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# Data collection of last 30 years ship accidents at the Baltic Sea area

## Keywords

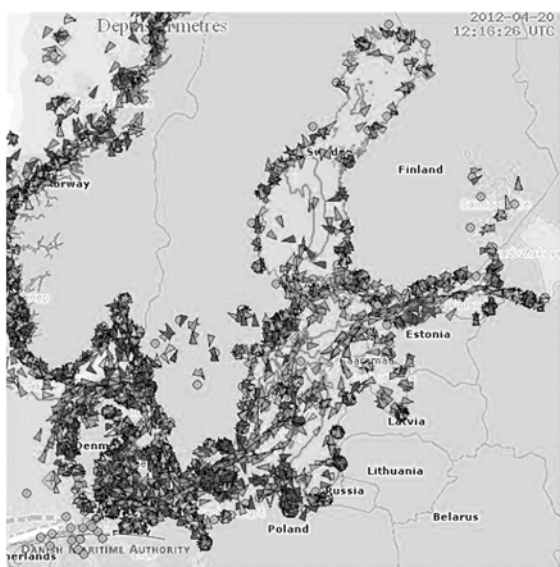
Baltic Shipping Critical Infrastructure Network (BSCIN), sea accident

## Abstract

The paper contains data collection of more than 100 sea accidents that have happened at the Baltic Sea area for last three decades. These accidents are classified according to kind and range of the casualty. Moreover, the location and weather parameters during the sea accidents are given.

## 1. Introduction

There are 15% of global transportation gathered at the Baltic Sea area. It means that there are more than 70,000 ships entering and living the Baltic Sea every year and about 2,000 vessels are at the Baltic Sea at any given moment as illustrated in *Figure 1*.



*Figure 1.* Snapshot from Automatic Identification System registered ships at the Baltic Sea (each spot on the map is a ship, the source: HELCOM).

The set of ships operating at the Baltic Sea waters at the fixed moment of time (or at the fixed time interval) is called the dynamic Baltic Shipping Critical Infrastructure Network – BSCIN [Bogalecka et al., 2016].

The huge traffic is a reason of sea accidents. The *m/s Globe Asimi* accident was the most severe accident that has ever been happened in the Baltic Sea area, causing its pollution. On November 19<sup>th</sup>, 1981, in rough weather conditions, the British tanker loaded with 20,000 tons of oil was leaving the port in Klaipėda when it hit the pier. Most of the oil spilled into the sea (16,000 tons), causing an environmental disaster. The spillage was classified as a medium one, compared to the most tragic sea accident in the world. On July 19<sup>th</sup>, 1979 *m/s Atlantic Empress* and *m/s Aegean Captain* collided with each other in the Caribbean Sea, 10 miles off Tobago and 287,000 tons of oil spilled as a result of the accident [Bogalecka, 2009, Cedre, 2017].

There is a lack of exhausting, detailed and completed documents on ship accidents at the Baltic Sea for last three decades. Annual reports on shipping accidents in the Baltic Sea area have been compiled by HELCOM since year 2000 [HELCOM, 2014]. These paper include accidents both in territorial seas or *exclusive economic zones* (EEZ) of the HELCOM Contracting Party.

The last two decades data show more than 100 accidents and incidents at the Baltic Sea every year (Figure 2). HELCOM reported approximately 1840 accidents with 1960 vessels at the Baltic Sea in 1989-2013. On average 4.7% of them (in 2004-2013) occurred the sea environment pollution with usually no more than 0.1-1 tones of oil substances rather than others chemicals [HELCOM, 2014]. The pollution with substance other than oil has noted only once since 1996 (a leakage of 0.5 m<sup>3</sup> of orthoxylene in Gothenburg on 13<sup>th</sup> February 1996) [Häkkinen, Posti, 2014].

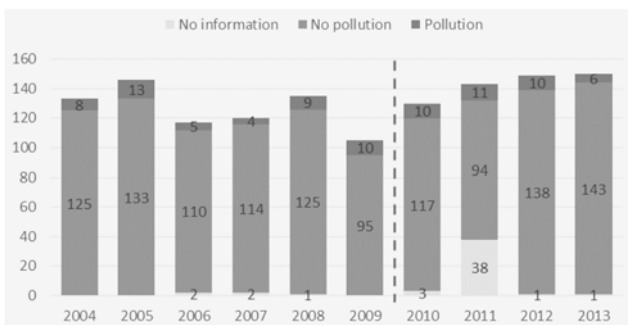


Figure 2. Number of reported accidents in the Baltic Sea [HELCOM, 2014].

The last report on shipping accidents in the Baltic Sea area was performed in 2014 by the HELCOM. The report contains the shipping accidents data collected for years 2004-2013 [HELCOM, 2014]. According to the HELCOM report, collisions and groundings are the main causes of the accidents in the Baltic Sea (18% and 20% in 2013 respectively). The most of accidents occurred in the coastal areas (especially Swedish, Danish and Finnish), making ports, beaches and coasts the most threatened zones. Fortunately, only few accident caused marine pollution (4% in 2013). Moreover, it occurred that human violations and errors (routine, alcohol and drugs) as well as environmental causes (heavy sea, restricted visibility and fog) were often the primary causes of the initial events. Cargo and passenger ships are vessels most usually involved in sea accidents (49% and 25% in 2013 respectively). A lot of sea accidents were noted in the first and second quarter of the year. Short day and bad weather during winter and early springtime could be reasons for this. Moreover, 15 accidents in 2013 took place in ice conditions [Bogalecka, 2012].

## 2. Data collection of ship accidents at the Baltic Sea area

In spite of the HELCOM reported approximately 1840 accidents with 1960 vessels at the Baltic Sea in 1989-2013 years, there are not their detailed

descriptions. Therefore only small part of these accidents is presented in Table 1. The compilation was performed based on some accessible reports of ship accidents at the Baltic Sea [Cedre, 2017, European Maritime Safety Agency, 2014, GISIS, 2017, HELCOM, 2014] and included the date of accident, its location, the weather condition during the accident, and the detailed description of an accident.

Table 1. Data collection of ship accidents at the Baltic Sea area (own calculations based on data for years 1989-2014).

<p>1. Date / Time: 4 XI 1989  Ship: dry cargo ship <i>Julie A</i>  Location: Harbour of Århus, Denmark, 56°9'24.03"N, 10°12'59.86"E  Weather: wind speed: 2-4.8 m/s; wind direction: N, NE; height waves: 0.3-0.9 m; period waves: 3.6-5.2 s</p>
<p>2. Date / Time: 14 I 1993, 5:12  Ship: ferry <i>Jan Heweliusz</i>  Location: 54°36'58"N, 14°13'16"E  Weather: height waves: 6 m; wind speed: 180 km/h</p>
<p>3. Date / Time: 10 X 1993,  Ship: dry bulk carrier <i>Frank Michael</i>  Location: North of the island of Gotland, approx. 58°N, 19°E  Weather: height waves: 1.07 m; period waves: 4.6 s; wind direction: SW; wind speed: 7.5 m/s; the weather got worse during emergency response</p>
<p>4. Date / Time: 28 III 2000  Ship: chemical tanker <i>Martina</i> and container ship <i>Werder Bremen</i>  Location: Northern Öresund, Sweden (offshore), 56°17.66'N, 12°24.29'E  Weather: height waves: 1.28 m; period waves: 5.0 s; wind direction: NE, wind speed: 5.47 m/s; poor visibility; strong winds; heavy snowfall</p>
<p>5. Date / Time: 28 III 2001, 12:30  Ship: oil tanker <i>Baltic Carrier</i> and cargo vessel <i>Tern</i>  Location: 54°43.10'N, 12°35.00'E  Weather: wind: S/SE 15-18 m/s gust 22 m/s; height waves: 2-3 metres; visibility: good; air temp. 3°C; water temp: 2°C</p>
<p>6. Date / Time: 31 V 2003, 12:15  Ship: bulk carrier <i>Fu Shan Hai</i> and container ship <i>Gdynia</i>  Location: off Bornholm Island / Denmark, 55°21.0'N, 014°44.6'E  Weather: visibility: good approx. 10 nm; clear weather; wind direction: WSW, wind speed: 6 m/s; clear skies, the visibility was 16-18 km;</p>

height waves: 1 m
7. Date / Time: 16 II 2004, 04:33 Ship: passenger vessel <i>Stena Nautica</i> and smaller vessel <i>Joanna</i> Location: off Varberg, 56°57.50'N, 12°07.40'E Weather: the weather was calm with intermittent fog; cloudy: 4 oktan; wind direction: NW; wind speed: 1 m/s; temperature: 1.2°C; humidity: 96%; height waves: 0.1 m
8. Date / Time: 28 II 2004, 00:23 Ship: general cargo vessel <i>Hannes</i> Location: after departure from Oskarshamn, 57°16.60'N, 16°30.60'E Weather: cloudy: 5 oktan; wind direction: WS; wind speed: 2 m/s; temperature: 1.6°C; height waves: 0.2 m
9. Date / Time: 13 III 2004, 18:30 Ship: general cargo vessel <i>Dan Trimmer</i> Location: open sea, 55°32.00'N, 18°35.00'E Weather: cloudy: 8 oktan; wind direction: SSE; wind speed: 7 m/s; temperature: 5°C; rough weather; height waves: 1 m
10. Date / Time: 13 IV 2004 Ship: <i>Wani Pride</i> Location: coastal waters (within 12 miles), 55°39.00'N, 12°42.00'E Weather: cloudy: 5 oktan; wind direction: NE; wind speed: 2 m/s; temperature: 5°C; height waves: 0.2 m
11. Date / Time: 21 V 2004, 12:40 Ship: general cargo ship <i>Adriane</i> Location: Dirhami / Estonia, port approach, 59°12.00'N, 23°25.00'E Weather: visibility: 8 km; cloudy: 3 oktan; wind direction: NW; wind speed: 5 m/s; temperature: 13.8°C; height waves: 0.6 m
12. Date / Time: 7 VI 2004 Ship: bulk carrier <i>Domiat</i> Location: 400 m before SW entrance to Flintrännen, port approach, 55°30'.96N, 012°44'.32E Weather: wind: westerly force 3, slight current; visibility: good; sea: calm; water level: 1 cm below average; height waves: 0.6 m; wind speed: 3.4-5.4 m/s
13. Date / Time: 11 VII 2004, 2:00 Ship: cargo ship <i>Stadiongracht</i> Location: Great Belt – Hatter, coastal waters (within 12 miles), 55°54'13.00"N, 10°49'26.58"E Weather: cloudy: 4 oktan; wind direction: WSW; wind speed: 4 m/s; temperature: 12.7°C; height waves: 0.6 m
14. Date / Time: 30 VIII 2004, 19:17 Ship: <i>Saint Nicholas</i> Location: Great Belt – Hatter, coastal waters (within 12 miles), 55°54.20'N, 10°51.30'E

Weather: cloudy: 6 oktan; wind direction: SW; wind speed: 2 m/s; temperature: 13.7°C; height waves: 0.2 m
15. Date / Time: 14 IX 2004, 23:10 Ship: <i>Fjord Ice</i> Location: S-E of the lighthouse Flintrännen NO, The Sound, 55°36.80'N, 12°53.60'E Weather: cloudy: 3 oktan; visibility: 8 km; wind direction: SW; wind speed: 4 m/s; temperature: 18.6°C; height waves: 0.6 m
16. Date / Time: 30 IX 2004, 13:55 Ship: <i>Fotini Lady</i> Location: Great Belt – Hatter, coastal waters (within 12 miles), 55°54.00'N, 10°50.80'E Weather: cloudy: 6 oktan; visibility: 8 km; wind direction: NW; wind speed: 10 m/s; temperature: 12.4°C; height waves: 2 m;
17. Date / Time: 22 XI 2004, 05:19 Ship: general cargo ship <i>Ileksa</i> and container ship <i>Cepheus J</i> Location: 28 miles SW of Gothenburg / Sweden, 57°13.85'N, 11°32.65'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: SE; wind speed: 3 m/s; temperature: 0.9°C; height waves: 0.2 m
18. Date / Time: 9 XII 2004, 09:05 Ship: <i>Mastrogiorgis</i> Location: Great Belt, 55°15.00'N, 11°06.30'E Weather: cloudy: 6 oktan; visibility: 7 km; wind direction: WS; wind speed: 1 m/s; temperature: 4.6°C; height waves: 0.1 m
19. Date / Time: 19 I 2005, 15:50 Ship: <i>Alga</i> Location: Great Belt / Denmark, 55°42.00'N, 10°40.00'E Weather: cloudy: 5 oktan; visibility: 7 km; wind direction: SW; wind speed: 3 m/s; temperature: 2.9°C; height waves: 0.2 m
20. Date / Time: 21 I 2005, 07:10 Ship: <i>Sea Venturer II</i> Location: Kerteminde Bay / Denmark, 55°27'N, 10°46'E Weather: cloudy: 6 oktan; visibility: 8 km; wind direction: WN; wind speed: 6 m/s; temperature: 2.6°C; height waves: 1 m
21. Date / Time: 31 I 2005, 05:52 Ship: <i>Pomerania</i> Location: Western Baltic (Falsterbo rev lighthouse) / Sweden, 55°18.7'N, 12°40.7'E, coastal waters (within 12 miles) Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: WS; wind speed: 4 m/s; temperature: 4.4°C; height waves: 0.6 m
22. Date / Time: 4 II 2005 Ship: chemical tanker <i>Kerima</i> Location: Helsingborg, Sweden, port, 56°02.33'N,

12°41.44'E Weather: cloudy: 6 oktan; visibility: 7 km; wind direction: S; wind speed: 2 m/s; temperature: 1.6°C; height waves: 0.2 m	Weather: cloudy: 5 oktan; visibility: 8 km; wind direction: NNW; wind speed: 4 m/s; temperature: 19°C; height waves: 0.6 m
23. Date / Time: 6 II 2005, 06:10 Ship: <i>Transmar</i> Location: The Great Belt / Denmark, 54°45.2'N, 10°44.7'E Weather: cloudy: 3 oktan; visibility: 6 km; wind direction: SE; wind speed: 3 m/s; temperature: (-5.2°C); height waves: 0.2 m	31. Date / Time: 10 X 2005, 23:42 Ship: general cargo vessel <i>Lerrix</i> Location: off the Darss peninsular, Germany, 54°24.9'N, 12°24.6'E Weather: wind: SE; 4°B; sea state: 3; pressure: 1024 millibars; visibility: 5 nm; wind speed: 3.4-5.4 m/s; height waves: 0.6 m
24. Date / Time: 12 III 2005, 10:35 Ship: fishing vessel <i>Baltic Tara</i> Location: 55°26'N, 14°54'E, coastal waters (within 12 miles) Weather: cloudy: 5 oktan; visibility: 8 km; wind direction: WSW; wind speed: 4 m/s; temperature: 2.2°C; height waves: 0.6 m	32. Date / Time: 11 XI 2005, 01:00 Ship: <i>Ever Mighty</i> Location: Hatter Rev/Dania, 55°54'N, 10°51'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: SW; wind speed: 3 m/s; temperature: 8°C; height waves: 0.6 m
25. Date / Time: 17 III 2005, 11:00 Ship: tanker <i>Olivia</i> Location: Køge Harbour / Denmark, 55°27.3'N, 12°12'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: WS; wind speed: 3 m/s; temperature: 10.9°C; height waves: 0.2 m	33. Date / Time: 13 XI 2005, 04:45 Ship: ro-ro passenger ship <i>Finnsailor</i> and <i>General Grot-Rowecki</i> Location: 54°24.52'N, 12°11.12'E, coastal waters (within 12 miles) Weather: SW wind force 4B (6-8 m/s); overcast with good visibility: and 0.5 m sea from SW; it was dark; height waves: 1 m
26. Date / Time: 20 III 2005, 16:15 Ship: <i>Steel Queen</i> Location: off Oxelösund / Sweden, 58°40.8' N, 17°9' E Weather: cloudy: 3 oktan; visibility: 8 km; wind direction: NW; wind speed: 3 m/s; temperature: 0.2°C; height waves: 0.2 m	34. Date / Time: 28 XII 2005, 04:50 Ship: oil tanker <i>Sydstraum</i> Location: Kadetrenden / Denmark, 54°45'N, 11°3'E Weather: cloudy: 1 oktan; visibility: 8 km; wind direction: EN; wind speed: 8 m/s; temperature: (-3.2°C); height waves: 2 m
27. Date / Time: 13 V 2005, 23:50 Ship: <i>Munsu</i> Location: the Sound / Denmark, 55°36'N, 12°46'E Weather: cloudy: 0 oktan; visibility: 8 km; wind direction: ES; wind speed: 2 m/s; temperature: 7.9°C; height waves: 0.2 m	35. Date / Time: 2 I 2006, 12:30 Ship: <i>Egon W</i> Location: north of Bornholm / Denmark, coastal waters (within 12 miles), 55°38.3'N, 15°11.8'E Weather: cloudy: 8 oktan; visibility: 4 km; temperature: 1.8°C; height waves: 0.0 m; wind speed: 0 m/s
28. Date / Time: 26 VI 2005, 04:40 Ship: <i>Pochard</i> Location: Hatter Rev / Denmark, 55°54'N, 10°50'E Weather: cloudy: 2 oktan; visibility: 6 km; wind direction: SW; wind speed: 2 m/s; temperature: 13.4°C; height waves: 0.2 m	36. Date / Time: 5 I 2006, 01:47 Ship: <i>Berit</i> Location: Trindelen Bank / Denmark, 54°31.17'N, 12°03.31'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: ENE; wind speed: 6 m/s; temperature: 1°C; height waves: 1.0 m
29. Date / Time: 30 VII 2005, 6:20 Ship: ferry <i>Stena Baltica</i> Location: Gdynia harbour, 54°5333'N, 18°5500'E Weather: temperature: 20.6°C; relative humidity 90%; visibility: good; strong wind SE-SW from 5° upto 8°-9°B; cloudy: 7 oktan; visibility: 7 km; height waves: 2-7 m; wind speed: 10.8-24.4 m/s	37. Date / Time: 25 I 2006, 09:00 Ship: general cargo vessel <i>Harrix</i> Location: Riga / Latvia, 56°57.00'N, 24°05.00'E Weather: cloudy: 5 oktan; visibility: 6 km; wind direction: S; wind speed: 5 m/s; temperature: (-8.0°C); sea water temperature: (-18°C); height waves: 0.6 m
30. Date / Time: 4 VIII 2005, 10:50 Ship: <i>Atlantic</i> and <i>Arngast</i> Location: DW Route East of Langeland / Denmark, 54°43'N, 10°47'E	38. Date / Time: 22 II 2006, 21:35 Ship: <i>Varmland</i> Location: Rauma / Sweden, 61°6.5'N, 21°21'E Weather: cloudy: 6 oktan; visibility: 8 km; wind

direction: NNE; wind speed: 4 m/s; temperature: 0.9°C; ice condition; height waves: 0.6 m
39. Date / Time: 4 III 2006, 07:45 Ship: <i>Pandion</i> Location: Holmsund, Sweden, (port approach), 63°40.28'N, 20°20.15'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: NW; wind speed: 3 m/s; temperature: 0.6°C; height waves: 0.2 m
40. Date / Time: 22 III 2006, 12:30 Ship: motor tanker <i>Azov Mariner</i> Location: Malmö / Sweden, 55°30.71'N, 12°53.63'E Weather: cloudy: 3 oktan; visibility: 8 km; wind direction: NNW; wind speed: 3 m/s; temperature: 2°C; height waves: 0.2 m
41. Date / Time: 30 III 2006, 16:40 Ship: <i>MSC Patricia</i> Location: 56°5.4'N, 10°31.85'E, port approach Weather: cloudy: 7 oktan; wind direction: S, SW; wind speed: 5.5-7.9 m/s; temperature: 8.3°C; visibility: is about 0.7 MM; height waves: 1.0 m
42. Date / Time: 13 IV 2006, 02:55 Ship: <i>Volgo-Balt 211</i> Location: the Sound, 56°05.40'N, 12°30.70'E Weather: cloudy: 5 oktan; visibility: 5 km; wind direction: SSW; wind speed: 2 m/s; temperature: 4.9°C; height waves: 0.2 m
43. Date / Time: 27 VI 2006, 15:55 Ship: bulk carrier <i>Conrad Oldendorff</i> Location: 54°52.7'N, 14°44.48'E, coastal waters (within 12 miles) Weather: cloudy: 4 oktan; visibility: 8 km; wind direction: WN; wind speed: 2 m/s; temperature: 21°C; the weather and the visibility: good; height waves: 0.2 m
44. Date / Time: 25 VII 2006, 04:36 Ship: <i>Sylve</i> Location: Bornholm, 55°9'N, 14°42'E Weather: cloudy: 0 oktan; visibility: 8 km; wind direction: NE; wind speed: 4 m/s; temperature: 25.7°C; height waves: 0.6 m
45. Date / Time: 4 VIII 2006, 04:15 Ship: <i>Plato</i> Location: the Sound, 55°42.5'N, 12°40.3'E Weather: cloudy: 3 oktan; visibility: 7 km; wind direction: N; wind speed: 0 m/s; temperature: 12.9°C; height waves: 0.0 m
46. Date / Time: 20 VIII 2006, 12:15 Ship: container ship <i>Star Ismene</i> Location: 56°2'N, 10°51.5'E Weather: cloudy: 6 oktan; visibility: 6 km; wind direction: SES; wind speed: 2 m/s; temperature: 20°C; height waves: 0.2 m
47. Date / Time: 4 XI 2006, 06:20 Ship: <i>Mercandia</i> and <i>Sundbuss Pernille</i>

Location: the Sound, 56°2.2'N, 12°37.4'E Weather: cloudy: 7 oktan; visibility: 6 km; wind direction: WSW; wind speed: 4 m/s; temperature: 2.2°C; dense fog; height waves: 0.6 m
48. Date / Time: 11 I 2007, Ship: bulk carrier <i>Golden Sky</i> Location: Latvia (inshore), 57°24'1.23N, 21°32'21.26E Weather: visibility: 6-9 km; wind direction: SW, W, WSW; wind speed: 7-10 m/s; temperature: < 0°C; cloudy: 5-7 oktan; height waves: 1.0-2.0 m
49. Date / Time: 14 I 2007, 16:55 Ship: <i>Trans Frej</i> Location: Oxelösund / Sweden, coastal waters (within 12 miles), 58°40.90'N, 17°13.65'E Weather: visibility: 7 km; cloudy: 7 oktan; wind direction: W; wind speed: 17 m/s (max 24 m/s); temperature: 7.3°C; strong wind with showers of snow and rain; height waves: 4.0 -7.0 m
50. Date / Time: 14 V 2007, 18:30 Ship: oil tanker <i>Minerva Concert</i> and m/t <i>Duk Blend Grude Oil</i> Location: Hatter Barn, 55°53.70'N, 10°56.30'E Weather: visibility: 8 km; cloudy: 7 oktan; wind direction: SSW; wind speed: 2 m/s; temperature: 19.1°C; height waves: 0.2 m
51. Date / Time: 10 VI 2007, 02:40 Ship: ro-ro / cargo vessel <i>Breant</i> Location: Olands Sodra Grund (off Sweden), 56°01.00'N, 16°41.00'E Weather: visibility: 7 km; cloudy: 0 oktan; wind direction: E; wind speed: 1 m/s; temperature: 18.8°C; height waves: 0.1 m
52. Date / Time: 26 VI 2007, 16:22 Ship: <i>Barri</i> Location: Riga harbour (at berth), 56°56'38.13"N, 24°6'11.79"E Weather: visibility: 9 km; cloudy: 4 oktan; wind direction: WS; wind speed: 3 m/s; temperature: 18.6°C; height waves: 0.2 m
53. Date / Time: 12 XII 2007, 11:00 Ship: ferry <i>Spodsbjerg</i> Location: Langelandsbælt (at berth), 54°56.00'N, 10°50.00'E Weather: visibility: 7 km; cloudy: 8 oktan; wind direction: NEN; wind speed: 6 m/s; temperature: 5.7°C; height waves: 1.0 m
54. Date / Time: 10 I 2008, 19:20 Ship: ro-ro cargo ferry <i>Stena Danica</i> Location: Arhipelag Gothengurg, 57°39.62'N, 11°46.01'E Weather: visibility: 7 km; cloudy: 4 oktan; wind direction: SW; wind speed: 3 m/s; temperature: 3.1°C; height waves: 0.2 m
55. Date / Time: 18 I 2008, 04:30 Ship: general cargo ship <i>Rubyn</i> and dredger

<p><i>Ahlsell</i>                  Location: south of Bornholm, coastal waters (within 12 miles), 54°56.00'N, 14°50.00'E                  Weather: visibility: 6 km; cloudy: 7 oktan; wind direction: S; wind speed: 4 m/s; temperature: 4.5°C; height waves: 0.6 m</p>	<p>55°07.50'N, 14°40.90'E                  Weather: visibility: 7 km; cloudy: 3 oktan; temperature: 10.3°C; fair weather; wind speed: 0.0 m/s; height waves: 0.0 m</p>
<p>56. Date / Time: 31 I 2008, 16:45                  Ship: <i>Schleswig-Holstein</i>                  Location: Snaevringen – Lille Baelt, 55°33.30'N, 9°46.40'E                  Weather: wind: SW 22 m/s, and the current was to the NE speed 3.4-5.4 m/s; visibility: 8 km; temperature: 3.6°C; cloudy: 7 oktan; height waves: 7 m</p>	<p>64. Date / Time: 21 V 2008, 05:25                  Ship: <i>Rudokop</i> and one-man operated fishing vessel                  Location: SW of Bornholm, 54°56.00'N, 14°40.80'E                  Weather: visibility: 8 km; cloudy: 3 oktan; wind direction: ENE; wind speed: 5 m/s; temperature: 11.7°C; height waves: 0.6 m</p>
<p>57. Date / Time: 24 II 2008, 05:26                  Ship: <i>Wani Will</i>                  Location: open sea, 55°05.39'N, 14°41.65'E                  Weather: visibility: 6 km; cloudy: 7 oktan; wind direction: SWS; wind speed: 3 m/s; temperature: 9.0°C; height waves: 0.2 m</p>	<p>65. Date / Time: 23 V 2008, 14:30                  Ship: <i>Helenic</i>                  Location: Oxe'lösund / Sweden, 58°39'29.38"N, 17°7'8.65"E                  Weather: visibility: 8 km; cloudy: 7 oktan; wind direction: NE; wind speed: 5 m/s; temperature: 13.3°C; height waves: 0.6 m</p>
<p>58. Date / Time: 6 III 2008, 20:40                  Ship: ro-ro vessel <i>Tor Corona</i>, oil tanker <i>Anichkov Bridge</i> and oil tanker <i>Valle Di Nervion</i>                  Location: Klaipeda port, 55°43.50'N, 21°05.80'E                  Weather: visibility: 7 km; cloudy: 4 oktan; temperature: 4.8°C; wind: 15 m/s W and strong currents; height waves: 4 m</p>	<p>66. Date / Time: 2 VII 2008, 02:00                  Ship: general cargo ship <i>Rosethorn</i>                  Location: the Sound, coastal waters (within 12 miles), 55°40.50'N, 12°41.80'E                  Weather: visibility: 8 km; cloudy: 4 oktan; wind direction: SE; wind speed: 1 m/s; temperature: 11.2°C; height waves: 0.1 m</p>
<p>59. Date / Time: 16 III 2008, 07:50                  Ship: roro cargo ferry <i>Mercandia VIII</i>                  Location: Elsinore Harbour / Denmark, 56°02.10'N, 12°37.20'E                  Weather: visibility: 7 km; cloudy: 6 oktan; wind direction: NE; wind speed: 4 m/s; temperature: 2°C; dense fog; height waves: 0.6 m</p>	<p>67. Date / Time: 11 VII 2008, 12:12                  Ship: tug <i>Thor</i>, tug <i>Tyr</i> and motor yacht <i>Waterlilly</i>                  Location: Aarhus Harbour, 56°9'26.34"N, 10°13'27.52"E                  Weather: visibility: 8 km; cloudy: 5 oktan; wind direction: SW; wind speed: 3 m/s; temperature: 23.5°C; height waves: 0.2 m</p>
<p>60. Date / Time: 24 III 2008, 14:23                  Ship: <i>Lauwersborg</i>                  Location: Hundested / Denmark, port approach, 56°00.00'N, 11°50.00'E                  Weather: visibility: 8 km; cloudy: 2 oktan; wind direction: SSW; wind speed: 3 m/s; temperature: 5.5°C; poor visibility; height waves: 0.2 m</p>	<p>68. Date / Time: 23 VII 2008, 02:28                  Ship: dry cargo vessel <i>Vinga</i>                  Location: Trosa archipelago, 58°49.48'N, 17°44.48'E                  Weather: visibility: 7 km; cloudy: 1 oktan; wind direction: SW; wind speed: 2 m/s; temperature: 11.2°C; height waves: 0.2 m</p>
<p>61. Date / Time: 10 IV 2008, 18:28                  Ship: tug <i>Barta</i> and <i>m/v Magdalena</i>                  Location: Klaipeda, port, 55°42.30'N, 21°07.10'E                  Weather: visibility: 6 km; cloudy: 8 oktan; wind direction: NE; wind speed: 4 m/s; temperature: 3.5°C; height waves: 0.6 m</p>	<p>69. Date / Time: 6 IX 2008, 11:45                  Ship: general cargo ship <i>Noren</i>                  Location: the Sound, 55°49.40'N, 12°48.00'E                  Weather: visibility: 8 km; cloudy: 6 oktan; wind direction: SWS; wind speed: 2 m/s; temperature: 22.5°C; height waves: 0.2 m</p>
<p>62. Date / Time: 14 V 2008, 02:00                  Ship: <i>m/v Kemira Gas</i> and chemical tanker <i>Lycian</i>                  Location: Great Belt, 55°36.40'N, 10°54.00'E                  Weather: visibility: 8 km; cloudy: 0 oktan; wind direction: SSE; wind speed: 1 m/s; temperature: 5.8°C; height waves: 0.1 m</p>	<p>70. Date / Time: 14 X 2008, 21:25                  Ship: cargo vessel <i>Kormoran</i>                  Location: Kulhuse Rende, Roskilde Fjord, 55°56.00'N, 11°54.00'E                  Weather: visibility: 6 km; cloudy: 6 oktan; wind direction: SWS; wind speed: 2 m/s; temperature: 10.7°C; height waves: 0.2 m</p>
<p>63. Date / Time: 17 V 2008, 03:04                  Ship: general cargo ship <i>Mcl Trader</i>                  Location: coastal waters (within 12 miles),</p>	<p>71. Date / Time: 17 X 2008, 06:55                  Ship: dredger <i>Rozgwiazda</i>                  Location: Polish coastal area, 54°22.00'N,</p>

15°44.70'E Weather: visibility: 6 km; cloudy: 7 oktan; wind direction: WSW; wind speed: 3 m/s; temperature: 6.7°C; heavy weather; height waves: 0.2 m
72. Date / Time: 1 XII 2008, 20:49 Ship: dry cargo vessels <i>Hagland Bona</i> and dry cargo vessels <i>Bluebird</i> Location: Randers Fjord, 56°30.28'N, 10°13.77'E Weather: visibility: 5 km; cloudy: 7 oktan; wind direction: ESE; wind speed: 3 m/s; temperature: 5.5°C; height waves: 0.2 m
73. Date / Time: 2 XII 2008, 22:01 Ship: fishing vessel <i>Beverina</i> Location: 3 nm from port of Liepaja, 56°29.50'N, 20°54.10'E Weather: visibility: 8 km; cloudy: 6 oktan; wind direction: SWW; wind speed: 7 m/s; temperature: 5.8°C; height waves: 1.0 m
74. Date / Time: 16 XII 2008, 17:30 Ship: <i>Mirabelle</i> Location: 3 nm from port of Liepaja, 55°03.00'N, 10°36.70'E Weather: visibility: 6 km; cloudy: 7 oktan; wind direction: SE; wind speed: 1 m/s; temperature: 2.1°C; height waves: 0.1 m
75. Date / Time: 18 XII 2008, 05:32 Ship: tug <i>Castor</i> Location: 10 nm. W of Svetoje, 56°01.90'N, 20°45.75'E Weather: visibility: 5 km; cloudy: 8 oktan; wind direction: S; wind speed: 1 m/s; temperature: 3.5°C; height waves: 0.1 m
76. Date / Time: 11 I 2009, 07:33 Ship: <i>m/v Cranz</i> Location: South Karlshamn, Sweden, 56°07.47'N, 14°47.13'E Weather: visibility: 6 km; cloudy: 3 oktan; wind direction: SSW; wind speed: 4 m/s; temperature: (-4.1°C); height waves: 0.6 m
77. Date / Time: 17 II 2009, 10:03 Ship: fishing vessel <i>Unora</i> Location: approx. 37 nm E from Borholm, Denmark, approx. 55°9'14N, 16°15'10E Weather: visibility: 6 km; cloudy: 7 oktan; wind direction: ENE; wind speed: 17.2-20.7 m/s; temperature: (-2.1°C); stormy weather; height waves: 5.5 m;
78. Date / Time: 27 II 2009, 16:15 Ship: pilot boat <i>Servus</i> Location: Lille Baelt, 55°28.50'N, 9°41.60'E Weather: visibility: 7 km; cloudy: 7 oktan; wind direction: WNW; wind speed: 4 m/s; temperature: 4.8°C; height waves: 0.6 m
79. Date / Time: 28 II 2009, 07:50 Ship: sport fishing ship <i>Christa</i> and <i>Odin</i> Location: Wismar Bay, off Timmendorf, coastal

waters (within 12 miles), 53°59.47'N, 11°21.95'E Weather: visibility: 7 km; cloudy: 6 oktan; wind direction: N; wind speed: 2 m/s; temperature: 0.4°C; height waves: 0.2 m
80. Date / Time: 22 III 2009, 09:35 Ship: container ship <i>Karin Schepers</i> Location: the Sound, 55°39.44'N, 12°42.15'E Weather: visibility: 7 km; cloudy: 5 oktan; wind direction: NWN; wind speed: 8 m/s; temperature: 6.6°C; height waves: 2.0 m
81. Date / Time: 16 IV 2009, 22:47 Ship: hotel vessel <i>Queen of Scandinavia</i> Location: Oskarshamn, at berth, 57°15.91'N, 16°27.69'E Weather: visibility: 7 km; cloudy: 0 oktan; wind direction: E; wind speed: 5 m/s; temperature: 6.6°C; height waves: 0.6 m
82. Date / Time: 4 VI 2009, 16:24 Ship: <i>m/v Svalandia</i> Location: South of Trelleborg, coastal waters (within 12 miles), 55°19.18'N, 13°28.80'E Weather: visibility: 8 km; cloudy: 6 oktan; wind direction: SE; wind speed: 1 m/s; temperature: 9.9°C; height waves: 0.1 m
83. Date / Time: 3 VII 2009, 21:05 Ship: refrigerated cargo ship <i>Kea</i> Location: Kalundborg Fjord / Denmark, 55°41.33'N, 10°55.79'E Weather: visibility: 7 km; cloudy: 0 oktan; temperature: 16.8°C; wind speed: 0 m/s, height waves: 0.0 m;
84. Date / Time: 14 VII 2009, 22:26 Ship: chemical tanker <i>Maria M</i> Location: Gothenburg, 57°31.63'N, 11°40.30'E Weather: visibility: 7 km; cloudy: 4 oktan; wind direction: SSE; wind speed: 1 m/s; temperature: 17.7°C; height waves: 0.0 m
85. Date / Time: 23 VII 2009, 11:20 Ship: roro cargo ferry <i>Gotland</i> and roro cargo ferry <i>Gotlandia II</i> Location: Nynäshamn, port approach, 58°54.94'N, 17°59.50'E Weather: visibility: 8 km; cloudy: 6 oktan; wind direction: SE; wind speed: 8 m/s; temperature: 26.8°C; height waves: 2.0 m
86. Date / Time: 15 VIII 2009, 13:00 Ship: cement carrier <i>Cembalo</i> Location: Hals Barre, 56°55.30'N, 10°30.50'E Weather: visibility: 8 km; cloudy: 7 oktan; wind direction: SWS; wind speed: 3 m/s; temperature: 22.5°C; height waves: 0.2 m
87. Date / Time: 2 X 2009, 03:26 Ship: <i>Arctic Sky</i> Location: Sondra Kvarken, Gulf of Bothnia (open sea), 60°16.33'N, 18°54.68'E Weather: visibility: 9 km; cloudy: 4 oktan; wind

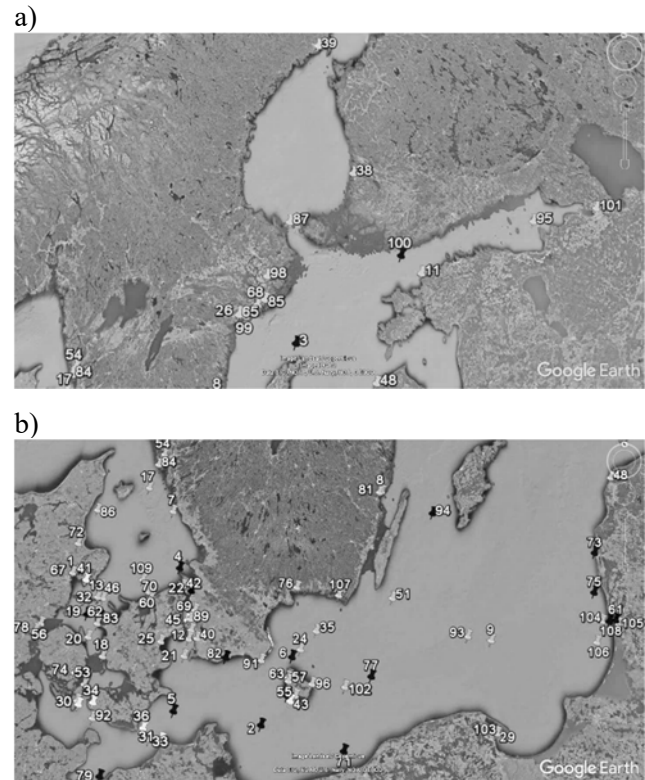
direction: WN; wind speed: 5 m/s; temperature: 8.4°C; height waves: 0.6 m;	condition; wind speed: 1 m/s; height waves: 0.1 m
88. Date / Time: 3 X 2009, 09:50 Ship: ro-ro ferry <i>Villum Clausen</i> Location: Rønne Harbour, 55°05.90'N, 14°41.60'E Weather: visibility: 6 km; cloudy: 8 oktan; temperature: 8.7°C; wind: SSE, 15 m/s (increasing); height waves: 4.0 m	96. Date / Time: 28 IV 2010, 22:00 Ship: fishing vessel <i>Rytas</i> Location: Nexø / Bornholm, port approach, 55°03.80'N, 15°08.30'E Weather: visibility: 8 km; cloudy: 5 oktan; wind direction: SE; wind speed: 2 m/s; temperature: 11.1°C; height waves: 0.2 m
89. Date / Time: 29 X 2009, 06:11 Ship: fishing ship <i>Simone</i> and container ship <i>Aurora</i> Location: the Sound, 55°43'15N, 12°43'35E Weather: visibility: 8 km; cloudy: 6 oktan; wind direction: ES; wind speed: 3 m/s; temperature: 7.7°C; height waves: 0.2 m	97. Date / Time: 9 VII 2010, 03:52 Ship: m/v <i>Odin Pacific</i> Location: 55°09.00' N, 14°41.00'E Weather: visibility: 8 km; cloudy: 4 oktan; wind direction: SW; wind speed: 2 m/s; temperature: 18.1°C; height waves: 0.2 m
90. Date / Time: 11 I 2010, 16:00 Ship: m/v <i>Monsunen</i> Location: Göteborg Archipelago, 57°55.33'N, 11°37.65'E Weather: visibility: 6 km; cloudy: 8 oktan; wind direction: ESE; wind speed: 2 m/s; temperature: (-2.8°C); height waves: 0.2 m	98. Date / Time: 18 VIII 2010, 17:25 Ship: passenger ship <i>Djurgården 4</i> Location: at Nybrokajen, Stockholm, 59°19'21.54"N, 18°4'50.63"E Weather: visibility: 7 km; cloudy: 7 oktan; wind direction: WSW; wind speed: 4 m/s; temperature: 16.8°C; height waves: 0.6 m
91. Date / Time: 11 I 2010, 19:00 Ship: high-speed craft <i>Villum Clausen</i> Location: NW Bornholm, 55°18.10'N, 14°09.70'E Weather: visibility: 7 km; cloudy: 6 oktan; wind direction: ESE; wind speed: 2 m/s; temperature: (-3.0°C); height waves: 0.2 m	99. Date / Time: 9 XI 2010, 02:00 Ship: chemical tanker <i>Chantaco</i> Location: 58°37.74'N, 17°21,'66'E Weather: temperature: 4.4°C; cloudy: 8 oktan; wind speed: 2 m/s (increasing); height waves: 0.2 m
92. Date / Time: 24 I 2010, 15:15 Ship: m/v <i>Ability</i> Location: Fehmarnbelt, 3 nm N of Fehman, Germany, 54°35.00'N, 11°05.00'E Weather: visibility: 7 km; cloudy: 6 oktan; wind direction: NW; wind speed: 3 m/s; temperature: (-8.8°C); height waves: 0.2 m	100. Date / Time: 23 X 2011, 05:15 Ship: fish catching vessel <i>Florence</i> Location: Gulf of Finland, 69 miles west of Tallinn, Estonia, 59°33.00'N, 22°47.00'E Weather: wind speed: 5 m/s; wind direction: SW; temperature: 2.4°C; cloudy: 3 oktan; height waves: 0.6 m
93. Date / Time: 28 I 2010, 21:00 Ship: <i>DC Merwestone</i> Location: 55°35.0'N, 18°08.0'E Weather: the weather conditions had greatly improved and the wind had dropped; visibility: 7 km; cloudy: 7 oktan; wind direction: ESE; wind speed: 3 m/s; temperature: (-1,8°C); height waves: 0.2 m	101. Date / Time: 21 II 2012, 18:55 Ship: m/v <i>Arizona</i> Location: port of St. Petersburg, at berth, 59°53'18.37"N, 30°12'49.59"E Weather: wind speed: 11.4 m/s; wind direction: WS; temperature: 2.7°C; ice condition; height waves: 3.0 m
94. Date / Time: 6 II 2010, 08:20 Ship: cargo ship <i>Linda</i> Location: south of Gotland, offshore, 57°00.6'N, 17°34.2'E Weather: wind blew from south with force 4 (5.5–7.9 m/s); it was cloudy; temperature: (-2°C); the atmospheric pressure was rising (1027 hPa); no rain; height waves: 1.0 m;	102. Date / Time: 23 IV 2012, 00:53 Ship: cargo and passenger ship <i>Victoria Seaways</i> Location: open sea, 55°02.24'N, 15°45.36'E Weather: wind speed: 6 m/s; wind direction: SWW; temperature: 6°C; height waves: 1.0 m
95. Date / Time: 16 II 2010, 08:45 Ship: <i>SC Nordic</i> and ship <i>Magdalena</i> Location: Gulf of Finland, 59°51.46'N, 27°44.34'E Weather: visibility: 6 km; cloudy: 8 oktan; temperature: (-1,8°C); visibility: poor; ice	103. Date / Time: 17 V 2012, 08:45 Ship: ferry <i>Stena Spirit</i> Location: Gdynia (port), 54°32'9.55"N, 18°33'30.96"E Weather: temperature: 8.0°C; relative humidity 65%; wind direction: WNW; wind speed: 6 m/s; cloudy: 5 oktan; visibility: 8 km; height waves: 1.0 m
	104. Date / Time: 12 VI 2012, 13:00 Ship: fishing vessel and m/v <i>Kurkse</i>



Location: port of Klaipeda, 55°42.00'N, 20°50.20'E Weather: wind speed: 4m/s; wind direction: NE; temperature: 15.1°C; height waves: 0.6 m
105. Date / Time: 17 IX 2012, 09:10 Ship: fishing vessel <i>1095</i> and <i>Tobis</i> Location: port of Klaipeda, 55°39.80'N, 21°08.90'E Weather: wind speed: 13.4 m/s; wind direction: S; temperature: 15.9°C; height waves: 3.0 m
106. Date / Time: 2 X 2012, 21:05 Ship: NN Location: 55°28.10'N, 20°40.20'E Weather: wind speed: 3,1 m/s; wind direction: SWW; temperature: 14.0°C; height waves: 0.2 m
107. Date / Time: 28 X 2013, 18:51 Ship: RoPax ferry <i>Stena Alegria</i> Location: Karlskrona / Sweden, anchorage, 56°2'39.03"N, 15°37'11.53"E Weather: wind speed: 27,3 m/s; wind direction: SWS; temperature: 15.3°C; height waves: 9.0 m
108. Date / Time: 3 XI 2012, 16:50 Ship: m/v <i>Johannis de Rijke</i> Location: 3,6 nm. SW of Klaipeda port breakwater, 55°41.80'N, 20°58.90'E Weather: wind speed: 12.6 m/s; wind direction: SWW; temperature: 10.1°C; height waves: 3.0 m
109. Date / Time: 4 XII 2013, 02:15 Ship: m/v <i>Corona Seaways</i> Location: 56°08.00'N, 11°41.00'E Weather: wind speed: 15.7 m/s; wind direction: WSW; temperature: 6.7°C; height waves: 4.0 m
110. Date / Time: 27 I 2014, 21:45 Ship: m/v <i>Neva-Leader 4</i> Location: port of Klaipeda, 55°41.60'N, 21°08.00'E Weather: wind speed: 16.9 m/s; wind direction: SE; temperature: (-2.7°C); height waves: 4.0 m

In the compilation, we classified each accident as a very serious casualty, serious casualty, less serious casualty or marine incidents, according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [International Maritime Organization, 2008]. Very serious casualties are casualties to ships which involve total loss of the ship, loss of life, or severe pollution. Serious casualties are casualties to ships which do not qualify as very serious casualties and which involve a fire, explosion, collision, grounding, contact, heavy weather damage, ice damage, hull cracking, or suspected hull defect, etc., resulting in: immobilization of main engines, extensive accommodation damage, severe structural damage, such as penetration of the hull under water, etc.,

rendering the ship unfit to proceed, or pollution and/or a breakdown necessitating towage or shore assistance. Less serious casualties are casualties to ships which do not qualify as very serious casualties or serious casualties and include marine incidents which themselves include hazardous incidents and near misses [EU-CIRCLE Report D1.1, 2015], [International Maritime Organization, 2008]. In the set of accidents at the Baltic Sea area presented in Table 1, there are 21 accidents classified as very serious casualties, 76 as serious casualties and 13 – less serious casualties (Fig. 3).



*Figure 3.* Ship accidents at a) the North Baltic Sea area b) the South Baltic Sea area according to the casualty class (the number on the map is corresponding to the accident number in Table 1; legend of pin colour: black – very serious casualty, grey – serious casualty, white – less serious casualty).

### 3. Conclusion

The collection of the ship accidents at the Baltic Sea waters was done in this paper. The data are the part of the set of sea accidents at the world sea waters. The data will be used to the risk analysis of chemical spill at sea. In regard to this, the modelling critical infrastructure accident consequences through designing the General Model of Critical Infrastructure Accident Consequences (GMCIAAC) was done in [EU-CIRCLE Report D3.3-GMU21, 2016]. Next, the identification of its unknown parameters and prediction of critical infrastructure

accident consequences was performed in [EU-CIRCLE Report D3.3-GMU22, 2016] and [EU-CIRCLE Report D3.3-GMU23, 2016] respectively. Its practical applications will be performed in [EU-CIRCLE Report D3.3-GMU24, 2017] to the chemical spill consequences generated by the accident of one of the ships of the BSCIN as the preparatory approach to the Case Study 2, Sea Surge and Extreme Winds at the Baltic Sea Area, Scenario 2: Chemical Spill Due to Extreme Sea Surges [EU-CIRCLE Report D6.4, 2018].

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## **References**

- Bogalecka, M., How safe is the Baltic, *Baltic Transport Journal*. 28, 37-38, 2009
- Bogalecka, M., The safety of maritime transport in the Baltic Sea region, *Zarządzanie i Finanse*. 3 (1), 570-580, 2012, (in Polish).
- Bogalecka, M., Kołowrocki, K., Soszyńska-Budny, J., Ledóchowski M. , Reszko M., Shipping critical infrastructure network, *Journal of Polish Safety and Reliability Association, Summer Safety and Reliability Seminars*. 7(2), 43-52, 2016
- Cedre. The Internet site of Centre of Documentation, Research and Experimentation on Accidental Water Pollution. [available at: [www.cedre.fr](http://www.cedre.fr); accessed 13.03.2017], 2017
- EU-CIRCLE Report D1.1., EU-CIRCLE Taxonomy, 2015
- EU-CIRCLE Report D3.3-GMU21, Modelling critical infrastructure accident consequences – designing the General Model of Critical Infrastructure Accident Consequences (GMCIAC), 2016
- EU-CIRCLE Report D3.3-GMU22, Identification of unknown parameters of the General Model of Critical Infrastructure Accident Consequences (GMCIAC), 2016
- EU-CIRCLE Report D3.3-GMU23, Adaptation of the General Model of Critical Infrastructure Accident Consequences (GMCIAC) to the prediction of critical infrastructure accident consequences, 2016
- EU-CIRCLE Report D3.3-GMU24, Practical application of the General Model of Critical Infrastructure Accident Consequences (GMCIAC) to the chemical spill consequences generated by the accident of one of the ships of the ship critical infrastructure network operating at the Baltic Sea waters, 2017
- EU-CIRCLE Report D6.4, Case study 2: Sea surge and extreme winds at Baltic Sea area, Scenario 2, Chemical spill due to extreme surges, 2018
- European Maritime Safety Agency – EMSA, Annual overview of marine casualties and incidents, 2014
- GISIS, Global Integrated Shipping Information System. [available at: <https://webaccounts.imo.org/>; accessed 13.03.2017], 2017
- Häkkinen J.M, Posti A.I., Review of maritime accident involving chemicals – special focus on the Baltic Sea, *The International Journal on Marine Navigation and Safety of Sea Transportation*. 8(2), 295-305, 2014
- HELCOM, Annual report on shipping accidents in the Baltic Sea in 2013, 2014
- International Maritime Organization – IMO, Casualty-related matters reports on marine casualties and incidents. MSC-MEPC.3/Circ.3, London, 2008