
CDOIF

Chemical and Downstream Oil Industries Forum

Preparing for a Flood:

Guidance and Best Practice

Foreword

Many businesses across all sectors are vulnerable to severe weather conditions. Flooding is the most common and widespread natural hazard event that occurs in the UK.

The risk of flooding can never be completely eliminated. By preparing in advance you can minimise the impact flooding could have on your businesses activities.

Preparing for these risks ensures you are more resilient to flooding. Sites that prepare and practice flood plans are typically impacted less and recover faster.

Natural hazard triggered technical accidents (Natechs) may be caused directly or further aggravated by powerful events such as flooding, leading to the potential release of hazardous materials. Control of Major Accident Hazard (COMAH) operators of high hazard sites need to understand how flooding might initiate or escalate a major accident directly or indirectly and take the necessary measures to prevent or limit the consequences to people and the environment.

The Chemical and Downstream Oil Industries Forum (CDOIF) has brought together industry, regulators, trade associations and other professional bodies to share the best information, guidance and best practice available.

The guidance will support your understanding of the risks and what measures or procedures could be implemented to help improve your flood resilience. It will help COMAH operators and other large industrial sites review the measures in place to prevent or mitigate major accidents that are initiated or escalated during a flood.

Structure of this guide

This document is split into four sections.

1. Preparing for a flood
2. Flood warnings
3. Response
4. Recovery

Each section is split into the following headings:



How to do it

This describes how to go about the activity within the section



Guidance & Best Practice

Outlines the industry recommended information and guidance



Getting help

Identifies some of the key organisations who can help you develop flood mitigation and response measures for your business.



Other information

Presents a limited number of the most relevant additional resources or paid for services that may help improve flood preparedness¹. This information may vary depending on where you operate within Great Britain.

¹ It is not a full representation of all additional information that is available on flood preparedness or a full listing of referenced academic papers.

Contents

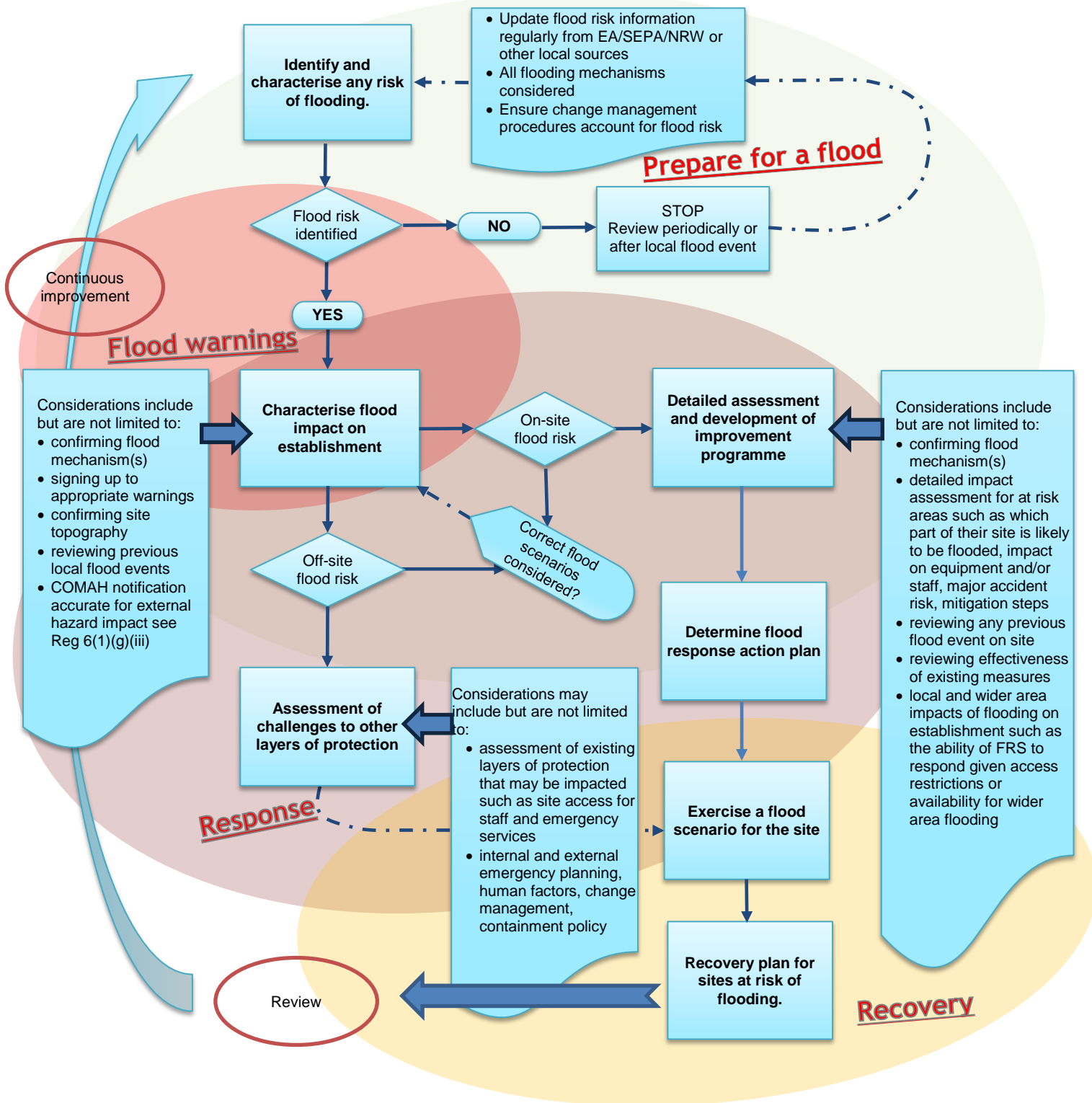
Improve your flood resilience: Overview for COMAH establishments.

Each section highlighted within the diagram is hyperlinked from the flow diagram to the text for quick reference.

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Overview of flood preparedness improvement steps for COMAH establishments.

The flow chart presents important actions to consider in assessing and improving flood resilience. The steps are specific to COMAH establishments² although the key elements would also apply to other industrial sites.



² The steps identified are not exhaustive or site specific but simply meant as an indicative step wise approach to identifying flood risk and improving flood preparedness.

1. Prepare for a flood



How to do it

How do I find out if my business is at risk from flooding?

You can find out if you are at risk of flooding through the following methods:

Check the flood maps

The flood maps show the areas at risk of flooding from the rivers and the sea. There are additional maps which show the risk from other sources including surface water, ground water and reservoirs.

In England visit the [Long term flood risk assessment information pages](#) and check if your site is at risk from flooding from rivers, the sea, surface water or reservoirs.

In Scotland visit the [flood maps information pages](#) to view your location and the information held on flood risk.

In Wales visit the [Long term flood risk assessment information pages](#) and check if your site is at risk from flooding from rivers, the sea, surface water or reservoirs.

By phone

In **England, Wales** and **Scotland**, you can call **Floodline** on **0345 988 1188** 24 hours a day.

In **England** and **Wales** Floodline staff can check your postcode to see if your site is in a flood risk area.

In **Scotland** staff can confirm if you are in a flood warning area.

You should also consider the risk of flooding from other sources such as over loaded drainage systems and from rising groundwater. Your local authority and Water Company may be able to provide advice on flooding from public sewers and other local sources of flooding.

When considering geographical flood risk, you should consider that in some locations, whilst your site might not be impacted, a flood nearby could have consequences such as loss of power, telephone or disruption of access to or from your site which could pose risks to your business.

To help reduce the direct and indirect impacts of flooding and encourage communities to be actively involved, Flood Risk Management Plans (FRMPs) identify risk associated with flooding and set out ways in which Risk Management Authorities and communities can

work together to reduce the impact of flooding. The relevant FRMP's can be found via the following links for [England](#), [Wales](#) and [Scotland](#).



Guidance & Best Practice

If your business is at risk of flooding it is essential that you are prepared for any future events. If you are regulated by the COMAH Regulations then you should ensure that your COMAH Notification reflects the risks of flooding and that this is translated into other appropriate documentation and management systems. There are many documents and sources of information available that can help with your preparation and planning to minimise the impact of a flood. A selection of related guidance is provided below³.

[Preparing for flooding. A guide for regulated sites under EPR and COMAH](#) (May 2015) has been written by CDOIF and includes the most recent lessons learned from significant flooding events including the East Coast surge 2013 to help the process industries prepare for flooding. Similarly, [Preparing for flooding. A guide for regulated sites in Scotland](#) an equivalent guide for the process industries in Scotland is available.

[Would your business stay afloat? A guide to preparing your business for flooding](#) is another guide to help business prepare for flooding. This guide is written for all businesses and is not specific to the process industries.

The [Flood guidance website](#) provides flood guidance and further links to identify critical issues that affect the UK's homes, commercial buildings and infrastructure for extreme weather events including flooding.

Flood resilience action plans and associated standards are available and under development to support assessment and resilience to flooding. Examples include Annex 2 of a recent action plan ([Bonfield 2016](#)). Although focussed on protection of domestic homes it details the British Standards for flood risk assessment e.g. BS8533: 2011 Assessing and Managing Flood Risk in Development. Other examples include information on assessment of flood and coastal risk via the [EurOtop assessment manual](#) and associated tools.

For establishments regulated by the COMAH Regulations, [L111 \(3rd Edition\)](#) A guide to the Control of Major Accident Hazards Regulations (COMAH) 2015 provides guidance on those regulations where the likely impact of flooding on major accident risk needs to be considered for COMAH establishments (see end note i)

The [Safety Report Assessment Manual](#) is also available to COMAH upper tier operators. This is primarily internal guidance to assist the Competent Authority (CA) when assessing the adequacy of safety reports, however some operators find it useful when they are writing their reports to see the criteria against which the report is assessed (see end note ii)

³ Please note this is not a comprehensive list and additional guidance/advice is available

[Safeguarding chemical businesses in a changing climate. How to prepare a climate change adaptation plan](#) is a publication prepared by a partnership between Chemical Business Association (CBA), Chemical Industries Association (CIA), and the Non-Ferrous Alliance (NFA) – led and supported by the Environment Agency’s Climate Ready Support Service and issued in March 2015. It looks broader than flooding, assessing risk from many extreme weather events caused by climate change, including flooding. Section 2 How to prepare an adaptation plan along with information provided in the appendices provides support on how to prepare a plan. It breaks the process down into steps including getting started, identifying the risks and monitoring and review. It also provides case studies to put its theory into practice.

As well as planning how you can help to minimise the impact of flooding at your site and how you would respond to a flood event, it’s also important to consider the implications of flooding in the detail of process design or improvement. There are several publications that provide support for the management of flooding through the design phases of process plant. They also consider wider environmental management and safety management issues at sites.

They include the Energy Institute **Guidelines on environmental management for facilities storing bulk quantities of petroleum, petroleum products and other fuels (3rd edition, May 2015, ISBN: 9780852937266)**. In Section 3.3 extreme weather events including flooding are considered as a factor in site selection highlighting the importance of for example site topography within a site when locating equipment or processes. Consideration is also given to oil-water separators regarding inlet sizing and inability to deal with large liquid flows, and refers to designing to a foreseeable rainfall criterion in Section 3.4.4.5. In section 5.6 design considerations for water treatment systems where flooding is foreseeable are included.

The Energy Institute **Guidance on risk assessment and conceptual design of tertiary containment systems for bulk storage of petroleum, petroleum products, or other fuels (1st ed., 2013, ISBN: 9780852936528)** also looks at flooding factors in design. Section 2.1 introduces a secondary and tertiary containment risk assessment decision tree including rainfall and the impact of flooding. Section 2.2.1 refers to identifying major accident hazard (MAH) scenarios including ‘..... damage caused by natural phenomenon, such as high wind or flooding.’ Section 2.2.2.3 gives a point of reference for determining direct precipitation volumes.

Both of these documents are available through the [Energy Institute Knowledge Service](#).

[CIRIA C736, Containment systems for the prevention of pollution. Secondary, tertiary and other measures for industrial and commercial premises](#) highlights the importance of considering flooding impacts on the design of containment systems. For example Section 1.5.6 refers to the Flood and Water Management Act 2010 and its relationship and importance in the volumes of water stored at a site.

Section 2.3.2 discusses climatic conditions and the impacts of flooding on pathways of releases from primary containment. It also considers impacts on waste water treatment works (WwTWs) essential factors to consider in assessing the risk from and improving resilience to flooding. Section 2.3.3 discusses flood water as a potential receptor and looks at the impacts that could occur to this from dangerous substances. Section 2.5 uses flooding as an example in establishing the site risk ranking and makes reference to web based information on flood risk.

The importance of the volume of rainfall across the different parts of the country and where to obtain information on this is also discussed and illustrated in section 4.3.3 which refers to rainfall depths and flooding in the context of bund design and containment volumes.

[ONR Technical Assessment Guides](#) (TAGs) and Safety Assessment Principals (SAPs) are available online and make reference to flooding in many areas. NS-TAST-GD-013 (TAG 13), Annex 6: refers specifically to flooding. This makes many valid points including the need to have a more considered view of the impacts of flooding other than directly onto a site, looking at the wider geographical area such as the impacts on access routes.

Their report on the [Fukushima nuclear accident](#) (a tsunami following an earthquake that inundated a nuclear power site) contains recommendations to enhance the safety of the UK nuclear industry. A number of the recommendations concern external flooding hazards which may be of relevance at other major accident hazard or industrial sites. The main themes covered include off-site and on-site infrastructure resilience, site and plant layout including reviewing existing plant and site layouts and any proposed new designs to ensure that safety systems and their essential supplies and controls will withstand severe flooding and other extreme external events.

Many of the lessons learned are published after investigations into major accidents reported to the appropriate authorities. In Europe this is via the European Major Accident Reporting System (e-MARS). This provides insights and lessons learned from reported accidents which can be found on the [Learning lessons from accidents to prevent future accidents](#) home page. A full set of publications from the Major Accident Hazards Bureau (MAHB) can be found [here](#).

Flooding features in 2 of the bulletins:

Bulletin No 3: has an example of flooding (Accident No. 5) which looks at the impact of buoyancy on tanks during a flood event.

Bulletin No 6: has 2 examples from flooding amongst other examples of natural hazard (Natech) based accidents. The first is focussed on the risk and preparedness for flooding even if the location of a site is not known for flooding. The second is focusses on the spread of flammable liquids and fire as a result of a release caused through damage from flooding.

Wider lessons learned from extreme weather events are being developed through a [European Natech database](#). Heavy rain and flooding impacts feature heavily across the

database and although it is still in development it provides a summary of the events and lessons learned.

UK based lessons learned have often been published via conference proceedings or papers for example in the Institution of Chemical Engineers (IChemE) Loss Prevention Bulletin or France's [ARIA database](#). Internationally lessons learned can be found in journals through bodies such as the American Institute of Chemical Engineers (AIChemE) in the Centre for Chemical Process Safety's [Process Safety Beacon](#).

As an example the lessons learned from the East Coast tidal surge of 2013 can be found in papers including [Lessons learned from the coastal flooding of process industry sites by a storm surge on 5-6 December 2013](#) which is a collaborative paper by regulators and industry.



Getting help

The links below may provide further information and support on your preparation for a flooding event. There are variations in products and services depending on your location:

[Flooding and extreme weather information for England.](#)

[Flooding information for Wales.](#)

[Flooding information for Scotland.](#)

You can also get help to prepare for a flood from:

- your local authority;
- utility companies such as water companies;
- the highways authorities (the Highways Agency and unitary/county councils);
- Internal Drainage Boards (IDBs) (England only) - public bodies that manage water levels where there is a special need for drainage to reduce flood risk;
- in **Wales** this function is undertaken by NRW.



Other information

For **England**: Products or packages of information are available to help you complete your flood risk assessment. They may be of particular use where you wish to assess trigger levels associated with the responses to specific flood risk scenarios for your site. Example products include Product 8: Flood Defence Breach Hazard Map including, maximum flood

depth, maximum flood velocity, maximum flood hazard. Further information can be found on [Gov.uk](#).

In **Wales**: Additional information to assist you in completing a Flood Consequence Assessment (FCA) can be found in the Welsh Government (WG) document [TAN15: Development and Flood Risk](#). [Lle](#): A Geo-Portal for Wales is a good source of spatial flood risk and coastal erosion/processes data developed in partnership with WG & NRW. NRW can also provide product information for Wales such as Product 4: Detailed FCA map & data. These are available from: datadistribution@naturalresourceswales.gov.uk

Localised flood risks information may be obtained from the Lead Local Flood Authority (LLFA) with additional [coastal flood risk information](#) also available to assist in the completion of the FCA.

2. Flood warnings

How to do it

Understanding if you are at risk of flooding and obtaining early information to ensure that you can respond with as much preparation time as possible is vital to improving resilience to flooding at your site. Weather and flood warnings are issued through various bodies including the Met Office, the Environment Agency (EA), Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW).

Guidance & Best Practice

The links below that highlight and explain what warning information is available. Your business can register to receive flood warnings and any other bespoke services that may be available to aid improvement in understanding the risk to your business.

The [Met Office web site](#) has a list of services that may help you prepare to enact preventative plans in response to flooding. Links from here allow you to view [severe weather warnings](#). There are also links to information around [Community Resilience](#) including flooding, with onward links to flood warning pages.

If you know you are at risk of flooding, flood warnings are available in [England](#), [Scotland](#) and [Wales](#). An explanation of the [flood warnings](#) is also provided.

A Process Safety Forum Safety Alert ([Safety Alert 012](#)) has been issued for a flooding event. It contains the learning from an event where a site was partly flooded with learning for any industrial site at risk of flooding. The learning captured in the alert identifies the importance of sites that receive flood warnings understanding the limitations and the

context of these. It also describes the importance of using other information sources to ensure that the expected extent of flooding is understood enabling safe activation of relevant measures to protect a site.

Getting help

The links below may provide further information and support on your preparation for a flooding incident. There are variations in products and services such as smart phone apps that may be available depending on your location:

For **England**, visit the [Gov.uk](http://gov.uk).

For **Wales**, visit the [Natural Resources Wales website](http://naturalresources.wales).

For **Scotland**, visit the [Scottish Environment Protection Agency website](http://scottishenvironment.gov.uk).

Other information

For more information on severe weather and flood warnings, visit the [Met Office website](http://metoffice.gov.uk) which combines information for England, Scotland and Wales.

3. Response

How to do it

Planning and exercising how your business will respond to an event such as flooding is vital. Through exercising plans you can ensure that you build the competence and confidence of staff. This will ensure that preventative actions are realistic given the likely time and on-site resources that would be available.

Guidance & Best Practice

There are many areas of guidance and best practice to help you understand the most appropriate way for your business to respond in the event of a flooding incident. The most recent update of the [Preparing for flooding: A guide for sites regulated under EPR and COMAH](http://www.comah.gov.uk) (June 2015) includes the lessons learned from the East Coast surge 2013.

Other guidance relevant to emergency planning at COMAH establishments includes [L111 \(3rd Edition\)](http://www.comah.gov.uk) Guidance on the COMAH regulations 2015 and [HSG191 Emergency planning](http://www.comah.gov.uk)

[for major accidents](#). The latter provides further guidance on good practice for emergency planning with reference to COMAH emergency planning requirements.

Following the major incident at the Buncefield Oil storage Depot in 2005, the CA working with industry, emergency planners and other external organisations, produced further COMAH specific guidance on emergency planning at COMAH establishments and their integration with wider civil contingencies emergency planning requirements. This Competent Authority [guidance for inspectors](#) on emergency arrangements is available on the HSE website.

The study of [human factors](#) linked to a response to flooding events including reducing error and influencing behaviour can be found in [HSG48](#) and is an important document in understanding the CA approach and how it may affect an individual and their work activities.

An example may include a scenario where an operator at a site has a key role in ensuring that certain actions are taken as a result of a flood warning to minimise the impact on your business. If they are distracted by the concern that their own home or family may also be affected by the same flooding they may not be able to perform the tasks required of them. Consideration to their wellbeing and their role in the flood response for your business should be considered as part of the scenarios that are used to develop a response plan.

Emergency response information recommendations can be found in the Buncefield investigation reports on [HSE COMAH website](#). Although this guidance is aimed at the Major Accident Hazard sites, the main themes can be applied to any industry sector.

In the [Safeguarding chemical businesses in a changing climate. How to prepare a climate change adaptation plan](#). Section 2 considers response by asking questions about priority risks. It asks readers to consider 5 key questions whilst considering factors such as both permanent and temporary arrangements in response to an incident or measures that would benefit from working in partnership (such as with other companies on the same industrial park) to share costs or other resources, information or learning. Example questions include “How could you improve resilience generally by targeting the business consequences of incidents for example disruption, costs or reputation?”



Getting help

The links below provide further information and support on your response to a flooding incident:

Local resilience forums (LRFs). The role of LRFs is captured in reference documents specific for your location. They cover the role of LRFs in relation to the duties within the Civil Contingencies Act 2004 (CCA); the associated Contingency Planning Regulations 2005 and guidance; the National Resilience Capabilities Programme (NRCP); and Emergency Response and Recovery.

In **England and Wales** more information can be found on [The role of Local Resilience Forums](#) pages.

In **Scotland** more information can be found on the [SEPA website](#).



Other information

[CIRIA C688](#) is the main output from a project concerning flood resilience and resistance for critical infrastructure (CI). It provides an overview of the regulatory framework and outlines the key issues. It gives a brief introduction to the principles of flood risk management and also explains some of the background and wider context. It then uses a range of case studies to describe the lessons learned by operators who have experienced flooding. Flood risk management is then considered for 3 areas (flood risk assessment, adopting resilience & resistance measures and investment prioritisation).

In C688, “flood resilience measures should be adopted as an integral part of individual organisations’ business continuity management processes, whole-life asset management plans and climate change adaptation strategies.”

4. Recovery



How to do it

Recovery from events such as flooding can be just as hazardous as the original event. Planning for recovery is as important as planning for emergency response. The response and recovery are likely to work better if relationships have been built up prior to a flood event.

The recovery phase can be distinct from, but overlap with the response phase and could potentially be a far longer process than responding to the immediate flood event. Recovery often begins when the response is still underway, and is more effective when the process is well planned prior to an event and started as early as possible during an event.

As well as very site specific procedures for complex industrial sites there is guidance available on some of the key things to consider when entering a recovery phase. The guidance includes post flooding activities such as removal of flood water, integrity checks of plant and equipment, inventory checks to identify losses of polluting, hazardous or radioactive material. It is important that you understand the gap between your companies own capability and those required in the recovery phase before you develop and practice a plan.

Guidance & Best Practice

A key objective of emergency planning for upper tier COMAH establishments (both internal and external plans) is to provide for restoration and clean-up of the environment following a major accident (including those initiated by flooding). The principals of recovery from major incidents including flooding are outlined in [L111 \(3rd Edition\) Guidance on the COMAH regulations 2015](#) with further guidance provided in the Competent Authority [guidance for inspectors on emergency arrangements for COMAH establishments](#). The guidance is based on the Buncefield Major Incident Investigation Board (MIIB) recommendations on the emergency preparedness for, response to and recovery from incidents (EPRR) report. The guidance takes into account integration of the requirements under COMAH with those established under the Civil Contingencies Act (CCA) ^(see end note iii).

The [Emergency Response and Recovery guidance](#) shares understanding of the multi-agency framework for emergency response and recovery at a local level and looks at roles and responsibilities of individual organisations. Focussed on the Civil Contingencies Act 2004 it is aimed towards civil protection professionals but is also useful for senior staff involved in post incident recovery including flooding.

The key elements regarding health are highlighted by Public Health England in [4 guidance notes](#). Whilst aimed primarily at domestic and small businesses, many of the elements covered remain true for larger more complex industrial sites including correctly managing the health and wellbeing of staff members involved in any clear up or support for recommissioning electrical, power or control systems. Public Health Wales also provide information on [extreme weather public health alerts](#) and [advice](#) for Wales.

The HSE also offer guidance on the key elements of [recovery after a flood event](#). This is web based content that covers key subjects such as electrical safety and has onward links to The Electrical Safety Council. It also considers working with harmful substances that may be present if chemicals have leaked during the flooding for example creating a build-up of gases in an enclosed space [Guidance on working with harmful substances](#).

The US Chemical Safety and Hazard Investigation Board (US CSB) have issued a [Safety Alert](#) detailing special precautions for complex oil and chemical facilities when restarting after severe weather events such as hurricanes and floods.

It was issued in the wake of a multiple hurricanes and points to the importance of process safety requirements during the start-up of major processes at chemical facilities describing these as a hazardous phase. It asks facility operators to “pay particular attention to process safety requirements....to ensure a safe and expeditious return to normal operations”.

CDOIF

**Chemical and Downstream Oil
Industries Forum**

CDOIF is a collaborative venture formed to agree strategic areas for joint industry / trade union / regulator action aimed at delivering health, safety and environmental improvements with cross-sector benefits.



Getting help

The links below may provide further information and support in any recovery from a flooding incident:

In addition to Public Health England and the HSE the [Association of British Insurers](#) may be able to provide advice and information on recovery from flooding.

In England and Wales more information can be found on the role of Local Resilience Forums in the [recovery sections](#).

In Scotland more information can be found on the [SEPA website](#).

In England recovery schemes may be available depending on the level of impacts. The [Department for Business, Energy & Industrial Strategy](#) (BEIS) may provide further information on this. The Lead Flood Unit based within your Local Authority may be able to provide additional advice accessed via the [Local Government Association](#).

In Wales further information can be found via the [Welsh Government website](#).

In Scotland further information can be found via the [Scottish Government website](#).



Other information

Further information on recovery support through other commercial organisations is available through various media including trade journals and the internet. These facilities may be useful in providing services that may be required in recovery which you have identified at the planning stage gap analysis.

End Note

The information provided in the end note is specific to COMAH operators and the requirements of the COMAH Regulations 2015.

End Note i: L111 provides guidance on those regulations, where the likely impact of flooding on MA risk needs to be considered for COMAH establishments.

For both upper and lower tier establishments these include:-

- General duties on operators (Regulation 5) - to demonstrate they have selected and implemented appropriate preventative and mitigation measures, identified from the findings of their risk assessment.
- Notifications (Regulation 6)-if relevant, the notification should describe if the establishment is located in a flood risk area.
- MAPP (Regulation 7) and safety management system requirements (Schedule 2) - must address the identification and evaluation of major hazards arising from external natural hazards such as flooding and emergency response arrangements in place.

End note ii For upper tier establishments only:

- Safety reports (Regulation 8-10) and safety report minimum information requirements (Schedule 3)- describe how to prepare a safety report to show that adequate arrangements are in place for the control and mitigation of major accident hazards including external hazards such as flooding. Information on expected content of Safety Reports can be found in the Safety Report Assessment Manual. The primary aim of this information is to assist the Competent Authority when undertaking safety report assessments, however it can prove useful to upper tier COMAH establishment operators when considering the impact of flood risk. The assessment information contained within the main body of the assessment manual and in the detailed supporting sections including Section 9; Descriptive Criteria, Section 10; Predictive Criteria, Section 13; Environmental Criteria and Section 14; Emergency response Criteria may assist upper tier COMAH establishment operators when considering the impact of flood risk. It may also reveal short comings in preventative and mitigation measures at establishments. For example, Appendix 13.2, Criteria 13.16 highlights the typical issues the Competent Authority (CA) will look at during inspection when considering natural hazards, including flood risk.

End note iii The principals of recovery from major incidents including flooding are outlined in Competent Authority guidance for inspectors on emergency arrangements for COMAH establishments. It includes detailed sections on the principles underpinning COMAH emergency planning and response arrangements, implementing emergency plans and a template for a site specific recovery plan. In Annex 12, Rcs 8 - Guidance: On-Site Emergency Response Inspection the aims of the aims of a good emergency response are explored through a series of questions including recovery. Recovery is also discussed in Annex 14 Mutual Aid and National Inventory.