

# **Woodfibre LNG – Wrong Location:**

**Woodfibre LNG fails all of SIGTTO's internationally accepted industry standards for the safe siting of LNG terminals**

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This paper advances the argument that the Woodfibre site on BC's Howe Sounds is not now and can never be a safe location to construct an LNG export terminal despite what the proponent, Woodfibre LNG alleges. Further, the potential disruption to other marine traffic, commercial and recreational, is too disruptive with too great an adverse economic impact on the communities within Howe Sound to permit.

Both the federal and provincial governments have invested considerable political capital responding to the industry push for substantial LNG exports from BC's coast to offshore markets. The respective federal and provincial politicians are keen to be seen to deliver on their pronouncements as quickly as possible and their electoral imperatives run the risk of producing hasty and ill-conceived decisions. Alongside this governmental/industry push there is a parallel, growing debate over the wisdom of ramping up fossil fuel consumption and exports, inclusive of LNG - Liquefied Natural Gas - as opposed to placing greater emphasis on the development of renewable energy technologies and how and to what extent fossil fuel consumption is contributing to climate change and its effects.

Regardless of where one comes down on the issues of fossil fuel exports, climate change and related issues, when one examines the specific site of Woodfibre as a potential location for an LNG terminal, in the light of internationally accepted LNG industry standards for the safe siting of LNG terminals, one must come to the conclusion that Woodfibre is not a safe site to build such a terminal.

SIGTTO – the Society of International Gas Tanker and Terminal Operators is the defacto global authority on the safe transport of LNG. SIGTTO is the industry association representing virtually all state owned and private sector LNG shippers around the world. Their LNG terminal siting standards are founded on fifty years of relatively accident free LNG shipping. Neither Canada nor British Columbia have detailed standards with respect to the safe siting of LNG terminals and would do well to heed the collective wisdom of SIGTTO with respect to terminal siting.

Building an LNG terminal at Woodfibre entails too much risk to human life and the immediate environment of and too disruptive to other marine traffic within Howe Sound due a number of key factors that run afoul of internationally accepted LNG industry siting standards:

- LNG terminal and tanker safety standards demand 3,500 metre Hazard Zones within which other marine traffic and human habitation represent potentially catastrophic ignition sources in the event of a breach in the LNG containment vessels either at the terminal or enroute to and from the terminal.
- Woodfibre is located up a long and relatively narrow busy shipping and recreational boating channel and crosses three BC Ferries routes out of Horseshoe Bay. LNG tanker movements represent disruptions to other marine traffic and could restrict the long-term development of the Port of Squamish.
- Woodfibre is located on the west shore and on an outside of the curve of the Howe Sound shipping channel around Watts Point on the opposite shore. The outside curve location places the terminal and loading LNG tankers at the terminal at greater risk of being accidentally struck by a passing ship that could breach the LNG containment system sparking a catastrophic incident. Placing an LNG terminal on the outside curve of a shipping channel violates one of the most critical SIGTTO safe siting standards.

We will discuss these issues in greater detail later.

### **Howe Sound – a primer**

Until 2006 Woodfibre was the site of an operating pulp mill. The Port and City of Squamish sit at the north end of Howe Sound approximately 6 km north east of Woodfibre, which in turn is approximately 40 km up the Howe Sound fiord from Point Atkinson in West Vancouver.

Howe Sound is a hub of year around marine activity, commercial and recreational as well as being home to three BC Ferries' routes from Horseshoe Bay to Langdale on the Sunshine Coast, Bowen Island and the TransCanada Highway connector to Nanaimo on Vancouver Island. There are residential and commercial properties up and down both shores of Howe Sound and on the islands within the Sound in into West Vancouver. The Sea-to-sky Highway to Squamish and Whistler runs along and above the east shore of Howe Sound.

The navigation channel is winding and relatively narrow, averaging 3 km in width for most of the passage to Squamish, with a number of considerably narrower pinch points along the way. That puts the centerline of the navigation channel just 1,500 m from the shore lines, less at the pinch points. While not a problem for smaller craft or medium sized freighters the channel is much more problematic for the Suezmax class, close to 300 metre long LNG tankers which are proposed to service the LNG terminal.

The Port of Squamish is serviced by a variety of large commercial shippers with vessels upwards of 90,000+ tones displacement, registered around the world. The Port of Squamish is also serviced by CN Rail (formerly BC Rail) giving it rail access to

the interior of British Columbia. It plays a vital role in British Columbia's marine export and import trade.

### **Woodfibre LNG**

Woodfibre LNG, the proponent applying to build the LNG facility at Woodfibre is a subsidiary of Pacific Oil and Gas, which is in turn owned by Royal Golden Eagle (formerly Raja Garuda Mas), the holding company owned by Indonesian billionaire Sukanto Tanoto. The company has no prior expertise in building or operating LNG facilities anywhere. Tanoto has a chequered past. In 2012 he was fined \$200 million US\$ as a result of a conviction for tax evasion. His companies are known to flout government regulations. Tanoto is infamous in Indonesia for rainforest destruction and illegally expanding his forestry and oil palm plantations into parks and community lands. Tanoto has not been shy in the past to use his considerable wealth to hire banks of lawyers to silence his critics.

Woodfibre LNG is not a member company of SIGTTO.

Woodfibre LNG President Anthony Gelotti does have extensive experience in the global LNG industry, having worked for Chevron, Shell, BG LNG and ExxonMobil, all of which are members of SIGTTO. It is unlikely Gelotti is unfamiliar with SIGTTO's LNG terminal siting standards.

Woodfibre LNG Vice-President Byng Giraud, was formerly a Vice-President of Imperial Metals, which owns the Mount Polley mine in BC's Cariboo, whose tailings containment dam burst in August of 2014 due to poor dam design. Giraud says Woodfibre LNG will follow the rules, regulations and conditions required of them. He is also on record as saying "There needs to be a public realization that the costs imposed on industry to remove extreme risks – reducing a risk from one in 1,000 to one in 10,000 – comes with a price." (Who's who behind Woodfibre LNG? Margot Grant)

Woodfibre LNG has identified two possible LNG tanker routes within Howe Sound: Route A, the current standard route from Point Atkinson passing to the east of Bowen Island and following the main channel to Woodfibre, and Route B via Thornborough Channel on the west side of Gambier Island and out between Keats and Bowen Islands into the Salish Sea. Route B is considerably narrower and more winding than Route A. The company currently says it only plans to use Route A based on their initially applied for terminal capacity. However recent company statements suggest that the initial capacity may well be substantially expanded at a later date, in which case the frequency of LNG tanker traffic could increase significantly well beyond their initially stated plans. In which case the attendant risks and inconvenience to other marine traffic and human habitation would increase commensurately.

LNG tankers are required to maintain separation distances between themselves and other vessels as those other vessels constitute a potential ignition source that could spark an LNG fire in the event of an LNG leak or spill. The global LNG industry standard for that separation distance or Hazard Zone is 3,500 m while US Coast Guard experts suggest 4,800 m may be more prudent. Given that the Howe Sound navigation channel varies from 2000 to 3000 m wide for much of the passage, the Hazard Zone for an LNG tanker transiting the centre of the channel will encompass much of the Sea-to-sky Highway, virtually all of the beaches and much of the residential and commercial properties overlooking the channel. The potential ignition sources are innumerable and totally uncontrollable.

Woodfibre LNG says that the Suezmax class tankers will transit Howe Sound at 10 knots/hr or 18.5 km/hr. Given that Woodfibre is about 40 km up the sound from Point Atkinson, it will take a little over 2 hours for an LNG tanker to complete the transit from Woodfibre to clear Point Atkinson and enter into the Salish Sea where separation distances are more easily maintained. Those LNG tanker transits will delay other marine traffic in Howe Sound in order to maintain separation distances.

Depending on the specific LNG terminal loading equipment installed and the specific loading capacity of the Suezmax tankers loading at Woodfibre it will take many hours to fill to the LNG tanker to capacity. LNG tankers loading at the terminal are at their most vulnerable while loading and the need for extreme caution may result in significant disruption to other marine traffic seeking the pass by Woodfibre in order to restrict potential ignition sources in the event of an accident.

Woodfibre is a large salt-water industrial site with existing infrastructure servicing or at close proximity to the site. From the perspective of Woodfibre LNG the development costs are therefore lower than would be the case were a safer and more remote location to be chosen for their LNG terminal. It should be noted that for reasons of safety, limiting disruption to other marine traffic and protection of the considerable capital investment that an LNG terminal represents, the vast majority of global LNG terminals are located remotely from human habitation and with open ocean access.

## **Global LNG Safety and Woodfibre LNG**

The Woodfibre LNG corporate website makes reference to the global LNG industry's "excellent safety record" and goes on to say that "Woodfibre LNG will not make any compromises when it comes to safety". What it doesn't say is that it intends to consciously ignore the very safety standards that have been responsible for that global safety record.

The global LNG industry has experienced very few accidents affecting civilian populations beyond the confines of their industrial locations, due mostly to companies adhering to the accepted industry standards. Unfortunately, there have been significant accidents within and around LNG facilities, many with substantial

fatalities and injuries for the workforces involved. Design and operational procedures are always being improved.

LNG is super-cooled to -160 degrees C in order to liquefy it and reduce its storage volume by 600 times compared to its gaseous state. LNG is stored and shipped in double-walled, heavily insulated containers made of specialized materials at normal atmospheric pressure. The cryogenic temperature of LNG demands intensive monitoring and control to ensure that internal pressures caused by excess fuel vaporization within the containment vessels are safely controlled.

The global LNG industry is quick to point out that LNG is neither flammable nor explosive in its contained, liquefied form as there is insufficient oxygen available to support combustion. They are correct. So long as the LNG is properly contained there are limited risks. However, in the event of a leak or breach of the containment system, caused by an accident, equipment malfunction, human error or a deliberate act of sabotage or terrorism, the released LNG immediately begins to warm, re-gasify, evaporating and mixing into the surrounding air mass, which does contain the oxygen necessary for combustion. The evaporating LNG can form a whitish cloud, which can drift with the breeze to points well beyond the source of the breach. If an ignition source is present the gas cloud could ignite, producing intense fire and burn back to the source of the breach. Accidents can and do happen and when they do, the possibility of a catastrophic event presents itself.

The Woodfibre LNG corporate website suggests that it will adhere to *“established safe distances from the facility and carriers away from communities, ships and recreational users, as determined by Transport Canada’s Technical Review Process of Marine Terminal Systems and Transshipment Sites, known as TERMPOL”*. In doing so it implies that TERMPOL is a regulatory body ensuring public safety. This is simply not the case. TERMPOL is a voluntary governmental process to encourage proponents to outline their plans and consider state of the art safety measures in its siting, facility design and manner of operation. It has no established standards whatsoever. Participation in the process is non-mandatory and TERMPOL has absolutely no legislated enforcement mechanisms to ensure corporate compliance with their non-existent standards.

Woodfibre LNG’s website, shows the company is clearly aware of the legitimacy of public concerns over siting an LNG facility in close proximity to populated areas. They make the following statement: *“There are many LNG facilities around the world that operate safely adjacent to or within existing urban areas such as: Fortis BC’s Tilbury LNG plant in Delta, the Everett Marine Terminal near Boston, Barcelona LNG in Barcelona, and the Shanghai LNG terminal in Shanghai.”*

All four are cited as examples to assuage public concern by suggesting that if those four can operate in close proximity to population centres, then why shouldn’t Woodfibre LNG be allowed to do the same.

There are about 140 LNG terminals around the world, almost all of which are constructed at substantive distance from population centres at locations allowing open ocean access. Citing the four locations, three of which do not parallel the Woodfibre siting problems, does little to support Woodfibre LNG's arguments or assuage public concerns.

The Fortis LNG facility on Tilbury Island in Delta on the Fraser River produces LNG for the local transportation industry. It is small by global standards and is not designed to fill Suezmax tankers or anything close to that size coming up the river. It is located on the inside curve of the shipping channel in a river with a considerable rate of flow. As such, a disabled ship that might otherwise become a battering ram, putting the LNG terminal or a ship at the terminal as risk will tend to be carried away from the terminal by the natural flow of the current to the outside of the curve of the river thereby reducing the risk of a catastrophic event occurring.

The Barcelona LNG facility is actually sited well down the open coastline from Barcelona. The Shanghai LNG facility is located on Zhong Ximentang Island, at distance from Shanghai. Both terminals have open ocean approaches, which minimize conflicts and potential collisions with other marine traffic.

Only the 40 old Everett Marine LNG terminal, on the Mystic River near Boston comes close to paralleling the problems of the Woodfibre location, that is, it is located down a narrow channel, with innumerable surrounding potential ignition sources and with substantive impacts on other marine traffic. Since 9/11 the US Coast Guard has taken to providing security escorts for each and every LNG tanker transit in and out of Everett Marine. It is doubtful that the Everett Marine location would be considered an appropriate location for new construction of an LNG terminal in 2015.

Woodfibre LNG's website states that in the event their proposed LNG terminal is allowed to go ahead *"An incident response process would be in place for all aspects of the Woodfibre LNG facility and vessel shipping. These emergency response procedures are regulated under the BC Oil and Gas Commission, the provincial and federal environmental assessment processes and by individual provincial and federal regulators for the protection and safety of the general public, employees and the environment."* The reference to the BC Oil and Gas Commission and provincial and federal regulators is intended to assuage the reader that there are comprehensive government regulations and oversight mechanisms in place to ensure all aspects of LNG safety, including where to place an LNG terminal. This is not the case.

The concept of exporting LNG from Canada and British Columbia is relatively new. As a consequence both the Government of British Columbia and the Government of Canada have limited expertise about where LNG terminals should be allowed.

As previously stated, Woodfibre LNG and its parent corporations have no prior experience in building and/or operating an LNG terminal.

So if the Governments of BC and Canada and Woodfibre LNG all lack the experience to evaluate the safe criteria for siting of LNG terminals, who does? The answer, it turns out, is the global LNG industry itself.

### **SIGTTO: the defacto global authority on LNG terminal siting standards**

#### **Welcome to SIGTTO**

*The Society of International Gas Tanker and Terminal Operators (SIGTTO) was formed as an international organization through which all industry participants might share experiences, address common problems and derive agreed criteria for best practices and acceptable standards.*

*From SIGTTO's website: <http://www.sigtto.org>*

SIGTTO – the Society of International Gas Tanker and Terminal Operators is the defacto global authority on the safe transport of LNG from terminal to ship to terminal. It's almost 180 members include virtually all of the world's major private and public sector gas companies and shippers such as: Abu Dhabi Gas, Angola LNG, China LNG, Chevron, Dubai Gas, Esso, Gazprom, Kinder Morgan, Saudi Arabian Oil, Shell, Total and the list goes on. [The full SIGTTO membership list can be viewed at <http://www.sigtto.org/sigtto/members> ]

The SIGTTO membership represents 50 years of global experience in shipping LNG. They are acutely aware of the inherent dangers in storing and transporting LNG and have developed safety guidelines to minimize the risks to people, the environment and the physical LNG infrastructure itself. There have been relatively few serious industrial accidents among the SIGTTO membership over the years. This attests to the importance of adhering to their well-conceived safety standards. SIGTTO's adherence to their Siting Standards is not the product of altruism; rather it is borne of a hardnosed business assessment. SIGTTO is acutely aware that when LNG accidents do happen, the consequences can be devastating. SIGTTO knows that the social license they have earned and require for continuing operation can evaporate in an instant following a catastrophic accident.

Unfortunately, not all corporations are as committed to safety as SIGTTO members would wish. Here's what SIGTTO had to say about "LNG speculators" in their March 26, 2008 White Paper on LNG safety:

#### ***LNG Industry Wisdom***

*It dismays LNG speculators and their supporters when it is pointed out that their projects violate the industry's own standards. They argue that the LNG industry has a good safety record, and that the risks to the public are minimal.*

*As SIGTTO points out, that good history is the result of research and establishing standards and best practices. By following those standards, the LNG industry continues to operate in the most safe manner possible. By violating those standards, the health of the entire industry is threatened. If an LNG tragedy were to kill civilians, it would likely result in the complete shutdown of the industry. Like falling dominoes, that would lead to energy security failure, and a weakened economy.*

[http://www.savepassamaquoddybay.org/lngtss/documents/whitepapers/2008mar26\\_states\\_trump\\_ferc.html](http://www.savepassamaquoddybay.org/lngtss/documents/whitepapers/2008mar26_states_trump_ferc.html)

Here are SIGTTO's LNG Terminal Siting Standards. It is their position that these standards should be considered the minimum standards acceptable, not the maximum.

<http://www.quoddyloop.com/lngtss/standards.html>

## **SIGTTO LNG Terminal Siting Standards Abbreviated Summary**

**The LNG industry has a good safety record. Any LNG catastrophe could destroy public confidence in the industry, ending the import of LNG.**

**Observing the industry's best practices and standards helps to preserve safety, public confidence, the industry, energy security, and the economy.**

- 1 There is no acceptable probability for a catastrophic LNG release [<sup>1</sup>];
- 2 LNG ports must be located where LNG vapors from a spill or release cannot affect civilians [<sup>2</sup>];
- 3 LNG ship berths must be far from the ship transit fairway;
  - 1 To prevent collision or allision [<sup>3</sup>] from other vessels;
  - 2 To prevent surging and ranging along the LNG pier and jetty that may cause the berthed ship to break its moorings and/or LNG connection;
  - 3 Since all other vessels must be considered an ignition source;
- 4 LNG ports must be located where they do not conflict with other waterway uses [<sup>4</sup>] — now and into the future. [This requires long-range planning for the entire port area prior to committing to a terminal location];
- 5 Long, narrow inland waterways are to be avoided, due to greater navigation risk;
- 6 Waterways containing navigation hazards are to be avoided as LNG



- ports;
- 7 LNG ports must not be located on the outside curve in the waterway, since other transiting vessels would at some time during their transits be headed directly at the berthed LNG ship;
- 8 Human error potential always exists, so it must be taken into consideration when selecting and designing an LNG port.

>> Additional items exist in the standard than are summarized here. Please refer to "[Site Selection and Design for LNG Ports and Jetties.](#)"

<sup>1</sup> While risk of small LNG spills is acceptable, any risk of catastrophic LNG release is unacceptable.

<sup>2</sup> Sandia National Laboratories defines for the US Department of Energy three Hazard Zones (also called, "Zones of Concern") surrounding LNG carriers. The largest Zone is 2.2 miles/3,500 meters around the vessel, indicating that LNG ports must be located at least that distance from civilians. Some world-recognized LNG hazard experts, such as Dr. Jerry Havens (University of Arkansas; former Coast Guard LNG vapor hazard researcher), indicate that three miles or more is a more realistic Hazard Zone distance.

<sup>3</sup> Allision — (nautical term) Collision between a moving vessel and a stationary vessel or object.

<sup>4</sup> Conflicting waterway uses include fishing and recreational boating.

The Woodfibre location fails all of SIGTTO's Siting Standards for an LNG terminal location.

It would appear that Woodfibre LNG chose the Woodfibre site to minimize their development costs and enhance corporate profitability. Securing and servicing an LNG terminal site that did adhere to SIGTTO's Siting Standards would require longer development times and significantly more start up costs than utilizing the existing Woodfibre site. Bluntly put, it would appear Woodfibre LNG is placing their corporate profitability ahead of our public and environmental safety.

### **Why Woodfibre is not a safe location for an LNG terminal**

Let's look at SIGTTO's Siting Standards, one by one, in relation to the Woodfibre LNG proposal. [Key points appear in bolded and italicized text. Footnotes appear in non-bolded italicized text within square brackets.]

1) ***There is no acceptable probability for a catastrophic LNG release.***  
*(Emphasis added)*

*[<sup>1</sup> While risk of small LNG spills is acceptable, any risk of catastrophic LNG release is unacceptable.] (emphasis added)*

Woodfibre LNG apparently does not understand what “**no** acceptable probability” or what “**any** risk of catastrophic LNG release is unacceptable” means. Siting an LNG terminal at Woodfibre puts residents of Squamish, Lions Bay, the Sunshine Coast, on the various islands in Howe Sound, West Vancouver and recreational boaters and commercial marine traffic at risk. Woodfibre LNG knows those risks include a catastrophic LNG release, but that is appears to be a risk they are prepared to take with our lives and our communities.

**2) LNG ports must be located where LNG vapours from a spill or release cannot affect civilians.**

*[<sup>2</sup> Sandia National Laboratories defines for the US Department of Energy three Hazard Zones (also called, "Zones of Concern") surrounding LNG carriers. The largest Zone is 2.2 miles/3,500 meters around the vessel, indicating that LNG ports must be located at least that distance from civilians. Some world-recognized LNG hazard experts, such as Dr. Jerry Havens (University of Arkansas; former Coast Guard LNG vapor hazard researcher), indicate that three miles or more is a more realistic Hazard Zone distance.]*

The timing of an accident is not predictable while the need to respond is immediate. Howe Sound’s marine activity by choice or necessity passes by the Woodfibre site at relatively close quarters. Spills or releases can emanate from the terminal, or an LNG tanker either at berth or in transit and **can** affect civilians.

Winds sweeping up Howe Sound could carry an ignitable cloud of gas towards Squamish. LNG tankers would regularly pass in close proximity to residential areas and commercial properties around and within Howe Sound. A spill or release from Woodfibre LNG or from a tanker **will** potentially affect civilians.

The largest Hazard Zone surrounding LNG carriers is 3,500 m. Some experts consider 4,800 m more prudent. Given that most of Howe Sound is only 2 to 3 km wide, it is impossible to maintain that Hazard Zone separation from marine or land based ignition sources while in transit.

**3) LNG ship berths must be far from the ship transit fairway;**

- a) To prevent collision or allision from other vessels;**
- b) To prevent surging and ranging along the LNG pier and jetty that may cause the berthed ship to break its moorings and/or an LNG connection;**
- c) since all other vessels must be considered an ignition source.**

*[<sup>3</sup> Allision — (nautical term) Collision between a moving vessel and a stationary vessel or object.]*

The Woodfibre location fails miserably in meeting this standard. It is located on the side of a busy shipping channel with considerable marine traffic that does pose potential collision, allision and ignition risks. Activities along the shipping channels, over and above other vessels represent innumerable, uncontrollable ignition

sources, including trucks and automobiles, transom bar b-qs on a sailboats, a beach fire, house chimneys, or something as innocent as someone lighting a cigarette while walking the beach or looking over their deck pondering the strange, enveloping whitish cloud from over the water!

- 4) LNG ports must be located where they do not conflict with other waterway uses now and in the future. [This requires long-range planning for the entire port area prior to committing to terminal location.]**  
*[<sup>4</sup> Conflicting waterway uses include fishing and recreational boating.]*

Allowing Woodfibre LNG to go ahead in the absence of a detailed, long range plan as to how its siting would or would not affect the port capacity and the social and economic future of Squamish is irresponsible in the extreme. One critical waterway use that could be adversely impacted by LNG tankers transiting Howe Sound are the three BC Ferries' routes from Horseshoe Bay to Nanaimo, Bowen Island and the Sunshine Coast. Recreational boaters are numerous. One company's desire for profit cannot be allowed to trump the needs of all other marine users.

- 5) Long, narrow inland waterways are to be avoided, due to greater navigation risk.**

Woodfibre is located up a long, narrow inland waterway and LNG tankers do pose substantial navigation risks from and for other marine traffic and the surrounding, unforgiving topography.

- 6) Waterways containing navigation hazards are to be avoided as LNG ports.**

There are numerous navigation hazards within the Howe Sound shipping channels for ships the size of Suezmax class vessels.

The vast majority of global LNG terminals are located with open ocean access, frequently with shallow, sloping seabeds of mud and/or sand so that a tanker grounding is slowed by running up the sloping seabed, minimizing hull damage. The topography of Howe Sound, in contrast, is steep, deep and hard. Islands and rock outcroppings present themselves as substantial navigation hazards and the potential hull damage, if struck at anticipated navigational speeds, can be very dramatic and runs the risk of breaching the LNG containment. Recall the fate of the Costa Concordia! If that should happen it would have a high probability of occurring in close proximity to an area of human habitation and the consequences are incalculable.

**7) LNG ports must not be located on the outside curve in the waterway, since other transiting vessels would at some time during their transits be headed directly at the berthed LNG ship. (Emphasis added)**

Here is the reference from SIGTTO's 1997 report on the unsuitability of building LNG terminals on the outside curves of shipping channels.

*From Site Selection and Design for LNG Ports and Jetties – Information Paper #14 – Published 1997 – ©Society of International Gas Tanker and Terminal Operators P.7*

*Jetty location should also be chosen to reduce the risk of passing ship striking a berthed LNG carrier but subjective judgment comes into assessing safety from this standpoint. The acceptability of such positions should be determined only after a detailed consideration of local circumstances. **However, as far a port design is concerned, some features are clear-cut. For example, positioning an LNG terminal on the outside of a river bend raises the risk that a passing ship may strike the berthed carrier if the maneuver is not properly executed. This is possible because, at some point on the bend, the maneuvering ship must head directly at the berthed LNG carrier.** In this respect, and following the reasoning in reference [3], ships of over **10,000 tonnes** displacement operating at normal harbour speeds – say 10 knots – when striking at 90°, present a hazard to a berthed LNG carrier's containment system. **It follows, therefore, that building a jetty in such locations is normally considered unsuitable.** (Emphasis added)*

*[3] Safety Aspects of Liquefied Natural Gas in the Marine Environment – 1980, the National Research Council (Report NMAB 354); sponsored by the United States Coast Guard.*

What is **clear-cut** is that Woodfibre **is located on the outside curve** of the Howe Sound shipping channel. Ships coming in and out of the Port of Squamish would all as they navigate around Watts Point on the eastern shore, opposite to Woodfibre, find themselves pointed directly at the Woodfibre LNG terminal, like a dagger. If at that point in their transit they should lose navigation and are unable to steer away or stop, they could well become a battering ram and run directly into the LNG terminal and/or an LNG tanker at the terminal with potentially catastrophic consequences.

Newton's First Law of Motion says that an object in motion, in this case, another large ship, stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force. A ship unable to steer or stop has only water resistance and drag to slow it down until it eventually coasts to a stop or strikes another object stopping or deflecting it. Ships, by definition, are designed to minimize water resistance and drag and can therefore coast a long way before coming to a stop. Unlike LNG tankers in transit, none of those passing ships will travel with tethered escort tugs.

The topography of Howe Sound above and below the tide line is steep and deep, too deep to construct an effective breakwater to protect LNG tankers berthed at the terminal from being struck by passing ships. As a result, berthed LNG tankers will

necessarily be parallel to the outside curve of the shipping channel and openly exposed and at risk to passing ships.

Note that while the SIGTTO reference above raises concerns of ships as small as 10,000+ tonnes presenting a collision hazard, recall that the ships servicing the Port of Squamish are upwards of 90,000 tonnes. The immutable laws of physics tells us that larger ships present a greater hazard because in the event of a collision their greater mass can produce greater penetration, larger breaches and faster spills with amplified risks.

***8) Human error potential always exists, so it must be taken into consideration when selecting and designing an LNG port.***

The potential for human error exists regardless of where an LNG terminal is located. However, the consequences flowing from human error at the Woodfibre site or from an LNG tanker in transit has the potential to be much more serious if located at Woodfibre than would be the case were the company to chose a site adhering to SIGTTO's Siting Standards.

### **Woodfibre LNG Fails**

On every single point of SIGTTO's LNG Terminal Siting Standards Woodfibre LNG fails. Woodfibre is not now and can never be an acceptable location to construct an LNG terminal.

Should the provincial and/or federal government give Woodfibre LNG the permit to construct their proposed LNG terminal at Woodfibre, despite the siting being in contravention of the best global standards in existence, that is the SIGTTO LNG Terminal Siting Standards, provincial and federal authorities could and should be held jointly and severally legally liable in the event of a serious accident or catastrophic incident.

Given the absence of detailed LNG terminal siting standards by either the provincial or federal governments one would expect, based on the precautionary principle, that SIGTTO standards would be fully adopted with respect to the Woodfibre LNG and all other LNG terminal applications. Indeed, one would expect that a detailed and rigorous scientific study justifying why a lesser standard to the SIGTTO standards should be allowable in the case of Woodfibre LNG's application to build an LNG terminal in Howe Sound.

Apparently Woodfibre LNG has mused about joining SIGTTO after the terminal is constructed. That is a little like closing the barn door only after the horse has bolted. Woodfibre as a site for an LNG terminal, for reasons outlined above, does not now and can never meet the SIGTTO LNG Siting Standards.

### **Frequency of transits**

Woodfibre LNG's initial proposal is to construct an LNG terminal with the capacity to fill 40 Suemax class LNG tankers per year. That represents 40 transits in and 40 out for a total of 80 total transits per year or 6 to 7 per month.

However, late in the public commentary process it was learned that Woodfibre LNG has plans to expand the capacity of the terminal in the future, after the approvals have been obtained! It has also been learned that Woodfibre could have access up to as much 6 times more electrical power capacity and gas supply capacity than needed to supply an LNG terminal at the capacity proposed in their initial application. This raises serious concerns that Woodfibre LNG is deliberately understating the scale of their eventual operations in the hopes of getting the green light for a small operation only to expand to a much larger size after the fact.

If Woodfibre LNG were to expand to 6 times its currently proposed capacity, then based on a straight line projection, the initial 80 transits in and out per year could jump to around 480 per year or 40 per month, which is more than one a day, each and every day, in good weather and bad!

While Woodfibre LNG is now saying they do not plan to utilize the Route B shipping channel down the narrow and winding Thornborough Channel on the northwest side of Gambier Island, moving to anything close to 480 LNG tankers per year would virtually necessitate use of both channels in order to maintain separation between incoming and outgoing LNG tankers. It would also likely produce frequent daytime transits at considerable disruption to all other marine traffic in Howe Sound.

Clearly such an expanded capacity would greatly exacerbate the risk factors down narrow navigation channels, with uncontrollable ignition sources and adverse impacts on other marine users. Such a scenario could adversely affect access to and the development opportunities for the Port of Squamish and adversely impact the employment opportunities of their citizens. 480 LNG tankers transits per year would not be considered a tourist attraction in anyone's book and could damage the economics of the tourism industry.

### **Other Considerations**

As part of the advance work prior to considering shipping of tar sands diluted bitumen and LNG out through Kitimat a navigation study was undertaken for the tankers proposed to service Kitimat. It provides some useful information noted below to consider with respect to the Woodfibre LNG application.

The link to Kitimat navigation study is: <https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/384192/620327/624798/691974/B23-18 - TERMPOL TDR ->

[Maneuvering Study of Escorted Tankers to and from Kitimat Part 1 Executive Summary \(FORCE Technology\) A1Z6K2 .pdf?nodeid=692014&vernum=-2](#)

It would seem to be advisable to conduct a similar study for Howe Sound and the Salish Sea in advance of any consideration of the Woodfibre LNG application.

The Kitimat study looked at navigation issues employing different sized tankers. The sizes quoted for use by Woodfibre LNG are of the Suezmax class, carrying up to 160,000 metric tonnes and approaching 300 metres in length. In the Kitimat study ship #3017 is of that Suezmax class. That study showed a Suezmax tanker has an approximately 1,000 metre turning circle, 500 metre radius, when fully loaded at 10 knots. It has a 2250 metre stopping distance when fully loaded with engines full astern at full power from an initial traveling speed of 10 knots, precisely what Woodfibre LNG is quoting for its LNG tanker transiting speed when servicing the Woodfibre facility.

That a loaded LNG tanker has tethered escort tugs is of limited value in an emergency stopping scenario as the combined thrust of the escort tugs pales in comparison to the mass of the loaded tanker, particularly in tight quarters and in poor weather. In tight navigation quarters a tanker could ground before the escort tugs could maneuver into position to provide whatever emergency stopping assistance might be possible. In an emergency stopping scenario, a ship with a 2250 m emergency stopping distance would need to be in the centre of a 4.5 km wide channel to avoid running around, assuming no complications due to tides, currents and/or windage, which can extend both the stopping distances and the turning circles. Significant portions of both Routes A and B are narrower than 3 km meaning that an LNG tanker could easily be less than half the emergency stopping distance away from a very large, immovable piece of granite which could rupture the LNG containment vessels. If the ship is travelling at 10 knots and loses steerage necessitating an emergency stop it could run aground mere minutes after the emergency became known and long before any escort tugs could provide any substantial relief. If the transits are being done at night to limit disruption to other marine traffic, without the benefit of having visual sight of land, especially in heavy weather, the situation could be that much more treacherous and the consequences of an accident that much more dire.

If a departure transit is occurring as the tide is running out of Howe Sound that will increase both stopping distances and turning circles as the current pushes on the hull in a similar fashion to how wind pushes on the superstructure above the waterline. The capacity of a ship to steer is its speed relative to the current. Most ships of the Suez Max class require around 10 knot speed just to maintain steerage. If they are running with a 5 knot current, they are running at 15 knots or 28 km/hr relative to the land. That produces commensurately larger turning circles and longer stopping distances and increases the risks in the event of an emergency. This is particularly so in bad weather and more so with a following wind running out of Howe Sound. Winter outflow winds running down Howe Sound can be substantial.

LNG tankers because of their sheer size and the fact that LNG is about half the density of water ride high in the water and present a very large 'sail' to the wind which can have a substantive impact on the ship's navigational capacity, particularly in tight turns in close quarters.

Given the nature and timing of the tides, which don't neatly conform to human circadian cycles and daytime activities -- damn moon -- the tides will extend the transiting times as outgoing tankers fight against an incoming tide, or incoming tankers fight against an out flowing tide: either of which will have the effect of extending the duration of the transiting time and the required marine traffic ban to maintain the safety separation of the Hazard Zone. Tidal currents of 4 – 6 knots are common in Howe Sound. The venturi effect as the current is forced past pinch points increases the speeds of those tidal currents where the channel narrows. The tidal current can also increase the adverse sound factors for surrounding residential areas as the tanker's engines run harder to maintain speed against the running tide.

If weather and tidal factors make a night transit too risky, the LNG tanker may then be forced to transit by day and will disrupt other marine traffic, including BC Ferries runs, much to the to the chagrin of passengers and their schedules.

If this project is expanded to as much as 480 LNG tanker transits per year that could mean a tanker or two transiting the shipping route every night.

Everyone knows how sound travels over water. If the LNG tankers are using Route A, running past Lions Bay, Bowen Island and Cliff Point to beyond Point Atkinson, or using Route B down Thornborough Channel, running past Langdale, Hopkins Landing, the eastern side of Keats Island and the western side of Bowen Island the noise factors could be a huge annoyance for residents and could adversely affect property values. It could downgrade the development possibilities of the lands within Howe Sound.

Big ships produce big wakes. An LNG tanker running at 10 knots/hr – 18.5 km/hr. would produce a very sizeable wake, sufficient to capsize smaller craft, erode beaches and shorelines and wreak havoc on vessels at moorage and on dock facilities.

## **Conclusion**

Regardless of how one views the advisability of shipping LNG from BC's shores we all need to be concerned for human safety, the environment and the impacts on other marine traffic. In doing so, one cannot not come to any other conclusion than the cold hard reality that Woodfibre is simply not a safe location for an LNG shipping terminal of any scale. The risks are simply too great to consider allowing the proposal to proceed.



If the proponents behind Woodfibre LNG are serious about wanting to get into the LNG business, it behooves them to identify and seek to develop a site that does conform to the SIGTTO industry accepted Siting Standards. If the entry level costs too high for them to consider proceeding, so be it. British Columbians should not be expected to put our physical safety, our environment and our marine access at risk simply to boost the bottom line of an LNG speculator.

Woodfibre is simply not an acceptable site on which to construct an LNG terminal. Woodfibre LNG's application should be denied. Full stop!

Sincerely,

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