Executive summary

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with the Consultees including river users and associated stakeholders as part of the Development Consent Order (DCO) application process. A number of questions have been raised regarding the potential impact on marine operations.

A Formal Safety Assessment (FSA) in accordance with the Port Marine Safety Code (Department for Transport, 2015) was requested by the Marine and Coastguard Agency as a Relevant Representation. (The purpose of FSA was to consider risks associated with the operational phase only - marine construction related issues, including dredging, were considered to be in a separate exercise.) The FSA was undertaken on 21st July in a workshop with the Harbour Master and representatives from the Tees Bay Pilots, Foy Boatmen (the organisation responsible for mooring of vessels), Svitzer (the tug providers), York Potash Ltd (YPL) and Royal HaskoningDHV.

The workshop concluded that:

- The Harbour Master and operational services foresees no problem in dealing with YPL associated increase of traffic in the same as existing operations. The current volumes, circa 4,200 vessel calls per year, are far below previous peaks in 2005-2007 which experienced peaks in excess of 5,500 calls per year.
- The size and type of vessels are within the experience of the Harbour Master, tugs, Pilots and Foy Boatmen.
- Support services will be expanded as necessary to service the increased demands.
- The modelling demonstrates that largest delays would be experienced by YPL.
- A separate construction phase review of operations in the river is still required.
- The Harbour Master confirmed that there will not be a significant impact to the other users on the river due to the operations from YPL. The inclusion of the YPL activities is business as usual.

1.0 Introduction

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with the Consultees including river users and associated stakeholders as part of the
Development Consent Order (DCO) application process. This process has raised a number of issues and concerns. These are concerns associated with marine operation and marine constructability issues including the interface with existing operations and infrastructure within the river.

The purpose of this document is to consider risks associated with the operational phase only - marine construction related issues, including dredging are to be considered in a separate exercise. In order to assess the future vessel movements of polyhalite vessels at Tees River, York Potash Ltd. (YPL) has commissioned Royal HaskoningDHV (RHDHV) to prepare a Marine Risk Assessment Study (PB1586/R003-Rev 3, July 2014). In addition, a Traffic Simulation Addendum has been prepared (PB1586 - N013 - Rev 1, 15 July 2015). The purpose of the addendum is to assess the potential impact of the vessel movements associated with the revised operational berth length and vessel characteristics for Phase 2 (13 mtpa), as this represents the more critical scenario based on previous analysis.

The FSA, as additionally required, has been carried out by RHDHV on behalf of YPL. The FSA in particular assesses the potential safety impacts associated with the forecasted increase in vessel movements of polyhalite exports from YPL.

This note is structured with the following headings:

- Abbreviations
- Methodology - discussion on the approach taken
- Conclusions
- Recommendations

1.1 Abbreviations

The following abbreviations are used in this report:

- AIS - Automatic Identification System
- ALARP - As Low As Reasonably Practicable
- ARPA - Automatic Radar Plotting Aid
- ATBA - Area To Be Avoided
- AtN - Aid to Navigation
- CPA - Closest Point of Approach
- DWT - Dead Weight Tonnes
- ECDIS - Electronic Chart Display and Information System
- EIA - Environmental Impact Assessment
- GIS - Geographical Information Systems
- GPS - Global Positioning System
- GRT - Gross Register Tonnage
- HAZID - Hazard Identification (workshop)
- FPSO - Floating Production Storage and Offloading
- FSA - Formal Safety Assessment
- HSE - Health and Safety Executive
- IMO - International Maritime Organisation
- ISPS - International Ship and Port facility Security Code
- LOA - Length Overall
- MJ - Megajoule
- Mtpa - mega ton per annum
2.0 Methodology

2.1 Objective

The major objective of the FSA is early identification and risk assessment of safety hazards in order to provide essential input to project decisions. The FSA is a process for proactive identification of hazards and is characterized by:

- Identification of safety hazards at the earliest practicable stage.
- Assessment of risks against standards of acceptability
- Reduction of risks to an acceptable level.

The HAZID study technique has been developed specifically to reflect the importance of HSE issues on the fundamental decisions that are made at this (relatively early) engineering stage of the project. The HAZID study is the first opportunity to assemble experienced operational, engineering and HSE staff together to address, in a short time frame, the HSE issues surrounding the project.

2.2 FSA Standards and Risk Assessment process

The Port Marine Safety Code [Department for Transport, 2015] and the IMO FSA guidelines [approved by IMO, 2002] have been applied within this study. The FSA is a structured and systematic methodology based on risk analysis and cost benefit assessment (if applicable). In addition, the Guide to Good Practice on Port Marine Operations [Prepared in conjunction with the Port Marine Safety Code] is applied. The relationship of Port Management System and Risk Assessment is demonstrated in Figure 1.
2.3 Approach

The FSA stages include:

- Stage 1: Data gathering and preliminary identification of hazards.
- Stage 2: Hazard Identification (HAZID) Workshop with stakeholders in order to include local knowledge and experience in the FSA. The workshop is a meeting, employing a highly experienced multi-discipline team using a structured brainstorming technique, based on a tailor made checklist of potential failure cases.
- Stage 3: Decision making, on basis of conclusions and recommendations.

For the FSA, reference is made to the Marine Risk Assessment and the Addendum, including marine traffic simulations, as prepared by RHDHV previously. The FSA focusses on the potential safety impacts associated with the forecasted increase in vessel movements of polyhalite exports from YPL. The FSA considers both the related consequences of marine operations related to the port, as well as the effects on existing navigation and port and terminal operations and polyhalite vessel berthing occupancy.

The FSA activities include:

- Step 0: Data gathering (the potential impact of polyhalite vessel movements).
- Step 1: Hazard identification (a list of all relevant failure cases with potential causes and outcomes).
- Step 2: Risk assessment (evaluation of risk factors, both with- and without risk control options).
- Step 3: Identification of Risk Control Options (RCO’s) (devising regulatory measures to control and reduce the identified risks).
- Step 4: RCO Effectiveness Assessment (determining the residual risk and the (cost) effectiveness of risk control options).
- Step 5: Conclusions and recommendations (for decision-making, i.e. information about the hazards, their associated risks and the (cost) effectiveness of risk control options).
### 2.3.1 FSA Stages

The FSA Stages and FSA Activities are summarized in Table 1.

<table>
<thead>
<tr>
<th>FSA Activities</th>
<th>FSA Stages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stage 1: Desk study [RHDHV]</td>
</tr>
<tr>
<td>Step 0: Data gathering</td>
<td>X</td>
</tr>
<tr>
<td>Step 1: Hazard identification</td>
<td>(X)</td>
</tr>
<tr>
<td>Step 2: Risk assessment (without RCO)</td>
<td>(X)</td>
</tr>
<tr>
<td>Step 3: Identification Risk Control Options</td>
<td>(X)</td>
</tr>
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<td>Step 4: RCO Effectiveness assessment</td>
<td>X</td>
</tr>
<tr>
<td>Step 5: Conclusions and recommendations</td>
<td>(X)</td>
</tr>
</tbody>
</table>

*Table 1 FSA Process*

(X) : Preliminary information

X : Determined information

#### Stage 1: Desk Study

The desk study was carried out by RHDHV based on the DCO plans and Marine traffic simulation results. The desk study included a preliminary identification of hazards (step 1), preliminary risk assessment (step 2), and suggestions for possible RCO’s (step 3). The findings from the desk study, along with the Risk Management Matrix (RMM), were summarised into a preliminary HAZID worksheet.

#### Stage 2: HAZID Workshop

A HAZID workshop was held on 21 July 2015 in the Harbour Master’s Office at Teesport in order to assess hazards, risks and RCO’s. During the workshop the data gathered and preliminary hazards identified are presented and discussed. Outcomes are fine-tuned, optimized and determined.

The HAZID Workshop attendees (i.e. the “HAZID Team”) are noted in Table 2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position / Title</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. James Barrie</td>
<td>Port Area Project Manager</td>
<td>York Potash Ltd.</td>
</tr>
<tr>
<td>Mr. Will Woods</td>
<td>Project Development Manager</td>
<td>York Potash Ltd.</td>
</tr>
<tr>
<td>Mr. Jerry Drewitt</td>
<td>Harbour Master</td>
<td>Teesport</td>
</tr>
<tr>
<td>Mr. Paul Brooks</td>
<td>Deputy Harbour Master</td>
<td>Teesport</td>
</tr>
<tr>
<td>Mr. Andrew Knox</td>
<td>Pilot</td>
<td>Rep of Tees Bay Pilots</td>
</tr>
</tbody>
</table>
Table 2 HAZID Workshop participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Stephen Brown</td>
<td>Rep. of Svitzer</td>
<td></td>
</tr>
<tr>
<td>Mr. Gavin Allen</td>
<td>Rep. of Foy Boatmen</td>
<td></td>
</tr>
<tr>
<td>Mr. Richard Parsons</td>
<td>Project Manager</td>
<td>Royal HaskoningDHV</td>
</tr>
<tr>
<td>Mr. Tim Raby</td>
<td>Project Maritime lead</td>
<td>Royal HaskoningDHV</td>
</tr>
<tr>
<td>Mr. Johan van Middelaar</td>
<td>Marine Safety Specialist</td>
<td>Royal HaskoningDHV</td>
</tr>
<tr>
<td>Mr. Jacco Valstar</td>
<td>Marine Navigation Specialist</td>
<td>Royal HaskoningDHV</td>
</tr>
</tbody>
</table>

Stage 3 Decision making

Following the HAZID workshop, the initial HAZID worksheet was updated to final, incorporating the risk assessment and RCO’s agreed during the workshop.

2.3.2 FSA Activities

An initial ranking of the hazards was carried out following the HAZID workshop to identify the priority failure cases requiring further risk assessment. This was based on RHDHV’s maritime safety, process & chemical and oil & gas experience, taking into account the discussion at the workshop and the baseline data review.

Step 1: Hazard Identification

The identification of hazards is done by analysing the nautical processes of port approach (incl. pilotage), port entry, berthing and departure to and from the port. The loading and unloading process of ships with polyhalite is considered outside the scope of the FSA.

In each part of the process failure cases are identified per incident category. For each failure case the typical causes and potential consequences are identified. Four (4) typical marine incident categories have been preselected for YPL i.e. potential increase of polyhalite traffic movements:

1. Pilotage; Port approach (Pilot station to/from North/South Gare Breakwater).
2. Port entry; Main port area (North/South Gare Breakwater to/from Bran Sands quay/Tees Dock).
3. Berthing operations; incl. assessment of construction (Bran Sands quay/Tees Dock).
4. General; calamity on board of polyhalite vessel (all area’s).

For each incident category, failure cases were identified, including potential causes and consequences.

Step 2: Risk Assessment

As per the IMO FSA guidelines, a Risk Assessment Matrix (RAM) was used to rank the hazards by applying the frequency and consequence categories shown below. The second step of the FSA consisted of qualitatively assessing the expected impact of each hazard based on expert opinion and (local) incident statistics.
The expected impact of a risk depends on both the probability of occurrence and the potential consequences and is generally summarized by the formula:

\[ \text{Risk} = \text{Probability of occurrence} \times \text{Consequence} \]

Since the risk is defined as the product of probability of occurrence and the consequences, the risk assessment focused on “non-frequent high impact” events as well as “frequent low impact” events.

In Figure 2 the RAM is depicted. On the top right the different frequencies/probabilities of occurrence are shown. The probability of occurrence of the various risks is categorised in 5 categories of expected frequency of occurrence. On the left side the consequence classification is shown with the classes. The consequences are grouped in the following categories:

- People (human injuries and casualties).
- Assets (financial and economical consequences).
- Environment (damage to natural habitat).
- Reputation (damage to image).

The combination of a consequence and a probability of occurrence results in a risk. The colours of the matrix indicate whether further action is required/ advised/ unnecessary.

![Figure 2 Risk Assessment Matrix](image-url)

The colours in the prioritization matrix indicate the level of risk of the considered hazard:

- Green: Broadly Acceptable region (Low Risk): Generally regarded as insignificant and adequately controlled. None the less the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
- Orange: Tolerable Region (Medium Risk): The risks are as low as reasonably practicable (ALARP). The risks are tolerable however action would be beneficial. Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks
are properly assessed, appropriate control measures are in place, residual risks are ALARP and that risks are periodically reviewed to see if further controls are appropriate.

- Red: Unacceptable Region (High Risk). Generally regarded as unacceptable whatever the level of benefit associated with the activity.

**Step 3: Risk Control Options**

The third step was identification of Risk Control Options (RCO’s) for the risks with the expected largest impact. After the determination of the RCO’s these were evaluated in the workshop on the basis of completeness and their effectiveness.

The RCO’s are targeted to:

- Reduction of the probability of an incident.
- Reduction or mitigation of the consequences of an incident.
- Alleviate external circumstances in which an incident occurs.

**Step 4: RCO Effectiveness Assessment**

The fourth step was used to indicate the perceived effect of the suggested RCO’s. With the RCO’s in place the probability and/or consequence of a failure case were reduced to either Low Risk or Medium Risk (ALARP) level.

**Step 5: Conclusions and recommendations**

Drawing up conclusions and recommendations is the final step in the FSA process.

### 3.0 Discussion Points Arising and Conclusions from the Workshop

In this section the general conclusions from the HAZID workshop, are summarized.

1. Risk level [reference to HAZID worksheet]:
   - High risks: none of the failure cases is reassessed as ‘high risk’.
   - Medium risks (ALARP): Medium risks identified are related to:
     - [1.c] Wrong weather forecasts, local weather changes.
     - [2.b] Marine traffic in (main) port area: intense marine traffic due to congestion, in particular from Seaton turning area up to Tees Dock.
     - [2.c] Marine traffic in (main) port area: hazards due to manoeuvring errors and engine/rudder failure at Tees River.
     - [2.d] Marine traffic at channel/river/turning area: drifting/non-powered vessel at turning area; Failure of tug operations.
     - [3.a/b/c/d] Construction activities w.r.t. Jetty construction, Delivery of materials behind jetty, Dredging activities and Survey activities (water-side) respectively.
     - [3.s] Emissions to the environment; (Unintended) release of polluted materials (e.g. waste/cleaning water).
     - [3.u] Emissions to the environment; Waste Disposal.
The HAZID team concludes that medium risks are acceptable and no additional RCO’s are required, taking recommendations (see next section) into account.

Low risks: risks identified are considered as acceptable; no additional RCO’s are required, taking recommendations (see next section) into account.

2. At present the port does not experience any material delays. With about 27 vessels moves per day there is no perceived delay and all vessels receive a time slot within 1 to 2 hours around their requested time. With the YPL development the traffic increases to 28 vessel moves per day. The Harbour Master and operational services see no problem in dealing with this increase of traffic in the same manner.

3. During the peak year of 2005 the port successfully and without significant delays or incidents managed approximately 5,900 vessel calls per year including large size and tidally restricted tankers. Currently there are circa 4,200 vessel calls per year. YPL will provide an additional 252 YPL vessel arrivals with an additional 104 vessel movements per year. Consequently the Harbour Master and operational service providers (pilot, tugs and boatmen) see no problem in dealing with the future forecasted traffic. It is noted that due to a reduction in North Sea pipeline imports tanker traffic on the Tees has declined (assessed by the Harbour Master as equivalent to 10 mtpa) and is not expected to return to the port.

4. The type and dimensions of the vessels that will visit the YPL facility are within the range of vessels that at present visit Teesport. The Harbour Master and operational services are familiar with these vessels.

5. The largest vessels foreseen for YPL are the 85,000 DWT bulk carriers. The vessels arrive in ballast and can navigate to the berth in all states of tide. At departure these vessels are loaded and have a draught of about 14.5m, which gives them a tidal window of 4 hours before HW to 4 hours after HW (an 8 hour window every 12 hours). This means that the vessel although tidally restricted is flexible with plenty of opportunities for other tidal restricted vessels.

6. Traffic simulation suggests that at present there is a total average delay of 3 minutes per day for all vessel movements combined. This is a delay that can, in practice, hardly be noticed. With the YPL development of the reduced berth length being considered and the phase 2 (13 mtpa) cargo volume this combined delay increases to 9 minutes and when adding the forecasted additional bulk carriers (3 mtpa) for the Tees Dock the combined delay increases to 20 minutes. When these delays are distributed over all vessels it will be less than 1 minute per vessel, and even if all delay is absorbed by one vessel, the delay is still marginal.

7. The maximum delays resulting from the simulations show values that are twice the average delay. Even these maximum delays of 40 minutes on one day over 27 vessels movements are insignificant and within the normal margin of the operational planning of the port.

8. The need for support services such as pilots, tugs and boatmen is continuously monitored and adapted to the demand. The port does not have experience with delays due to shortage of support services and will respond adequately to any change in demand.

9. Port closure due to environmental conditions can happen and are independent of the YPL activities. YPL however must consider these periods for the required storage at the terminal.

10. Most convenient and shortest disruption of the other traffic is achieved when the vessels for YPL are turned at arrival when they are in ballast condition. This should be taken into account when designing the equipment and logistic operations at the berth.

11. Not included in the traffic studies are delays caused by deficiencies on board of vessels.
12. The Traffic Simulation Addendum (PB1586 - N013 - Rev 1, 15 July 2015) noted that ro-ro traffic was given priority. It was confirmed by the Harbour Master that this is not the case. (Post meeting note: the removal of the Ro-Ro Ferry priority rule would likely only have a small impact. Delays to Ro-Ro vessels may increase marginally but the overall delays would likely remain at a similar level or reduce slightly as an overall combined total.)

13. Conoco Philips shipping has reduced in the last few years as oil production arising from the North Sea has reduced.

14. The General Management requirements for operating in the river are defined in Notice to Mariners No. 18 of 2015 which sets out the requirements for vessel travelling in the river. Topics discussed include requirement for pilots, anchorages, VTS and hazardous cargo.

15. Pilots for large vessels are picked up 3 miles out from the channel entrance. Smaller vessels will be picked up approximately 1.8 miles from the channel entrance.

16. The risk of YPL utilising poor quality vessels was highlighted as this potentially had a direct impact on YPL’s business operations. Vessels in poor condition and untrained crew (e.g. in the use of lifeboats) are potential grounds for impounding a vessel until changes are made. The vessel may not be moved until the required changes are completed and therefore will therefore seriously limit the loading of potash. This risk can be avoided by using vessels maintained to a high standard with a competent crew.

17. The Harbour Master will supply York Potash details of weather events when the port was unable to operate. This will be useful if YPL’s operational planning.

18. Currently it typically takes approximately 1 hour for a vessel to enter the channel, swing, and get alongside. In total a vessel should be ready for loading/unloading within 1.5 hours including mooring.

19. The Harbour Master offered to advise on optimal berthing arrangements.

20. The Harbour Master confirmed that there will not be a significant impact to the other users on the river due to the operations from YPL. The inclusion of the YPL activities is business as usual.

4.0 Recommendations

In this section the recommendations are summarized.

[1.c Adverse weather conditions]
- Wrong weather forecasts, local weather changes:
  - Investigate impact of weather delays on material storage.
  - Consider appropriate mitigation activities.
  - Review impact of wind on loading operations.
  - Weather delay information for range of vessels anticipated (from Harbour Master).

[2.1 Berthing operations]
- The impact of increased berthing operations ("delays up to 94 mins/day, only for polyhalite vessels, single berth, phase 2 option - 13 mtpa") applies to polyhalite i.e. YPL only. Action: YPL to manage. Actual berthing does not impact other operations on the river.
[3.a/b/c/d. Construction activities]

- Requirement for proposed construction operations to be subject to a separate development and agreement with the Harbour Master. Findings of constraints from that study will be adopted in the construction contract requirements.

The assessment represents RHDHV’s best judgment based on the information available at the time of preparation and the content of this document should not be edited without approval from RHDHV. Any use which a third party makes of this report is the responsibility of such third party. RHDHV accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.
ANNEX 1 Agenda HAZID Workshop

Objective: Formal Risk Assessment, York Potash Ltd.
Scope: Marine Risks due to additional vessel movements of vessels from polyhalite exports
Location: Harbour Master Office Tees Port
Date, time: July 21st 2015; 10:00 h – 15:00 h

1. Welcome, introduction
2. Formal Safety Assessment:
   - Summary, findings Tees Marine Risk Assessment Study and additional modeling
   - Scope, objectives and methodology
   - Hazard Identification, Risk Assessment, team recommendations - part 1
   - Lunch break
   - Hazard Identification, Risk Assessment, team recommendations - continued
3. Planning, actions, follow up
4. Closure (15:00 h)
ANNEX 2 HAZID Worksheet
<table>
<thead>
<tr>
<th>No.</th>
<th>Failure Case Description</th>
<th>Failure Case</th>
<th>Cause</th>
<th>Consequence</th>
<th>Probability</th>
<th>Control Probability</th>
<th>Consequence Mitigation Probability</th>
<th>Consequence Mitigation Severity</th>
<th>Recommended Action</th>
<th>Risk</th>
<th>No.</th>
<th>Actions and Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Absence of aids to navigation (e.g. drifting buoys, missing RADAR, fog)</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
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<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
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<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
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<td>Consequence Mitigation Severity</td>
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<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
</tr>
<tr>
<td>3</td>
<td>Previous assessment, including limiting weather parameters, No judgment</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
<td>Consequence Mitigation Severity</td>
<td>Recommended Action</td>
<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
</tr>
<tr>
<td>4</td>
<td>Pilot resource planning</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
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<td>Consequence Mitigation Severity</td>
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<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
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<td>5</td>
<td>Pre-entry checks and vetting procedures</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
<td>Consequence Mitigation Severity</td>
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<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
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<td>Up to date admiralty nautical charts or Electronic Chart Display</td>
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<td>Actions and Recommendations</td>
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<td>Maintenance dredging</td>
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<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
<td>Consequence Mitigation Severity</td>
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<td>Actions and Recommendations</td>
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<td>Maintenance management system for navigational equipment,</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
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<td>Consequence Mitigation Severity</td>
<td>Recommended Action</td>
<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
</tr>
<tr>
<td>9</td>
<td>Maintenance of Aids to Navigation</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
<td>Consequence Mitigation Severity</td>
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<td>No.</td>
<td>Actions and Recommendations</td>
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<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
<td>Consequence Mitigation Probability</td>
<td>Consequence Mitigation Severity</td>
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<td>No.</td>
<td>Actions and Recommendations</td>
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<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
<td>Control Probability</td>
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<td>Cause</td>
<td>Consequence</td>
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<td>Risk</td>
<td>No.</td>
<td>Actions and Recommendations</td>
</tr>
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<td>13</td>
<td>Maintenance management of ships' operating procedures (e.g. testing of rudder, telegraph, etc.) at departure/proceeding</td>
<td>Failure Case</td>
<td>Cause</td>
<td>Consequence</td>
<td>Probability</td>
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### Marine Hazards

#### Hazard Identification

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<th>Recovery Preparedness</th>
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<td>Damage to infrastructure</td>
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<td>3</td>
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# MARINE HAZARDS

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## Actions and Recommendations

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28/07/2015

ROYAL HASKONINGDHV

TYP 0038

FEFile Worksheet York Polak continued v1 / 2 HAZO
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<td>1</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
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<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>Good seamanship w.r.t. weather, meteorology and forecasting</td>
</tr>
<tr>
<td>2</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>Proper loading</td>
</tr>
<tr>
<td>3</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>Equipment for salvage objects</td>
</tr>
<tr>
<td>4</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>Local inspection authorities (inspection from air, sea, land)</td>
</tr>
<tr>
<td>5</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>Emergency Response Arrangements (ER equipment, ER staff, ER terminals)</td>
</tr>
<tr>
<td>6</td>
<td>General: Calamity on board</td>
<td>Failure case</td>
<td>Calamity on board</td>
<td>Loss of life, e.g., from deck or collision</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
<td>A 1 1 1 1 1.0</td>
</tr>
</tbody>
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