

Joint Defra / EA Flood and Coastal Erosion Risk Management R&D Programme

SCHO0307BMIP-E-P

Risk assessment for flood incident management

Science Summary SC050028/SS

Background to the project

Failure to deliver effective flood incident management can give rise to an increased risk of harm to people, as well as posing a significant risk to the Environment Agency's business and reputation. The success of the flood incident management process is, however, dependent on a large number of operational components and human decision-making.

The research team was led by HR Wallingford Ltd and comprised Dione Complex Systems, Flood Hazard Research Centre, RM Consultants and the Water and Engineering Development Centre at Loughborough University.

The purpose of the research was a scoping study to formulate a framework and outline tools that could be used to assess the probability and impacts of various modes of "failure" in the chain of response from flood forecasting and warning, to dissemination and emergency response. The framework and tools would assist the Environment Agency to

- Understanding the behaviour of the process;
- Improve the performance of the process;
- Understand where the "weak links" in the process may be;
- Understand the potential consequences of any "weak links";
- Mitigate the potential consequences of "weak links".

The specific objectives of the project were as follows:

- To define what is meant by a "failure" of the flood incident management process;
- To produce an outline method by which "failure" in the existing forecasting, warning and response system can be identified and to test this in a case study;
- To develop a conceptual framework for identifying the risk of the operational failure of active flood defence assets (e.g. barriers and gates);

- To produce a conceptual framework for analysing and assessing the aggregate risk as a result of failure of the supporting infrastructure (e.g. telecommunications, utilities, transport infrastructure);
- To investigate and outline requirements for a complex systems model of the flood incident management system;
- To develop a framework by which risk assessment for flood incident management can be achieved.

Results of the project

The conclusions of the research indicated the following:

- There has been little research carried out on both the effectiveness of and risk assessment for flood incident management both in the UK and overseas;
- The quantitative data available on the flood incident management process is limited and tends to be focused on more "technical" parts of the process such as flood forecasting;
- The performance of the flood incident management process is rarely measured and a "failure" of the flood incident management process is not well defined;
- There is a requirement to development performance indicators for the flood incident management process so that "failures" and "underperformance" can be quantified in terms of their effect on the process and the outcomes;
- The consequences that occur because of the "failure" or the "underperformance" of the flood incident management process are rarely quantified;
- There is little Government guidance on what constitutes "good incident management" (other than minimising loss of life);

The research recommended that a three tiered approach to risk assessment in flood incident management is adopted. This would allow proportionate effort to be applied, based on a number of factors including the following:

- Decision-making requirements;
- Scale of the risk;
- Degree of uncertainty;
- Size of the catchment; and
- Unique characteristics of the catchment.

This tiered approach would need to be tested in close collaboration with a number of different actors in the flood incident management process.

The recommended tiered risk framework comprised the following:

- Tier 1 Screening tool based on the Analytic Hierarchy Process and flood incident management performance indicators;
- Tier 2 and 3 tools that would use a Bayesian network to model the critical parts of flood incident management process and make important predictions about minimising risk in the flood incident management process. This approach would be used to estimate how the probability and consequences of “failures” in the flood incident management process could be modified in different ways.

Outputs and their Use

The work was undertaken in a series of five work packages (WPs) each of which produced a stand-alone report. The WPs were as follows:

- WP1 Failure, performance and response in flood incident management
- WP2 Impacts of failure of flood defence asset and operational
- WP3 Risks and consequences of failure of reactive mitigation measures
- WP4 Understanding and application of complex system risk assessment models
- WP5 Framework and recommendations for minimising flood incident management system vulnerability.

SC050028/SR1 is the main report based on WP5. SC050028/SR2/SR3/SR4/SR5 are the Annex based on WP1, WP2, WP3 and WP4. The main report should be read with the above Annex reports.

This summary relates to information from Science Project SR11206, reported in detail in the following outputs:-

Science Report: SC050028/ SR1

Title: Risk assessment for flood incident management: Framework and tools.

ISBN: 978-1-84432-707-2

March 2007

Report Product Code: SCHO0307BMIK-E-P

Science Report: SC050028/ SR2

Title: Risk assessment for flood incident management: Failure, performance and response

ISBN: 978-1-84432-708-9

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Report Product Code: SCHO0307BMIL-E-P

Science Report: SC050028/ SR3

Title: Risk assessment for flood incident management: Impacts of failure of flood defence asset and operation.

ISBN: 978-1-84432-709-6

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Report Product Code: SCHO0307BMIM-E-P

Science Report: SC050028/ SR4

Title: Risk assessment for flood incident management: Risks and consequences of failure of reactive mitigation measures.

ISBN: 978-1-84432-710-2

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Report Product Code: SCHO0307BMIN-E-P

Science Report: SC050028/ SR5

Title: Risk assessment for flood incident management: Understanding and application of complex risk assessment models

ISBN: 978-1-84432-711-9

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