

Inclusive Planning for Changing Arctic Futures: Demonstrating a Scenario-Based Discussion

**A Tabletop Exercise Demonstration at the
Arctic Futures 2050 Conference
September 5, 2019**

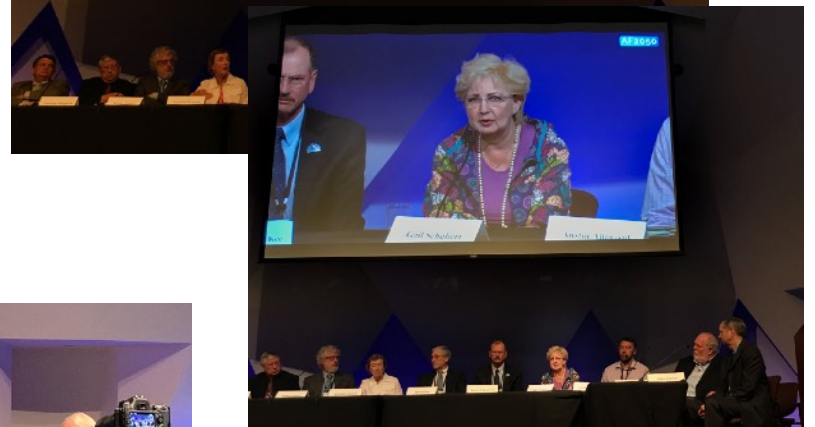
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This report describes preparation and execution of a tabletop demonstration exercise held on September 5th, 2019 at the Arctic Futures 2050 Conference.

The goal of this session was to demonstrate how a table-top exercise can be used to bring science, indigenous and policy communities together to develop information, ideas and proposed actions to drive future research directions, policy initiatives and planning for emergency response in the Arctic of 2050. This exercise used as a triggering event an Arctic maritime incident that takes place in the year 2050 in which a Chinese-owned LNG tanker collides with its Russian nuclear powered icebreaker escort in a winter storm.

This scenario was used to frame two subsequent discussions: 1) what network of institutions and communities will need to engage in response to the incident, and what information will be needed to inform that response; 2) what planning, research and policy actions, had they been taken twenty five years earlier, would significantly strengthen situational awareness, effective communications and operational response to this 2050 Arctic nuclear incident?

The table-top panel included participants with backgrounds in science, indigenous community leadership, national security, policy development, Arctic marine shipping, emergency response, and multiple federal agencies. This 90-minute session was not intended to serve as a full blown table-top exercise, which typically would take multiple days to complete. Rather, it was intended to demonstrate how the scenario-based mechanism can serve to bring multiple communities together to develop focused ideas and actions to inform future research, policy and planning.

Additional tabletop information is included in the following Appendices:

- Appendix I -- Tabletop Scenario
- Appendix II -- Tabletop Script
- Appendix III -- Tabletop Development Team and Panelists
- Appendix IV -- Tabletop Session Discussion Notes
- Appendix V -- Tabletop Introduction Slides

Key Takeaways

The following key takeaways reflect six themes that emerged over the course of the tabletop exercise. These themes provide a potential framework for future work related to nuclear shipping incidents in the Arctic. In-depth information for each of these themes is contained in the detailed tabletop discussion notes in Appendix IV.

The initial operational response to any major Arctic shipping incident will follow well established search and rescue protocols, and will be led by the United States Coast Guard.

Other cooperating agencies will be quickly brought into the response at local, regional, state and federal levels. Communications infrastructure in this region is, and will likely continue to be, quite sparse and communications effectiveness is likely to be an issue, unless communication infrastructure needs are addressed. The DoD response network is effective and has been exercised. However, exercise of DoD response capabilities for winter conditions has been very limited. Severe Arctic conditions, large distances and lack of communications and response infrastructure will present major challenges.

If a nuclear incident of this type occurs, it is likely to become an incident of national significance and an incident command structure will be established. A nuclear accident in shallow water has the potential to become a very serious incident. In a serious incident with a nuclear powered ship, losing cooling water circulation in the reactor with the ship in shallow water has the potential for very serious consequences. If there is a release, iodine and cesium-137 will be the major elements of concern, iodine in the near term and cesium in the long term. Cesium is important with respect to long term contamination of food sources etc. US nuclear plants conduct probabilistic risk assessments in order to develop an understanding of what could happen in incidents like this, and what is most important. In order to prepare for response to a nuclear shipping incident, some form of risk study for these scenarios should be completed.

Important predictive capabilities for situational awareness and informing response decisions does not currently exist for winter Arctic conditions. If a radioactive release were to occur, it will be important to quickly get trajectory analysis information for predictions of where wind and water currents could potentially carry contaminants. This capability must be in place long before an incident occurs. The climatology of Arctic storms is changing. The tracks of storms are changing. With more open water storms are behaving differently. The Arctic used to be a “graveyard for storms.” We are now seeing storms that not only not die but actually regenerate in Arctic waters because their warming allows the storm to gain energy. We need a better observation network. Modeling requires good data. This is beyond the capability of any single agency. There must be a single, common model.

The US Arctic currently lacks multiple facets of both operational and research infrastructure needed to provide key elements of both short and long-term response to a major winter-time incident. From an operational perspective, only 6% of Arctic waters are charted to modern standards. High quality charts will be very important to enable effective response. Other infrastructure will be important as well, including: an Arctic port, communications infrastructure, and other important maritime support capabilities. There are very few ways to bring in response teams and the support to sustain them, not to mention if there was a mass casualty incident. From a research perspective, both near- and long-term decisions must be based on solid science. Understanding the near-term states of winter atmospheric and ocean conditions will be very important. Currently we have very limited observation and research infrastructure capable of producing the kind of data required to build effective predictive atmospheric and ocean circulation models, especially under winter conditions. In order to have the information necessary to plan for and respond to a major contamination incident, we must have rigorous understanding of changing Arctic ecosystems, and the impacts on migrating species.

There must be a strong indigenous voice and participation in the response effort. Arctic indigenous communities have important knowledge to inform response decisions and must be part of response decisions. By 2050 there is a need to transform indigenous emergency response infrastructure so that it is integrated into other infrastructure elements. Indigenous communities have some of the highest percentages of former US military personnel. Local communities will be ready to step forward to assist with response and will be most directly affected. This kind of incident would potentially have impact on subsistence level food supplies. It is important that we understand the impact of indigenous peoples' experience of historical incidents will have on this situation. Radioactivity moves quickly into human population because the food chain is shorter. The legacy of US nuclear activity in the Arctic region needs to be remembered and there needs to be transparency. Project Chariot by the US government exposed indigenous people to radiation with a near total lack of transparency. Hence, planning for a response to such a future incident should recognize the need to build trust with local communities. Transparency will be key.

This incident has the potential to rapidly become a major international incident. Communication lines with Russian (and other country's) institutions will be important. Confidence Building Measures (CBM) could help to prepare both the US and Russia for a future contingency. Current US Coast Guard relationships and regular communications with the Russian coast guard equivalent addresses current states of shipping and navigation in the region. However, both the US and Russia would rise to a high level of decision making an incident with a nuclear component. As these channels of communication and decision making are not regularly needed today, they would benefit from planning and exercise for future contingencies. In the Cold War, this type of contingency planning with Russia took the form of "Confidence Building Measures". As the incident is elevated to the Russian military and other agencies, communications could become very difficult. Multiple different and powerful parts of Russian government may become involved: For example, Yamal and Gazprom (very powerful); ROSATOMFLOT directs vessels; Ministry of Transport sets standards. Relationship with the

Russian Coast Guard may not be adequate because they do not have the authority that our US Coast Guard does. The US and Russia should develop procedures and plans to exchange appropriate information and open needed communication channels.

Recommendations for Next Steps

Both participants and observers for this tabletop exercise have commented that completing a full tabletop exercise would provide significant additional information on the core question of what planning, research and policy actions would significantly strengthen situational awareness, effective communications and operational response to this 2050 Arctic nuclear incident. Indigenous participants expressed a strong desire to have some component of tabletop and/or other planning exercises take place in Alaska with direct participation from their communities.

Appendices

Appendix I -- Tabletop Scenario

Appendix II -- Tabletop Script

Appendix III -- Tabletop Development Team and Panelists

Appendix IV -- Tabletop Session Discussion Notes

Appendix V -- Tabletop Introduction Slides

***Appendix I -- Tabletop Scenario
Inclusive Planning for Changing Arctic Futures:
Demonstrating a Scenario-Based Discussion
Final - August 19, 2019***

The goal of this session is to demonstrate how a scenario-based exercise can be used to bring science, Indigenous and policy communities together to develop information, ideas and proposed actions to drive future research directions, policy initiatives and planning for emergency response in the Arctic of 2050. This exercise will use as a triggering event an Arctic maritime incident that takes place in the year 2050 in which a Chinese-owned LNG tanker collides with its Russian nuclear powered icebreaker escort in a winter storm. This scenario is intended to frame two subsequent discussions: 1) what network of institutions and communities will need to engage in response to the incident, and what information will be needed to inform that response; 2) what planning, research and policy actions, had they been taken twenty five years earlier, would significantly strengthened situational awareness, effective communications and operational response to this 2050 Arctic nuclear incident.

The discussion panel will include participants with backgrounds in science, Indigenous community leadership, policy development, Arctic marine shipping, emergency response, and multiple federal agencies. This 90-minute session is not intended to serve as a full blown tabletop exercise, which typically would take multiple days to complete. Rather, it is intended to demonstrate how a scenario-based discussion can serve to bring multiple communities together to develop focused ideas and actions to inform future research, policy and planning.

Scenario:

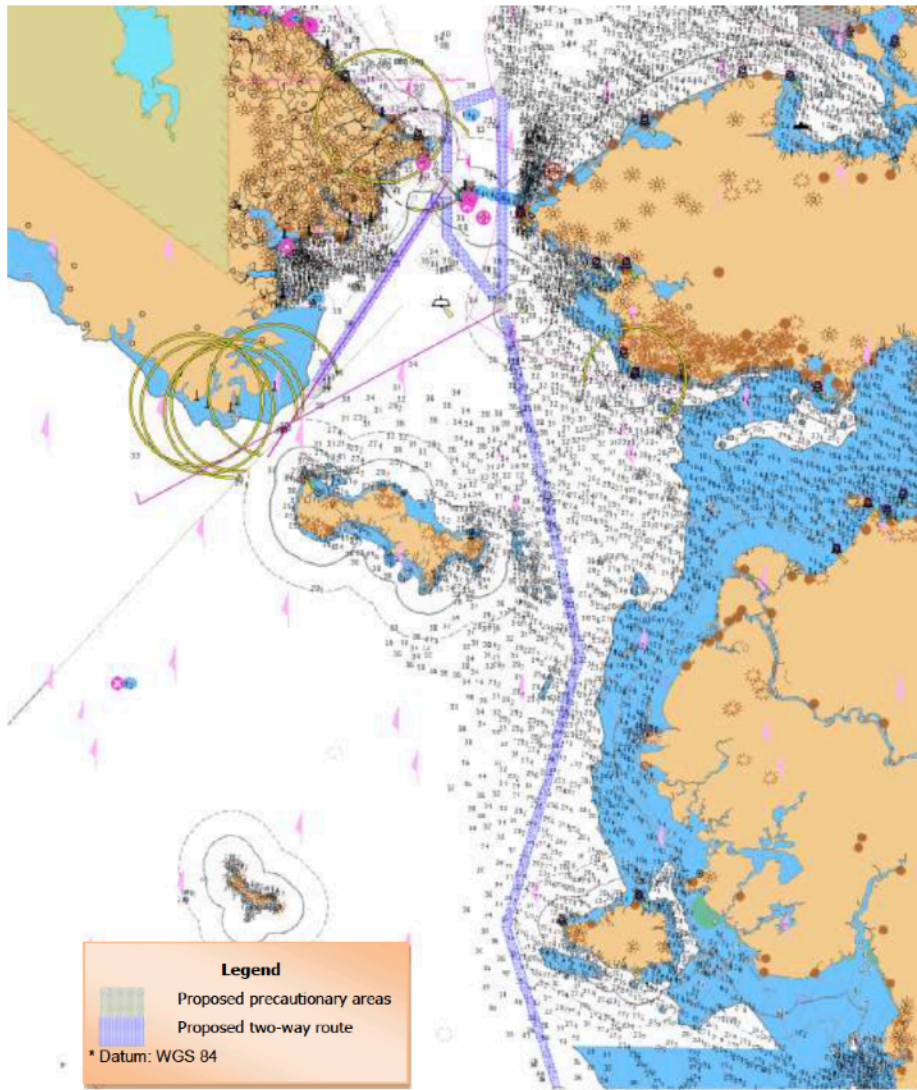
- By 2050 Russian oil and gas fields are producing large quantities of LNG that is shipped year round along the Northern Sea Route. In winter months during the extended navigation season, ice-hardened LNG tankers are escorted by Russian nuclear powered ice breakers. In late November 2050, a LNG tanker is transiting the Northern Sea Route. This tanker is Chinese owned, but operated under a flag of convenience from another country.
- A powerful winter cyclone hits these ships as they approach the Bering Straits Region, and the LNG tanker astern the icebreaker, collides with the icebreaker. Nuclear icebreakers are steam-turbo electric, and during the collision, the electric motors are damaged, the icebreaker loses power and grounds in US waters in the Bering Strait region.
- As the storm progresses, the condition of both the nuclear icebreaker and LNG tanker are unknown. The potential for release of radioactive contaminants is a realistic possibility. The fate of the LNG tanker integrity is unknown.
- Given uncertain weather and current activity, there is potential for sea-born contaminants to be carried north and then eastward in the Alaskan Coastal Current or air-born contaminants to be carried eastward to Alaskan coastal and inland regions.

Core questions:

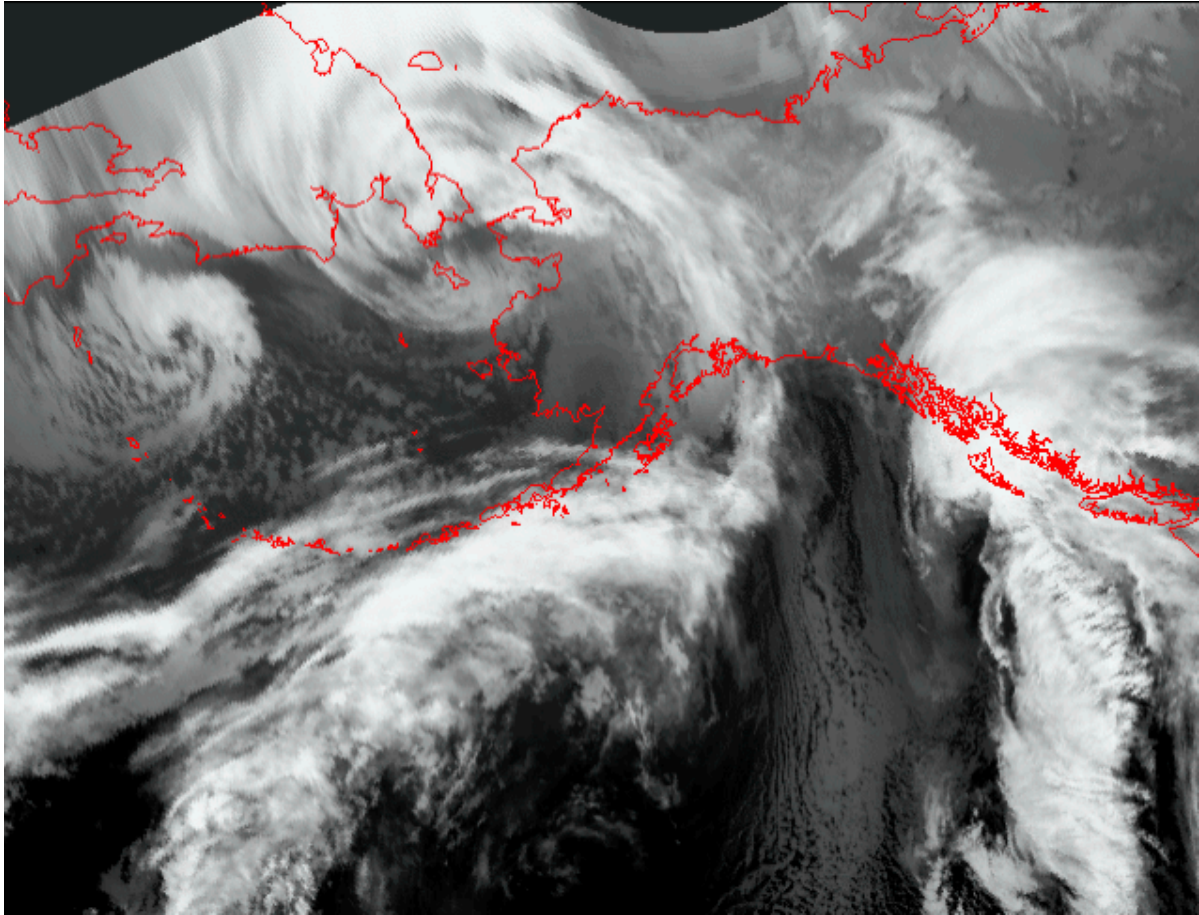
- What network of international, national, state, community and scientific institutions will need to engage in response to this incident, and what information will be needed to inform that response?
- What planning, research and policy actions, had they been taken twenty five years earlier, would significantly strengthened situational awareness, effective communications and operational response to this 2050 Arctic incident.

Additional Information

Shipping Channels in the Bering Straits Region (International Maritime Organization, 2017, Establishment of two-way routes and precautionary areas in the Bering Sea and Bering Strait)



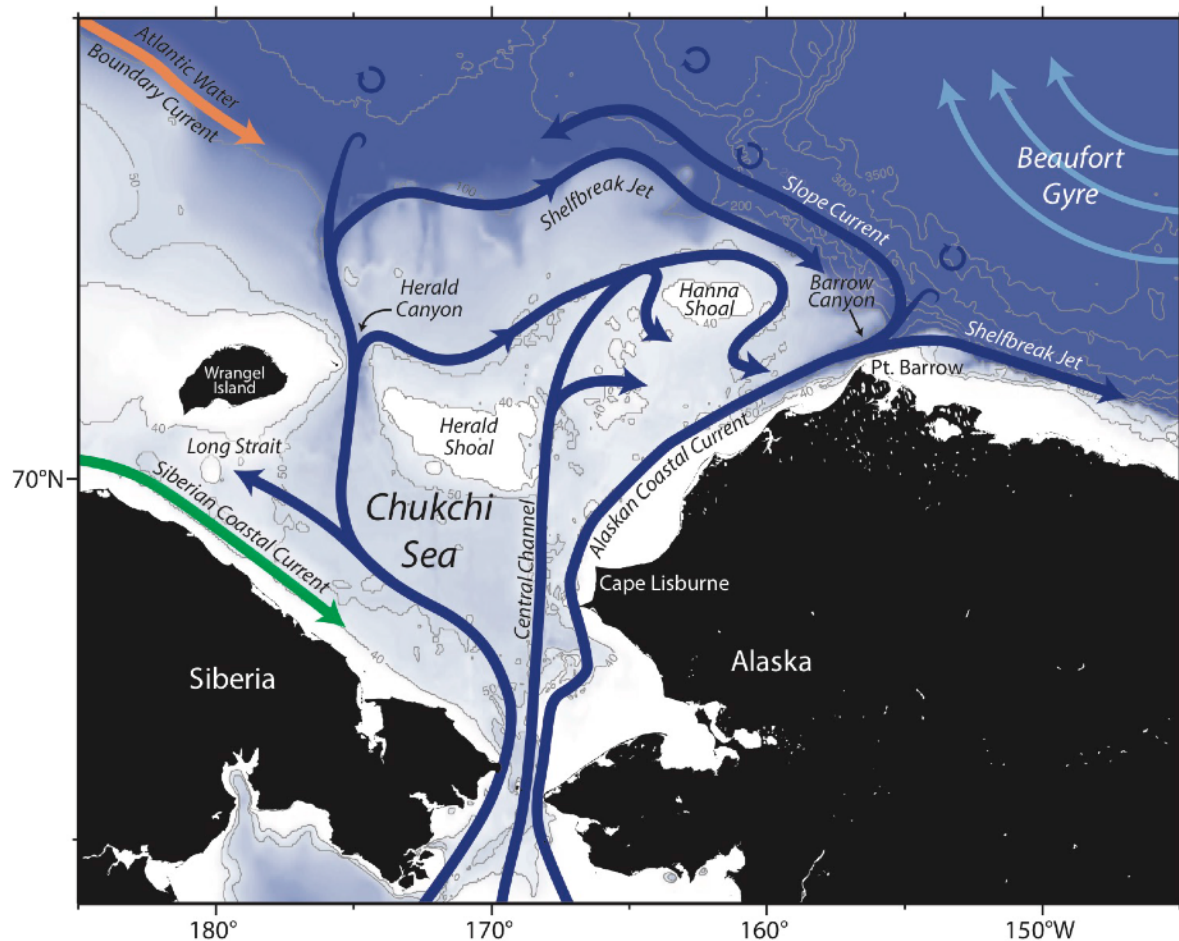
November 2011 Bering Sea Cycle (GOES Satellite Image, November 9, 2011)



Bering Strait Cyclone - 2011 (from National Weather Service and Wikipedia)

- The November 2011 Bering Strait Cyclone was one of the most powerful extratropical cyclones to affect Alaska on record.
- Recorded wind speeds along the coast of Alaska were over 70 mph. The highest gust recorded was 93 mph on Little Diomedede Island.
- Observed wave heights in the Bering Sea were as high as 40 feet.

Dominant Bering Strait Ocean Current Directions



Bering Strait and Alaska Coastal Currents (from Bureau of Ocean Energy Management, Department of Interior report BOEM 2107-065)

High level description of the three main branches of ocean currents flowing northward through the Bering Straits:

- The westernmost branch enters Herald Canyon and while some of it appears to spread eastward across the northern shelf, a significant portion of the water exiting Herald Canyon forms an eastward-flowing shelf break jet along the edge of the Chukchi Sea.
- According to the models and observations a portion of the water that enters the Central Channel flows eastward toward the Alaskan coast across the central shelf.
- The third branch of Bering Sea water flows northeastward along the Alaskan coast towards Barrow Canyon at the junction of the Chukchi and Beaufort shelves.

Icebreaker Escort



Russian Nuclear Icebreakers (Bukharin, 2006)

- Soviet nuclear icebreaker technology was a spinoff of the nuclear submarine program. It was a useful demonstration of the civilian benefits of nuclear propulsion. It also was seen as an important element of the national strategy to develop Russia's Arctic regions, a vast stretch of land rich in natural resources.
- The USSR's first icebreaker *Lenin* was put into operation in 1959 and operated until 1966 with three reactors. In 1970, the icebreaker was retrofitted with two OK-900 reactors. Elements of the OK-900 reactor and associated turbine technology (commonly referred to as the KLT-40 reactor technology) have been used in every commercial nuclear-powered ship built after *Lenin*.
- In 1974, the Baltiiskiy Zavod shipyard in St. Petersburg completed the Arktika icebreaker, designed by the Iceberg Design Bureau. It was the lead unit of 54-MWe Arktika-class icebreaker ships powered by two OK-900A reactors each. The fifth and last vessel of this class, the 50 Years of Victory icebreaker, was expected to enter the operation in 2006.
- Reactor and ship designers are investigating the feasibility of extending reactor service life from 100,000 hours to 150,000 hours, corresponding roughly to 10 additional years of icebreaker operation. Currently, life extension activities, involving a safety analysis of the reactor and propulsion system and component replacement, are being conducted on the icebreaker Arktika. Arktika has operated for 142,000 hours; its life is being extended to 175,000 hours. Experts believe that life extension to 200,000 hours (corresponding to 30–35 years of service) is feasible.

Nuclear Reactor Safety Considerations (Discussion with Sandia Labs reactor safety expert, 7/25/19)

- The likely response to a serious incident (e.g. grounding of the ship) would be to scram the reactors to move them into a lower energy state. However, even in their scrammed state, the reactors will continue to generate decay heat.
- The key to maintaining core stability in a scrammed reactor is maintaining cooling water circulation in order to reject decay heat.
- Therefore, the most critical reactor management action at this point will be to keep cooling water circulating through the reactors to dissipate decay heat. The pumps moving water (fresh water) through the core must still be operational and receiving electric power. An important first line of defense will be the diesel generators that generate power for other systems. There may also be backup battery power (typically 4-8 hours of power in commercial nuclear power stations).
- If enough water cannot be circulated to remove decay heat in the scrammed reactor, at some point, cooling water will boil and no longer be able to cool the core.
- Once cooling water is lost, the time to core melt is measured in hours.
- In the event of core melt, the most likely early releases would be airborne - iodine, cesium and hydrogen.

LNG Tanker Safety (DOE LNG Safety Research Program, Sandia Labs LNG pool fire and LNG tanker structural modeling)

Cascading damage testing and analysis results:

- About 40% of LNG spilled can stay with the LNG vessel, causing significant cryogenic and fire thermal damage to the vessel's structure.
- The range of credible breach events vary in their level of damage.
- Cargo tank insulation and relief valve systems appear adequately designed to prevent an over pressurization of cargo tanks due to an LNG fire.
- Simultaneous, multiple cargo tank spills (cascading failure) from a single initial cargo tank breach are unlikely to occur.

Appendix II -- Tabletop Script

Scenario-Based Discussion

Goal: The goal is to identify information that would be needed to respond to a nuclear ship incident in the Arctic.

Objective: The objective of this scenario-based discussion is to utilize as a triggering event an Arctic maritime incident that takes place in the year 2050 in which a Chinese-owned LNG tanker collides with its Russian nuclear powered icebreaker escort in a winter storm. This scenario is intended to frame two subsequent discussions: 1) what network of institutions and communities will need to engage in response to the incident, and what information will be needed to inform that response; 2) what planning, research and policy actions, had they been taken twenty five years earlier, would significantly strengthen situational awareness, effective communications and operational response to this 2050 Arctic nuclear incident?

The roundtable discussion uses one scenario with one move to confront roundtable participants with a complex maritime emergency which they must address. Roundtable participants will be asked specific questions by the rapporteurs during the move to provoke discussion. A session in the second-half of the roundtable fleshes-out what planning, research and policy actions taken today would significantly strengthen situational awareness, effective communications and operational response to improve crisis decision-making in 2050.

The specific information being elicited from the group can help enable Arctic nations, US government, State of Alaska, Indigenous communities, and scientific research communities to cooperate in planning and execution of emergency response, environmental response and scientific research

Total time for the roundtable is one hour and thirty minutes, with the move lasting 45 minutes followed by a 45 minute discussion period.

Scenario

Background: By 2050, Russian oil and gas fields are producing large quantities of LNG that is shipped year round along the Northern Sea Route. In winter months during the extended navigation season, ice-hardened LNG tankers are escorted by Russian nuclear powered icebreakers. In late November 2050, an LNG tanker is transiting the Northern Sea Route, escorted by a Russian nuclear powered icebreaker. This tanker is Chinese owned, but operated under a flag of convenience from another country.

Move

- **A powerful winter cyclone hits these ships as they approach the Bering Straits region, and the LNG tanker astern the icebreaker collides with the icebreaker. The Master of the LNG tanker sends out a call for help.**

Discussing the first core question: What network of international, national, state, community and scientific institutions will need to engage in response to this incident, and what information will be needed to inform that response?

- What Alaskan State agencies have responsibility and experience in managing response to an Arctic nuclear maritime incident?
- What actively exercised lines of communication do Alaska emergency response agencies have with national level lead agencies for response to a maritime nuclear incident: DHS/USCG; DOE/NNSA Office of Emergency Operations; DOE/FRMAC (Federal Radiological Monitoring & Assessment Center; DOD Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs; EPA Office of Emergency Management?
- Are these lines of communication well established and regularly exercised?
- Are the mobile federal radiological monitoring capabilities at FRMAC (Federal Radiologic Monitoring & Assessment Center) capable of operating in Arctic conditions?

- **Nuclear icebreakers are steam-turbo electric, and during the collision, the electric motors are damaged, the icebreaker loses power and grounds off a populated island in the Bering Strait. The potential for release of radioactive contaminants is a realistic possibility and there is potential for sea-born contaminants to be carried north and then eastward in the Alaskan Coastal Current or air-born contaminants to be carried eastward to Alaskan coastal and inland regions.**
 - What emergency response systems in indigenous communities would be called upon for response to a nuclear maritime incidents? Do these emergency response systems have knowledge and effective communications lines with State and federal level agencies responsible for radiological incidents?
 - Given the potential for radionuclide release to both the ocean and atmosphere, what do we need to know about regional ocean currents and atmospheric circulation patterns, and how and where contaminants could potentially be transported along the Alaskan coast and into the interior? And, do we have the modeling and analysis capabilities today to make accurate predictions?
 - What do we currently know about the construction, nuclear materials and safety systems used in Russian nuclear icebreakers that will inform reactor accident analysis and characterization of potential radionuclide release source terms?

---Transition---

Discussing the second core question: what planning, research and policy actions, had they been taken twenty-five years earlier, would significantly strengthened situational awareness, effective communications and operational response to this 2050 Arctic incident?

- What sensor and sensor systems (e.g. aircraft, UAV, ship based, etc.) should be deployed to monitor potential water born and atmospheric contaminant transport? Have these systems be developed and tested to operate in Arctic conditions?
- What short and long-range ice migration tracking and modeling systems are needed to inform Arctic marine navigation in winter months? Are current tracking and modeling systems capability of provided real-time and predictive situational awareness to nuclear incident response teams under Arctic conditions?
- What information on transport mechanisms and predictive models for radionuclide transport in/on ice are needed for radiological incident response analysis?
- Given the potential for radionuclide release to the ocean, what do we need to know about human food resources that would be susceptible to contamination? How could the security of food be monitored and communicated?
- What international, federal, state and community cooperative policies and programs are needed to coordinate planning, research and response exercises?

Appendix III -- Tabletop Development Team and Panelists

Tabletop Development Team

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Appendix IV -- Tabletop Session Discussion Notes

Part I - A powerful winter cyclone hits these ships as they approach the Bering Straits region, and the LNG tanker astern the icebreaker collides with the icebreaker. The Master of the LNG tanker sends out a call for help. Discussing the first core question: What network of international, national, state, community and scientific institutions will need to engage in response to this incident, and what information will be needed to inform that response?

- Kee (ADAC) - First call will go to District 17 Coast Guard; Coast Guard will radio the ship in attempt to gather information and learn conditions aboard the ship. State of distress need to be assessed. Are they taking on water, at the mercy of weather, what is level of stress? Given sparsity of communications and difficult physical conditions, communications are not assured.
- Thorne (USCG) - The earlier stages of this incident will be a search and rescue mission for the coast guard. In addition to their own response, coast guard will contact key local/regional partners: State Troopers; DoD; Anchorage Alaska Rescue Coordination Center. There will be many calls among first responders to gather information and assess the situation.
- Kennedy (NOAA) - Regional response team (federal and state agencies) would be activated by USCG.
- Townsend (Moderator) - Is the communications network robust, and is it regularly exercised?
- Brown (NORAD/USNORTHCOM) - The DoD network is robust, and has been exercised. However, DoD has much less experience under winter conditions.
- Brown (NORAD/USNORTHCOM) - “There is no place to go.” Where would you put it for 2050? How would you sustain it? Would there be someone in place to sustain it? It’s expensive. The tyranny of distance. There are very few sources of bringing in response teams and the support to sustain them, not to mention if there was a mass casualty incident. Need better incident awareness. Right now they use assets in the Arctic and then put them away- these assets are not available on demand without preparation.
- ??? - What could be done to incorporate additional state of ship/state of conditions into AIS systems so that this information could be broadcast on a continuous basis? Do this within the Polar code so that it applies to all ships.
- Francis (Woods Hole) - It will be important to quickly get trajectory analysis information for predictions of where wind and water currents could potentially carry contaminants. Must have this capability in place long before an incident occurs.
- Farrar (Air Force Weather) - Search and Research (SAR): can assets be safely deployed? Need to know near-term conditions. Monitoring and forecasting not optimal in the high north.

Understanding the near term states of atmosphere and ocean will be very important. Currently we have very sparse coverage for this kind of information.

- Ahmasuk (Kawerik) - By 2050 we need to transform our infrastructure- need emergency response integrated into infrastructure. We must change (increase/improve) the amount of emergency response infrastructure that we have in place.

Part II - Nuclear icebreakers are steam-turbo electric, and during the collision, the electric motors are damaged, the icebreaker loses power and grounds off a populated island in the Bering Strait. The potential for release of radioactive contaminants is a realistic possibility and there is potential for sea-born contaminants to be carried north and then eastward in the Alaskan Coastal Current or air-born contaminants to be carried eastward to Alaskan coastal and inland regions. Discussing the first core question: What network of international, national, state, community and scientific institutions will need to engage in response to this incident, and what information will be needed to inform that response?

- Ahmasuk (Kawerik) - How are local communities involved? Must communicate with the people on the island. When feds respond - the VPSO (Village Public Safety Officer) or President of the Tribe are POCs (Point of Contact. VPSO cannot be the point person though because they will be protecting the village. To support indigenous response, we must have a robust response vessel; must develop/strengthen more robust local community response capabilities.
- Schubert (Bering Straits Native Corporation) - Are assets in place to deal with a situation like this? Alaska is a huge state. How long does it take to get assets to the island? What happens in the interim? Communication with island inhabitants in key and alerting them to risk. Whoever is determined to be in charge in the village needs to be kept up to date with external actors.
- Gauntt (Sandia Labs) - For US nuclear power plants, it is the plant operator who makes the initial calls on emergencies. The Governor makes the call on evacuation. All this must be worked out ahead of time. Rehearsed and staged evacuations are conducted. If there is a release, iodine and cesium-137 will be the major elements of concern, iodine in the near term (short half life) and cesium in the long term (100 years to drop by a factor of 10x). Cesium is important with respect to long term contamination of food sources etc.
- Rosen (Center for Naval Analysis) - This becoming a nuclear incident certainly ups the ante. The search and rescue may become quite complicated. This will involve US, Russia, China and perhaps other countries as well. This will require a seat of government response. In the US, the Department of State will be involved. May have to board the ship without permission to make people safe.

- Pincus (Naval War College) - Need high level and clear channel of communication. Must open communications lines with Russian and China. Must get permission to go aboard the ice breaker. ROSATOMFLOT, Ministry of Natural Resources, Coast Guard, etc. Does Russia have ability to coordinate communications between those agencies for response?
- Brigham (University of Alaska Fairbanks, former USCG) - we have been practicing this kind of rescue mission for five decades. We have regular, weekly communications with the Russian coast guard. We have excellent maritime communications with the Russians.
- Farrar (Air Force Weather) - We are not as good today in the Arctic as we are in other parts of the world, and we are limited in our ability to predict today. Hopefully by 2050 we will have prioritized the area. Modeling requires good data. The terrain and sea ice are complicated. This is beyond the capability of any single agency. There must be a single, common model.
- Ahmasuk (Kawerik) - This kind of incident would potentially have impact on substance level food supplies. Work has started on looking at marine mammal stranding responses.
- Francis (Woods Hole) - We need a better observation network. "The climatology of storms is changing". The tracks of storms are changing. With more open water storms are behaving differently. The Arctic used to be a "graveyard for storms." We are seeing storms not only not die but actually regenerate in Arctic waters because their warming allows the storm to gain traction. Open ocean of an ice-thawed Arctic brings with it high temperate variability. This will drive complex weather patterns.
- White (Consortium for Ocean Leadership) - It will be important to know: "is radioactive release going on?" Drone and unmanned vehicle technologies may be important for gathering data on this. New technologies must be bright to bear. Development of this technology must be funded at appropriate levels.
- Rosen (Center for Naval Analysis) - There is a strong need for research and technology development. We have needs for research and technology that greatly outweighs the funding that exists. We have emergency response agreements in place, but not the funding commitments to make them effective.
- Gauntt (Sandia) - US nuclear plants conduct probabilistic risk assessments in order to develop an understanding of what could happen in incidents like this, and what is important. Some kind of risk study for this situation should be done.
- Pincus (Army War College) - It's important that we understand the impact of indigenous peoples experience of historical incident will have on this situation. Radioactivity moves quickly into human population because the food chain is shorter. Legacy needs to be remembered and there needs to be transparency. This is not a blank slate and we need to involve locals in this from the beginning. Project Chariot by the US government exposed

indigenous people to radiation with a near total lack of transparency,. Hence, there will be a very low level of trust. Transparency will be key.

Part III - Discussing the second core question: what planning, research and policy actions, had they been taken twenty-five years earlier, would significantly strengthened situational awareness, effective communications and operational response to this 2050 Arctic incident?

- SLIDO question/suggestion - Key assumptions are being made in the discussion so far. We need to document what we have now, and what we need by 2050.
- Townsend (Moderator) - USCG will be stretched thin. How prepared is the USCG for a nuclear incident? With ship capabilities? With preparation? Will they be ready?
- Thorne (USCG) - Large incidents at sea have much in common. USCG does have radiation capabilities. Also, as soon as radiation is part of the incident, this will trigger incident of national significance. This will trigger National Threat Reduction Agreement, as well as formation of a unified command, with a designated lead.
- Townsend (Moderator) - Has this been exercised? How deep is the bench?
- Jenkins (USCG) - Response will be similar to Deep Water Horizon. In addition to unified command, an "interagency solutions group will be formed". Anything in the Arctic will be a "national incident", not just if it is nuclear. NOAA important partner in conveying chain of command info up and down.
- Kennedy (NOAA) - How we share information and science with the Russians will be important. We must have Russian data in this incident otherwise one side of Bering Strait will be an unknown.
- Gauntt (Sandia) - At Fukushima, the first signal of an issue was the first large explosion. The emergency at the plant had been going on for some time, but the plant has lost power and was under station blackout conditions. In a serious incident with a nuclear powered ship, as soon as risk is identified, we must be prepared for the worst possible outcome. Losing cooling water circulation in the reactor in shallow water conditions has the potential to have very serious consequences.
- SLIDO question/suggestion - There needs to be an evacuation plan. How will this all operate in Arctic conditions?
- Kee (ADAC) - Unified command, at multiple levels, with multiple agencies will be important. These will provide lines of activity; smart people; and will enable good decisions. A unified fabric with combined authorities can reduce the human footprint near radioactive material. Must work with leaders on island to convey threat and evacuate.

- Pincus (Naval War College) - In the middle of an incident like this, the Russians might fly a drone to the scene of the incident, in US air space. What will be the US response? Open lines of communications with the Russians will be important.
- Schubert (Bering Strait Native Corp) - Indigenous communities have some of the highest percentages of former US military personnel. These people will be ready to step forward to assist with response.
- Jenkins (USCG) - Any drones will face very difficult Arctic conditions. "Response ship... what response ship... what works in the lower 48, won't work in the Arctic. We must have ice-capable assets"
- Brigham (former USCG) - Only 6% of these waters are charted to modern standards. High quality charts will be very important to enable effective response. Other infrastructure will be important as well - an Arctic port; communications infrastructure; we are missing important maritime infrastructure. By 2050 IMP Polar Code should consider decision support - why are vessels operating during high risk conditions. Don't steam during storms- make smarter decisions - seek safe record. During high risk times of year could there be vessel restrictions?
- Gauntt (Sandia) - We must have good decision support tools to reduce risk.
- Rosen (Center for Naval Analysis) - Yamal is huge. 6 large oil exploration fields and multiple wells. IMO needed to play a more aggressive role. Should have worked with Russia to deal with safety and navigation. Five to six years ago this should have happened. Polar Code is good but nothing deals with ow much a ship owner would pay- at most \$2bn based on his research. OSPAR system (The OSPAR maritime area covers the North-East Atlantic including the North Sea part of the Arctic; complements the work of the Arctic Council and its Working Groups). Has put in place a The North Sea region response agreement. The western Arctic has no such response agreement in place.
- Schubert (Bering Strait Native Corp) - There was an incident in the Bering Strait today with a cruise ship that couldn't get into port. The response was effective. The ship went to a nearby natural harbor, and people were taken ashore in zodiacs. This is an example of an adaptive response to local conditions.
- Pincus (Naval War College) - The response relationship with Russia will be complex. Multiple different, and powerful parts of Russian government may become involved. Yamal and Gazprom (very powerful). ROSATOMFLOT directs vessels. Ministry of Transport sets standards. Relationship with Russian Coast Guard may be inadequate because they do not have the authority that our US Coast Guard does. Do we need to have Russian speakers on ships in case? Need a line into GAZPROM to communicate needing to turn one of their tankers around during bad weather. Also would US allow Russia on our vessel and vice versa? It is not clear that those other parts of government will take orders from the Russian coast guard (who

will have the best, on-the-ground incident information). We will need to be able to talk with Rosatom, and with Gazprom. Note -- communications with key US entities will need to be reciprocal for the Russians as well.

- Brown (NORAD/USNORTHCOM) - An exercise program will be important. Will need congressional support to fund preparedness. Will need to communicate this effectively. How can this be made important from a congressional perspective. For example... make the comparison with flood frequency and insurance -- if this is 1:500 per year probability, and flood is 1:100 per year, then make the comparison to make the case.
- Jenkins (USCG) - There are avenues for engagement open today. The port studies and coastal shipping lanes studies are currently open for public comment. These provide important avenues for engagement.
- Hodgdon (Deg Xit'an Dene/ Supiaq, Brown University) - There is a major need for indigenous communication infrastructure. Lack connectivity and comms so people are often unable to have internet access during public comment periods even when it's something that will affect their region.
- White (Consortium for Ocean Leadership) - Both near- and long-term decisions must be based on solid science. We have the opportunity now to put in place the international structure for operational environmental prediction. There should be an Arctic operations center with predictive capabilities from multiple disciplines, a capability that would enable the best possible predictive capabilities on multiple scales.
- Kennedy (NOAA) - If we do not do serious work before 2050, we will be seriously behind. Commercial fishery would have to be shut down. Subsistence fishery issue would be problematic. Also we do not understand how fisheries would be impacted since they are migrating. A new ocean species has just been identified in the Barrow region. In order to have the information necessary to plan for and respond to a major contamination incident, we must have a baseline understanding of changing Arctic ecosystems, and the impacts on migrating species.
- SLIDO question/suggestion - There has been no mention of indigenous knowledge in the discussion so far. There must be a strong indigenous voice and participation in the response effort. It will be important to break the stovepipe apart, and include indigenous science (UIC Science). There needs to be mechanisms to coproduce information to inform response decisions.
- Kee (ADAC) - There is a need for co-equal representation, collaboration. Need to break stovepipes. Indigenous people should be co-producing knowledge to balance the western scientific model. ADAC partnering with government partners and Alaska native services.

- Schubert (Bering Strait Native Corp) - Indigenous knowledge is critical. Some agencies do consult with them. Die-off of salmon (early run) from water being too warm.

Wrap up comments

- Pincus (Navy War College) - The legacy of the Exxon Valdez was reactive responses. We now need to take a proactive approach. We can learn from those disasters.
- White (Consortium for Ocean Leadership) - There needs to be an effective mechanism for individual scientist to put individual ideas forward. We must have the best answers. NOAA will be the authorized lead for the science.
- ??? - Keep in mind that social media will rapidly engage in this kind of incident, and will greatly complicate and potentially distort communications.
- Ahmasuk (Kawerik) - We need to do more of this kind of event
- Hodgdon (Deg Xit'an Dene/ Supiaq, Brown University) - I invite you to come to Alaska to have these conversations.

Appendix IV - Tabletop Introduction Slides

Inclusive Planning for Changing Arctic Futures: Demonstrating a Scenario-Based Discussion

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Inclusive Planning for Changing Arctic Futures: Demonstrating a Scenario-Based Discussion

Goal — Demonstrate how a table-top exercise can be used to bring science, Indigenous and policy communities together to develop information, ideas and proposed actions to drive future research directions, policy initiatives and planning for emergency response in the Arctic of 2050.

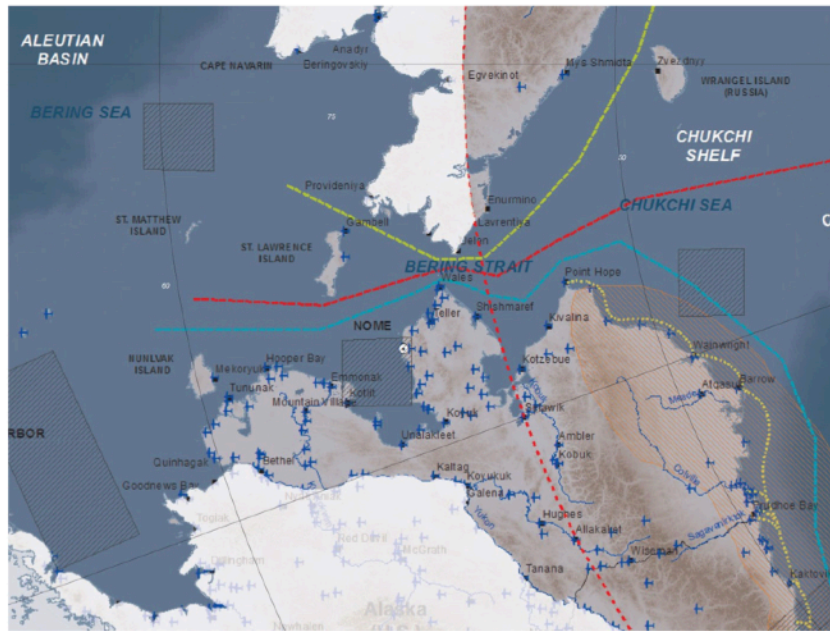
Scenario — Arctic maritime incident in the year 2050 in which a Chinese-owned LNG tanker collides with its Russian nuclear powered icebreaker escort in a winter storm.

Core Questions —

1) What network of institutions and communities will need to engage in response to the incident, and what information will be needed to inform that response?

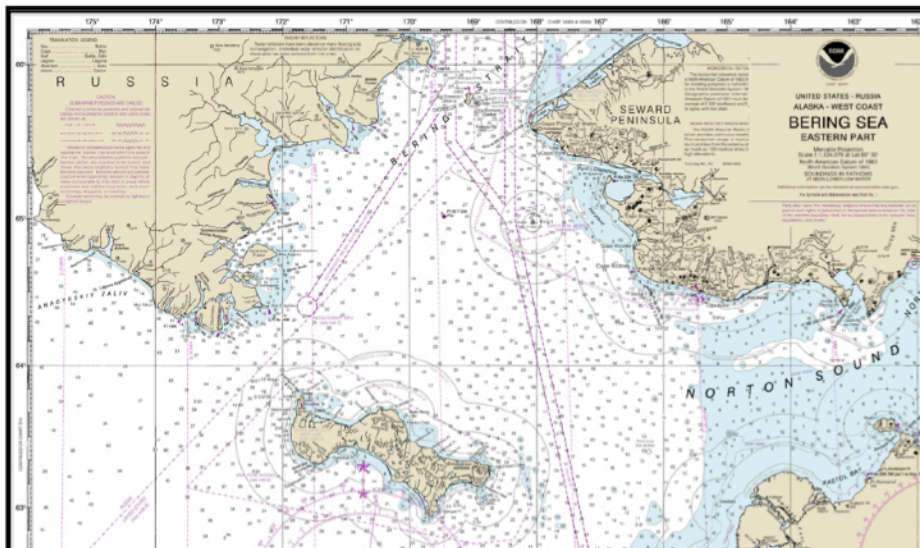
2) What planning, research and policy actions, had they been taken twenty five years earlier, would significantly strengthen situational awareness, effective communications and operational response to this 2050 Arctic nuclear incident?

Shipping Routes in the Bering Straits Region



National Geospatial-Intelligence Agency

Shipping Channels in the Bering Straits Region



NOAA Chart 16006