



Post-incident reporting for UK Reservoirs - annual report 2013

We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

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Introduction

In 2007, Defra requested the Environment Agency to collect information on incidents at all reservoirs in the United Kingdom.

We collect and record information on incidents at raised reservoirs, both large and small. Large raised reservoirs are currently those with a volume of more than 25 000 cubic metres and are covered by the Reservoirs Act 1975.

We use the information that we are sent to:

- Investigate incidents (where appropriate);
- Inform the reservoir industry of any trends and key lessons identified;
- Contribute to research into reservoir safety and incident frequency analysis.

All incident data is entered onto a database which can be used to inform reservoir safety research.

Any requests we receive for information relating to reservoir incidents are considered under the Freedom of Information Act 2000, Environmental Information Regulations 2004 and the Data Protection Act 1998.

Changes to reservoir safety legislation

England

For incidents at large raised reservoirs located in England, incident reporting is now a legal requirement under the provisions of section 21B of the Reservoirs Act 1975 and regulation 14 of Statutory Instrument 2013 No. 1677.

As soon as the incident is under control a reservoir owner or operator must provide a preliminary report of the incident to reservoirs@environment-agency.gov.uk or call 01392 442001 (9am-5pm Monday to Friday). The preliminary report must contain:

- the date and time of the incident;
- the location of the reservoir;
- any immediately observable relevant facts.

Within a year from the day after the incident, the reservoir owner or operator must send the Environment Agency a final post-incident report, preferably using the form available from the GOV.UK website. The final report of the incident must contain sufficient:

- information about the facts relating to it;
- analysis of its circumstances;
- particulars to support the conclusions that can be drawn from it;
- particulars to support the lessons learned from it.

The Environment Agency will review the final report and seek further clarification if necessary.

Incidents are classified according to the following levels of severity:

Level 1: Failure (uncontrolled sudden large release of retained water).

Level 2: Serious incident involving any of the following:

- Emergency drawdown;
- Emergency works;
- Serious operational failure in an emergency.

Level 3: Any incident involving:

- A precautionary drawdown;
- Unplanned physical works;
- Human error leading to a major (adverse) change in operating procedures.

An incident in any of the above incident categories is covered by the regulations.

Post-incident reporting for *small* raised reservoirs in England remains voluntary.

It is important to note that the above post-incident reporting process is separate and subsequent to the immediate incident response which should be reported to the emergency services as necessary. For incidents in England the Environment Agency's incident hotline number is 0800 80 70 60.

Wales, Scotland and Northern Ireland

In Wales, Natural Resources Wales (NRW) is now the enforcement authority for the Reservoirs Act 1975. Forthcoming amendments to the Reservoirs Act are expected to make post-incident reporting a legal requirement in Wales in the near future. In the mean time, incidents in Wales should be reported on a voluntary basis to NRW reservoirs@naturalresourceswales.gov.uk.

In Scotland, new legislation is in the process of being introduced, which will supersede the Reservoirs Act 1975. This legislation may make post-incident reporting a legal requirement and make SEPA the enforcement authority. Until this time, Scottish local authorities will remain the enforcement authority. Incidents in Scotland can continue to be reported on a voluntary basis to the Environment Agency.

In Northern Ireland, there is currently no specific reservoir safety legislation, but this is in the process of being introduced. Incidents in Northern Ireland can continue to be reported on a voluntary basis to the Environment Agency.

Reported incidents

In 2013, we received information on one incident that occurred in 2012 and four incidents that occurred in 2013. There were no reservoir incident investigations carried out in 2013 as none of the incidents that occurred required a more detailed investigation.

2012 incident

Incident 379	
Dam type	Earthfill embankment
Reservoir legal status	Statutory impounding reservoir
Dam height (m)	6
Incident type	Inflow flood, gate malfunction, overtopping, erosion
Incident severity	2

Description

This incident occurred at a flood storage reservoir that had suffered erosion damage to the spillway section three months earlier. The damage had recently been repaired when another significant flood event filled the reservoir. The control gates failed to fully operate which restricted the outflow from the reservoir and caused the reservoir to spill. The overtopping flow caused erosion of the spillway section of the dam.

The gates are located at the downstream end of the outlet culverts and had to operate under off-seating pressure (that is, with the gates being forced away from the culverts by the water pressure) under changing pressure conditions. The gate failure resulted from a combination of factors. The penstocks provided were only secure in their bearings when fully closed. The thick mortar packing used behind the gate frame also failed due to a misalignment in the concrete face. This caused the frame to twist and the gates to slip out of their bearings and jam.

Lessons learned

This incident highlights the importance of providing a robust flow control system at flood detention reservoirs. A system that relies on moveable gates will inevitably be less robust as there are risks associated with instrumentation and electrical control systems and power supplies, as well as risks associated with the mechanical control mechanisms. In this case it appears that the gates were not specified correctly for the function required and this problem was exacerbated by construction-related issues. As a general rule, control gates are easier to implement at the upstream end of the control section. The wider lessons regarding the spillway design are covered in the 2012 report (refer to incident 366).

2013 incidents

Incident 381	
Dam type	Earthfill embankment
Reservoir legal status	Statutory impounding reservoir
Dam height (m)	18
Incident type	Inflow flood, spillway deterioration
Incident severity	3

Description

The reservoir was subjected to unusually high water levels in the previous year which led to leakage through the embankment that had to be repaired by grouting. Following another period of sustained high water level, the spillway structure was found to have deteriorated with brickwork plucked from the base of the spillway channel and displacement of concrete ground slabs in the central section. Investigations found that voids had formed under some of the slabs, probably through internal erosion. This allowed floodwater to exert an increased uplift pressure on the underside of the slabs which led to the displacement. A controlled lowering of the reservoir level was carried out to allow temporary and permanent repair work to be safely carried out.

Lessons learned

Spillway structures can be subjected to both negative and positive pressures during the passage of a flood event. Any masonry in poor condition or voids below or behind a spillway channel lining can lead to damage to the structure. If left unchecked this could lead to dam failure. In this case, the damage was identified through a routine surveillance visit which underlines the value of such visits, especially in times of flood.

Photos courtesy of Welsh Water.



Incident 389	
Dam type	Earthfill embankment
Reservoir legal status	Statutory impounding reservoir
Dam height (m)	41
Incident type	Embankment instability
Incident severity	2

Description

A routine inspection of a large embankment dam identified a shallow slip on the downstream face of the dam over a large area close to the right mitre. The slip covered an area of approximately 27m by 25m and extended to a depth of up to 1m. The area had previously been noted in an inspection report a few months earlier as wet and in need of drainage. There was no clear indication of seepage flowing through the embankment although the slumped material was very wet from recent rain. A precautionary lowering of the reservoir level was carried out. Urgent measures were planned and implemented to stabilise the area. A rockfill buttress was placed against the face of the slip area, separated by a geosynthetic membrane.

Investigations were carried out under the direction of a panel engineer to evaluate the performance of the embankment in terms of seepage and stability.



Lessons learned

Investigations failed to link the incident with seepage through the core of the dam. The area of the slip was known to be relatively wet, presumably due to local drainage conditions, and the depth of the topsoil was found to be relatively thick at approximately 600mm. It appears that the slip occurred due to the weak nature of the surface material during a wet period.

Photos courtesy of Scottish Water.

Incident 388	
Dam type	Earthfill embankment
Reservoir legal status	Statutory impounding reservoir
Dam height (m)	5
Incident type	Inflow flood, embankment overtopped, erosion
Incident severity	2

Description

This incident occurred at a reservoir where most of the spillway capacity is provided by manually operated spillway gates. The gates had been partially opened the day before in response to a forecast for heavy rainfall in the area. During the night the reservoir water level rose rapidly and the embankment crest was overtopped. Staff working at the dam found that substantial sections of the downstream face had been eroded by water overtopping the dam. Fortunately the dam crest has a tarmac road which stopped the erosion at the downstream edge of the crest. Safe access to the spillway gates was initially prevented by the depth and velocity of the water passing over the crest but the gates were eventually fully opened and the reservoir substantially drained to allow the embankment to be repaired.

Lessons learned

This incident demonstrates the importance of reliable and adequate spillway facilities. Ideally, the flood safety of a reservoir should not greatly or wholly rely on gate operation unless the gates operate automatically in response to a rise in reservoir water level. The incident also demonstrates the importance of access to safety-critical structures.

When planning emergency responses, it is important to consider whether safe access is likely to be possible under extreme weather conditions. A tarmac access road will reduce the risk of dam failure due to overtopping as illustrated by this incident. A paved access road also provides other benefits in promoting a level crest, preventing rutting and reducing the ingress of moisture into the embankment fill which can soften and deteriorate when used by vehicles, creating low spots.

Incident 390	
Dam type	Earthfill embankment
Reservoir legal status	Non-statutory impounding reservoir
Dam height (m)	2
Incident type	Inflow flood, embankment overtopped, erosion
Incident severity	1

Description

A small reservoir formed by an earth embankment was overtopped and breached during a flood event. The breach occurred close to an outlet culvert and was reported by the local fishing club. It appears that the released reservoir water was contained behind a bridleway embankment a short distance downstream, so fortunately there was no threat to life or properties.

Lessons learned

The breach mechanism is not clear. Erosion due to overtopping appears more likely than internal erosion although the proximity to the culvert might indicate that internal erosion was a factor. This incident illustrates the importance of providing adequate spillway facilities to pass flood events without overtopping the dam embankment. Small embankment dams with no crest road will generally have a low tolerance to overtopping flow.

Photo courtesy of Alan Brown, Stillwater Associates



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