutralization tank through a closed system. There is no other

discharge point for the waste until it reaches the holding tank. The fluids are then held in this tank until they are neutralized and safe to discharge, meeting all environmental standards.
The amount of acid (HCL) or base (NaOH) in the waste liquid is measured by its pH level. A meter to measure pH is located inside the neutralization tank and will monitor neutralization activity. A computer controlled monitoring system will keep track of these pH readings, and add additional acid (HCL) or base (NaOH) as needed to ensure neutralization occurs. **A commitment has been made to the council that the effluent monitoring results will be provided to the town on a regular basis or at an interval that is satisfactory to the town. In addition Quinlan's commits to fully train an individual appointed by council under the same standards as staff. This person will be completely familiar with the system process from start to finish and allow such an individual to monitor process flows at random without any input from Quinlan employees and report on this to council.**

The fluid is considered neutral when it reaches a pH level of approximately 5.5-8.5. The natural phenomena of combining the chemicals HCl and NaOH in the proper quantities is the production of salt water - the neutralized waste water referred to in this process is a salt water. Before being discharged from the holding tank, the waste effluent is also monitored for Total Suspended Solids (TSS) and Total Dissolved Solids (TDS), which ensures there are no particles or solid waste being discharged as well. Unlike the shrimp plant, there is no continual stream of waste water draining into the harbour. Contents of the neutralization tank are released as needed and only once neutralization is at the appropriate level.

Tony Doyle brought forward concerns of accidental release of chemicals into the harbour or problems with the system failing. The closed system design means that all chemicals and waste water are contained in a piping system that does not have drainage into the harbour – all fluids eventually end up in the neutralization tank. If the system fails, whereby the neutralization tank is not operating properly, or waste effluent is not meeting environmental standards for release, the processing activities would be stopped to prevent the build-up of excessive waste water. Waste material can be maintained in the tanks indefinitely to allow repairs to be made to the system. **Quinlan's further commits to the establishment of a safety committee, comprised of members from council, the fire department and company employees. The committee would be fully advised on any safety issues that have or**

may arise. In the event of a safety concern, it would be the committees mandate to finalize the solution, not just the company.

Water Usage

The process does require large amounts of fresh and salt water for its operation. The decision to install a dedicated pipe was made based on Quinlan Brothers projections for additional water needs at the existing shrimp plant and to alleviate low flow and water quality issues experienced with the shared pipe. The engineers designed the new pipeline based on a future projected anticipated flow. Quinlan's current usage is approximately 55 million gallons and our projected total increase from the chitin facility is 15 million gallons.

An increase in consumption provides increases to town revenues with no additional costs. The current water tax of $50,000 would increase by up to 20% annually from the chitin plant alone. For improved environmental and operational savings, part of our ongoing research is to refine water reuse options, and to use salt instead of fresh wherever possible. **The installation of the new line is a great example of cooperation between the company and the town, where needs of both parties were evaluated and met by implementing a solution that was beneficial to all. Quinlan's is interested in continuing this relationship building as we move forward with new and innovative projects in the community.**

Odour from the process

Chitosan is produced through a process of purifying the shell until all that's left is a translucent white material. All odour causing agents are removed through the pre-treatment and chemical processes so what's left to dry is the white flakes that were passed around during the meeting. It is important to know that this is not like a fish meal plant, where the protein itself is being dried. There is no residual smell from the chitin or chitosan flakes and no odour is created through the process. The technology process does not require ventilation stacks or specialty exhaust towers. It is also important to note that workers in the chitosan plant are not required to wear specialty air filtration masks or protective equipment on a daily basis moving about the facility. Protective goggles and clothing are to be worn when handling the solution in the mixing tanks for testing and analysis or conducting visual inspection inside the mixing tanks but not for normal operations.

The issue of odour was brought up by several residents. **The proposed process will not add any further foul smells but will actually reduce the severity of the current odour problems experienced outside the plant.** As mentioned by both Wayne Noonan and Brian Walsh, much of the existing odour is concentrated at the paved lot in front of the shrimp plant. Unloaded shrimp is stored in insulated containers in this area, dispersing shrimp 'juice' and materials onto the parking lot during lifting and transport. During hotter summer months, his spillage dehydrates, rots, and bakes in the sun on the parking lot, creating the odour. The building extension proposed to house the chitosan plant has been sized larger than needed, to accommodate the storage of the fresh raw shrimp inside. This will significantly reduce the smell emanating from that area and help provide improvements to the existing operation. In addition the removal of shell is expected to have a significant reduction in the amount of seabirds in the area, also reducing sources of odour as well as improving food safety for the company.

Economic impact on the community

Bren Doyle was looking for information on any economic impacts this operation would have on the community, while others questioned whether it was worth it for 'only 10' jobs.

Quinlan Brothers has a vested interest in the growth and sustainability of this community. It is integral to the ongoing success and sustainability of the plant, particularly as changes in the fishery place continual strain on both communities and processors across the Province. We are continually investing in new initiatives as part of our effort to expand and diversify our processing capabilities, helping to ensure the plants long term viability. The chitosan plant will further strengthen Quinlan Brothers Bay de Verde operation and its ability for continued success in the community.

10 jobs may not seem like much in a community where there is currently high employment, but they are good jobs, created for the long term, helping to maintain a vibrant community and providing new sources of revenue for the council and residents. These new jobs can be mostly filled from within the area, involves semi-skilled, non-physical work and will create over $150,000 in new wealth. The town will receive direct benefit as new tax dollars are generated from increases in business tax and water tax amounts, and potentially increasing the residential tax base.

Finally, the chitosan facility proposed will be a model for waste shell management and full resource utilization within the fishery. It will draw attention globally from customers looking to purchase the product as well as communities looking to transfer the technology.