



## 5.10. Radiological Incidents

### 2023 SHMP UPDATE CHANGES

- ❖ This hazard was not included in the 2018 State Hazard Mitigation Plan (SHMP).
- ❖ The hazard profile includes a detailed description of the hazard, location, extent, previous occurrences, probability of future occurrence (including how future conditions may impact the hazard), vulnerability, and consequences.

#### 5.10.1. Hazard Profile

The radiological exposure hazard focuses on the risk from releases of radiological material from the Beaver Valley Power Station (BVPS) in Pennsylvania.

##### HAZARD DESCRIPTION

Radiological hazards and incidents generally refer to incidents involving (1) a release of significant levels of radioactive materials or (2) exposure of workers or the general public to radiation. Primary concerns following a radiological incident or accident are the impact on public health from (1) direct exposure to a radioactive plume; (2) inhalation of radioactive materials; (3) ingestion of contaminated food, water, and milk; and (4) long-term exposure to deposited radioactive materials in the environment that may lead to either acute (radiation sickness or death) or chronic (cancer) health effects (Centers for Disease Control and Prevention [CDC] 2019).

The nuclear industry has adopted pre-determined, site-specific Emergency Action Levels (EAL) defined by the U.S. Nuclear Regulatory Commission (U.S. NRC). The EALs provide the framework and guidance for observing, addressing, and classifying the severity of site-specific incidents and conditions that are communicated to off-site emergency response organizations (U.S. NRC 2021). Additional EALs specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or attack on the facility. These EALs ensure that appropriate notifications of a security threat will occur in a timely manner.

The NRC encourages the use of probabilistic risk assessments (PRA) to estimate quantitatively the potential risk to public health and safety considering the design, operations, and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. The Federal Emergency Management Agency (FEMA), West Virginia Emergency Management Division (WVEMD), and county governments have formulated radiological emergency response plans to prepare for radiological emergencies at the BVPS. These plans include a plume exposure pathway emergency planning zone (EPZ) (an area with a radius of 10 miles from the nuclear power facility) and an Ingestion Exposure Pathway EPZ (an area with a radius of 50 miles from the facility) (WVEMD 2019).

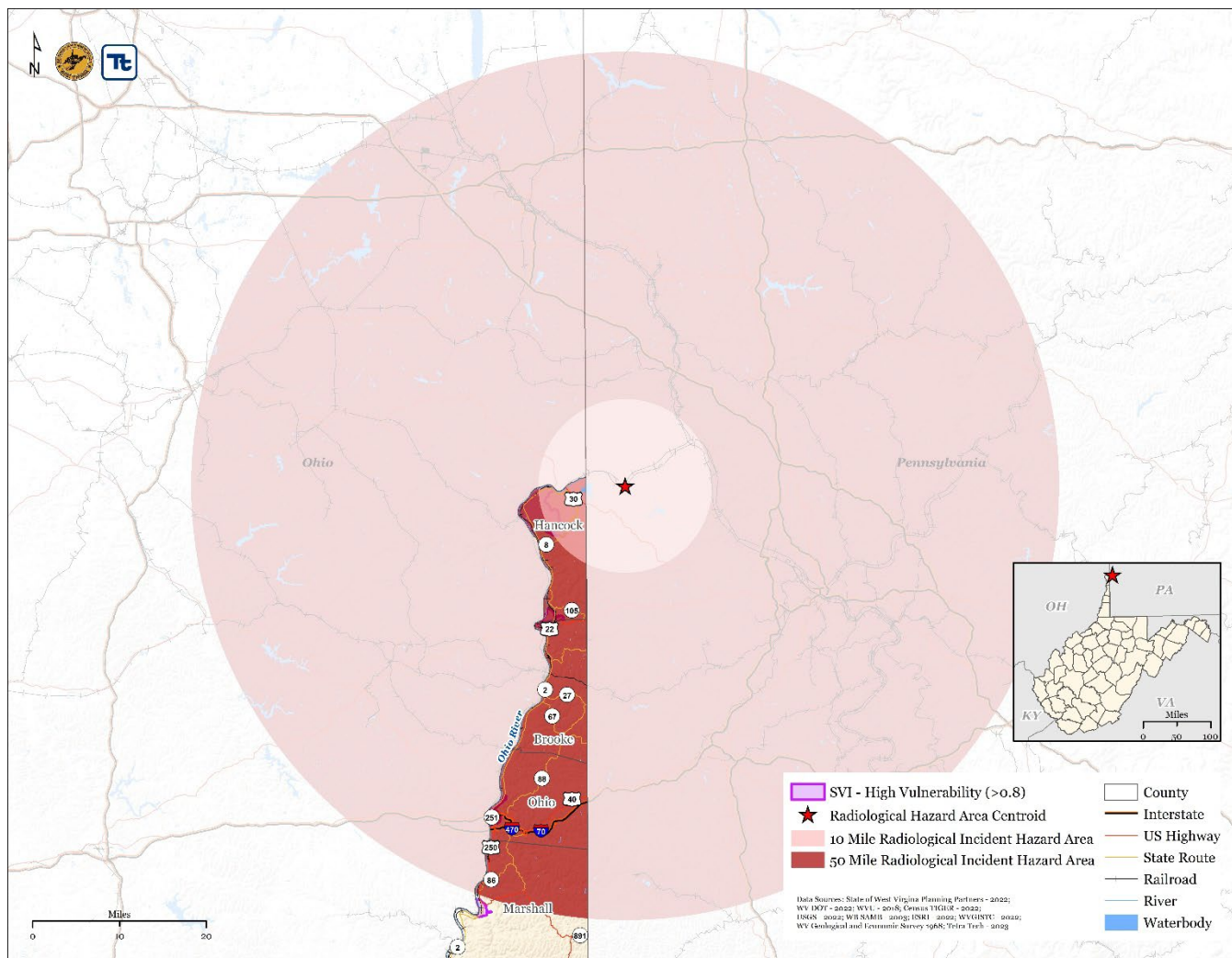
The wide use of radioactive and nuclear material in research, education, medicine, and industry, as well as the potential for terrorism, requires all levels of government to be prepared for response, mitigation, and recovery efforts should a radiological or nuclear emergency occur.



## LOCATION

The BVPS is a two-unit nuclear power plant located in Shippingport, Pennsylvania, east of West Virginia. BVPS is owned and operated by Energy Harbor Corporation. The plant consists of two Westinghouse pressurized water reactors that started operation in July 1976 (Unit One) and August 1987 (Unit 2) (WVEMD n.d.). The location of the facility is shown in Figure 5.10-1.

**Figure 5.10-1. BVPS Location**



WVEMD and Hancock County coordinate emergency response plans and activities with BVPS, the State of Ohio and its Columbiana County, and the Commonwealth of Pennsylvania and its Beaver County. State of West Virginia (the State) and county agencies have the primary responsibility for the safety of the general public outside of the nuclear facility. Most of these protective actions center around a 10-mile Plume Exposure Pathway EPZ that includes parts of Hancock County, Ohio, and Pennsylvania (WVEMD n.d.), though there are protective actions to be taken to protect the food supply (i.e., the ingestion exposure pathway) in the area within 50 miles (the Ingestion Exposure Pathway EPZ) of the power plant. Table 5.10-1 lists the area of each county within the two EPZs. For brevity, only the counties affected are listed.



**Table 5.10-1. Total Acres of Land Area Located in the Radiological Incidents Hazard Areas**

County	Total Acres of Land Area (Excluding Waterbodies) Located in the Radiological Incidents Hazard Areas				
	Total Acres of Land Area	Total Acres Within 10 Miles of the BVPS	Percent of Total	Total Acres Within 50 Miles of the BVPS	Percent of Total
Brooke	59,321	0	0.0%	59,321	100.0%
Hancock	56,222	22,668	40.3%	56,222	100.0%
Marshall	199,304	0	0.0%	57,651	28.9%
Ohio	69,666	0	0.0%	69,666	100.0%
<b>Total</b>	<b>15,466,796</b>	<b>22,668</b>	<b>0.1%</b>	<b>242,860</b>	<b>1.6%</b>

Source: USGS 2022; West Virginia University Geographic Information Systems (GIS) Technical Center (WVU GISTC) 2022

**EXTENT**

The Plume Exposure Pathway EPZ is designed to consider whole-body external exposure to radiation from a radioactive plume and deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The 50-mile Ingestion Exposure Pathway EPZ considers exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation. This kind of exposure can stem from any of the three categories of nuclear accident listed below (U.S. NRC 2020).

- *Criticality accidents:* Involves loss of control of nuclear assemblies or power reactors.
- *Loss-of-coolant accidents:* Occurs whenever a reactor coolant system experiences a break or opening large enough that the coolant inventory in the system cannot be maintained by the normally operating make-up system.
- *Loss-of-containment accidents:* Involves the release of radioactivity from materials such as tritium; fission products; plutonium; and natural, depleted, or enriched uranium. Points of release have been containment vessels at fixed facilities or damaged packages during transportation accidents.

In accordance with regulations specified by FEMA and NRC, each facility is required to notify jurisdictional agencies of an incident or occurrence within that facility. NRC uses four classification levels for nuclear incidents (U.S. NRC 2021). Agencies involved in responding to radiological incidents use the following notification levels based on an internal trigger:

- *Unusual Event:* Incidents are occurring or have occurred that indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring off-site response or monitoring is expected unless further degradation occurs.
- *Alert:* Incidents are in process or have occurred that involve actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the U.S. Environmental Protection Agency (U.S. EPA) Protective Action Guides (PAG).
- *Site Area Emergency:* Incidents are in process or have occurred that resulted in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed U.S. EPA PAGs except near the site boundary.



- *General Emergency*: Incidents are in process or have occurred that have caused actual or imminent substantial core damage or melting of reactor fuel with potential for loss-of-containment integrity. Radioactive releases during a General Emergency can reasonably be expected to exceed the U.S. EPA PAGs over more than the immediate site area (U.S. NRC 2021).

After a nuclear incident, the primary concern is the effect on the health of the population located near the incident. The duration of primary exposure could range in length from hours to months, depending on the proximity to the point of radioactive release. External radiation and inhalation and ingestion of radioactive isotopes can cause acute health effects (e.g., death, severe health impairment), chronic health effects (e.g., cancers), and psychological effects (U.S. EPA 2023).

Potential environmental impacts specific to the 50-mile Ingestion Exposure Pathway EPZ include the long-term effects of radioactive contamination in the environment and in agricultural products. The State can expect some radioactive contamination in very small amounts in the case of a radiological incident. This is not a significant concern in terms of external exposure and immediate health risks, but even a small amount of radiation will require the protection of the food chain, particularly milk supplies. Small amounts of radiation ingested over time could lead to future health issues. As a result, in the case of a radiological incident, foodstuffs, crops, milk, livestock feed and forage, and farm water supplies will need to be protected from and tested for contamination in accordance with State and local radiological emergency response procedures. Additionally, spills and releases of radiologically active materials from accidents can result in the contamination of soil and public water supplies (U.S. EPA 2023).

### **Warning Time**

Warning time for radiological incidents will vary based on the nature of the incident. Incidents at the BVPS may start as minor issues and progress through the emergency classification levels over a period of days. Other incidents may cause a release of radiological materials immediately, bringing the site to General Emergency without first passing through the precursor levels.

## **PREVIOUS OCCURRENCES AND LOSSES**

### **Federal Emergency Management Agency (FEMA) Disaster Declarations**

Between 1953 and 2022, the State was not included in any disaster (DR) or emergency (EM) declarations for radiological incidents (FEMA 2023).

### **U.S. Department of Agriculture (USDA) Disaster Declarations**

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, West Virginia was not included in any agricultural disaster declarations pertaining to radiological incidents nor were any declarations related to releases of radiological materials (USDA 2023).

### **Previous Events**

There are no records of releases of radiological materials from the BVPS (U.S. NRC 2023).



## PROBABILITY OF FUTURE HAZARD EVENTS

### Overall Probability

Based on the history of events of the BVPS, and the low occurrence of events nationwide, the State has a low probability of events in the future.

*Table 5.10-2. Probability of Future Radiological Incidents in West Virginia*

Hazard Type	Number of Occurrences	Percent Chance of Occurrence in Any Given Year
Radiological	0	Cannot be determined based on past events

Source: U.S. NRC 2023

### Projected Future Conditions

Radiological incidents can be caused by other hazards, including weather-related hazards. More frequent, more intense storms or flood events impacting BVPS could damage the infrastructure at the site, which could cascade into an incident that releases radioactive material into the State.

### 5.10.2. Vulnerability Assessment

Effects from a radiological incident at BVPS would vary depending on the product released (type of radiation), amount of radiation released, current weather conditions, and time of day. The priority following an incident at BVPS is the life safety of all individuals within the area impacted. Secondary to health and safety would be effects on critical infrastructure, environment, property, and the economy.

Contamination of agriculture, livestock, and production can lead to loss of commerce with other regions of the State, country, and even the world. In 2011, many countries halted imports of products from Japan for fear of contamination following the tsunami-related nuclear incident at the Fukushima Power Plant. This loss in revenue compounded losses that Japan and the region surrounding the power plant were already experiencing following the initial disaster.

Impacts within the affected area can include loss of utility service, contamination of local crops and livestock, loss of residential property due to measurable quantities of nuclear materials, and increased risk to health and well-being of individuals within the area.

### STATE ASSETS

The spatial analysis for the radiological incidents hazard determined there are three State-owned or -leased buildings located in a 10-mile radius of BVPS (as shown in Table 5.10-3). All three of these facilities are located in Hancock County and have a replacement cost value of \$3,470,052 for structures and contents. Two of the buildings within 10 miles of BVPS are used by the Department of Environmental Protection, and the other is used by the Division of Natural Resources - Parks, as shown in Table 5.10-4.



**Table 5.10-3. State Buildings Within 10 Miles of the BVPS**

State Facilities Within 10 Miles of BVPS		Replacement Cost Value for State Facilities Within 10 Miles of the BVPS		
County	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Hancock	3	\$2,853,152	\$616,900	\$3,470,052
<b>Total</b>	<b>3</b>	<b>\$2,853,152</b>	<b>\$616,900</b>	<b>\$3,470,052</b>

Source: WVBRIM 2022

**Table 5.10-4. State Buildings Within 10 Miles of the BVPS by Agency**

State Facilities Within 10 Miles of BVPS		Replacement Cost Value for State Facilities Within the Radiological Incidents 10-Mile Buffer Hazard Area		
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Environmental Protection, Department of State of West Virginia	2	\$23,000	\$45,700	\$68,700
Parks, West Virginia State C/O Division of Natural Resources	1	\$2,830,152	\$571,200	\$3,401,352
<b>Total (WV State)</b>	<b>3</b>	<b>\$2,853,152</b>	<b>\$616,900</b>	<b>\$3,470,052</b>

Source: WVBRIM 2022

There are 47 State buildings located within 50 miles of BVPS, with the greatest number of buildings located in Ohio County (30 structures); those facilities have a replacement cost value of \$28.7 million for structures and contents, as shown in Table 5.10-5. The majority of the State facilities within 50 miles of the BVPS are occupied by the Department of Health and Human Resources (5 buildings), Division of Highways (5 buildings), and the Department of Military Affairs and Public Safety – State Police (5 buildings), but the Northern Community and Technical College has the highest replacement cost value of State buildings (\$10.9 million) within 50 miles of BVPS, as shown in Table 5.10-6.

**Table 5.10-5. State Buildings Within 50 Miles of the BVPS by County**

State Facilities Located Within the Radiological Incidents 50-Mile Buffer Hazard Area		Replacement Cost Value for State Facilities Within 50 Miles of the BVPS		
County	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Brooke	4	\$3,040,000	\$140,000	\$3,180,000
Hancock	11	\$3,563,152	\$2,336,900	\$5,900,052
Marshall	2	\$480,000	\$34,600	\$514,600
Ohio	30	\$20,465,072	\$8,195,209	\$28,660,281
<b>Total</b>	<b>47</b>	<b>\$27,548,224</b>	<b>\$10,706,709</b>	<b>\$38,254,933</b>

Source: WVBRIM 2022





**Table 5.10-6. State Buildings Within 50 Miles of the BVPS by Agency**

State Facilities Located Within 50 Miles of BVPS			Replacement Cost Value for State Facilities Within 50 Miles of the BVPS	
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Adjutant General's Office State of West Virginia	1	\$140,000	\$55,000	\$195,000
Administration, Secretary of Department of Administration	0	\$0	\$0	\$0
Agriculture, Department of State of West Virginia	0	\$0	\$0	\$0
Air And Environmental Quality Boards State of West Virginia	0	\$0	\$0	\$0
Alcohol Beverage Control Administration State of West Virginia	0	\$0	\$0	\$0
Architects, Board of State of West Virginia	0	\$0	\$0	\$0
Armory Board State of West Virginia	2	\$3,691,000	\$2,500,000	\$6,191,000
Arts, Culture & History, Department of State of West Virginia	1	\$4,384	\$2,000	\$6,384
Attorney General, Office of The State of West Virginia	0	\$0	\$0	\$0
Aviation, Division of	0	\$0	\$0	\$0
Bar, State State of West Virginia	0	\$0	\$0	\$0
Barbers & Cosmetologists, Board of State of West Virginia	0	\$0	\$0	\$0
Blue Ridge Community & Technical College	0	\$0	\$0	\$0
Bluefield State College	0	\$0	\$0	\$0
Board of Treasury Investments	0	\$0	\$0	\$0
Bridgevalley Community & Tech College	0	\$0	\$0	\$0
Cedar Lakes Conference Center State of West Virginia	0	\$0	\$0	\$0
Chiropractic Examiners Board State of West Virginia	0	\$0	\$0	\$0
Commission For National And Community Service, WV	0	\$0	\$0	\$0
Concord University	0	\$0	\$0	\$0
Conservation Agency, West Virginia State of West Virginia	1	\$0	\$9,600	\$9,600
Consolidated Public Retirement Board Department of Administration	0	\$0	\$0	\$0
Consumer Advocate, Division of WV Public Service Commission	0	\$0	\$0	\$0
Corrections, Division of State of West Virginia	1	\$0	\$11,600	\$11,600
Courthouse Facilities Improvement Authority	0	\$0	\$0	\$0
Dentistry, Board of State of West Virginia	0	\$0	\$0	\$0
Department of Transportation	0	\$0	\$0	\$0
Dietitians, Board of Licensed	0	\$0	\$0	\$0
Eastern Panhandle Instructional Coop	0	\$0	\$0	\$0
Eastern WV Community & Tech. College	0	\$0	\$0	\$0
Economic Development Authority State of West Virginia	0	\$0	\$0	\$0



State Facilities Located Within 50 Miles of BVPS			Replacement Cost Value for State Facilities Within 50 Miles of the BVPS	
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Economic Development, WV Dept of	0	\$0	\$0	\$0
Education, Department of State of West Virginia	2	\$0	\$173,000	\$173,000
Educational Broadcasting Authority State of West Virginia	0	\$0	\$0	\$0
Enterprise Resource Planning Board, WV	0	\$0	\$0	\$0
Environmental Protection, Department of State of West Virginia	4	\$37,000	\$1,184,459	\$1,221,459
Ethics Commission, West Virginia Department of Administration	0	\$0	\$0	\$0
Examiners In Counseling, Board of State of West Virginia	0	\$0	\$0	\$0
Fairmont State University	0	\$0	\$0	\$0
Fire Commission State of West Virginia	0	\$0	\$0	\$0
Fleet Management Office, Dept of Admin State of West Virginia	0	\$0	\$0	\$0
Forestry, Division of State of West Virginia	0	\$0	\$0	\$0
General Services Division Department of Administration	0	\$0	\$0	\$0
Geological And Economic Survey State of West Virginia	0	\$0	\$0	\$0
Glenville State College	0	\$0	\$0	\$0
Governor, Office of The State of West Virginia	0	\$0	\$0	\$0
Health & Human Resources, Department of State of West Virginia	5	\$4,060,000	\$880,000	\$4,940,000
Higher Education Policy Commission, WV	0	\$0	\$0	\$0
Highways, Division of State of West Virginia	5	\$401,800	\$112,650	\$514,450
Homeland Security & Emergency Management Division	0	\$0	\$0	\$0
Insurance Commissioner, Office of The State of West Virginia	1	\$0	\$25,000	\$25,000
Investment Management Board, WV State of West Virginia	0	\$0	\$0	\$0
Joint Committee On Government & Finance State of West Virginia	0	\$0	\$0	\$0
Justice & Community Services, Div. of	0	\$0	\$0	\$0
Juvenile Services, Division of	1	\$0	\$50,000	\$50,000
Labor, Division of State of West Virginia	0	\$0	\$0	\$0
Land Division/Dept of Agriculture State of West Virginia	0	\$0	\$0	\$0
Landscape Architects, Board of State of West Virginia	0	\$0	\$0	\$0
Library Commission State of West Virginia	0	\$0	\$0	\$0
Lottery Commission State of West Virginia	1	\$0	\$1,500,000	\$1,500,000
Marshall University	0	\$0	\$0	\$0
Military Affairs, Secretary of And Public Safety	0	\$0	\$0	\$0





State Facilities Located Within 50 Miles of BVPS			Replacement Cost Value for State Facilities Within 50 Miles of the BVPS	
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Miner's Health Safety, Division of And Training, State of West Virginia	0	\$0	\$0	\$0
Motor Vehicles, Division of State of West Virginia	0	\$0	\$0	\$0
Mountain State Esc	0	\$0	\$0	\$0
Mountwest Community & Technical College	0	\$0	\$0	\$0
National Coal Heritage Area Authority	0	\$0	\$0	\$0
Natural Resources, Department of State of West Virginia	0	\$0	\$0	\$0
New River Community & Technical College	0	\$0	\$0	\$0
Northern Community & Tech College, WV College Square	1	\$8,900,000	\$2,000,000	\$10,900,000
Occupational Therapy Board State of West Virginia	0	\$0	\$0	\$0
Office of Technology/Is&C Department of Administration	0	\$0	\$0	\$0
Osteopathic Medicine, WV Board of State of West Virginia	0	\$0	\$0	\$0
Osteopathic Medicine, WV School of	1	\$0	\$10,200	\$10,200
Parks, West Virginia State C\O Division of Natural Resources	1	\$2,830,152	\$571,200	\$3,401,352
Pharmacy, Board of State of West Virginia	0	\$0	\$0	\$0
Physical Therapy, Board of State of West Virginia	0	\$0	\$0	\$0
Pierpont Community And Technical College	0	\$0	\$0	\$0
Practical Nurses, Board of State of West Virginia	0	\$0	\$0	\$0
Prosecuting Attorneys Institute, WV	0	\$0	\$0	\$0
Psychologists Examiners, Board of State of West Virginia	0	\$0	\$0	\$0
Public Service Commission State of West Virginia	0	\$0	\$0	\$0
Purchasing, Division of Department of Administration	0	\$0	\$0	\$0
Rail Authority State of West Virginia	0	\$0	\$0	\$0
Real Estate Commission State of West Virginia	0	\$0	\$0	\$0
Regional Jail & Corr. Fac. Authority State of West Virginia	0	\$0	\$0	\$0
Registered Nurses, Board of State of West Virginia	0	\$0	\$0	\$0
Rehabilitation Services Division of Commerce	1	\$0	\$675,000	\$675,000
Respiratory Care, WV Board of	0	\$0	\$0	\$0
School Building Authority, West Virginia	0	\$0	\$0	\$0
Schools For The Deaf And The Blind State of West Virginia	0	\$0	\$0	\$0
Senior Services, Bureau of State of West Virginia	0	\$0	\$0	\$0
Shepherd University	0	\$0	\$0	\$0
Southern Educational Services Coop	0	\$0	\$0	\$0



State Facilities Located Within 50 Miles of BVPS			Replacement Cost Value for State Facilities Within 50 Miles of the BVPS	
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Southern WV Community & Tech College	0	\$0	\$0	\$0
Speech Pathology & Audiology Examiners West Virginia Board of	0	\$0	\$0	\$0
State Police, West Virginia Dept of Military Affairs & Public Safety	5	\$1,210,000	\$80,000	\$1,290,000
Supreme Court of Appeals State of West Virginia	4	\$0	\$266,000	\$266,000
Tax Appeals, WV Office of	0	\$0	\$0	\$0
Tax Department State of West Virginia	1	\$0	\$60,000	\$60,000
Treasurer of State State of West Virginia	0	\$0	\$0	\$0
University Physicians And Surgeons	0	\$0	\$0	\$0
Unknown	4	\$0	\$0	\$0
Veterans Assistance, Department of State of West Virginia	1	\$0	\$10,000	\$10,000
Veterinary Medicine, Board of State of West Virginia	0	\$0	\$0	\$0
Water Development Authority State of West Virginia	0	\$0	\$0	\$0
West Liberty University	3	\$6,273,888	\$531,000	\$6,804,888
West Virginia Parkways Authority	0	\$0	\$0	\$0
West Virginia State University - Institute	0	\$0	\$0	\$0
West Virginia State University - Malden	0	\$0	\$0	\$0
West Virginia University	0	\$0	\$0	\$0
West Virginia University Arthurdale	0	\$0	\$0	\$0
West Virginia University At Parkersburg	0	\$0	\$0	\$0
West Virginia University Beckley	0	\$0	\$0	\$0
West Virginia University Bruceton Mills	0	\$0	\$0	\$0
West Virginia University Charleston	0	\$0	\$0	\$0
West Virginia University Fort Ashby	0	\$0	\$0	\$0
West Virginia University Granville	0	\$0	\$0	\$0
West Virginia University Jacksons Mill	0	\$0	\$0	\$0
West Virginia University Kearneysville	0	\$0	\$0	\$0
West Virginia University Keyser	0	\$0	\$0	\$0
West Virginia University Montgomery	0	\$0	\$0	\$0
West Virginia University Reedsville	0	\$0	\$0	\$0
West Virginia University Union	0	\$0	\$0	\$0
West Virginia University Wardensville	0	\$0	\$0	\$0
West Virginia University Weston	0	\$0	\$0	\$0
Workforce West Virginia	0	\$0	\$0	\$0
WV Public Employees Grievance Board	0	\$0	\$0	\$0
WVsom Clinic Inc Db a Robert C Byrd Clinic	0	\$0	\$0	\$0



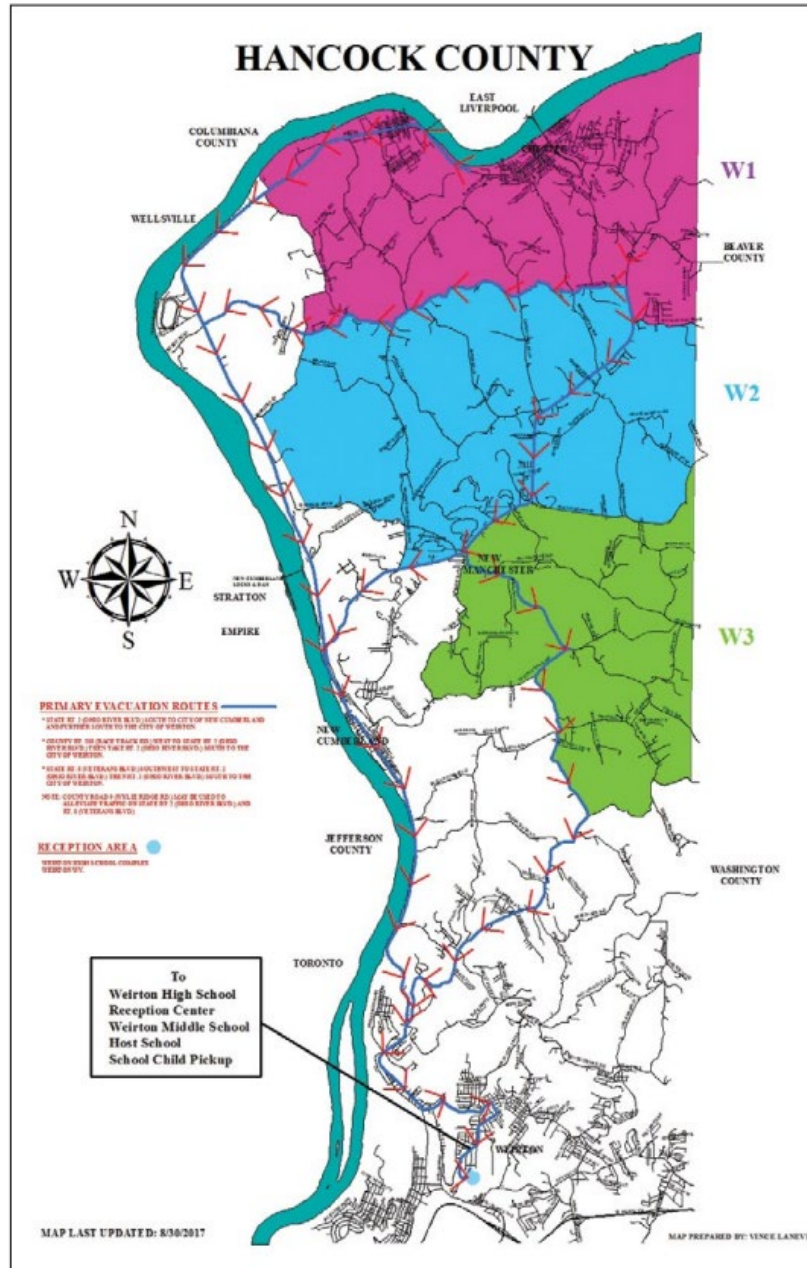
State Facilities Located Within 50 Miles of BVPS			Replacement Cost Value for State Facilities Within 50 Miles of the BVPS	
Agency	Number of Structures	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value
Total (WV State)	47	\$27,548,224	\$10,706,709	\$38,254,933

Source: WVBRIM 2022

Roads provide a vital transportation link between populated areas. During a radiological incident, some roads will be closed to traffic while others will serve as vital evacuation routes for people leaving the affected areas. Figure 5.10-2 shows the designated evacuation routes in Hancock County for use during an incident at BVPS.



Figure 5.10-2. BVPS Evacuation Routes in Hancock County



Source: Hancock County Office of Emergency Management 2021

There are 10.26 miles of State-owned roads located within 10 miles of the BVPS, all of which are in Hancock County. There are 126.45 miles of State-owned roads within 50 miles of the BVPS, in Brooke, Hancock, Marshall, and Ohio Counties.



**Table 5.10-7. State Roads Located in Areas Vulnerable to Radiological Incidents by County**

County	State Roads Located Within the Radiological Incidents 10-Mile Buffer Hazard Area	State Roads Located Within the Radiological Incidents 50-Mile Buffer Hazard Area
	Mileage of Roadways	Mileage of Roadways
Brooke	0.00	52.01
Hancock	10.26	34.87
Marshall	0.00	12.91
Ohio	0.00	26.66
<b>Total</b>	<b>10.26</b>	<b>126.45</b>

Source: WVDOT 2022

### CRITICAL FACILITIES AND COMMUNITY LIFELINES

It is important to determine the critical facilities and infrastructure within the State that may be at risk during a radiological incident. While damage to structures is not expected during radiological incidents, critical services during and after an event may not be available if transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the State to many service providers needing to get to vulnerable populations or to make repairs.

The State has not identified critical facilities within 10 miles of BVPS (WVEMD 2022). Table 5.10-8 summarizes the total number of critical facilities by lifeline category located in areas within 50 miles of BVPS, by county. Ohio County has the greatest number of critical facilities (6) within 50 miles of BVPS, with the majority of the facilities being categorized as Safety and Security lifelines.

**Table 5.10-8. Critical Facilities Within 50 Miles of the BVPS by County**

County	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health & Medical	Safety & Security	Transportation	Total
Hancock	0	0	1	0	0	1	0	2
Ohio	0	0	1	0	0	5	0	6
<b>Total</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>8</b>

Source: WVEMD 2022

### POPULATION

The population within 10 miles of the BVPS resides within Hancock County, as shown in Table 5.10-9. Table 5.10-10 shows similar details for populations within 50 miles of the BVPS. The tables show the total number of people exposed to radiological incidents, the number of those people identified as “highly vulnerable” in the CDC’s Social Vulnerability Index (SVI) data, and the percentage of the exposed people who are considered highly vulnerable.

**Table 5.10-9. 2020 U.S. Census Population Located Within 10 Miles of BVPS**

County	Total Exposed Population	Highly Vulnerable Exposed Population	% Exposed Population Highly Vulnerable
Hancock	1,995	7,913	25.21%
<b>Total</b>	<b>1,995</b>	<b>7,913</b>	<b>25.21%</b>

Source: CDC 2022



**Table 5.10-10. 2020 U.S. Census Population Located Within 50 Miles of BVPS**

County	Total Exposed Population	Highly Vulnerable Exposed Population	% Exposed Population Highly Vulnerable
Brooke	2,543	22,162	11.47%
Hancock	6,126	29,118	21.04%
Ohio	3,851	41,875	9.20%
<b>Total</b>	<b>12,520</b>	<b>93,155</b>	<b>13.4%</b>

Source: CDC 2022

**Impacts on Socially Vulnerable Populations**

Vulnerable populations are all populations within 10 miles of the BVPS that are incapable of escaping the area within an allowable time frame. This population includes the elderly, young, and individuals with disabilities, access, or functional needs who may be unable to get themselves out of the affected areas. The vulnerable population also includes those who would not have adequate warning from the emergency warning system (e.g., television or radio). To help identify the populations especially vulnerable to incidents at BVPS, Hancock County distributes an annual mailer to all residents within 10 miles of BVPS that includes an Access/Functional Needs Information Card (Hancock County Office of Emergency Management 2021). This card collects information on hearing impairments, visual impairments, mobility impairments, and lack of transportation to affect one’s own evacuation.

**FUTURE CHANGES THAT MAY IMPACT STATE VULNERABILITY**

Understanding future changes that impact vulnerability in the State can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The State considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of future hazard conditions

**Potential or Projected Development**

Any development within the areas of Hancock, Brooke, Ohio, or Marshall Counties that are within 10 miles or 50 miles of the BVPS could increase vulnerability to radiological incidents. This is particularly true for the portions of Hancock County within 10 miles of the nuclear power plant.

**Projected Changes in Population**

As shown in Section 2, the State is experiencing a net loss of population. This could lead to fewer people in areas within 10 or 50 miles of the BVPS, reducing overall vulnerability of the population to a radiological incident. As the population ages, more residents may face challenges quickly evacuating an area in the event of an emergency at BVPS.





## Other Factors of Change

In February 2022, Governor Jim Justice signed a bill eliminating West Virginia's ban on nuclear power. According to the Nuclear Energy Institute, coal currently provides 88 percent of West Virginia's energy needs, followed by 5 percent from natural gas, 3.3 percent from wind, 3.1 percent from hydroelectric, and 0.2 percent from other energy sources (NPR 2022). In coming years, the State is likely to diversify its electric power sources to include nuclear power. Construction of nuclear power facilities in West Virginia would increase the risk of a radiological incident.

### 5.10.3. Consequence Analysis

#### IMPACTS TO THE PUBLIC

WVEMD and the Hancock County Office of Emergency Management (OEM) are responsible for ensuring the safety of West Virginia residents during an incident at BVPS. Significant effort has been made to plan for the response to such incidents and minimize impacts on the general public. However, during an incident, thousands of people are at risk of being contaminated by radioactive material and will need to be evacuated, and a subset of those people will require temporary housing. Some portions of the population will be placed under shelter-in-place orders and unable to leave their residences for an undetermined period of time.

While only the population within 10 miles of the BVPS are considered vulnerable to being directly contaminated by radioactive material, multitudes of people become vulnerable to a radiological incident as radioactive material settles on farm and pastureland and contaminates the food chain. Should an incident occur, State and federal agencies would sample and monitor milk, livestock feed, storage crops, and water supplies within the Ingestion Exposure Pathway EPZ, and may issue public health advisories to avoid certain crops and foodstuffs.

#### IMPACTS TO RESPONDERS

Emergency responders (e.g., police, firefighters, public works/highway crews) will be deployed to set up and staff access control and traffic control points, possibly putting them in danger of being contaminated by radioactive material. Radiation exposure can lead to leukemia, breast, bladder, colon, liver, lung, esophagus, ovarian, multiple myeloma, and stomach cancers (U.S. NRC 2020).

#### IMPACTS TO CONTINUITY OF OPERATIONS

Staff from WVEMD, WVDEP, and WV Department of Health and Human Resources, among other departments and agencies, may be deployed to manage response operations. Daily operations of affected agencies would be impacted.

#### IMPACTS TO PROPERTY, FACILITIES, AND INFRASTRUCTURE

A radiological incident at the BVPS would have very little direct impact on property, facilities, and infrastructure in the State. Facilities and infrastructure may require decontamination after a radiological release. Transportation infrastructure may also be impacted by restrictions (e.g., road closures) in and around the Plume Exposure Pathway EPZ.



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### **IMPACTS TO THE ENVIRONMENT**

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The release of radioactive materials has a profound impact on animals. Radiation causes genetic anomalies, leading to decreased reproduction, deformities, and death. High levels of contamination can also appear in plants and last for decades. For instance, Cesium-137, a radioactive fission product of nuclear plants, still appears around the 1986 Chernobyl incident site (Wai 2020).

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### **IMPACTS TO THE ECONOMIC CONDITION OF THE STATE**

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Contamination of agriculture, livestock, and production can lead to loss of commerce with other regions of the State, country, and even the world. In 2011, many countries halted imports of products from Japan for fear of contamination following the tsunami-related nuclear incident at the Fukushima Power Plant. This loss in revenue compounded losses that Japan and region surrounding the power plant were already experiencing following the initial disaster.

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### **IMPACTS TO PUBLIC CONFIDENCE IN STATE GOVERNANCE**

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A radiological incident would have a significant impact on the public's confidence in State governance. Whether that impact is good or bad depends on the efficiency and effectiveness of the response effort. Given the amount of time and financial resources spent on preparing for incidents at nuclear power plants, any errors or inefficiencies, whether actual or perceived, in the response will have cascading political impacts on local and State officials.