Environmental Assessment Information

Shell By-product Drying Facility
Bay de Verde, NL.

Quinlan Brothers Limited
Corporate Office:
Atlantic Place, Suite 302
215 Water St., St. John's,
NL A1C 6C9

Date: July 27, 2015

Contact

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1.0 NAME OF UNDERTAKING:

Shell By-Product Drying Facility
Bay de Verde NL

2.0 PROPONENT:

Quinlan Brothers Ltd.

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

(ii) Mailing Address: Atlantic Place, Suite 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:

Quinlan Brothers Ltd. (QBL) is proposing the development of a shell by-product drying facility in an effort to deal with the vast quantities of shell waste generated from their primary shellfish processing activities in Bay de Verde. Currently, the shell is land filled at a site approved by the Town of Bay de Verde and the Province. QBL recently received notice, however, that the site must be discontinued to align with the Provincial Waste Management Strategy. Quinlan's has invested heavily in waste management research and development over the last five years in an effort to identify a non-disposal means of natural by-product management, dating back to a 2008 application made to the Department of Environment.

The proposed facility will be located on land along the same access road to their existing landfill site in Bay de Verde, pending approval by Crown Lands.

(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 within the province. 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 this shell by-product. This interest is shared by the provincial government as most plants in the province have no option other than waste disposal of the shell. Prohibitively high costs of the shell by-product processing have traditionally discouraged past efforts to utilize this resource. Quinlan Brothers Ltd processing facilities produce over 5 million pounds of shrimp and crab shell byproduct waste each year alone.

There are various by-products that can be extracted from the shell including oils, proteins and chitin. Recognizing the global market opportunities for these value-added products, Quinlan Brothers has been working aggressively over the past five years to assemble a development plan and secure access to

market that will allow the maximum gains needed to capitalize on the market potential while resolving a waste disposal dilemma.

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, followed by an amended application in 2011 for a change of location, registration number 1577. Unfortunately, due to supply economic factors, the project was withdrawn. Since that time QBL has continued its research and through 2013/2014 engaged in a large scale shell utilization pilot project for the extraction of value added substances. Shell was frozen and shipped off island to advanced processing facilities via reefer truck. While manageable for short term testing, the cost of this process is prohibitive for full scale implementation. It was determined that a drying process is critical to any viable business model that is based on value add of the shell by-product and shipments off island.

4.0 DESCRIPTION OF THE UNDERTAKING:

(i) Geographical Location:

The site selected for the construction of the proposed drying facility is near Quinlan Brothers existing waste disposal site in Bay de Verde. The general area is removed from residential construction and was originally used as the waste disposal site for the Town of Bay de Verde. Currently, all shell collected from Quinlan's plant is already transported to the area for disposal via landfill.

The proposed site is located approximately 600 meters off Main Road, Bay de Verde, opposite side of the road between the two intersections for Broom Cove Road. The land falls under Crown Lands and application is being made to acquire the property pending environmental approval. The site measurements approximately 244x69 meters and is bordered by access roads to the North and East and Crown Land for the remainder. The nearest body of water to the proposed land site border is a small pond/gully approximately 85 meters to the South, with a larger body of water, Clear Pond, 240 meters to the South East.

The route of access is an existing gravel road that provides access to both the Quinlan Brothers current land fill site and a gravel quarry site. The road is privately maintained by its users. As usage is primarily required April through October, road maintenance is minimal with no snow clearing requirements.

Please refer to the attached map and diagrams in Appendix A for site location.

(ii) Physical Features:

The undertaking will require construction of a new building on the proposed site to house the necessary drying equipment, provide storage of finished product and access by transport truck for outgoing shipments. The approximate footprint of the building itself will be 60m long by 30m wide (1,800m^2) with a height of 4 m and a 5 m chimney from the building top for steam exhaust. The facility will include a material receiving area, drying room, sieve and packaging area. A portion of space will be used for limited storage of finished product in a dry powder form, however product will typically be loaded into containers on a load and go basis. Additional space around the building is required for finished product container storage and transport truck accessibility.

There will be minimal requirement for storage of raw material as the shell product will be processed as received. A quality product is dependent on a fresh shell with minimal degradation due to decomposition. The drying equipment has been specified to process the volume of shell as produced on a daily basis at the primary processing plant's maximum capacity. Should a buffer be required, the shell can be stabilized to maintain freshness by utilizing chill storage tubs.

The facility will require a minimal supply of potable water, used primarily for facility equipment wash down and standard office functionality purposes. Accordingly, waste discharge requirements are also minimal, required for grey water and standard sewage. No pre-treatments or chemicals are required for the proposed process. As the town public water and sewer system does not service this area; required water and sewer disposal can be met by drilling of an artesian well and installation of a septic system, similar to residences located along the Main Road area.

A new electrical service transmission line will be required to service the new facility. Electrical requirement at peak load is 915 kw; Newfoundland Power has confirmed that existing infrastructure within the area has capacity to support the requested 1.2 MW service line that will be needed from the Main Rd into the new site.

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

(iii) Construction:

It is anticipated that construction of the facility will begin late Fall 2015 according to the proposed construction schedule for the facility as given below. Detailed design and layout requirements will be developed in tandem with the submission and review of the Environmental Assessment as the building is primarily a shell with limited interior structures requiring minimal engineering design. The drying equipment has been specified with suitable manufacturers identified however ordering of the equipment will be pending Environmental approval. The new construction will meet current construction code regulations and Health and Safety, WHIMIS, and HAZMAT criteria as required. No sources of pollutants are expected during this construction phase, aside from those typically produced during construction.

Construction Schedule

Building Construction	Fall 2015
Equipment Delivery	February 2016
Installation Completion	March 2016
Commissioning	March 2016
Pilot Production Start	April 2016

(iv) Operation:

Process Description

While the drying process is a new development, the delivery of waste to the proposed facility is an extension of regular operating processes at the primary plant in Bay de Verde. Currently, as shrimp are

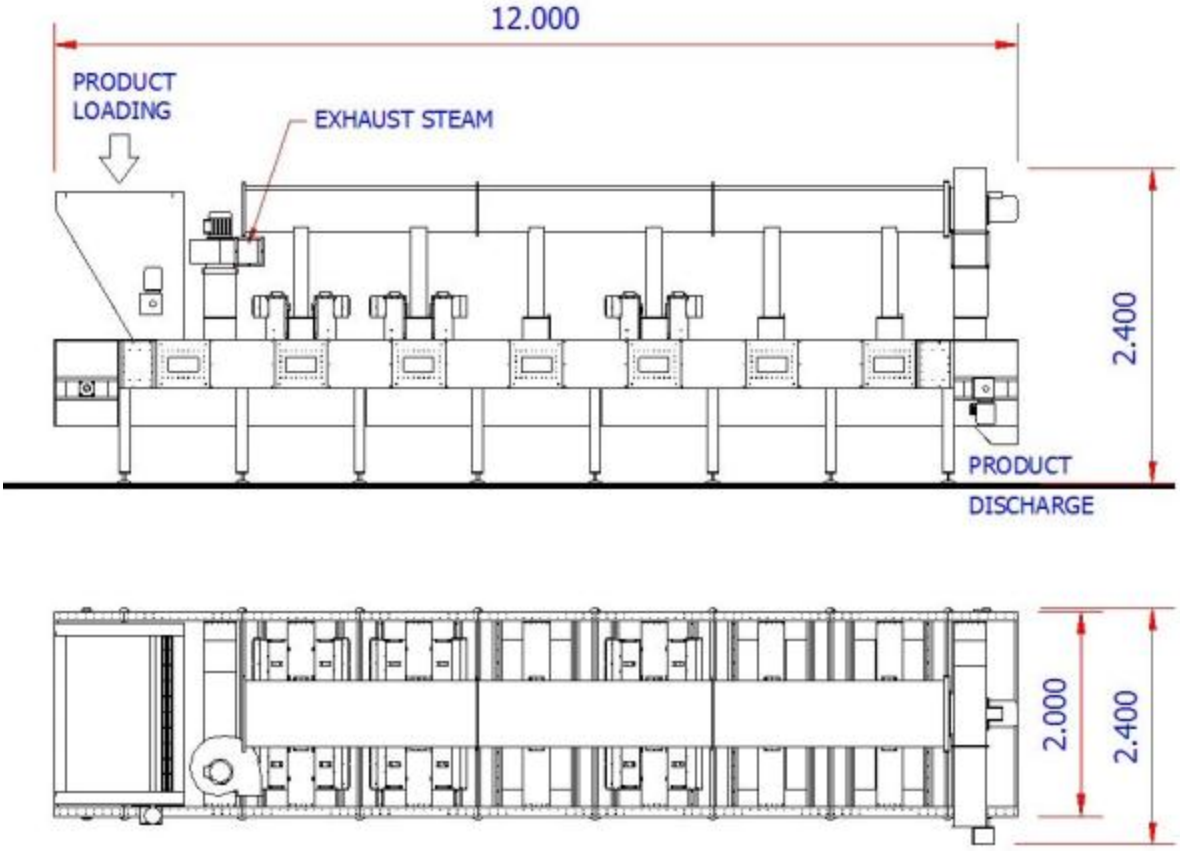
peeled and crab butchered, the waste shell is flumed to a collection area, drained of excess water and stored for transport to the current waste land fill site on a load and go basis.

Instead of delivering the shell to the landfill site, the shell will now be brought to the drying facility located in the same geographic area. Based on current operational conditions, the estimated number of truck arrivals per day is one to four trips per 24 hour period, depending on time of season and primary plant activity. This is the same level of traffic currently experienced from the plant.

Upon delivery to the drying facility:

1. raw material will be poured from containers into a feeder system which will feed even amounts of product into the product loading unit. Any additional water run off due to product settling during transport can be managed by the septic waste system.
2. Product loading then feeds material into a continuous drying tunnel which uses microwave technology for quick drying, with a hopper feeding system and belt conveyor for product handling. Refer to the Diagram below. The shell product is heated by the electromagnetic field generated by microwaves inside the treatment chamber with the temperature of the product controlled by infrared pyrometers that regulate the power of the microwave according to the operator's setup.
3. Extracted moisture will be exhausted via a fan aspirator running across the top surface of the tunnel and expulsed out in the exhaust steam directly to the chimney.
4. Dried product is discharged at end of drying unit into a filter where product is sorted by grain size. Large grains are packed into 200kg bales while small-grain product is packed in 50 kg bales and each loaded directly into onsite containers for transport.

Conveyor Drying Unit design



Period of Operation

The drying plant will operate one or two shifts per day (day shift/night shift), corresponding to the crab and shrimp production schedules at the primary processing facility, for approximately seven months of the year running from April to October.

Airborne Emissions, Effluent, Potable Water

As previously noted, fresh water requirements are limited to potable water for staff use and regular cleaning (wash down) of plant. Liquid outflows will also be limited, primarily composed of grey water as produced from the indicated wash down/staff use and limited additional drainage from the shell as it is off-loaded into the feeding system.

Moisture removed from shells during the microwave drying process will be via evaporation and exhausted as steam through a 5m chimney from top of the building. An industry standard charcoal

scrubbing system may be used to further reduce air emissions if required. It is estimated that 4,300-8,100 L of water will be evaporated from the production of the dried shell over a twenty four hour period.

Odour from the exhaust will be very limited, much less than that of a shrimp peeling plant as the fresh cooked shell has been stabilized and the continual drying process will limit further degradation which would negatively impact odour. Refer to documentation in Appendix B regarding "Odor formation during shrimp processing and shell drying". Air emissions produced are over-estimated at an Odour Dissipation Radius of 500m. Under normal circumstances the odour will dissipate within 250-300m from the facility. The targeted site is located 640 m from the Main Road, with no residential buildings located within a similar radius of the proposed site.

No hazardous chemicals or materials will be used in the plant. The only material going through the plant and used for production will be waste shell and water.

The project will draw on the approximate 5 million pounds of crab and shrimp shell generated from Quinlan's Bay de Verde processing plant. Equipment capacity can be scaled to accommodate additional shell waste from nearby plants to further reduce shell waste disposal, typically accommodated by dumping at sea.

(iv) Wildlife Management

The waste shell will be shipped in covered truck or container tubs, and upon receipt at the drying facility will be unloaded indoors directly into the product loading system. This will minimize the impact on or interference by wildlife in the area.

(vi) Occupations

It is anticipated that upon full production two full time equivalents and one part time will be required to operate the facility. Full time employees will be operational staff for the drying and packaging process while the part time resource will be a trained quality control technician that will be required periodically through the shift to check moisture/dryness levels and other operational criteria. This

resource will be sourced from the pool of qualified Quality Control personnel at Quinlan Brothers seafood processing facility in Bay de Verde. Quinlan's existing dedicated Health and Safety officer will be responsible for all training and documentation requirements of the new facility.

Neither of the positions identified are classified as a Hazardous Occupation according to the National Occupational Classification 2006.

(vii) Project Related Documents

No other project related documents have been produced for this project

7.0 APPROVAL OF THE UNDERTAKING:

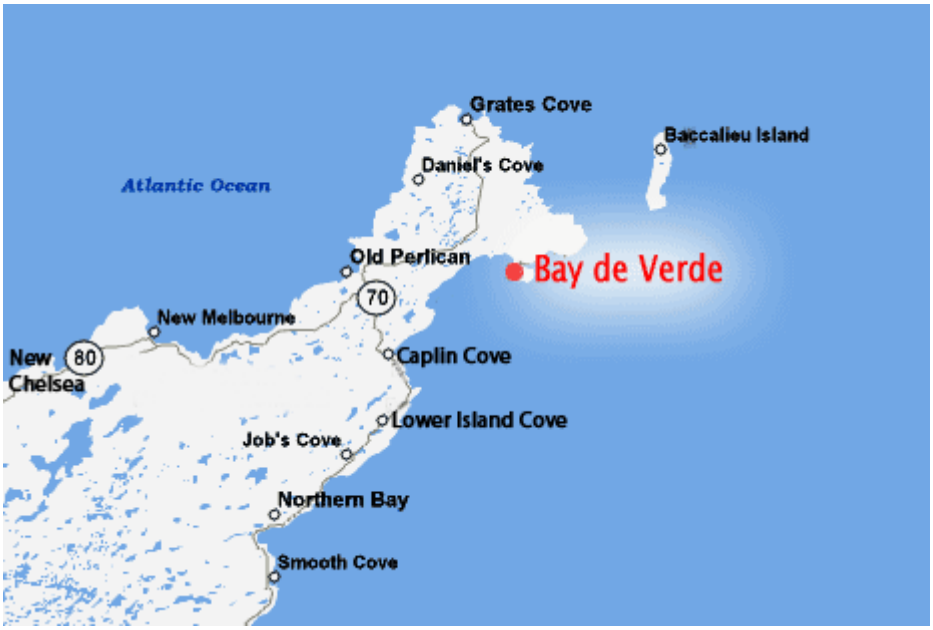
Permits, licenses, approvals and authorizations will be required from the following:

- Development Permit, Town of Bay de Verde Municipal Council
- Government Services, Septic system approval
- Crown Lands, approval to purchase land

8.0 FUNDING:

The project is not subject to funding approval from any government department of agency. Approximate investment required is three million dollars.

Appendix A: Aerial Photo and Map of Proposed Location


Grates Cove
Baccalieu Island
Daniel's Cove
Atlantic Ocean
Old Perlican
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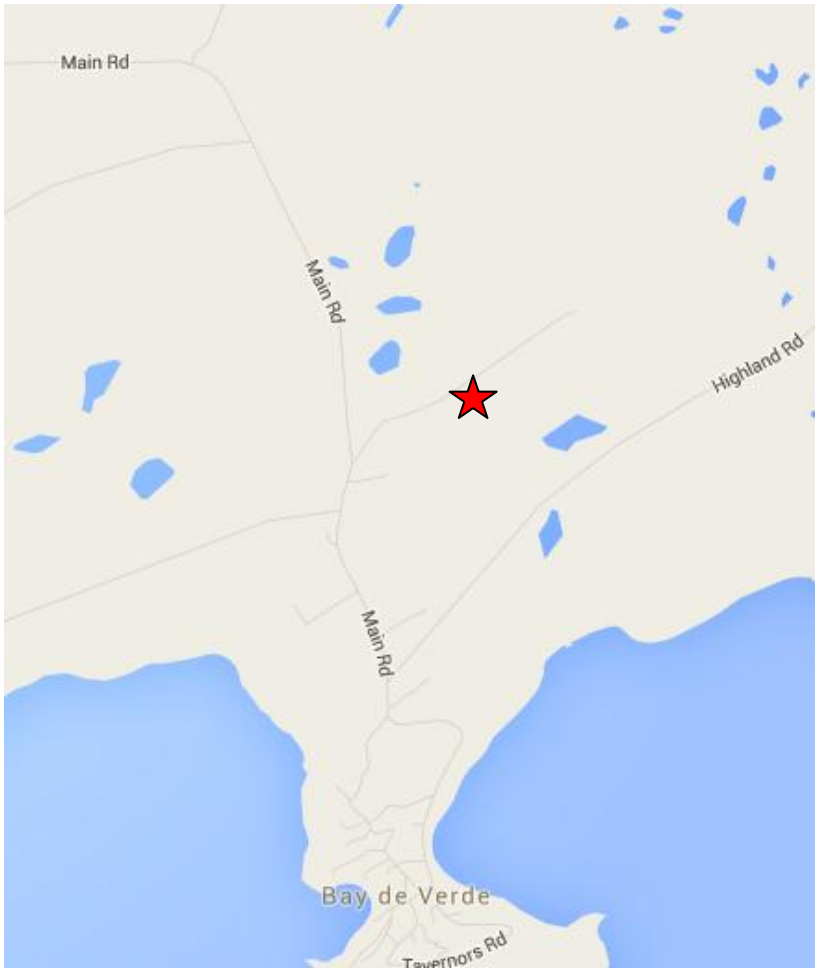
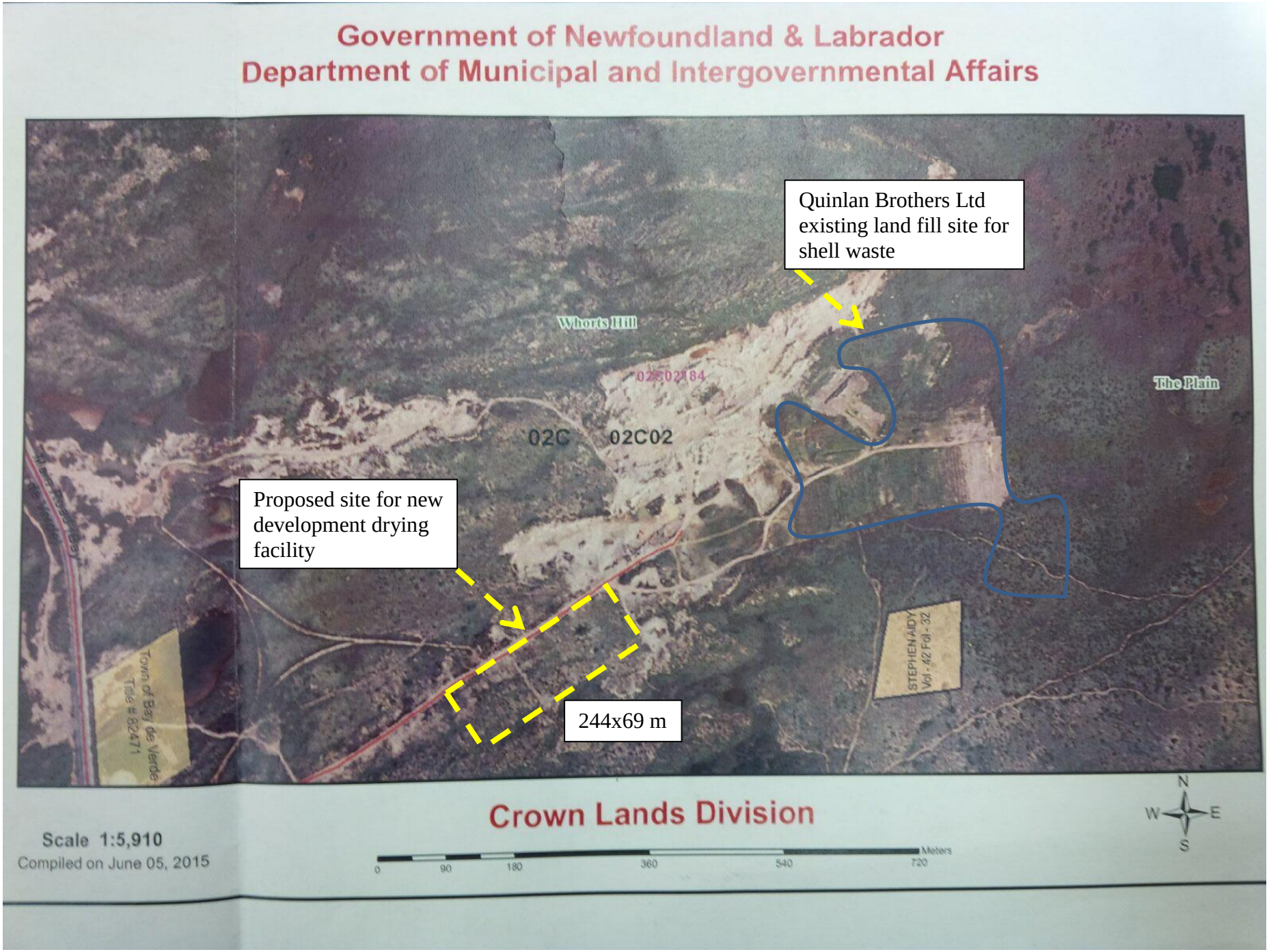
New Melbourne
New
80
Chelsea
Caplin Cove
Lower Island Cove
Job's Cove
Northern Bay
Smooth Cove


Bay de Verde


Main Rd
Main Rd
Highland Rd
Main Rd
Bay de Verde


Government of Newfoundland & Labrador
Department of Municipal and Intergovernmental Affairs
Quinlan Brothers Ltd existing land fill site for shell waste
Whorts Hill
02C02184
The Plain
02C
02C02
Proposed site for new development drying facility
244x69 m
Town of Bay de Verde Title # 82471
STEPHEN ADY Vol - 42 Fol - 32
Crown Lands Division
Scale 1:5,910
Compiled on June 05, 2015
0 90 180 360 540 720 Meters
N
W
E
S

Appendix B: Odor formation during shrimp processing and shell drying

Odor formation during shrimp processing and shell drying

Storage of iced whole shrimp over time will lead to the development of volatile compounds. Post mortem trimethylamine oxide (TMAO) in marine animals is reduced to trimethylamine (TMA), and the degradation of proteins and free amino acids causes an increase in the ammonia (NH_3) content. During ice storage NH_3 and TMA usually make up the major part of the total content of volatile nitrogen bases (TVN) forming during the degradation process. A content of TVN of approximately 50 mg/100 g peeled shrimp and a content of TMA-N of approximately 10 mg/100 g peeled shrimp probably represent such an objective lower limit if a comparison with organoleptic assessment is made. Assuming suitable storage conditions, this corresponds to a maximum period of 7 days (Nesbakken and Solberg 1981-I).
During automatic boiling, peeling and rinsing processes in shrimp factories, some of these water-soluble and volatile compounds will be extracted by the boiling water and evaporated. Nesbakken and Solberg (1981-II) estimated that about 50% of the contents of TMAO-N, TMA-N and TVN was lost from *Pandalus borealis* during automatic processing (boiling, peeling and rinsing). Indeed it has been demonstrated that ammonia concentration in cooked pink shrimp is lesser than raw shrimp as storage time increases (http://nsgl.gso.uri.edu/flsgp/flsgpr98015.pdf). This suggests that much lesser volatiles should result from further heating of newly peeled shell. Moreover, a rapid and mild heating technology, such as microwave drying, should contribute to a better maintenance of shell quality and a reduced formation of off-odors.

Microwave heating of foods is attractive due to its volumetric origin, rapid increase in temperature, controllable heat deposition, and the easy clean-up opportunities. Recently, microwaves have been used to heat foods in commercial pasteurization and sterilization applications to enhance microbial destruction and promote better product quality. Some European and Japanese food processing companies have utilized the technology for commercial pasteurization and sterilization of foods. Microwave heating is preferred for pasteurization and sterilization over the conventional heating for the basic reason that the process is fast and requires minimum come-up time (CUT) to the desired process temperature. Microwave heating has the advantage to overcome the limitation imposed by the slow thermal diffusion process of conventional heating. The volumetric heat generated by microwaves can significantly reduce the total heating time and severity at the elevated temperatures needed for commercial sterilization, whereby bacterial destruction is enhanced, but thermal degradation of the desired components is reduced (Ahmed & Ramaswamy 2007).

Handbook of Food Preservation, Second Edition
Edited by M . Shafiur Rahman
CRC Press 2007
Print ISBN: 978-1-57444-606-7
Chapter 28 - Microwave Pasteurization and Sterilization of Foods, by Jasim Ahmed and Hosahalli S. Ramaswamy

Nord Vet Med. 1981 Apr-May;33(4-5):250-9.

[Quality changes in iced shrimps (*Pandalus borealis*). I. Changes in the contents of trimethylamine oxide and volatile nitrogen bases and bacteria in raw shrimps after different storage periods compared with organoleptic examinations

[Article in Danish] Nesbakken T, Solberg T.

Abstract

On the basis of two experiments on the storage of raw shrimps (Pandalus borealis) in ice and on samples taken out from different trawlers after different days at sea, we have attempted to find the criteria of choice for the lower limit of quality of raw shrimps which are meant for further processing for human consumption. A content of TVN of approximately 50 mg/100 g peeled shrimp and a content of TMA-N of approximately 10 mg/100 g peeled shrimp probably represent such an objective lower limit if a comparison with organoleptic assessment is made. Assuming suitable storage conditions, this corresponds to a maximum period of 7 days. In this paper we have also attempted to find the content of TMAO in fresh raw shrimps from different fishing grounds in the Barents sea and off the Eastern coast of Greenland. The content of TMA-N was found to vary from 166 to 211 mg/100 g peeled shrimp.

Nord Vet Med. 1981 Apr-May;33(4-5):260-8.

[Quality changes in iced shrimps (*Pandalus borealis*). II Changes in the contents of trimethylamine oxide and volatile nitrogen bases during automatic boiling and peeling

[Article in Danish] Solberg T, Nesbakken T.

Abstract

Post mortem trimethylamine oxide (TMAO) in marine animals is reduced to trimethylamine (TMA), and the degradation of proteins causes an increase in the ammonia (NH3) content. During ice-storage NH3 and TMA usually make up the major part of the total content of volatile nitrogen bases (TVN) which are formed during the degradation process. The formation of TMA and NH3 is probably caused mainly by bacterial enzymes. The contents of TMA and TVN in marine fish and shrimps are important objective criteria in supporting organoleptic examinations of such raw materials. During automatic boiling, peeling and rinsing processes in shrimp factories, some of these water-soluble and volatile compounds will be extracted by the boiling water and possibly evaporated. In this investigation we have attempted to estimate the loss of TMAO, TMA and TVN in shrimp muscle during this automatic processing. The investigation includes experiments in the laboratory (Table I, Figure 1) and in two factories (Table II-III, Figure 2-3). The results show that about 50% of the contents of TMAO-N, TMA-N and TVN probably will be lost from the shrimps during automatic processing. Adding approximately 100% TMA-N and TVN to the analysed contents in boiled, peeled and rinsed shrimps will therefore probably give the same level of these compounds as that found in the raw shrimps used. An accurate measurement of the TMA- and TVN-content in shrimp produced under known condition in North-Norwegian shrimps factories could give an objective indication of the quality of the raw shrimps used. In accordance with Norwegian shrimp regulations, only the fresh, healthy shrimps are allowed to be produced.

Xx
Xx