

Post-incident reporting: the next steps

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SYNOPSIS. The new post-incident reporting system for UK dams has been active since January 2007. This paper aims to review the progress made under this system of incident reporting and investigation. The areas for discussion include the completeness of reporting, dam characteristics information, the use of the annual reports and bulletins for reporting to the reservoir industry, and the likely impact of regulatory change which will lead to mandatory incident reporting.

INTRODUCTION

The Environment Agency now has three years' experience in administering the post-incident reporting (PIR) system for UK dams. The system remains voluntary at present but mandatory reporting has been included in recent government proposals to amend the Reservoirs Act 1975 (the Act) both in England and Wales. Scottish legislation already accommodates the requirement for mandatory reporting. The purpose of this paper is to provide a review of the progress that has been made in collecting and disseminating information on reservoir incidents and to discuss the likely impact of the proposed changes in reservoir safety legislation.

CURRENT REPORTING REGIME

The development of the current specification has been described previously (Warren and Hope, Hamilton-King *et al*). The specification provides a consistent approach to capturing information on dam incidents, recording the details in a new database and for disseminating the main findings. Details of the incidents reported each year are reported through annual reports (Environment Agency, 2007 and 2008). The system also provides for incident investigations for very serious incidents or where precise information cannot be reliably gathered without appointing a qualified engineer to investigate the incident. Notably, the Ulley Reservoir incident in 2007 was investigated using the new system by commissioning two independent engineers to conduct an in-depth review. Indeed, the impact of the summer 2007 events on reservoir safety (Warren and Stewart) was

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marked: the system recorded a total of fifteen incidents in 2007, compared with seven in 2008 and two in 2009.

SYSTEM EFFECTIVENESS

The success of the system can be assessed mainly in terms of:

1. The 'completeness' of reporting (i.e. the proportion of the reportable incidents that actually occur that are reported and captured by the system);
2. The level of reporting (i.e. the degree of detail sought and recorded);
3. The effectiveness of the dissemination strategy
4. The avoidance of repeat incidents.

Completeness of reporting

The completeness of reporting is very difficult to assess and this will doubtless remain the case even with mandatory reporting. It is expected that the completeness of reporting will improve with the proposed change in legislation. The number of incidents reported in the forthcoming years under the mandatory reporting regime will inform the current level of reporting under the current voluntary arrangement. In the great majority of incident cases, it is believed that the main reasons for non-reporting are:

- The reservoir owner is unaware of the system (this will typically apply to incidents at small non-statutory reservoirs);
- Fear that the reporting of the incident will reflect badly at either a corporate or personal level;
- Fear that instigating the reporting process will take a long time or be complex (beyond the capability of those involved in managing the incident).

With the proposed changes to the Act the Environment Agency's ability to communicate with the owners of non-statutory reservoirs will significantly improve. In the near future it should be possible to communicate more effectively the existence and aims of the PIR system to small reservoir owners. Suspicion within the industry regarding how the information might be used and reported should hopefully have been reduced through the publication of the annual reports to date. From the inception of the reporting system the Environment Agency has been at lengths to emphasise that this database and information reported will not be used for regulatory purposes under the Act.

The need to maximise completeness of reporting is fundamental to the success of the system in terms of informing future research priorities and

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also in informing estimates of the probability of failure for quantitative risk assessments.

Level of reporting

The amount of information sought from reporters to date has had to reflect the fact that this is a voluntary system of reporting. The current incident report form was developed to encourage reporting of basic facts. To date, the amount of information provided on incident report forms has varied greatly; some have been very brief, others comprehensive. Every incident report form has been reviewed by an All Reservoirs Panel Engineer to provide technical judgement on whether any reported incident warrants:

- A request for further information from the reporter,
- An investigation, or
- A bulletin to raise industry awareness of a particular issue.

For the incidents reported, efforts to capture the dam characteristics have not been very successful to date. A dam characteristics form was developed to send to reporters but this has not been returned in the majority of cases. This means that the usefulness of the incident details is compromised in the national database by not knowing enough about the type/details of dam at which the incident occurred. This has undermined the effectiveness of the system under the voluntary reporting arrangement.

Following introduction of the proposed Floods and Water Bill which will amend the Act, there is an opportunity to significantly improve our knowledge of dam characteristics, both at a national level and for dams at which incidents arise. The current proposals are that owners will register their reservoir(s) with the Environment Agency for risk assessment purposes. Although this provides an opportunity to request dam and reservoir characteristics as part of the registration process, it is likely that the data sought from owners will need to be at a basic level to be workable. The level of detailed data sought when reportable incidents arise will demand very careful consideration. The information sought would have to be set at a level that the great majority of owners can readily provide and therefore might not be significantly more than the registration data. The question then arises how important, more detailed information should be acquired. One likely mechanism would be through incident investigations to gather more detailed information on the incident and dam characteristics where deemed appropriate. The source of funding for investigations would have to be determined.

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Dissemination strategy

Annual reports on the reported incidents have been produced to provide incident details by:

- Number of incidents in the year
- Dam category (A-D)
- Seriousness (1-3)
- Type of lesson learned by category

A brief description of every incident, together with key points of learning, is provided. The identity of the reservoir is not disclosed unless permission has been granted by the reservoir owner. Photographs are included where possible.

The annual reports provide an opportunity for the Environment Agency to inform the industry on a number of related issues and a summary of current related research is included. The annual reports are available on the Environment Agency's reservoir safety website.

The feedback received to date on the annual reports from the reservoir industry has been positive and it is believed that the majority of readers are content with the balance achieved between 'detail' and 'readability'. Some individuals have expressed a desire to increase the technical content and this is currently under consideration. An important limitation is the level of technical detail usually available from the incident reports. A more detailed level of technical reporting could only be achieved by requesting incident investigations for the great majority of incidents reported. As well as increasing public expenditure this might negatively affect the willingness of owners to report incidents, despite the fact that investigations are only carried out with the owner's consent. Under mandatory reporting, this consent might not be required and the opportunities for improving the technical content of the annual reports should increase.

A number of bulletins have been produced to date and the authors welcome feedback on the usefulness of those published to date. These are not intended to be in lieu of formal research or guidance. Arguably, the most useful application of the bulletins was illustrated by Bulletin No.1 whereby the findings of the Ulley reservoir investigation were promptly disseminated ahead of formal research and guidance on stepped masonry spillways.

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MANDATORY REPORTING

Current proposals

The provisions for mandatory reporting are included in the draft proposals for changes to the Act for England and Wales in the Floods and Water Management Bill.

For Scotland, Part 7 (section 77) of the Flood Risk Management (Scotland) Bill sets out provisions for the Scottish Ministers to make regulations for incident reporting by statutory instrument. The details of what might constitute a reportable incidents and the offence for non-reporting are not provided.

International precedents for reservoir safety incident reporting systems

Although an extensive search has not been carried out, it appears that there is little international legislation specific to reservoir safety that includes mandatory incident reporting. However the Alaska state authorities have mandatory incident reporting and define an incident as follows:

“The owner or operator of a dam shall report to the department, on a form provided by the department, each incident involving the dam. For purposes of this section, incidents include one or more of the following events:

- (1) the satisfactory or unsatisfactory performance of a dam during extreme loading periods caused by extraordinary seismic or hydrologic events;
- (2) the uncontrolled release of water from a dam due to improper operation, overtopping, excessive seepage, or piping, regardless of whether downstream flooding occurs;
- (3) indications of stress in structural features or appurtenant works that could potentially affect the structural or operational integrity of the dam;
- (4) severe deterioration or erosion of structural elements or materials of construction, including concrete, steel, timber, soil, rock, geosynthetics, pipes, and valves;
- (5) modifications or repairs to the dam required to satisfy regulatory requirements or other deficiencies that may be identified in the dam or the original design basis.”

Similarly, the US National Performance of Dams Programme (NPDP), based at Stanford University, define a dam incident as any event that provides insight to the performance (structural, hydraulic, operational, etc) of a dam, anticipated or not, satisfactory or not. It is interesting to note that

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examples of satisfactory performance are recorded as well as incidents of poor performance, i.e. wherever insight can be gained. However most researchers have only focussed on 'negative' incidents and dam failures for statistical analysis purposes. For example, the work by Foster *et al* relates mainly to dam failures. The NPDP approach has advantages for research purposes but is difficult to apply in legislation as it is very difficult to specify 'how well' a situation must be handled and 'how extreme' the prevailing circumstances should be to instigate a report.

The internationally based Dam Safety Interest Group (DSIG) is currently reviewing the potential for, and effectiveness of a proposed international reporting system for incidents on dams.

Precedents of incident reporting systems in other UK industries

There are precedents from other industries for mandatory reporting of incidents:

a) Railways (Accident Investigation and Reporting) Regulations 2005

“The Regulations apply when railway accidents or incidents ... occur. Railway accidents are unwanted or unintended sudden events, or specific chains of such events, which have harmful consequences”.

Notifiable incidents, which are listed in schedules, must be notified within three working days.

b) Civil Aviation (Investigation of Air Accidents and incidents) Regulations 1996

The Air Accidents Investigation Branch has an incident reporting system under the Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996. Under this statutory instrument, "incident" means an occurrence, other than an accident, associated with the operation of an aircraft which affects or would affect the safety of operation; and "serious incident" means an incident involving circumstances indicating that an accident nearly occurred. Incident investigators have wide-ranging powers.

The consequences of a dam failure can greatly exceed the consequences of a rail or air disaster and it can be argued that a mandatory incident reporting system for dams is long overdue.

Human error

Arguably owners/undertakers are reluctant to volunteer information on incidents caused by human error. There have been no such reports to date. By creating a fully open reporting system such causes should become

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apparent and these key sources of information serve to further reduce risk by onward dissemination and learning.

Human error is a recognised cause of failure (Mann 2008) together with systems behaviour and control system malfunction. Human error is already a key consideration in risk assessment and risk reduction methodology for reservoirs. These processes need to be better informed by further practical experience.

Defining a reportable dam safety incident in law

The exact wording proposed for regulations for defining a reportable incident is very important to ensure that:

- all serious incidents are reported, and
- the need to report does not affect the normal behaviour of undertakers in carrying out urgent safety works in managing incidents.

The purpose of the system is to provide positive benefit to the reservoir industry and ultimately reduce risk. The following definition is proposed, for discussion purposes only:

“Where –

- a) there is a sudden uncontrolled escape of water from a reservoir; or
- b) unforeseen safety measures are taken to prevent an uncontrolled escape of water from a reservoir or safeguard property or persons from the effects of a sudden uncontrolled escape of water from a reservoir,

the undertaker or the supervising engineer, where appointed, shall inform the enforcement authority within ten working days of the incident and provide information in the prescribed form.”

It might be argued that such a definition might encourage inaction on the part of an undertaker when faced with a problem that threatens reservoir safety. The counter-argument would be that the fear of dam failure and the consequences of failure (in addition to a possible fine for not reporting the incident) should always far outweigh the ‘fear’ of having to report an incident.

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CONCLUSIONS

The current voluntary post-incident reporting system has brought a number of clear benefits. It has:

- Enabled dissemination of the lessons learned from many dam incidents that have occurred each year,
- Provided a mechanism for investigating dam incidents (notably, the Ulley incident),
- Enabled a new, improved national database to store information on dam characteristics and types of incidents and to inform research needs.
- Provided evidence for regulatory change by highlighting the number of incidents on reservoirs below the current volumetric threshold, i.e. below 25,000m³ (Small Raised Reservoirs).

The incident reports have informed proposals for legislative change, particularly with respect to the need to regulate small 'high risk' reservoirs.

Mandatory reporting has been proposed both for England and Wales and for Scotland. If enacted, mandatory post-incident reporting should:

- Improve the completeness of reporting (thereby improving usefulness for risk analysis work),
- Provide for better capture of the dam characteristics for each incident,
- Enable incidents to be reported with a greater degree of technical detail and analysis to better inform research needs
- Further reduce risk by drawing attention to lessons learnt.

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