Dam Failure

General

A dam is defined as an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material to store or control 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. There are lesser degrees of failure; any malfunction or abnormality outside the design assumptions and parameters that adversely affect a dam's primary function of impounding water is considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure.[1] Dam failures usually are a secondary effect of massive rainfall and flooding, and occur when too much water enters the spillway system. This occurs 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; and
- 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. As of October 2001, 100 percent of the dams in Huntingdon County had been inspected.

There are nine dams in Huntingdon County registered with the National Inventory of Dams. The dams are classified in terms of hazard potential as high, significant, or low. High-hazard dams require emergency action plans (EAP). Of all the dams in Huntingdon County, only three require emergency action plans. According to the National Inventory of Dams, all high-hazard dams in Huntingdon County have emergency action plans. An inventory of Huntingdon County dams can be seen on the following chart.

[1] www.fema.gov, July 2006

Huntingdon County Dam Inventory					
Dam Name	**River**	**Owner Name**	**Year Completed**	**Hazard**	**EAP Completed**
Raystown Dam	Raystown Branch Juniata River	Cenab	1973	H	Yes
Lake Mount Union	Singers Gap Run	Mount Union Borough	1927	S	No
Huntingdon Smithfield Lily Creek	Lily Creek	Smithfield Township	1967	H	Yes
Warrior Ridge	Juniata River	American Hydro Power Partners	1906	L	No
Shaver Creek	Shaver Creek	Pennsylvania State University	1961	H	Yes
Whipple Dam	Laurel Run	DCNR-Bureau of State Parks	1920	L	Not Required
Hutchinson Dam	TR Shavers Creek	Harvey Hutchinson	1959	L	Not Required
PA05061501	TR Globe Run	Melvin Weyandt	1968	L	Not Required
Golden Pond	Globe Run	Hemlock Council of Girl Scouts	1968	L	Not Required

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 any of the nine dams in Huntingdon 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. More recently, the Pennsylvania Emergency Management Agency (PEMA) has recorded two incidents involving Huntingdon County dams. The first occurred on September 9, 2004, when a routine inspection revealed a crack in the wall of the Petersburg Power Dam in Logan Township; the second occurred on July 21, 2005, when the Warrior Ridge Power Dam in Porter Township was observed to have a large series of linear cracks in the dam face.

Vulnerability

There is always the possibility any dam could fail, however, the probability is low. According to 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. Huntingdon County has both high-hazard and significant-hazard dams.

Dams assigned the significant-hazard potential classification are those where failure or faulty results in no probable loss of human life, but can result in 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 can be located in areas with population and significant infrastructure. Dams assigned the high-hazard potential classification are those where failure or faulty operation will probably cause loss of human life.

While a dam failure is not imminent, it is critical that Huntingdon County consider the devastation likely if a significant dam failure were to occur at Raystown Lake. Raystown Lake is a high hazard dam and has an EAP in place. Nonetheless, Huntingdon County is unique in that it must consider this successful recreational dam as a vulnerability to the County's safety in terms of dam failures.

Probability

The probability of a significant dam failure occurring in Huntingdon 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, or hurricanes and tropical storms.

Maximum Threat

Huntingdon County is home to nine dams, of which three are listed as high hazard. The municipalities where these high-hazard dams are located are at the greatest risk for a significant dam failure. Moreover, Raystown Lake is 28 miles long, with over 8,300 acres of water. The dam is 225 feet high and over 1,700 feet long. A significant dam failure at Raystown Lake would be devastating to both the population and the economy of Huntingdon County. While these tremendous water levels would cause great destruction and possibly a high number of casualties, they could also greatly hinder an economic generator of nearly $40,000,000 annually from tourism, according to a report issued in *PennLines*, the monthly trade journal of the Pennsylvania Rural Electric Association.

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. There may be significant environmental vulnerability, depending on the contents of the water and the path it takes.