COMPENDIUM OF ARCTIC SHIP ACCIDENTS (CASA)

MAY 2021

ARCTIC COUNCIL

PAME
Protection of the Arctic Marine Environment

EP PR
EMERGENCY PREVENTION, PREPAREDNESS AND RESPONSE

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BACKGROUND

The shipping accident information in the 2009 AMSA Report covered 1995-2004 and is thus outdated. Since then, human activity, including shipping, in the Arctic region has increased and diversified with the reduction of seasonal sea ice. To obtain more current Arctic shipping accident information, PAME undertook a project led by the USA jointly with the Arctic Council's EPPR Working Group to develop a compendium of Arctic ship accidents covering 2005-2017.

Pursuant to the PAME II-2020 Record of Decisions (September 2020), the USA submitted this high-level final report of the CASA project and the ship accident data provided by Arctic States.

DISCUSSION AND SUMMARY

DATA COLLECTION AND COMPILING

To develop the CASA, PAME and EPPR invited all Arctic States to submit their Arctic ship accident data to the project lead (USA). While the USA provided initial guidance on the scope and types of accident data requested, it accepted all data submitted. Six Arctic States submitted relevant data. Sweden and Finland had no relevant data. Given the various forms and format of the information submitted, the USA devoted significant effort to reformatting, restructuring, and standardizing the data in a consistent fashion to compile it into a single table with one record/row per accident. Also, the USA identified and removed duplicate records. The result of this process was the identification of 5,656 unique accident records in the CASA data table.[1]

CHRONOLOGICAL SCOPE OF THE CASA

The original CASA project proposal contemplated covering Arctic ship accidents that occurred between 2005 and 2018. The project lead selected 2005 as the starting point because 2004 was the end date for the ship accident data in the 2009 AMSA Report." The original end date was adjusted from 2018 to 2017 since this was the last calendar year where all Arctic States submitted a complete set of accident data." As reflected below, four Arctic states submitted data for incidents after calendar year 2017. That data is not, however, included in the 5,004 incidents identified in the final data spreadsheet.

1 Unsurprisingly, Arctic States have different ship accident reporting thresholds, do not require that the identical types of accident information be reported, and do not require the identical level of detail for information that is reported. These differences made it challenging to standardize the data received with complete and perfect uniformity. The U.S. is proposing a follow-on PAME project for the 2021-2023 Work Plan to develop a standardized and uniform Arctic ship accident reporting template so that any future updates of the CASA project may be accomplished more easily with greater congruency and consonancy in the data submitted.

Source of Incident Data							
Year of Incident	Canada	Kingdom of Denmark	Iceland	Norway	Russian Federation	United States	*TOTAL*
2005	3	0	0	0	23	362	*388*
2006	12	0	0	0	19	392	*423*
2007	11	0	0	1	8	327	*347*
2008	8	0	0	3	17	311	*339*
2009	14	0	0	4	13	316	*347*
2010	9	6	0	1	18	291	*325*
2011	3	8	1	3	20	316	*351*
2012	13	10	0	3	10	351	*387*
2013	8	7	3	2	20	302	*342*
2014	13	7	74	2	10	345	*451*
2015	14	13	126	4	15	321	*493*
2016	16	5	96	5	17	217	*356*
2017	17	10	138	3	12	275	*455*
TOTAL	*141*	*66*	*438*	*31*	*202*	*4126*	*5004*

Table 1 - Data by Year of Incident and Source

Geographic Scope of the CASA

This project's geographic scope includes all accidents occurring north of 58 degrees North latitude, which is approximately the southern boundary of the IMO Arctic Polar Code area. Of the 5,004 unique accident records submitted by Arctic States for 2005-2017, 2,550 records were for accidents south of 58 degrees North latitude, and 60 incidents contained no geographic position data. The remaining 2,638 accident records were within the geographic scope of the CASA project.

Source of Incident Data							
Year of Incident	Canada	Kingdom of Denmark	Iceland	Norway	Russian Federation	United States	*TOTAL*
2005	3	0	0	0	23	168	*194*
2006	10	0	0	0	18	179	*207*
2007	11	0	0	1	7	139	*158*
2008	8	0	0	3	15	135	*161*
2009	13	0	0	4	11	127	*155*
2010	8	6	0	1	14	135	*164*
2011	3	6	1	3	12	134	*159*
2012	13	9	0	3	9	185	*219*
2013	7	2	1	2	17	138	*167*
2014	12	5	72	2	9	161	*261*
2015	14	10	122	4	12	132	*294*
2016	15	3	94	5	16	90	*223*
2017	16	4	134	3	11	108	*276*
TOTAL	*133*	*45*	*424*	*31*	*174*	*1831*	*2638*

Table 2 - Data by Year of Incident and Source, Incidents Occurring North of 58 degrees North Latitude

CHALLENGES

Multilateral bodies such as the International Maritime Organization (IMO) have long recognized the need to investigate marine accidents. They, along with States, shipowners, and marine insurers, have taken numerous steps to investigate marine accidents, cooperate on those investigations where appropriate, and share the lessons learned throughout the maritime community. More recently, the IMO and the European Maritime Safety Agency (EMSA) have made efforts to develop specific databases and guidance to facilitate the collection of accident data and provide a consistent form and format for it. Despite these efforts, the data collection associated with marine accidents still has a long way to go. The following are some of the basic problems with the data submitted for the CASA project. These problems highlight data structure and quality issues:

- 60 accident records did not include a geographic position;
- The form and format for the geographic position data varied. For example, latitude and longitude in one data cell captured as a string of data (*i.e.,*

58º30'30", 171º30'30"); latitude and longitude in degrees, minutes and seconds (*i.e.,* 58º 30' 30" N); latitude and longitude in degrees in decimal format (*i.e.,* 58.55ºN);

- Accident locations identified solely by a body of water (e.g., Chukchi Sea);
- 144 accident records categorized the Vessel Type as "Other", "N/A" or NULL/Blank;
- 238 accident records labeled the Accident Type as "Other" or NULL/Blank;
- Data submitted tagged Accident Types 79 different ways with many that were similar (*i.e.,* Fire, Fire – Initial, Fire-Reflash, Fire/Explosion, etc.);
- Data submitted identified 108 different Vessel Types with many that were similar. (*i.e.,* Barge, Deck Barge, Industrial Barge, Barge (general), etc.);
- Some Accident Type records contained the accident event (such as Collision or Grounding), while other Accident Type records contained the outcome of the accident event sequence (such as "Marine Pollution" or "Injury to Crewmember") and
- Accident data was not captured or provided for all years by all Arctic States.

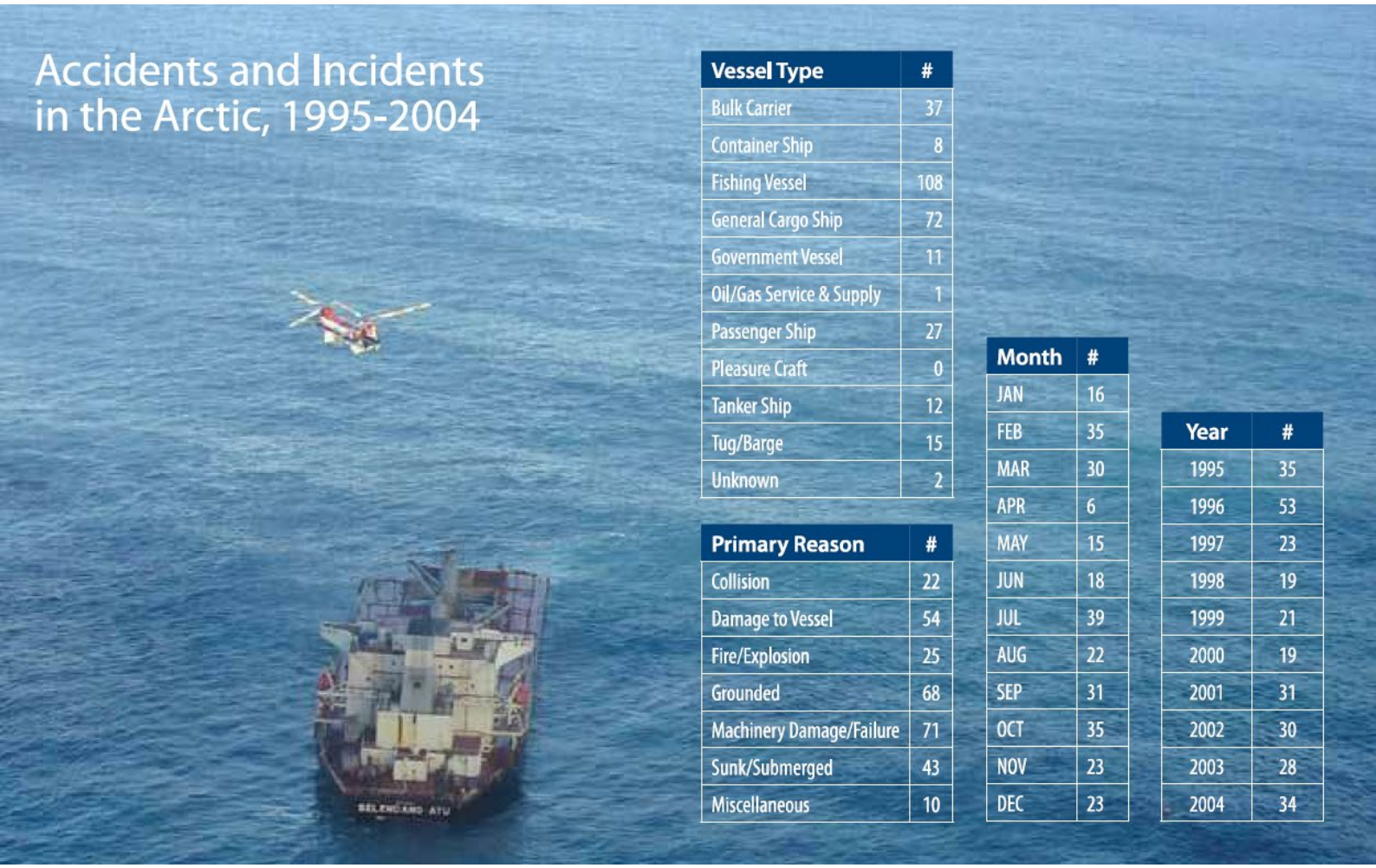
The inconsistent structure of the data submitted and the data gaps made it challenging to standardize the data. Substantial post-submission quality assurance/quality control and processing were necessary. Even with this post submission processing, inconsistencies in the data submitted and the data gaps made it challenging to analyze the data.

Future updates to the CASA would benefit from efforts to ensure a consistent, standardized structure and format for data submissions. Both the IMO and EMSA have developed guidance to improve the structure of ship accident data.[2] Both also operate databases for capturing accident data. For the IMO, it is the "Marine Casualties and Incidents" module within the online Global Integrated Shipping Information Systems (GISIS).[3] For EMSA, it is the online European Marine Casualty Information Platform (EMCIP).[4] Both GISIS and EMCIP use the same basic data structure, and the EMSA data submissions guidance was built upon the IMO guidance. To show how a consistent data structure would benefit the CASA, the following data summaries provide the data as submitted by Arctic States to CASA in their raw format, as well as the restructured data using the EMCIP structure and taxonomy.

[2] IMO's guidance is available at https://maiif.org/wp-content/uploads/2017/08/MSC_MEPC_3_Circ_4.pdf. EMCIP's guidance is available at http://www.emsa.europa.eu/emsa-homepage/141-implementation-tasks/accident-investigation/3024-emcip-taxonomy.html.
[3] https://gisis.imo.org/Public/Default.aspx.
[4] http://www.emsa.europa.eu/emcip.html.

UPDATED CASA DATA SUMMARIES

For reference, Figure 1 provides the Arctic ship accident data summaries from the 2009 AMSA Report.



Vessel Type	#
Bulk Carrier	37
Container Ship	8
Fishing Vessel	108
General Cargo Ship	72
Government Vessel	11
Oil/Gas Service & Supply	1
Passenger Ship	27
Pleasure Craft	0
Tanker Ship	12
Tug/Barge	15
Unknown	2

Primary Reason	#
Collision	22
Damage to Vessel	54
Fire/Explosion	25
Grounded	68
Machinery Damage/Failure	71
Sunk/Submerged	43
Miscellaneous	10

Month	#
JAN	16
FEB	35
MAR	30
APR	6
MAY	15
JUN	18
JUL	39
AUG	22
SEP	31
OCT	35
NOV	23
DEC	23

Year	#
1995	35
1996	53
1997	23
1998	19
1999	21
2000	19
2001	31
2002	30
2003	28
2004	34

Figure 1 – Accidents and Incidents in the Arctic (1995-2004). Source: 2009 AMSA Report, p. 86.

The following data summaries cover ship accidents in the geographic area covered by the CASA project from 2005 through 2017 - a total of 2,638 accident records.

Table 3a – Types of Vessels Involved in Accidents (CASA raw data)

Vessel Type	Count of Vessel Types
Barge	1
BARGE - LIQUID CARGO	1
Barge (Deck)	8
Barge (General)	40
Barge (Liquid)	34
Barge (Other)	2
Barge (Passenger)	1
Barge (self-propelled)	1
Barge (Unspecified)	3
Bulk Carrier	4
Bulk Liquid Cargo (Tank) Barge	4
CARGO - LIQUID	3
CARGO - SOLID	5
Cargo Ship	1
Cargo ship - Solid Cargo	1
Cargo ship - Solid Cargo - Container Ship	21
Cargo ship - Solid Cargo - General Cargo	3
Cargo ship - Solid Cargo - Refrigerated Cargo	1
Cargo Ship (Refrigerated)	4
Charter Fishing Vessel	2
Chemical Tank Ship	1
Chemical tanker	1
Container Ship	3
Cutter/Dredger	2
Diesel Electric Ship	1
Dredger	1
Excursion/Tour Vessel	1
Ferry	2
Fish Catching Vessel	45
Fishing	1
Fishing Catching/Processing Vessel	2
Fishing Vessel	752
Fishing vessel - Dredger	1
Fishing vessel - Gillnetter	23
Fishing vessel - Liner	83
Fishing vessel - Multipurpose - Other multipurpose	24
Fishing vessel - Multipurpose - Seiner-Handliner	56
Fishing vessel - Other	1

Fishing vessel - Seiner - Danish seiner	8
Fishing vessel - Trawler - Beam	1
Fishing vessel - Trawler - Stern	50
Floating Crane	1
General	28
General Cargo Ship	97
Government Vessel	23
Heavy Load Carrier	1
Icebreaker	23
Inland waterway vessel - Passenger	1
Loss of control - Loss of propulsion power	1
Motor Propelled Vessels	9
Motor Vessel	31
N/A	25
Ocean Cruise Vessel	6
Offshore Supply Vessel	1
Other	94
Passenger Ship	551
Passenger ship - Only passenger	3
Passenger ship - Only passenger - Domestic - Class A	12
Passenger ship - Only passenger - Domestic - Class B	4
Passenger ship - Only passenger - Domestic - Class C	9
Passenger ship - Only passenger - International	1
Passenger ship - Passenger and general cargo - Domestic - Class A	2
Passenger ship - Passenger and Ro-Ro cargo	5
Passenger ship - Passenger and Ro-Ro cargo - Domestic - Class B	3
Patrol Boat	3
Pilot	1
Pontoon	2
Port Boat	1
Recreational	143
Recreational craft - Motorboat	6
Refrigerated Cargo Ship	2
Refrigerator	1
Research	7
Ro-Ro	5
Rotary Crane	1
Service ship	5
Service ship - Dredger	3
Service ship - Multi-purpose	1
Service ship - Other	3
Service ship - Research ship	6
Service ship - SAR craft	2
Service ship - Tug (Towing/Pushing)	7

Serving Ship	1
Survey/Research	16
Tanker Ship	83
Towing Vessel	144
TUG	47
Unknown	16
Warship	1
Work Boat	1
Total	2638

Table 3b - Types of Vessels Involved in Accidents (EMCIP Vessel Type and Subtype)

EMCIP Vessel Types	Count of Vessel Types
Fishing vessel	800
Passenger ship	554
Unknown	207
Service ship - Tug (Towing/Pushing)	198
Recreational craft	149
Cargo ship	105
Barge	91
Cargo ship - Liquid Cargo	88
Fishing vessel - Liner	83
Fishing vessel - Seiner	64
Fishing vessel - Trawler	51
Cargo ship - Solid Cargo	48
Passenger ship - Only passenger	36
Navy/Government ship	27
Fishing vessel - Multipurpose	26
Fishing vessel - Gillnetter	23
Service ship - Ice breaker	23
Service ship - Research ship	22
Service ship - Other	15
Passenger ship - Passenger and Ro-Ro cargo	8
Service ship - Dredger	6
Service ship	6
Service ship - SAR craft	2
Passenger ship - Passenger and general cargo	2
Fishing vessel - Dredger	1
Fishing vessel - Other	1
Service ship - Multi-purpose	1
Service ship - Offshore supply ship	1
Total	2638

Table 4a – Types of Accidents (CASA raw data)

Types of Accidents	Count of Accident Types
Allision	96
Bottom Contact	18
Broke anchor	3
Capsize	21
Capsizing/Listing - Capsizing	1
Capsizing/Listing - Listing	2
Cast adrift	1
Collision	94
Collision - Ship not underway	2
Collision - With multiple ships	1
Collision - With other ship	18
Contact	6
Contact - Floating object - Other	2
Contact - Floating object - Unknown	1
Contact - Shore object	3
Damage/loss of equipment	3
Damage to Cargo	1
Damage to ship or equipment	33
Damage to towed object	1
DANGEROUS GOODS RELEASED	7
Death of crewmember	1
Discharge/Release - Pollution	28
Discharge/Release of Pollution	577
Equipment failure	256
Equipment failure/ Hazard to navigation	355
Equipment failure	1
Explosion	8
Fire	60
Fire/Explosion	6
Fire/Explosion - Explosion	4
Fire/Explosion - Fire	19
Flooding	70
Flooding - Initial	2
Flooding - Progressive	1
Flooding/Foundering - Flooding - Massive	6
Flooding/Foundering - Flooding - Progressive	5
Flooding/Foundering - Foundering	4
Fouling	15
Fouling/Equipment failure/Hazard to navigation	22
Grounding	250
Grounding/stranding - Drift	8

Grounding/stranding - Power	24
Injury	1
Injury to crew member	1
Intentional Beaching/Grounding/Anchoring To Avoid Occurrence	1
Loss of Cargo	1
Loss of control	1
Loss of control - Loss of containment	1
Loss of control - Loss of directional control	9
Loss of control - Loss of electrical power	6
Loss of control - Loss of propulsion power	133
Loss of electrical power	98
Loss of towing object	7
Loss/Reduction of Vessel Propulsion/Steering	27
Man Overboard	1
Material Failure/Malfunction	6
N/A salvage	12
Non-accidental event - Other	1
Other	5
Risk of Allision	1
Risk of Sinking	5
Set Adrift	10
Sinking	92
Striking	1
Sustains damage render unseaworthy/unfit for purpose	3
Total failure of any machinery or technical system	2
Vessel Maneuver	1
Vessel Yawl/Pitch/Roll/Heel	2
Wave Strikes/Impacts	1
Wave(s) Strikes/Impacts	1
Well Blowout	1
(blank)	171
Total	2638

Table 4b - Types of Accidents (EMCIP Event Types)

EMCIP Accident Types	Count of Accident Types
Accidental event: Equipment failure	618
Consequences - Marine Pollution	612
Casualty Event: Grounding/stranding	268
Casualty Event: Loss of control - Loss of propulsion power	180
#N/A	171
Casualty Event: Loss of control - Loss of electrical power	104
Casualty Event: Flooding/Foundering - Massive	103
Casualty Event: Contact - Fixed object	100
Casualty Event: Collision	94
Casualty Event: Fire/Explosion - Fire	79
Casualty Event: Flooding/Foundering	72
Casualty Event: Damage to ship or equipment	41
Casualty Event: Loss of control	40
Casualty Event: Grounding/stranding - Power	24
Casualty Event: Capsizing/Listing	21
Casualty Event: Collision - With other ship	18
Consequences: Loss/Damage to ship/Cargo	16
Casualty Event: Fire/Explosion - Explosion	12
Casualty Event: Loss of control - Loss of directional control	9
Casualty Event: Grounding/stranding - Drift	8
Casualty Event: Contact	8
Casualty Event: Fire/Explosion	6
Casualty Event: Flooding/Foundering - Progressive	6
OTHER	5
Casualty Event: Flooding/Foundering - Foundering	4
Consequences: People - People Injured	2
Casualty Event: Capsizing/Listing - Listing	2
Casualty Event: Collision - Ship not underway	2
Accidental event: Environmental effect	2
Casualty Event: Contact - Floating object	2
Accidental event: Equipment failure (Equipment failure)	2
Non-accidental event: Other	1
Casualty Event: Collision - With multiple ships	1
Non-accidental event	1
Consequences: People - Lives lost	1
Casualty Event: Capsizing/Listing - Capsizing	1
Consequences: People	1
Casualty Event: Loss of control - Loss of containment	1
Total	2638

Table 5 – Month and Year of Accidents

Month of Incident													
Year of Incident	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	*Total*
2005	10	13	11	11	14	19	31	32	21	12	8	12	*194*
2006	8	12	13	9	17	25	30	35	22	17	11	8	*207*
2007	10	4	16	8	9	23	32	19	15	10	7	5	*158*
2008	8	6	15	11	9	25	21	20	14	12	10	10	*161*
2009	16	9	7	6	11	16	21	28	17	9	11	4	*155*
2010	8	10	13	6	13	16	33	29	9	12	8	7	*164*
2011	9	10	7	6	13	27	21	25	17	10	5	9	*159*
2012	12	17	9	10	17	39	31	33	19	18	8	6	*219*
2013	8	6	0	7	21	18	34	27	14	17	9	6	*167*
2014	10	20	13	22	24	45	35	30	23	19	11	9	*261*
2015	20	10	18	20	25	45	44	42	33	17	10	10	*294*
2016	13	15	12	14	18	37	33	22	20	15	12	12	*223*
2017	7	8	19	10	35	40	39	47	27	17	16	11	*276*
Total	*139*	*140*	*153*	*140*	*226*	*375*	*405*	*389*	*251*	*185*	*126*	*109*	*2638*

Geographic Summary of Data Points

The 2009 AMSA Report provided a figure with a geographic plot of the ship accident data points. Given the larger quantity of CASA project data points in this version, the CASA data has not been summarized in this fashion as the scale of the data would prevent any meaningful analysis. Any type of geospatial analysis of the data should be conducted with a specific purpose in mind. It could also be combined with data from the Arctic Ship Traffic Database (ASTD) System, which may also help to normalize the data and provide further context to it.

REFERENCES AND RELATED DOCUMENTS

- PAME, Arctic Marine Shipping Assessment (AMSA) Report 2009
- PAME (II)/16.5.7/d (USA, CAN), Proposed Project for PAME Work Plan 2017-2019: Joint PAME-EPPR Project to Produce a Compendium of Arctic Ship Accidents Since 2005
- Senior Arctic Officials' Report to Ministers, Fairbanks, Alaska, United States (11 May 2017), pp. 50, 55
- Senior Arctic Officials' Report to Ministers, Rovaniemi, Finland (7 May 2019), p. 51.
- PAME 2017-2019 Work Plan & PAME 2019-2021 Work Plan
- EPPR, Record of Decisions, June 27-29, 2017, Vologda, Russian Federation ("*EPPR decided to support participation of the working group in the joint PAME/EPPR project titled the Compendium of Arctic Shipping Accidents. The United States will prepare a project proposal and submit to EPPR for approval intersessionally.*")
- PAME I-2018 ROD ("*PAME invites all members to submit by 1 April any available information on ship accidents in the Arctic since 2005 to the joint PAME/EPPR Compendium of Arctic Ship Accidents (CASA) project. PAME invites the US to provide an update of the project to the PAME SEG at PAME II-2018.*")
- PAME I-2019 ROD ("PAME notes with appreciation the submission by Arctic States of Arctic ship accident information to the joint PAME-EPPR Compendium of Arctic Ship Accidents (CASA) Project. PAME invites the USA to consolidate all data received and submit in advance of PAME II-2019 a revised draft compendium for review. PAME also invites the USA to submit a paper providing a high-level overview of the data to PAME II-2019.")
- PAME II-2019 ROD *("PAME II-2019 invites its members to inform the USA by 15 December 2019 of any errors or omissions in the data spreadsheet attached to the CASA Report (PAME (II)19/6.7/c). PAME requests that the USA continue to coordinate with EPPR on this joint project as necessary and appropriate and invites the USA to submit an update to PAME I -2020.")*
- PAME I-2020 ROD *("PAME invites the USA to update the CASA project data spreadsheet with information recently received from Canada, Norway, and Iceland, and to submit the updated data spreadsheet to PAME II-2020. PAME requests that Arctic States inform the USA by 1 June whether they have any reservation on the use of the data spreadsheet to create a new layer in the ASTD System.")*
- PAME II-2020 ROD *("PAME invites the USA to submit intersessionally for PAME approval a final report on the CASA project along with a final data spreadsheet. PAME approves the use of the CASA information to create an ASTD data layer, subject to an appropriate disclaimer about the multiple sources of the data and the work undertaken to standardize it.")*

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