

## **Dam Failure**

### **General**

A dam is defined as an artificial barrier with the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water. A dam failure is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. It is recognized that there are lesser degrees of failure and that any malfunction or abnormality outside the design assumptions and parameters that adversely affect a dam's primary function of impounding water is properly considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure. Dam failures are usually a secondary effect of massive rainfall and flooding, and occur when too much water enters the spillway system. This will occur with little or no warning. Spring thaws, severe thunderstorms, and heavy rainfall are also contributory factors. Additionally, poor engineering or poor maintenance may also cause dam failures. According to the Federal Emergency Management Agency, dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

The Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers award permits for dams and share inspection responsibilities. Inspection results are characterized as either safe or unsafe. Dams are evaluated on categories, such as slope instability, excessive seepage, and inadequate spillways.

The National Inventory of Dams is a registry that captures information about structures that are greater than or equal to 25 feet in height or impounding 50 acre-feet or more of water, (an acre-foot is equal to 325,851 gallons of water), and includes structures above 6 feet in height, where failure would potentially cause damage downstream. The dams are classified in terms of hazard potential as "High", "Significant", or "Low", with High-hazard dams requiring Emergency Action Plans. There are two dams in Montour County that are registered with the U.S. Army Corps of Engineers in the National Inventory of Dams. Of these, only one requires an Emergency Action Plan. According to the National Inventory of Dams, the Lake Chillisquaque Dam has an Emergency Action Plan.

<b>Montour County Dam Inventory</b>						
<b>Dam Name</b>	<b>River</b>	<b>Owner Name</b>	<b>Year Completed</b>	<b>Drainage Area</b>	<b>Hazard</b>	<b>EAP Completed</b>
Lake Chillisquaue	Chillisquaue Creek	PPL Montour LLC	1971	5.6	H	Yes
Montour Ash Basin No 1	Watershed Chillisquaue Creek	PPL Montour LLC	1971	0.2	L	NR

*Source: National Inventory of Dams*

**History**

The National Performance of Dams Program, which maintains a database of failures for all dams listed in the National Inventory of Dams, lists no occurrences of dam failure or major incidents occurring at either of the two dams in Montour County. While dam failures are mostly minor and cause little damage, Pennsylvania has experienced severe dam failures. The National Performance of Dams Program lists 13 dam failures in Pennsylvania since 1800. The worst dam failure experienced in the Commonwealth was in Johnstown in 1889. The resulting flood claimed 2,209 lives and resulted in an estimated \$3.5 million in damage.

**Vulnerability**

There is always the possibility any dam could fail, however the probability is low. According to Pennsylvania Emergency Management Agency (PEMA), minor dam failures occur every year, but their impact is minimal. Usually, they are gradual, low volume releases that are unexpected and do not cause loss of life or damage to the environment. Montour County has both high-hazard and low-hazard dams within the County.

Dams assigned the significant hazard potential classification are those where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure. Dams assigned the high-hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

**Probability**

The probability of a significant dam failure occurring in Montour County is very low. Minor failures occur annually, but have little-to-no impact. Dam failures are most often a secondary effect of another hazard, such as severe weather, flooding, hurricanes, and tropical storms.

**Maximum Threat**

Montour County is home to two dams, one of which is listed as high-hazard. The greatest threat to Montour County is a failure of the Lake Chillisquaque Dam. Built on the middle branch of Chillisquaque Creek by Pennsylvania Power & Light Co. in 1972, this 165-acre reservoir serves as a backup cooling water supply for the Montour power plant. A failure of this dam could cause significant downstream damage to several municipalities, including Strawberry Ridge and Washingtonville.

**Secondary Effects**

Flooding is the most common secondary effect of dam failure. If the dam failure is severe, a large amount of water will enter riverbeds and overflow the stream banks for miles. A dam failure at Lake Chillisquaque Dam could cause a reduction in output from the Montour power plant, due to the lack of available water for cooling. This reduction in output could result in a brownout or partial utility failure. There may be significant environmental effects, as the resulting flood from a dam failure is likely to disperse debris and hazardous materials downstream that can damage local ecosystems. Debris carried downstream can block roads, cause traffic accidents, disrupt traffic patterns, and delay the delivery of essential services along major traffic corridors. Debris flow can also cause landslides along steep slopes and embankments. The economic and financial impact from damage and recovery can range from minimal-to-severe, depending on the magnitude of damage and scale of failure.