2.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Item in Section 2.2:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information related to the identification of potential hazards stemming from nearby industrial, transportation, and military facilities within the site vicinity, including an evaluation of potential accidents (such as explosions, toxic chemicals, and fires).

This COL Item is addressed as follows:

{This section also establishes whether the effects of potential accidents in the vicinity of the BBNPP site from present and projected industrial, transportation, and military installations and operations should be used as design basis events for plant design parameters related to the selected accidents.

Significant facilities and activities within 5 mi (8 km) and major airports within 10 mi (16 km) of the BBNPP site were identified. These facilities and activities, and significant facilities at greater distances, were evaluated in accordance with Regulatory Guide 1.206 (NRC, 2007b), Regulatory Guide 1.91 (NRC, 1978a), Regulatory Guide 4.7 (NRC, 1998), and relevant sections of both 10 CFR Part 100 (CFR, 2007d) and 10 CFR Part 50 (CFR, 2007b).

2.2.1 Location and Routes

An investigation of industrial, transportation, and military facilities within 5 mi (8 km) of the BBNPP site identified the following significant industrial and transportation facilities for further evaluation:

- Industrial Facilities
  - Deluxe Building Systems
  - Heller's Gas and Custom Made Fireplaces
  - Western International Distribution Center
  - Susquehanna Steam Electric Station (SSES) Units 1 and 2
- Pipelines
  - Williams Gas Pipeline - Transco Natural Gas Pipelines (3 pipelines)
  - UGI Penna Natural Gas Pipelines (2 pipelines)
  - Sunoco Gasoline, Diesel Fuel, and Heating Oil Pipeline (1 pipeline)
- Waterways
  - Susquehanna River
- Highways
  - Interstate 80

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    - U.S. Route 11
    - Pennsylvania State Route 93
    - Pennsylvania State Route 239
- Railroads
    - Canadian Pacific Railway
    - North Shore Railroad
- Airports
    - SSES Helipad
    - Berwick Hospital Heliport
- Airways
    - Federal Airway V499
    - Federal Airway V106
    - Federal Airway V164
    - Jet Route J584

An investigation of additional industrial, military, and transportation facilities within 5 to 10 mi (8 to 16 km) of the BBNPP site identified the following transportation and industrial facilities for further evaluation:

- Industrial Facilities
    - UGIES Hunlock Propane Air Plant
- Airports
    - Sutliff Private Airport
    - Double D Skyranch Airport
    - Barratta Heliport
- Airways
    - Federal Airway V232
- Highways
    - Interstate 81

Figure 2.2-1 is a site vicinity map that shows the location of identified industrial and transportation facilities, with the exception of airways, within 5 mi (8 km) of the BBNPP site.

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Figure 2.2-2 illustrates the airports, jet routes, and airway routes within 10 mi (16 km) and significant facilities between 5 and 10 mi (8 to 16km) of the BBNPP site.

An investigation of additional facilities, routes, or activities located at a distance greater than 10 mi (16 km) from the BBNPP site identified the following airways that may represent hazards of sufficient significance to be included for further evaluation:

- Airways
  - Federal Airway V188/226
  - Jet Route J146
  - Military Training Route VR707.

2.2.2 Descriptions

Descriptions of the industrial, transportation, and military facilities located in the vicinity of the BBNPP site are provided in this section. The facilities described include those facilities identified in Section 2.2.1 that could represent potential hazards for the BBNPP site.

Section 2.2.2.1 through Section 2.2.2.8 are added as a supplement to the U.S. EPR FSAR.

2.2.2.1 Description of Facilities

In accordance with 10 CFR 50.34 (CFR, 2007c) and Regulatory Guide 1.206 (NRC, 2007b), five facilities were identified for review: SSES Units 1 and 2, Deluxe Building Systems, Heller's Gas and Custom Made Fireplaces, Western International Distribution Center, and UGIES Hunlock Propane Air Plant. Nearby sand and gravel facilities were not evaluated due to the low hazard posed by these facilities, which do not store or use explosives.

Table 2.2-1 provides a concise description of these facilities, including the primary functions and major products, as well as the number of persons employed. A more detailed description is provided in Section 2.2.2.2.1 through Section 2.2.2.2.6

2.2.2.2 Description of Products and Materials

A more detailed description of each of these facilities, including a description of the products and materials regularly manufactured, stored, used, or transported is provided in the subsequent sections. The chemicals identified for possible analysis and their locations associated with SSES Units 1 and 2 are presented in Table 2.2-2. The analysis of hazards associated with the chemicals for the four identified facilities is addressed in Section 2.2.3, and the disposition of hazards associated with these chemicals is summarized in Table 2.2-5 and Table 2.2-6.

2.2.2.2.1 SSES Units 1 and 2

The southwest corner of the existing SSES reactor building is located approximately 655 feet (200 m) north and 5,032 feet (1,534 m) east of the BBNPP reactor building. SSES Unit 1 and Unit 2 are both boiling water reactors (BWRs) licensed by the NRC. SSES Unit 1 has a generating capacity of 1,105 MWe, and has been in commercial operation since 1983. SSES Unit 2 has a generating capacity of 1,111 MWe, and SSES Unit 2 has been in commercial operation since 1985. (NRC, 2008a) (NRC, 2008b).

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2.2.2.2.2 Deluxe Building Systems

The Deluxe Building Systems facility is located approximately 4.6 mi (7.4 km) southwest of the BBNPP site. The activities at this site include manufacturing prefabricated buildings, including single and multi-family homes, apartment buildings, hotels, and other buildings (Deluxe, 2008).

2.2.2.2.3 Heller's Gas and Custom Made Fireplaces

The Heller's Gas and Custom Made Fireplaces facility is located approximately 2.1 mi (3.3 km) southeast of the BBNPP site. The activities at this site include selling propane to residential, commercial, and industrial customers (Heller's Gas, 2008).

2.2.2.2.4 Western International Distribution Center

The Western International Distribution Center facility is located approximately 1.5 mi (2.4 km) south-southeast of the BBNPP site. This facility is a distribution center for acetylene, cylinders, and valves. This facility does not have access to any railroads, with incoming and outgoing shipments delivered by truck only.

2.2.2.2.5 UGIES Hunlock Propane Air Plant

The UGIES Propane Air Plant is located approximately 9.2 mi (14.8 km) northeast of the BBNPP site. This facility stores eighteen, 90,000 gallon tanks of propane onsite. The facility is not a direct hazard to BBNPP, consistent with the guidance in Regulatory Guide 1.78, Section C1.1, "Chemicals stored or situated at distances greater than 5 miles from the plant need not be considered because, if a release occurs at such a distance, atmospheric dispersion will dilute and disperse the incoming plume to such a degree that either toxic limits will never be reached or there would be sufficient time for the control room operators to take appropriate action." The propane is delivered by transport which average about 9,800 gallons (41,160 pounds) each. Delivery is sporadic throughout the year but primarily occurs in the spring. Full transports deliver propane to the facility via Rt. 11 North from I-80.

2.2.2.2.6 Mining Activities

There are no mining activities above or underground within 5 mi (8 km) of the BBNPP site except for nearby sand and gravel facilities that were not evaluated due to the low hazard posed by these facilities.

2.2.2.3 Pipelines

Five natural gas distribution pipelines and one oil pipeline are located within 5 mi (8 km) of the BBNPP site as depicted in Figure 2.2-1. More detailed information about these six pipelines, including size, age, operating pressure, depth of burial, and isolation valve type and location descriptions, is included in Table 2.2-11.

Williams Gas Pipeline - Transco operates a pipeline corridor approximately 1.7 mi (2.7 km) north of the BBNPP at the nearest approach. The three Williams Gas Pipelines - Transco pipelines in the corridor carry natural gas and are not expected to carry a different product in the future.

UGI Penna Natural Gas operates a pipeline corridor (formerly owned by PG Energy) approximately 0.25 mi (0.4 km) north of the BBNPP at the nearest approach. The two UGI pipelines in the corridor carry natural gas and are not expected to carry a different product in the future.

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Sunoco operates an oil pipeline approximately 2.0 mi (3.2 km) northeast of the BBNPP at the nearest approach. Sunoco also owns another oil pipeline (formerly owned by Arco and Atlantic), but the pipeline is not actively operated and is expected to remain inactive. The active Sunoco pipeline carries gasoline, diesel fuel, and heating oil and is not expected to carry a different product in the future.

2.2.2.4 Description of Waterways

The Susquehanna River is located approximately 1.6 mi (2.6 km) south of the BBNPP at the nearest approach. The river bends from a north to south to an east to west flow as it approaches the area around the BBNPP site; therefore, the river is close to the south and east sides of the BBNPP site. However, in the vicinity of the BBNPP site, the water level of the river is too low to allow for navigation of any watercraft other than recreational watercraft.

2.2.2.5 Highways

U.S. Route 11, a north-south highway runs east and then south of the BBNPP site. Its closest approach is approximately 1.3 mi (2.0 km) south of the site. U.S. Route 11 is the main road through the borough of Berwick. Access to the site from U.S. Route 11 is via North Market Street, Confers Lane, and Beach Grove Road. Table 2.2-12 provides a concise desription of U.S. Route 11 and the following highways, including the closest approach and access points to the site.

Other major highways within 5 mi (8 km) of the site are Pennsylvania State Route (SR) 93 and SR 239. The closest approach of SR 93 is approximately 2.5 mi (4.0 km) to the southwest. The closest approach of SR 239 is approximately 1.9 mi (3.1 km) to the southeast. The BBNPP site cannot be accessed via either SR 93 or SR 239, but both routes connect to U.S. Route 11.

Two interstate highways (I-80 and I-81) are located within 10 mi (16 km) of the BBNPP site. The closest approach of I-80 to the site is approximately 4.8 mi (7.7 km) to the south. However, most of I-80 is located more than 5 mi (8 km) south of the site. I-80 bends to the north at a point directly south of the site, but quickly bends south again. Therefore, only a small portion of I-80 is within 5 mi (8 km) of the site. The closest approach of I-81 is approximately 8.6 mi (13.8 km) to the southeast. (ESRI, 2008)

Information is not available about the materials transported on the roads in the vicinity of BBNPP; therefore, Superfund Amendments and Reauthorization Act (SARA) Title III, Tier II reports for facilities within 5 mi (8 km) of BBNPP and the results of a survey were reviewed to determine chemicals that may be transported in the vicinity of BBNPP. However, when considering the locations of the facilities that may receive shipments of hazardous materials and the locations of the major roads (namely, I-80, I-81, U.S. Route 11, SR 93 and SR 239), it seems likely that normal delivery routes would exist along U.S. Route 11 for locations in the immediate area near BBNPP or in Shickshinny. Delivery routes along the other major roads appear to deliver shipments to facilities farther away from BBNPP.

2.2.2.6 Railroads

There are two railroad lines located within 5 mi (8 km) of the site. According to Columbia County, both railroads transport hazardous and non-hazardous material, with the majority of shipments being timber products.

The North Shore (formerly Conrail) line, approximately 1.1 mi (1.8 km) east of the BBNPP site, is the nearest railroad line to the plant with a spur serving the SSES site. The only traffic on this line goes to the SSES site and would carry materials needed at SSES and at BBNPP by

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extending the spur to the site. Trains on this line are very sporadic, with only a small number of trains each year. The railroad, north of the SSES site (Luzerne County, 2008), has been converted to a bike and walking trail, called the Susquehanna Warrior Trail.

The Canadian Pacific (formerly Delaware and Hudson Railway Company) line is located on the east bank of the Susquehanna River. Its closest approach to the site is approximately 1.9 mi (3.1 km) to the east. Trains run several times a day each day on this line. Table 2.2-7 details chemicals transported on the Canadian Pacific railroad in Columbia County; it can be assumed that these chemicals would also be transported along the railroad in Luzerne County as well.

2.2.2.7 Aircraft and Airway Hazards

Regulatory Guide 1.70 (NRC, 1978b), Regulatory Guide 1.206 (NRC, 2007b), and NUREG- 0800 (NRC, 2007a) require that the risks due to aircraft hazards are sufficiently low. In accordance with Regulatory Guide 1.206 and Regulatory Guide 1.70, one heliport (Berwick Hospital Heliport), and one helipad (SSES Helipad) were identified within a 5 mi (8 km) radius of the BBNPP site. Additionally, Regulatory Guide 4.7 (NRC, 1998) requires that major airports within 10 mi (16 km) be identified. In the vicinity of the BBNPP site, there are an additional two airports and one heliport located within 5 to 10 mi (8 to16 km).

A more detailed description of each of these airports is presented in the subsequent sections, including distance and direction from the site, number and type of aircraft based at the airport, largest type of aircraft likely to land at the airport facility, runway orientation and length, runway composition, hours attended, and yearly operations where available. Information pertaining to airports located within 10 mi (16 km) of the site is presented in tabular form in Table 2.2-4 (AirNav, 2008) (FAA, 2007). Similar information regarding the closest major airports in the region is also presented in this table to ascertain whether these airports are or may be of significance in the future.

2.2.2.7.1 Airports

2.2.2.7.1.1 SSES Helipad

The SSES Helipad is owned by PPL and is located on the north side of the entrance road to SSES. This helipad is privately owned for private use located approximately 1.6 mi (2.6 km) east of the BBNPP site. The helipad is approximately 100 ft (31 m) long by 100 ft (31 m) wide and is asphalt. Flights are approximately once per year and are usually due to a medical emergency, contaminated worker training activity or drill, dignitary visits, or related to State Police activities. No aircraft are based at this helipad. The number of operations per year by aircraft type and flying patterns are not available. The helipad requires permission to land and use is considered sporadic; therefore, further evaluation is not warranted.

2.2.2.7.1.2 Berwick Hospital Heliport

Berwick Hospital Heliport is a privately owned heliport for medical use located approximately 3.5 mi (5.6 km) west of the BBNPP site. Helipad H1 is 200 ft (61 m) long by 200 ft (61 m) wide and is asphalt (AirNav, 2008). The number of aircraft based at the heliport, number of operations per year by aircraft type, flying patterns, and future plans are not available for this heliport. Flights are determined by medical emergencies and, as such, further evaluation is not warranted.

2.2.2.7.1.3 Sutliff Private Airport

Sutliff Private Airport is a privately owned airport for private use located approximately 7.0 mi (11.3 km) northwest of the BBNPP site. Runway N/S is 1,200 ft (366 m) long by 100 ft (31 m)

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wide and is turf (AirNav, 2008). The number of aircraft based at the heliport, number of operations per year by aircraft type, flying patterns, and future plans are not available for this airport. This airport requires permission to land and use is considered sporadic; therefore, further evaluation is not warranted.

2.2.2.7.1.4 Double D Skyranch Airport

Double D Skyranch Airport is a privately owned airport for private use located approximately 8.1 mi (13.0 km) east-southeast of the BBNPP site. Runway 8/26 is 1,835 ft (559 m) long by 100 ft (31 m) wide and is turf. Runway 8/26 is marked by white tires that are 150 ft (46 m) apart. Five aircraft are based at this airport: one single engine airplane and four ultralights (AirNav, 2008). The number of operations per year by aircraft type, flying patterns, and future plans are not available for this airport. This airport requires permission to land and use is considered sporadic; therefore, further evaluation is not warranted.

2.2.2.7.1.5 Barratta Heliport

Barratta Heliport is a privately owned heliport for private use located approximately 9.3 mi (15.0 km) east-northeast of the BBNPP site. Helipad H1 is 400 ft (122 m) long by 300 ft (91 m) wide and is turf. One aircraft is based at the airport, which is a helicopter (AirNav, 2008). The number of operations per year by aircraft type, flying patterns, and future plans are not available for this airport. The heliport requires permission to land and use is considered sporadic; therefore, further evaluation is not warranted.

2.2.2.7.2 Aircraft and Airway Hazards

Regulatory Guide 1.70, Regulatory Guide 1.206, and NUREG-0800 indicate that the risks due to aircraft hazards should be sufficiently low. Further, aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) with a probability of occurrence greater than 1.0E-7 per year should be considered in the design of the plant.

NUREG-0800, Section 3.5.1.6 provides a three part acceptance criteria test for concluding the probability of aircraft accidents to be less than 1.0E-7 per year: (A) meeting plant-to-airport distance and projected annual operations criteria; (B) plant is at least 5 mi (8 km) from military training routes; and, (C) plant is at least 2.0 statute mi (3.2 km) beyond the nearest edge of a federal airway.

The nearest public airport is the Hazleton Municipal Airport, which is located 11.0 mi (17.7 km) from the center of containment for BBNPP. At this distance, the threshold of number of annual operations from proximity criterion (A) of the acceptance criteria section of Section 3.5.1.6 is 127,234 operations per year. As Table 2.2-4 shows, the projected number of annual operations at this airport through 2025 is 34,837 operations (FAA, 2007). The 2025 projected number of annual operations is less than the threshold number of 127,234 operations for this airport. For the other public airports in Table 2.2-4, the separation distance is greater than that for the Hazleton Municipal Airport. The threshold number of annual operations increases with the distance squared, and the data in the table shows that in terms of best available information (that is, either the 2025 projection of number of annual operations or the latest available number of operations), the separation criteria of Section 3.5.1.6 will be met by all listed public airports in Table 2.2-4.

Table 2.2-4 shows that there are several private airports, helipads, and heliports within the vicinity of the BBNPP site. The exact number of operations at the airports, helipad, or heliport is not available, but operations can be considered to be sporadic due to their private

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ownership. As stated earlier, these airports, heliports, and helipads do not require further hazard evaluations due to their private ownership and sporadic operations that are most likely below the proximity criteria.

The closest military training route is VR 707, located 18.5 mi (29.8 km) from the center of containment for BBNPP. This meets the distance screening criterion of 5 mi (8 km) in criterion B in the acceptance criteria section of NUREG-0800, Section 3.5.1.6. No additional review of military operations on VR 707 is necessary due to the proximity of the airway in comparison to the center of containment for BBNPP.

There are 7 federal airways: V499, V106, V164, V232, V188/226, J146, and J584 near BBNPP. Four of these, V499, V106, V164, and J584 do not meet the screening criterion of 2.0 mi (3.2 km) in criterion C of the acceptance criteria section of NUREG-0800, Section 3.5.1.6.; V232 is close to the screening criteria while J146 and V188/226 meets the distance criterion comfortably. A probablistic risk assessment of the aircraft hazard at BBNPP has been performed and shows a core damage frequency (CDF) of 9.9E-8/year, less that 1.0E-7/year. This analysis is demonstrably conservative, as it postulates the maximum possible damage to the structures that are not hardened for aircraft crash and applies this consequence to all crashes regardless of the size of plane. This analysis is summarized in FSAR Section 19.1.5.4.4.

2.2.2.8 Projections of Industrial Growth

Overall, a small percentage of Luzerne County is industrial, with the majority of industries in the larger cities of Wilkes-Barre, Pittson, and Hazelton. The major industry in Salem Township is SSES Units 1 and 2. Salem Township also includes part of Berwick, which includes several industrial areas (Lackawanna-Luzerne, 2007).

Luzerne County is in the process of developing a county comprehensive plan in a joint effort with nearby Lackawanna County. Therefore, no industrial growth projections are available for Luzerne County. However, the Luzerne County Office of Community Development released their "Action Plan" for 2007 to 2008 and Columbia County's comprehensive plan provides some insight into the industrial growth in that county.

The Luzerne County Office of Community Development's action plan identified several economic development needs in Salem Township, including acquiring and developing 120 ac (48 ha) of land for a business/industrial park and constructing another building in the Salem Industrial Estates industrial park (Luzerne County, 2007). Therefore, it can be inferred that the Office of Community Development expects to attract more industries to Salem Township, which is within the vicinity of the BBNPP site.

A review of nearby Columbia County's Comprehensive Plan shows that approximately 1,860 ac (753 ha) of the 83,134 zoned ac (33,643 ha) are zoned as industrial, while most of the land in the county is agricultural or open space. Within Berwick, which is in Columbia County, there are 2 industrial parks: the Berwick Industrial Park and the Briar Creek Industrial Park. The Berwick Industrial Park is located on the west side of Berwick, north of U.S Route 11, approximately 4.1 mi (6.6 km) southwest of the BBNPP site; the Briar Creek Industrial Park is located 6.1 mi (9.8 km) southwest of BBNPP. The plan states that through the year 2010, an additional 20 ac (8 ha) would be required for industries. However, a 1989 study showed that an additional 9.7 ac (3 ha) of land per year would be needed for industrial purposes. Therefore, approximately 136 ac (55 ha) may be required for industries through 2010.

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Salem Township forecasts only Western International Distribution Center for possible future expansion.}

2.2.3 Evaluation of Potential Accidents

The U.S. EPR FSAR includes the following COL Item in Section 2.3:

> A COL applicant that references the U.S. EPR design certification will provide information concerning site-specific evaluations to determine the consequences that potential accidents at nearby industrial, transportation, and military facilities could have on the site. The information provided by the COL applicant will include specific changes made to the U.S. EPR design to qualify the design of the site against potential external accidents with an unacceptable probability of severe consequences.

This COL Item is addressed as follows:

{On the basis of the information provided in Section 2.2.1 and Section 2.2.2, the potential accidents to be considered as design-basis events and the potential effects of those accidents on the nuclear plant, in terms of design parameters (e.g., overpressure, missile energies) or physical phenomena (e.g., impact, flammable or toxic clouds) were identified in accordance with 10 CFR 20 (CFR, 2007a), 10 CFR 52.79(a)(1)(vi) (CFR, 2007g), 10 CFR 50.34 (CFR, 2007c), 10 CFR 100.20 (CFR, 2007e) 10 CFR 100.21 (CFR, 2007f), Regulatory Guide 1.70 (NRC, 1978b), Regulatory Guide 1.78 (NRC, 2001), Regulatory Guide 1.91 (NRC, 1978a), Regulatory Guide 1.206 (NRC, 2007b), and Regulatory Guide 4.7 (NRC, 1998). The events are discussed in the following sections.

Sections 2.2.3.1 and 2.2.3.2 are added as a supplement to the U.S. EPR FSAR.

2.2.3.1 Determination of Design-Basis Events

Design-basis events internal and external to the nuclear plant are defined as those accidents that have a probability of occurrence on the order of magnitude of 1.0E-7 per year, or greater, with the potential consequences serious enough to affect the safety of the plant to the extent that the guidelines in 10 CFR Part 100 (CFR, 2007d) could be exceeded. The following accident categories were considered in selecting design-basis events: explosions, flammable vapor clouds (delayed ignition), toxic chemicals, fires, collisions with intake structure, liquid spills, and radiological hazards. The postulated accidents that would result in a chemical release were analyzed at the following locations:

- Nearby transportation routes such as U.S. Route 11, the Susquehanna River, the Canadian Pacific Railway, and nearby natural gas pipelines.
- Nearby chemical and fuel storage facilities (industry in the towns of Berwick, Nescopeck, and Shickshinny).
- Adjacent site chemical storage (SSES Units 1 and 2) and onsite chemical storage (BBNPP).

2.2.3.1.1 Explosions

Accidents involving detonations of high explosives, munitions, chemicals, or liquid and gaseous fuels were considered for facilities and activities in the vicinity of the plant or onsite, where such materials are processed, stored, used, or transported in quantity. The effects of explosions are a concern in analyzing structural response to blast pressures. The effects of

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blast pressure from explosions from nearby railways, highways, navigable waterways, or facilities to critical plant structures were evaluated to determine if the explosion would have an adverse effect on plant operation or would prevent a safe shutdown.

The allowable and actual distances of hazardous chemicals transported or stored were determined in accordance with NRC Regulatory Guide 1.91, Revision 1, Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants (NRC, 1978a). Regulatory Guide 1.91 cites 1 psi (6.9 kPa) as a conservative value of peak positive incident overpressure, below which no significant damage would be expected. Regulatory Guide 1.91 defines this safe distance by the relationship $R \geq kW^{1/3}$ where R is the distance in feet from an exploding charge of W pounds of TNT; and the value k is a constant. For hydrocarbons, the TNT mass equivalent, W, was determined following guidance in Regulatory Guide 1.91, where W is taken as being 240% of the explosive mass of the chemical. For non-hydrocarbons (ammonia and hydrogen), an equation from the Fire Protection Engineering Handbook (SFPE, 1995) comparing the heats of combustion to TNT was also used to determine the TNT mass equivalent. A second method, also using the idea of TNT equivalence, based on equations in NUREG/CR-2462 (NRC 1983), was also used to determine the allowable distance. The limiting explosive standoff distance between the Regulatory Guide 1.91 method and the NUREG/CR-2462 method is the distance listed below and in Table 2.2-8.

Conservative assumptions were used to determine a safe distance, or minimum separation distance, required for an explosion to have less than 1 psi (6.9 kPa) peak incident pressure. When the heat of combustion method was used, an explosion yield factor of 10 percent was applied for unconfined explosions and an explosion yield of 100 percent was used for confined explosions. The yield factor is an estimation of the available combustion energy released during the explosion as well as a measure of the explosion confinement (NRC, 2004a). Use of a 10 percent yield is conservative for unconfined explosions because it is the highest in the range of expected yields based on testing results (SFPE, 1995):

- For some atmospheric liquids (i.e., diesel) the storage vessel was assumed to contain the full volume at the upper explosive limit of the fuel vapors. This is conservative because this scenario produces the maximum flammable mass given that it is the fuel vapor, not the liquid fuel that explodes (NRC, 2004a). These assumptions are consistent with those used in Chapter 15 of NUREG-1805 (NRC, 2004a).

- For compressed or liquified gases (i.e., propane, hydrogen), it was conservatively assumed that the entire content of the storage vessel will be between the upper and lower explosive limits, given that the instantaneous depressurization of the vessel would result in vapor concentrations throughout the explosive range at varying pressures and temperatures that could not be assumed. Therefore, the entire content of the storage vessel was considered as the flammable mass.

The adjacent site and onsite chemicals (Table 2.2-5), nearby facilities chemicals (Table 2.2-6), and hazardous materials potentially transported on U.S. Route 11 or on railroads (Table 2.2-3 and Table 2.2-7) were evaluated to ascertain which hazardous materials had the potential to explode, thereby requiring further analysis. The effects of selected explosion events are summarized in Table 2.2-8 and in the following sections relative to the release source.

Pipelines

There are two bounding natural gas pipelines and one gasoline pipeline in the vicinity of BBNPP: a Transco 42 in. natural gas pipeline that is 1.7 mi (2.7 km) from BBNPP, a UGI 12 in. natural gas pipeline that is 0.25 mi (0.40 km) from BBNPP, and a Sunoco 6.625 in. gasoline

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pipeline that is 2.0 mi (3.2 km) from BBNPP. An explosion at the break point of one of these pipelines would involve a much smaller amount of mass than a delayed ignition vapor cloud explosion. Therefore, an explosion at the break point is bounded by the delayed ignition vapor cloud explosion discussed in Section 2.2.3.1.2. It is concluded that damaging overpressures from an explosion from a rupture in the natural gas or gasoline pipelines would not adversely affect the operations of BBNPP.

Waterway Traffic

The Susquehanna River is the only waterway within 5 mi (8 km) of BBNPP. The Susquehanna River is too shallow for any boat aside from personal watercraft. No releases or explosions are analyzed for any boats or barges.

Highways

Table 2.2-3 and Table 2.2-7 details the hazardous materials potentially transported on U.S. Route 11. The materials that were identified for further analysis for explosive potential were propane, gasoline, and acetylene. The maximum quantity of the identified chemicals assumed to be transported on the roadway was 80,000 lb (36,287 kg) (CFR, 1998). The maximum quantity of acetylene that is transported is 16,000 lb (7,260 kg) based in the survey of nearby facilities.

An analysis of the identified chemicals was conducted using TNT equivalency methodologies, as described this section. The results indicate that the minimum separation distances (i.e., safe distances) are less than the shortest distance to a safety-related BBNPP structure from any point on U.S. Route 11. The closest safety-related BBNPP structure is located approximately 0.98 mi (1.58 km) from U.S. Route 11. The minimum separation distance for propane and gasoline was calculated to be 0.72 mi (1.16 km); and for acetylene, 0.41 mi (0.66 km) (Table 2.2-8). Therefore, an explosion involving potentially transported hazardous materials on U.S. Route 11 would not adversely affect operation of BBNPP.

Adjacent Site and Onsite Chemicals

BBNPP is located in close proximity to the existing SSES Units 1 and 2, and their associated chemical storage locations. The hazardous materials stored at the SSES site that were identified for further analysis with regard to explosive potential are gasoline, hydrogen, and diesel.

The 61,642 lb (27,960 kg) of gasoline is in an underground storage tank. Therefore, it was assumed that the explosion would be bounded by an event involving an 80,000 lb (36,287 kg) gasoline delivery tanker, either in route, or during or following a filling operation.

A conservative analysis using TNT equivalency methods as described in this section was used to determine safe distances for the storage of the identified hazardous materials.

The safe distance for the hydrogen is 0.34 mi (0.55 km); and for diesel is 0.42 mi (0.68 km). The hydrogen tank is approximately 0.70 mi (1.13 km), and the diesel storage tank is approximately 0.85 mi (1.37 km) from the nearest safety-related structure for BBNPP (Table 2.2-8).

Two chemicals at SSES were identified for further analysis with regard to an explosive overpressure relating to a boiling liquid expanding vapor cloud explosion (BLEVE). A rupture of a storage tank of liquid nitrogen or liquid oxygen would cause a large fraction of the mass of gas to flash to vapor, sending an overpressure wave. The safe standoff distance for a BLEVE

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of the liquid nitrogen tank is 0.05 miles (0.08 km) and for the liquid oxygen tank is 0.10 miles (0.16 km). This is much less than the actual standoff distance of 0.70 miles (1.13 km) (Table 2.2-8).

The results using this methodology indicate that the minimum separation distances (i.e., safe distances) are less than the shortest distance from any safety-related BBNPP structure to the storage location of the identified chemicals. Therefore, an explosion of any of these chemicals would not adversely affect operation of BBNPP.

The hazardous materials stored on-site at BBNPP that were identified for further analysis with regard to explosive potential were ammonium hydroxide, diesel, dimethylamine, gasoline, hydrazine, hydrogen and argon-methane.

The safe distance for the ammonium hydroxide (28% solution) is 184 ft (56 m); for the diesel is 734 ft (224 m); for the dimethylamine (2% solution) is 290 ft (88 m); for the gasoline is 412 ft (126 m); for the hydrazine (35% solution) is 115 ft (35 m); for the hydrogen tank (48.05 pounds) is 271 ft (83 m); for the argon-methane mixture is 164 ft (50 m); and for hydrogen cylinder (1.45 pounds) is 78 ft (24 m). These chemicals will always be further than these standoff distances from the nearest BBNPP safety related building. These results are summarized in Table 2.2-8.

One material at BBNPP was identified for further analysis with regard to an explosive overpressure relating to a boiling liquid expanding vapor cloud explosion (BLEVE). A rupture of a storage tank of liquid nitrogen would cause a large fraction of the mass of nitrogen to flash to vapor, sending an overpressure wave. The safe standoff distance for this BLEVE of the liquid nitrogen tank is 360 ft (110 m) (Table 2.2-8).

Procedures ensure 1) the minimum separation distances (i.e., storage location and volume) for chemicals listed in Table 2.2-5 are maintained, 2) new chemicals to be stored on-site that are not listed in Table 2.2-5 are evaluated to establish the applicable minimum separation distance, storage location, and volume limit for that chemical.

Nearby Facilities

There are two additional offsite facilities that store explosive chemicals that are identified for further analysis. The hazardous materials stored at nearby facilities that were identified for further analysis with regard to explosive potential are propane stored at Heller's Gas & Custom Made Fireplaces, and natural gas stored at Deluxe Building Systems.

A conservative analysis using TNT equivalency methods as described in this section was used to determine safe distances for the storage of the identified hazardous materials.

The safe distance for the mass of propane is 1.07 mi (1.72 km); and for the mass of natural gas is 1.43 mi (2.30 km). Heller's Gas & Custom Made Fireplaces is approximately 1.78 mi (2.86 km), and Deluxe Building Systems is approximately 4.48 mi (7.21 km) from the nearest safety-related structure for BBNPP (Table 2.2-8).

The results using this methodology indicate that the minimum separation distances (i.e., safe distances) are less than the shortest distance from a safety-related BBNPP structures to the storage location of the identified chemicals. Therefore, an explosion of any of these chemicals would not adversely affect operation of BBNPP.

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Railways

The Canadian Pacific Railway is the only frequently operated railway within 5 mi (8 km) of BBNPP. This railway transports chemicals that could pose a threat of an explosion. The chemicals that were analyzed for potential stationary explosions are ammonia and butane. A conservative analysis using TNT equivalency methods as described in this section was used to determine safe distances for the storage of the identified hazardous materials.

The amount of hazardous chemical was conservatively chosen to be the maximum allowable capacity of a railroad tank car. This is 34,500 gal (130,600 l) or 263,000 lb (119,000 kg) per Federal Regulation 49 CFR 179.13 (CFR, 1970). In the cases of both ammonia and butane, the densities are low such that 34,500 gal is limiting. Ammonia is denser than butane, so the mass of ammonia bounds the mass of butane. In addition, it was found that the limiting method for determining the TNT equivalent weight of ammonia is the Regulatory Guide 1.91 (NRC, 1978a) method. Therefore, this case bounds butane. 34,500 gal of ammonia is equivalent to 196,234 lb (89,010 kg) of ammonia.

The safe standoff distance for ammonia is 1.0 mi (1.6 km). The nearest point of approach from the railroad to a BBNPP safety-related structure is 1.63 mi (2.62 km). The minimum separation distances (i.e., safe distances) are less than the shortest distance from a safety-related BBNPP structure to the storage location of the identified chemicals. Therefore, an explosion from any of these chemicals would not adversely affect operation of BBNPP (Table 2.2-8).

Explosion Related Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 per year. Regulatory Guide 1.91 (NRC, 1978a) cites 1 psi (6.9 kPa) as a conservative value of peak positive incident overpressure, below which no significant damage would be expected. Safety-related BBNPP structures are designed to withstand a peak positive overpressure of at least 1 psi without loss of function.

The analyses presented in this section demonstrate that a 1 psi (6.9 kPa) peak positive overpressure will not be exceeded at a safety-related structure for any of the postulated explosion event scenarios. As a result, postulated explosion event scenarios will not result in severe consequences.

2.2.3.1.2 Flammable Vapor Clouds (Delayed Ignition)

Flammable gases in the liquid or gaseous state can form an unconfined vapor cloud that could drift toward the plant before ignition occurs. When a flammable chemical is released into the atmosphere and forms a vapor cloud it disperses as it travels downwind. The parts of the cloud where the concentration is within the flammable range, between the lower and upper flammability limits, may burn if the cloud encounters an ignition source. The speed at which the flame front moves through the cloud determines whether it is a deflagration or a detonation. If the cloud burns fast enough to create a detonation an explosive force is generated.

The potentially explosive chemicals at SSES Units 1 and 2 and at BBNPP are shown in Table 2.2-5. Hazardous materials potentially transported on U.S. Route 11, the railways, or waterways are shown on Table 2.2-3 and Table 2.2-7, and hazardous materials at nearby facilities are shown on Table 2.2-6. These chemicals were evaluated to ascertain which hazardous materials had the potential to form a flammable vapor cloud or vapor cloud explosion. For those chemicals with an identified flammability range, the Areal Locations of

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Hazardous Atmospheres (ALOHA) air dispersion model was used to determine the distances where the vapor cloud may exist between the upper explosive limit (UEL) and the lower explosive limit (LEL), presenting the possibility of ignition and potential thermal radiation effects (ALOHA, 2007).

The identified chemicals were also evaluated to determine the possible effects of a flammable vapor cloud explosion. ALOHA was used to model the worst case accidental vapor cloud explosion, including the safe distances and overpressure effects at the nearest safety-related BBNPP structure. To model the worst case in ALOHA, ignition by detonation was chosen for the ignition source. The safe distance was measured as the distance from the spill site to the location where the pressure wave is at 1 psi (6.9 kPa) overpressure.

Conservative assumptions were used in both ALOHA analyses with regard to meteorological inputs and identified scenarios. The following meteorological assumptions were used as inputs to the computer model, ALOHA: Pasquill stability class F (stable), with a wind speed of 1 m/sec; ambient temperature of 25°C; relative humidity 50%; cloud cover 50%; and an atmospheric pressure of 1 atmosphere. Pasquill Stability class F represents the most limiting 5% of meteorological conditions observed at a majority of nuclear plant sites. For each of the identified chemicals, it was conservatively assumed that the entire contents of the vessel leaked forming a puddle or that the entire contents were released instantaneously as a gas. This provides a significant surface area to maximize evaporation and the formation of a vapor cloud in the case of liquid releases, and maximizes the peak concentration in the case of gas releases.

Using ALOHA is conservative, however, should the results not meet the acceptance criteria, additional mitigating factors (plume rise, plume meander, etc.) are considered in the analysis. The Safety Evaluation Report related to the construction of Hartsfield Nuclear Power Plants concluded that "the state of knowledge concerning the chemical reactions of natural gas mixed with air is sufficiently well established to form a basis for the judgment that the detonation of an unconfined natural gas dispersal in air is not a credible event" (NRC, 1976). If it can be shown that the vapor cloud rises to an elevation such that the concentration is below the lower flammable limit at the highest point of the plant structures, the cloud will be completely unconfined, and a vapor cloud detonation will not occur. Also, at that elevation there will be no credible ignition source. To determine if the vapor cloud will be above the plant structures, a plume buoyancy model was used. In addition, Regulatory Guide 1.145 indicates that meander can be considered in calculating the concentration at a point (NRC, 1982).

The analyzed effects of flammable vapor clouds and vapor cloud explosions from internal and external sources are summarized in Table 2.2-9 and are described in the following sections relative to the release source.

Pipelines

Transco operates a pipeline corridor that passes within the vicinity of the BBNPP site. At its closest distance, this pipeline passes within approximately 1.7 mi (2.7 km) of BBNPP. UGI operates a pipeline corridor that passes within the vicinity of the BBNPP site. At its closest distance, this pipeline passes within approximately 0.25 mi (0.40 km) of BBNPP.

These two limiting pipelines were analyzed using the methods detailed above including plume meander and buoyancy. The maximum concentration of natural gas at a BBNPP safety related building following a rupture of the Transco pipeline is 1.88%. The maximum

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concentration of natural gas at a BBNPP safety related building following a rupture of the UGI pipeline is 3.37%. These are less than the lower flammable limit for natural gas, 4.4%. In addition, because the concentrations are below the LEL, a delayed flammable vapor cloud ignition can not occur, and therefore there will be no explosive overpressure. The results of flammable vapor cloud ignition analyses are summarized in Table 2.2-9.

Waterway Traffic

The Susquehanna River is the only waterway within 5 mi (8 km) of BBNPP. The Susquehanna River is too shallow for any boat aside from personal watercraft. No releases or delayed ignition explosions are analyzed for any boats or barges in Table 2.2-9.

Highways

The closest safety-related BBNPP structure is located approximately 0.98 mi (1.58 km) from U.S. Route 11. The hazardous materials potentially transported on U.S. Route 11 that were identified for further analysis are propane, gasoline and acetylene. The methodology presented previously in Section 2.2.3.1.2 was used for determining the safe distance for vapor cloud ignition and delayed vapor cloud explosion. Consistent with Federal Regulation 23 CFR 658.17 (CFR, 1998), it was conservatively estimated that the propane and gasoline tanker trucks carried and released 80,000 lb (36,300 kg) of the identified chemical. The largest amount of acetylene on a truck that was analyzed was 16,000 lb (7,260 kg).

Each of the identified hazardous materials was also evaluated, using the methodology presented previously in this section, to determine the effects of a possible vapor cloud explosion. The minimum separation distance (i.e., safe distance) for propane is 0.75 mi (1.21 km), for gasoline is 0.40 mi (0.64 km), and for acetylene is 0.79 mi (1.27 km) when conservatively modeled as a direct release of the entire shipped quantity. The minimum separation distances for explosions involving the identified chemicals to have less than a 1 psi (6.9 kPa) peak incident pressure from a drifted vapor cloud are less than the shortest distance between any safety-related BBNPP structures and any point on U.S. Route 11. Therefore, a delayed flammable vapor cloud explosion involving the identified hazardous material with the potential to be transported on U.S. Route 11, would not adversely affect the safe operation of BBNPP.

The results of flammable vapor cloud ignition and explosion analyses are summarized in Table 2.2-9.

Adjacent Site and Onsite Chemicals

BBNPP is located in close proximity to the existing SSES Units 1 and 2 and the associated chemical storage locations. The hazardous materials stored at the SSES Units 1 and 2 site that were identified for further analysis with regard to the potential of delayed ignition and explosion of flammable vapor clouds are gasoline and hydrogen.

As described previously in this section, the dispersion model was used to determine the distance a vapor cloud can travel before reaching the LEL boundary (i.e., the point at which the vapor cloud is no longer explosive) once a vapor cloud has formed from release of the identified chemical. The maximum concentration of hydrogen at any safety related building is 1.49%. This is less than the lower flammable limit for hydrogen, 4%. In addition, because the concentration is below the LEL, a delayed flammable vapor cloud ignition can not occur, and therefore there will be no explosive overpressure. The results of flammable vapor cloud ignition analyses are summarized in Table 2.2-9.

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A vapor cloud explosion analysis was also performed using the methodology described in this section to obtain minimum separation distances (i.e., safe distances) for the identified chemicals. The results indicate that the minimum separation distance (i.e., the distance required for an explosion to have less than a 1 psi (6.9 kPa) peak incident pressure) is less than the shortest distance between a safety-related BBNPP structure from the storage location of these chemicals.

The minimum separation distance for the 80,000 lb (36,287 kg) of gasoline in the tank truck is 0.40 mi (0.64 km). This bounds the instance of 61,642 lb (27,960 kg) of gasoline that is stored on the SSES site. Because the minimum separation distance for a delayed vapor cloud explosion is less than the distance from the source to the nearest BBNPP safety related structure, the concentration of the gasoline will be less than the LEL at all BBNPP safety related structures. The results of flammable vapor cloud ignition analyses are summarized in Table 2.2-9.

Therefore, a flammable vapor cloud ignition or vapor cloud explosion involving the identified chemicals would not adversely affect the safe operation of BBNPP.

The hazardous materials stored onsite that were identified for further analysis with regard to the potential of delayed ignition and explosion of flammable vapor clouds were ammonium hydroxide, dimethylamine, gasoline, hydrogen and argon-methane.

The minimum separation distance for the ammonium hydroxide is 735 ft (224 m); for the dimethylamine is 291 ft (89 m); for the gasoline is 1,386 ft (422 m), for the hydrogen tank (48.05 pounds) is 990 ft (302 m); for the argon-methane mixture is 258 ft (79 m); and for the hydrogen cylinder (1.45 pounds) is 219 ft (67 m).

The results of flammable vapor cloud ignition and explosion analyses are summarized in Table 2.2-9.

Nearby Facilities

There are two additional offsite facilities that store explosive chemicals that are identified for further analysis. The hazardous materials stored at nearby facilities that were identified for further analysis with regard to explosive potential are propane stored at Heller's Gas & Custom Made Fireplaces, and natural gas stored at Deluxe Building Systems. The methodology presented previously in this section was used for determining the safe distance for vapor cloud ignition and delayed vapor cloud explosion.

The minimum separation distance for the propane is 1.1 mi (1.8 km). This is less than the distance between Heller's Gas & Custom Made Fireplaces and any BBNPP safety related structure, 1.78 mi (2.86 km). The minimum separation distance for the natural gas is 2.9 mi (4.7 km). This is less than the distance between Deluxe Building systems and any BBNPP safety related structure, 4.48 mi (7.21 km). Because the minimum separation distance for a delayed vapor cloud explosion is less than the distance from the source to the nearest BBNPP safety related structure, the concentration of these chemicals will be less than the LEL at all BBNPP safety related structures.

The results of flammable vapor cloud ignition and explosion analyses are summarized in Table 2.2-9.

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Railways

The Canadian Pacific Railway is the only frequently operated railway within 5 mi (8 km) of BBNPP. This railway transports chemicals that could pose a threat of a delayed vapor cloud ignition. The chemicals that were analyzed for potential delayed vapor cloud ignitions are ammonia and butane. The methodology presented previously in this section was used for determining the safe distance for vapor cloud ignition and delayed vapor cloud explosion.

The safe standoff distance for a delayed vapor cloud ignition is 1.2 mi (1.9 km) for an ammonia release and 1.2 mi (1.9 km) for a butane release. The nearest point of approach from the railroad to a BBNPP safety related structure is 1.63 mi (2.62 km). Because the minimum separation distance for a delayed vapor cloud explosion is less than the distance from the source to the nearest BBNPP safety related structure, the concentration of these chemicals will be less than the LEL at all BBNPP safety related structures.

The results of flammable vapor cloud ignition and explosion analyses are summarized in Table 2.2-9.

Flammable Vapor Cloud (Delayed Ignition) Related Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 occurrences per year. Regulatory Guide 1.91 (NRC, 1978a) cites 1 psi (6.9 kPa) as a conservative value of peak positive incident overpressure, below which no significant damage would be expected. Safety-related BBNPP structures are designed to withstand a peak positive overpressure of at least 1 psi without loss of function.

The analyses presented in this section demonstrate that a 1 psi (6.9 kPa) peak positive overpressure will not be exceeded at a safety-related structure for any of the postulated flammable vapor cloud, delayed ignition event scenarios.

2.2.3.1.3 Toxic Chemicals

Accidents involving the release of toxic chemicals from adjacent and on-site storage facilities and nearby mobile and stationary sources were considered. Toxic chemicals known to be present on-site or in the vicinity of the BBNPP site, or to be frequently transported in the vicinity were evaluated. NRC Regulatory Guide 1.78, Revision 1, Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release (NRC, 2001), requires evaluation of control room habitability after a postulated external release of hazardous chemicals from mobile or stationary sources, off-site or on-site.

The potential adjacent site and on-site chemicals are identified in Table 2.2-5, hazardous materials potentially transported on U.S. Route 11, the railroads, or the waterways are identified inTable 2.2-3 and Table 2.2-7. Hazardous materials at nearby facilities are identified in Table 2.2-6. These chemicals were evaluated to ascertain which hazardous materials were analyzed with respect to their potential to form a toxic vapor cloud after an accidental release.

The first screening of hazardous chemicals follows an equation from Regulatory Guide 1.78 (NRC, 2001). This equation uses the toxicity limit of the chemical, the control room conditions, the weather conditions, and the storage distance to determine a maximum allowable mass of the chemical. If this mass is greater than the actual mass then the chemical is screened out as

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not posing a hazardous threat to the main control room (MCR) operators. Those chemicals that do not meet this mass limit are further analyzed below.

The ALOHA model was used to determine the maximum distance various postulated vapor clouds would travel before they dispersed enough to fall below the associated National Institute of Occupational Safety and Health (NIOSH) defined Immediately Dangerous to Life and Health (IDLH) threshold values. The ALOHA model was also used to predict the post-release chemical concentrations in the control room to ensure that under a worst case scenario event the control room operators will have sufficient time to take appropriate action.

The IDLH is defined by the NIOSH as a situation that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment. The IDLHs determined by NIOSH are established such that workers are able to escape such an environment without suffering permanent health damage.

Some chemicals, for example, gasoline, do not have an IDLH. For these chemicals, other toxicity limits are used. The Short Term Exposure Limit (STEL) is defined as the limit that a person can tolerate without any side effects for 15 minutes. The Time Weighted Average (TWA) is defined as the average concentration that a person can be exposed to for 8 hours a day, day after day. For chemicals with no defined IDLH, both of these exposure limits must be met.

Meteorological assumptions were used to determine chemical concentrations: Pasquill stability class F (stable), with a wind speed of 1 m/sec; ambient temperature of 25°C; relative humidity of 50%; cloud cover, 50%; and an atmospheric pressure of 1 atmosphere. For sources that are described using the ALOHA model, a control room air exchange rate of 0.3 air changes per hour was used. This air exchange rate was calculated from the control room volume and the rate of air intake. U.S. EPR FSAR Section 9.4.1 provides a description of the Control Room HVAC System. Under normal operation, outside air is brought in through two air intakes in order to maintain the control room envelope at a positive pressure. The control room envelope has a volume of approximately 200,000 ft^3 (5,663 m^3) and the flow rate of outside air through the two air intakes is as much as 1,000 cfm (total) (28 m^3/min). Using this information results in an effective air change rate (based on outside air) of:

$(1000 \text{ cfm} * 60) / 200{,}000 \text{ ft}^3 = 0.3$ air changes per hour

In addition, Regulatory Guide 1.78 states that if the toxic gas can be detected within two minutes of reaching the IDLH, the MCR operators will have enough time to don a respirator (NRC, 2001).

The effects of toxic chemical releases from internal and external sources are summarized in Table 2.2-10 and are described in the following sections relative to the release source.

Pipelines

Transco operates a pipeline corridor that passes within the vicinity of the BBNPP site. At its closest distance, this pipeline passes within approximately 1.7 mi (2.7 km) of BBNPP. The Transco pipeline carries natural gas. UGI operates a pipeline corridor that passes within the vicinity of the BBNPP site. At its closest distance, this pipeline passes within approximately 0.25 mi (0.4 km) of BBNPP. The UGI pipeline carries natural gas. Sunoco operates a pipeline

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corridor that passes within the vicinity of the BBNPP site. At its closest distance, this pipeline passes within approximately 2.0 mi (3.2 km) of BBNPP. The Sunoco pipeline carries gasoline.

From NUREG/CR-6624, the IDLH for natural gas should be taken as 10% of the lower explosive limit (NRC, 1999). 5,000 ppm is used as the IDLH for natural gas. Natural gas concentrations were determined at the control room following the ruptures in the UGI and Transco pipelines. The maximum concentration of natural gas in the main control room following the release was calculated to be greater than 5,000 ppm. However, more than two minutes will elapse between the time when the concentration of natural gas in the main control room reaches the odor threshold (20 ppm for odorized natural gas) and the time when the concentration reaches the IDLH. Because of this, the main control room operators will have the expected two minutes to don a respirator.

The STEL for gasoline is 500 ppm and the TWA for gasoline is 300 ppm. The maximum outdoor concentration of gasoline vapor at BBNPP following the release of gasoline from the gasoline pipeline is less than 100 ppm. This is less than the STEL and TWA for gasoline; therefore the concentration of gasoline in the main control room will always be less than the allowable concentration.

The identified chemicals had analyzed consequences that were below the guidance provided in 10 CFR Part 100. Therefore, toxic vapor clouds resulting from ruptures of pipelines will not adversely affect the safe operation of BBNPP. The effects of toxic chemical releases are summarized in Table 2.2-10.

Waterway Traffic

The Susquehanna River is the only waterway within 5 mi (8 km) of BBNPP. The Susquehanna River is too shallow for any boat aside from personal watercraft. No releases of toxic chemicals are analyzed for any boats or barges.

Highways

The BBNPP reactor building is located 1.3 mi (2.0 km) from U.S. Route 11 at its closest approach. The hazardous materials transported on U.S. Route 11 satisfy the Regulatory Guide 1.78 (NRC, 2001) screening criteria and therefore did not require further analysis with regard to the potential of forming a toxic vapor cloud after an accidental release. Therefore, toxic vapor clouds resulting from chemical spills on U.S. Route 11 will not adversely affect the safe operation of BBNPP. The effects of toxic chemical releases are summarized in Table 2.2-10.

Adjacent Site and On-site Chemical Storages

The hazardous material stored at SSES that were identified for further analysis with regard to the potential for the formation of toxic vapor clouds formed after an accidental release is sodium hypochlorite. Sodium hypochlorite is commonly known as bleach, however, to be conservative, it was assumed that the entire mass of chlorine in the sodium hypochlorite disassociated instantaneously into chlorine gas. The largest tank of sodium hypochlorite is 72,571 lb (32,918 kg) of sodium hypochlorite solution.

As described in this section, the identified hazardous material was analyzed utilizing the ALOHA dispersion model to determine whether the formed vapor cloud will reach the control room intake and what the concentration of the toxic chemical will be in the main control room after an accidental release.

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Chlorine gas concentrations were determined at the control room after a release of the largest vessel. The maximum concentration of chlorine in the main control room following the release was calculated to be 4.94 ppm. This is less than the IDLH for chlorine gas, 10 ppm.

The identified chemical had an analyzed consequence that was below the guidance provided in 10 CFR Part 100. Therefore, toxic vapor clouds resulting from chemical spills of adjacent site chemicals will not adversely affect the safe operation of BBNPP.

The hazardous on-site chemicals that were identified for further analysis with regard to toxicity are ammonium hydroxide, dimethylamine, gasoline, hydrazine, hydrogen, liquid nitrogen, argon, argon-methane mixture, nitrogen gas, oxygen, Depositrol BL5323, and sodium bisulfite. These chemicals were analyzed in ALOHA in order to determine the minimum safe distance. The minimum distance is safe if: a) the concentration will not be greater than the IDLH, or b) more than two minutes will elapse between the time when the concentration in the MCR reaches the odor threshold and when the concentration reaches the IDLH.

The minimum safe distance from the MCR air intakes for the dimethylamine is 33 ft (10 m); for the gasoline is 823 ft (251 m); for the hydrogen tank (48.05 pounds) is 173 ft (53 m); for the liquid nitrogen is 375 ft (114 m), for the argon-methane mixture is 33 ft (10 m); for the hydrogen cylinder (1.45 pounds) is 33 ft (10 m); for the nitrogen gas is 33 ft (10 m); for the oxygen is 33 ft (10 m); and for the sodium bisulfite is 479 ft (146 m). The Depositrol BL5323 is bounded by the gasoline, and the standoff distance is therefore 823 ft (251 m). Each of these chemicals will be always be further from the MCR air intakes than these standoff distances.

The hydrazine and ammonium hydroxide will be stored greater than 4,500 feet (1,372 m) from the main control room air intakes. At this distance, the peak MCR concenration of hydrazine is 0.327 ppm and the peak concentration at the intakes is 1.96 ppm. The ammonium hydroxide tank will have a 20 foot (6.1m) diameter berm around it. At this distance and with the berm, the peak concentration of ammonia in the MCR is 10.6 ppm and the peak concentration at the intakes is 71.4 ppm.

The effects of toxic chemical releases are summarized in Table 2.2-10.

Railways

The hazardous material transported along the Canadian Pacific Railway that was identified for further analysis with regard to the potential for the formation of toxic vapor clouds formed after an accidental release is ammonia. As discussed in Section 2.2.3.1.1, 196,234 lb (89,010 kg) of ammonia is released in this analysis.

As described in Section 2.2.3.1.3, the identified hazardous material was analyzed utilizing the ALOHA dispersion model to determine whether the formed vapor cloud will reach the control room intake and what the concentration of the toxic chemical will be in the main control room after an accidental release.

Ammonia concentrations were determined at the control room after a release of the largest vessel. The maximum concentration of ammonia in the main control room following the release was calculated to be greater than the IDLH for ammonia, 300 ppm. However, more than two minutes will elapse between the time when the concentration of ammonia in the main control room reaches the odor threshold (50 ppm) for ammonia and the time when the

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concentration reaches the IDLH. Because of this, the main control room operators will have two minutes to don a respirator.

Toxic vapor clouds resulting from spills of chemicals that are transported by railways in the vicinity of BBNPP will not adversely affect the safe operation of BBNPP. The effects of toxic chemical releases are summarized in Table 2.2-10.

Toxic Chemical Related Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 per year. The analyses presented in this section demonstrate that toxic chemical concentrations that could present an immediate hazard to plant personnel will not result from postulated chemical releases. For ammonia and natural gas, it was demonstrated that the main control room operators will have more than two minutes to don a respirator, meeting the acceptance criteria from Regulatory Guide 1.78 (NRC, 2001).

2.2.3.1.4 Fires

Accidents leading to high heat fluxes or smoke, and non-flammable gas or chemical bearing clouds from the release of materials, as the consequence of fires in the vicinity of the plant were considered. Fires in adjacent industrial plants and storage facilities, oil and gas pipelines, brush and forest fires, and fires from transportation accidents were evaluated as events that could lead to high heat fluxes or to the formation of such clouds.

The chemical releases that were analyzed for potentially leading to high heat fluxes at BBNPP safety related buildings were: a hydrogen tank boiling liquid expanding vapor explosion (BLEVE) on the Susquehanna site, a gasoline pool fire due to a spill of a tanker truck, an acetylene tank BLEVE from a delivery truck to Western International Gas, a butane BLEVE of a Canadian Pacific Railway tankcar, a propane tank BLEVE from Heller's Gas & Custom Made Fireplaces, and the jet fires caused by the rupturing of the two natural gas pipelines UGI and Transco.

Of these instances, the highest heat flux into a BBNPP safety related building is 0.929 kW/m^2 resulting from the hydrogen tank BLEVE, however the fireball will fully burn in 7 seconds, so the total heat transfer to the building is limited. The jet fire from the UGI pipeline will have a maximum radiative heat flux of 0.346 kW/m^2 and a steady state heat flux of 0.13 kW/m^2, which will continue until the pipeline is isolated. The rest of the chemical fires are bounded either in terms of time or intensity by these two instances.

Fires which could result in smoke clouds at the site may arise from brush and forest fires, oil spills from adjacent pipelines, and transportation accidents. A fire from a natural gas pipeline could result in a transient radiant heat flux of very short duration (a few seconds) if the flame front were as close as 1,500 ft (457 m). However, the condition is not sustainable and would become limited to about 2,000 ft to 3,000 ft (610 m to 914 m) from the point of pipeline rupture.

An oil fire from a pipeline rupture at the river, followed by ignition of a pool of floating oil could produce 1.5 kg/sec (3.3 lb/sec) of particulates for each 1,000 barrels per hour of fuel consumed in open area burning. For pool or choked burning, i.e., sooting conditions, the particulate generation could reach 10 kg/sec (22 lb/sec). Maximum smoke concentration at the site could reach 250 milligrams/cubic meter. No radiant heat problem at the site would be expected, since firefighting equipment would normally be able to use the road between the

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site and river bank. However, the onsite fire brigade would respond to any fire at the intake location. The fire hydrant and hose located at the intake would be used to mitigate the effects of the potential radiant heat associated with an oil fire at the river.

The usual failure mode of oil pipelines, the distances to structures containing safety related equipment, and the nature of oil spills on rivers minimize the potential of an oil fire impacting BBNPP. However, as a worst case, it could be assumed that the pipeline will continue to flow for one half hour after the rupture. Since the maximum flow rate in the Sunoco Pipeline (the closest oil pipeline to the site) is 800 barrels per hour, this would produce a spill of 400 barrels plus the amount remaining in the pipeline up to the points of shutoff in each direction. This distance would be about 0.75 mi (1.21 km) in the near direction and about 8 mi (13 km) in the far direction, if it is assumed that pipeline rupture occurs at the shutoff point closest to the site. This gives a volume of approximately 1,970 barrels. When added to the 400 barrels for the amount spilled before shutoff, the total worst case spill would be 2,370 barrels.

The fire would basically burn until the spill was shutoff, one half hour under the worst case conditions. However, it may be that the spill, if it reaches the Susquehanna River, might spread out on the surface of the river and continue to burn until the spill thickness passes below some minimum which will no longer sustain combustion. Under the worst case circumstances, the thickness of the slick by the area over which the spill will spread can be estimated. A well recognized formula (Fay 1971) for this spreading is:

$$A = 10^5 \text{ x } v^{3/4}$$

where A is the spill area in square meters and V is the spill volume in cubic meters. The thickness is then estimated by dividing the volume by the spill area. For the aforementioned worst case 2,370 barrel spill, the formula gives a thickness (at maximum spread) of only 4.2E-03 cm. At a typical burning rate of one inch per hour, this thickness would be consumed in less than 10 seconds. Therefore, it would appear that a spill from the Sunoco Pipeline would not be able to burn for much longer than the one half hour maximum flow time until shutoff. This evaluation assumes the oil is spilled on a calm lake. The postulated exposure and the chance for ignition would be minimized by the river flow. The gas line would not create any smoke problem, but could ignite brush or forest areas. Combustible cover to the northwest of the plant is heavy along Lee Mountain, 3,200 ac (1,295 ha) at about 3 mi (4.8 km) distance, and over a low ridge north of the plant boundary, 250 ac (101 ha) at 1 mi (1.6 km). The smoke particulate load estimated from a fire consuming 40 ac per hour (low wind condition, associated with atmospheric stagnation) would be at 210 kg total particulates per hectare (EPA, 1996), 160 and 22 milligrams/cubic meter for fires at 1 mi (1.6 km) and 3 mi (4.8 km), respectively.

According to the National Fire Protection Association (NFPA) Standard 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire, a defensible space is an area that is typically defined as having a width of at least 30 ft (9 m) between an improved property and a potential wildland fire where combustible materials and vegetation have been removed to reduce the potential for fire on improved property spreading to wildland fuels or to provide a safe working area for fire fighters protecting life and improved property from wildland fire. A minimum distance for fuel modification should be 30 ft (9 m) from structures. Studies of structural ignition from radiant heat indicate that ignitions are unlikely to occur from burning vegetation beyond 120 ft (37 m) from a structure. Therefore, clearing of vegetation and thinning of trees to a distance of 120 ft (37 m) from a dwelling, as in a zoned Firewise

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landscape, will prevent ignition of a structure from the radiant heat from a flame front in a high-risk ecosystem. (NFPA, 2008)

The BBNPP site will be sufficiently cleared of brush, forest, woodland prior to construction and operation. These cleared zones are of sufficient size to afford substantial protection in the event of a fire, and it is not expected that there would be any hazardous effects from fires or heat fluxes associated with wild fires, fires in adjacent industrial plants or from on-site storage facilities.

Fire Related Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 occurrences per year. The use of cleared fuel breaks around safety-related BBNPP structures will ensure that external fire related impacts will not have severe consequences.

2.2.3.1.5 Collisions with Intake Structure

The BBNPP Intake Structure is located on the Susquehanna River downstream of the SSES Unit 1 and 2 intake structure. The Susquehanna River is not used as a navigable waterway for other than small recreational boats, which do not constitute any hazard potential to the BBNPP Intake Structure.

2.2.3.1.6 Liquid Spills

The accidental release of oil or liquids that may be corrosive, cryogenic, or coagulant were considered to determine if the potential exists for such liquids to be drawn into the BBNPP Intake Structure and circulating water system or otherwise affect the plant's safe operation.

The BBNPP Raw Water Supply System (RWSS) pumps and Circulating Water System (CWS) makeup pumps draw water through the BBNPP Intake Structure forebay on the bank of the Susquehanna River. Present at the forebay of the BBNPP Intake Structure is a curtain wall that assists in preventing floating pollutants, such as petroleum products, from reaching the intake pumps suction.

The Susquehanna River is not utilized for industrial transportation; however, petroleum spills could occur from a pipeline rupture near the Susquehanna River. Any chemical liquids that have a specific gravity of less than one would float on the surface of the river. Therefore, these liquids if spilled would not only be diluted by the Susquehanna River water, but would float on the surface and consequently would not likely reach the pumps suction beyond the BBNPP Intake Structure's curtain wall.

Any liquid spills that would solidify in the water that reached the BBNPP Intake Structure would be removed by the bar grating or traveling screen in the intake structure system.

Liquid Spill Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 occurrences per year. In the case of liquid spills, the BBNPP Intake Structure is well protected. Chemical spills would either be sufficiently diluted before reaching the BBNPP Intake Structure or would be swept downstream of the Intake Structure by the Susquehanna River current. Any liquid spills that would solidify in the water that reached the intake structure would be removed by the traveling screens on the Intake Structure. In each

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case, there would be no significant damage to the BBNPP Intake Structure. As a result, the unlikely event of liquid spills will not result in severe consequences.

2.2.3.1.7 Radiological Hazards

The release of radioactive material from SSES Units 1 and 2 as a result of normal operations or an unanticipated event would not threaten the safety of the plant or personnel at BBNPP. The control room habitability system for the U.S. EPR provides the capability to detect and protect main control room personnel from external fire, smoke, and airborne radioactivity. In addition, safety-related structures, systems, and components for the U.S. EPR have been designed to withstand the effects of radiological events and the consequential releases that would bound the contamination from a release from either of these potential sources.

Radiological Hazard Impacts Affecting the U.S. EPR Design

The U.S. EPR design is acceptable for any site when reasonable qualitative arguments can demonstrate that the realistic probability of severe consequences from any external accident is less than 1.0E-6 occurrences per year. In the case of radiological hazards, the control room habitability system for the U.S. EPR provides the capability to detect and protect main control room personnel from external fire, smoke, and airborne radioactivity. In addition, safety-related structures, systems, and components for the U.S. EPR have been designed to withstand the effects of radiological events and the consequential releases that would bound the contamination from a release from either of these potential sources. As a result, radiological hazards will not result in severe consequences.

2.2.3.2 Effects of Design-Basis Events

As concluded in the previous sections, the only event requiring further analysis for consideration as a design-basis is related to the frequency of aircraft impact in the vicinity of the BBNPP site. A probabilistic analysis which presents the probability of aircraft accidents which could potentially result in radiological consequences for the U.S. EPR at the BBNPP site is presented in Section 19.2.}

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Table 2.2-1— {Description of Facilities, Products, and Materials}

Facility	Concise Description	Primary Function	Number of persons employed	Major Products or Materials
Susquehanna Steam Electric Station (SSES) Units 1 and 2	SSES Units 1 and 2 are an 1,105 MWe and an 1,111 MWe, respectively, General Electric Type 4 boiling water reactors licensed by the Nuclear Regulatory Commission.	Nuclear Power Generator	1,000	Electrical Power
Deluxe Building Systems	Manufacturer of prefabricated structures, including single family homes, apartment buildings, hotels, and other buildings.	Manufacturer	150 - 300	Paint, adhesives, natural gas
Heller's Gas and Custom Made Fireplaces	Seller of propane.	Distribution	4	Propane
Western International Distribution Center	An acetylene distribution center.	Distribution	34	Acetylene
UGIES Hunlock Propane Air Plant	Seller of Propane.	Distribution	1	Propane

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Table 2.2-2— {SSES and BBNPP Chemical Storage}
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Material	Toxicity Limit	Largest Container Amount	Location
Susquehanna Steam Electric Station (SSES) Units 1 and 2			
Alcohol, Isopropyl	2,000 ppm	676 lbs (307 kg)	Warehouse
Argon, Liquid	69,200 ppm	4,315 ft^3($122m^3$)	Cylinder Storage Area
Carbon Dioxide	40,000 ppm	25,000 lbs (11,340 kg)	Between Turbine Bldg and Circ Water Pumphouse
Diesel Fuel	Not toxic threat	1,940,072 lbs (880,002 kg)	Next to DG Buildings
Freon R-114	7,000 mg/m^3	24,343 lbs (11,042 kg)	Resin Bldg
Freon R-12	15,000 ppm	60,120 lbs (27,270 kg)	Resin Bldg
Gasoline, Benzene	500 ppm STEL 300 ppm TWA	61,642 lbs (27,960 kg)	Fuel Farm
Halon 1301	40,000 ppm	590 lbs (268 kg)	Security Control Center
Hydrogen, Liquid	4,000 ppm	10,017 lbs (4,544 kg)	Hydrogen-injection Tank Farm
Nitrogen, Liquid	69,200 ppm	10,318 lbs (4,680 kg)	N of S&A Bldg
Oxygen, Liquid	683,700 ppm	85,500 lbs (38,782 kg)	Hydrogen-injection Tank Farm
PCL-57 (1-hydroxyethlyidene-1,1-diphosphonic acid or HDEP)	500 mg/m^3	24,490 lbs (11,108 kg)	Circ Water Pumphouse
Sodium bisulfite solution	100 ppm	17,100 lbs (7,756 kg)	Shed behind Acid/Chlorine Bldg
Sodium Hypochlorite, 12% (CWPH)	10 ppm	72,571 lbs (32,918 kg)	Circ Water Pumphouse
Sulfur Hexafluoride, Compressed	1,000 ppm	115 lbs (52 kg)	Hydrogen Tank Farm
Bell Bend Nuclear Power Plant (BBNPP)			
Ammonium Hydroxide (28% solution)	300 ppm	8,500 gal (32,176 l)	Potential Onsite Chemical at BBNPP
Diesel Fuel	Not toxic threat	125,000 gal (4.7E5 l)	Potential Onsite Chemical at BBNPP
Dimethylamine (2% solution)	500 ppm	350 gal (1,300 l)	Potential Onsite Chemical at BBNPP
Gasoline	500 ppm STEL 300 ppm TWA	4,000 gal (15,000 l)	Potential Onsite Chemical at BBNPP
Hydrazine (35% solution)	50 ppm	350 gal (1,300 l)	Potential Onsite Chemical at BBNPP
Hydrogen Tank	4,000 ppm	51.1 ft^3 (1.44 m^3) at 2,450 psig, -20°F to 200°F	Potential Onsite Chemical at BBNPP
Liquid Nitrogen	69,200 ppm	11,300 gal (42,800 l) sat liquid at -250°F	Potential Onsite Chemical at BBNPP
Sodium Hypochlorite	10 ppm	12,000 gal (45,425 l)	Potential Onsite Chemical at BBNPP
Argon	69,200 ppm	270 scf (7.65 Nm^3) [(1)]	Potential Onsite Chemical at BBNPP
Argon-Methane (considered Methane)	5,000 ppm	282 scf (7.99 Nm^3) [(1)]	Potential Onsite Chemical at BBNPP
Hydrogen Cylinder	4,000 ppm	278 scf (7.87 Nm^3) [(1)]	Potential Onsite Chemical at BBNPP

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Table 2.2-2— {SSES and BBNPP Chemical Storage}
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Material	Toxicity Limit	Largest Container Amount	Location
Nitrogen Gas	69,200 ppm	235 scf (6.65 Nm^3) (1)	Potential Onsite Chemical at BBNPP
Oxygen	683,700 ppm	282 scf (7.99 Nm^3) (1)	Potential Onsite Chemical at BBNPP
Deposit Control Agent BL5323	-	1,000 gal (3,785 l)	Potential Onsite Chemical at BBNPP
Sodium Bisulfite 38%	100 as SO_2	500 gal (1,893 l)	Potential Onsite Chemical at BBNPP

Note:
(1) Standard conditions are 68°F and 14.7 psia

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Table 2.2-3— {Hazardous Chemical Railway, Road, or Waterway Freight}

Material	Toxicity Limit (IDLH) ppm	Transportation Method	Amount (lbs) (kg)
Sodium Chlorate	(2)	Canadian Pacific Railway	(1)
Napthalene, Molten	(2)	Canadian Pacific Railway	(1)
Liquefied Petroleum Gases (Butane)	(2)	Canadian Pacific Railway	(1)
Chlorosilanes	(2)	Canadian Pacific Railway	(1)
Ammonia, Anhydrous	300	Canadian Pacific Railway	(1)
Sodium Hydroxide	(2)	Canadian Pacific Railway	(1)
Sulphur, Molten	(2)	Canadian Pacific Railway	(1)
Phenol, Molten	(2)	Canadian Pacific Railway	(1)
Gasoline, Benzene	(2)	Canadian Pacific Railway	(1)
Potassium Hydroxide	(2)	Canadian Pacific Railway	(1)
Acetone	(2)	Canadian Pacific Railway	(1)
Ammonium Nitrate Fertilizer	(2)	Canadian Pacific Railway	(1)
Terpene Hydrocarbons	(2)	Canadian Pacific Railway	(1)
Methyldichlorosilane	(2)	Canadian Pacific Railway	(1)
Ethyl Acetate	(2)	Canadian Pacific Railway	(1)
Gasoline	500 STEL 300 TWA	Truck on U.S. Route 11	80,000 (36,287)
Propane	2100	Truck on U.S. Route 11	80,000 (32,287)
Chlorine	10	Truck on U.S. Route 11	100 (45)
Acetylene	2,500 (3)	Truck on U.S. Route 11	16,000 (7,257)

Notes:
IDLH: Immediately Dangerous to Life and Health threshold value.
STEL: Short Term Exposure Limit threshold value. This is more conservative than IDLH. It is the limit that a person can tolerate for 15 minutes.
TWA: Time Weighted Average threshold value. This is the average concentration that a person can be exposed to over an 8 hour period, day after day.
(1) Per 49 CFR 179.13, the maximum load on a rail tank car is the lesser between 34,500 gal (130,597 l) or 263,000 lbs (119,295 kg).
(2) Ammonia is selected as the most toxic chemical that is transported by the Canadian Pacific Railway. All others are either less toxic or have a vapor pressure less than 10 mmHg (0.0013 MPa) at 100°F (38°C).
(3) The IDLH of acetylene is 10% of the LEL. This is consistent with guidance provided in NUREG/CR-6624 (NRC, 1999).

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Table 2.2-4— {Aircraft Operations - Significance Factors}

Airport	Number of Operations	Distance from Site	Annual Operations Threshold (1)
SSES Helipad	Sporadic	1.6 mi (2.6 km)	Not calculated
Berwick Airport	None - Closed indefinitely	2.7 mi (4.35 km)	Not calculated
Berwick Hospital Heliport	Sporadic	3.5 mi (5.6 km)	Not calculated
Sutliff Private Airport	Sporadic	7.0 mi (11.3 km)	25,463
Double D Skyranch Airport	Sporadic	8.1 mi (13.0 km)	33,392
Baratta Heliport	Sporadic	9.3 mi (15.0 km)	43,460
Seesholtz Airport	Sporadic	10.4 mi (16.7 km)	107,309
Hazelton Municipal Airport	24,617 (2006) 34,837 (2025)	11.0 mi (17.7 km)	127,234
Bloomsburg Municipal Airport	12,350 (2006) 17,486 (2025)	15.2 mi (24.5 km)	237,881
Wilkes-Barre Wyoming Valley Airport	32,170 (2006) 45,625 (2025)	22.1 mi (35.6 km)	478,253
Northumberland County Airport	21,700 (2006) 30,773 (2025)	26.6 mi (42.8 km)	706,927
Schuylkill County/Joe Zerbey Airport	27,700 (2006) 31,873 (2025)	28.5 mi (45.9 km)	808,248
Jake Arner Memorial Airport	27,399 (2006) 32,640 (2025)	28.6 mi (46.1 km)	808,248
Wilkes-Barre/Scranton International Airport	211,480 (2006) 331,346 (2025)	28.7 mi (46.2 km)	828,001

Notes

(1) Per NUREG-0800, Section 3.5.1.6, if the plant-to-airport distance (D) is between 5 and 10 statute mi (8 and 16 km), then the annual operations threshold is calculated by $500 \times D^2$ or if the plant-to-airport distance (D) is greater than 10 statute mi (16 km), then the annual operations threshold is calculated by $1000 \times D^2$. If the airport is within 5 mi (8 km), then a detailed review of aircraft hazards must be performed. If the probability of aircraft hazards from airports within 5 mi (8 km) is acceptably low, then the design-basis acceptance criteria is met.

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Table 2.2-5— {SSES Site and BBNPP Site Chemical Disposition}
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Material	Toxicity Limit	Flammability	Explosion Hazard?	Disposition
SSES				
Alcohol, Isopropyl	2,000 ppm	2.0%-12.7%	Bounded	Meets RG 1.78 Limit
Argon, Liquid	69,200 ppm	Not Flammable	No	Meets RG 1.78 Limit
Carbon Dioxide	40,000 ppm	Not Flammable	No	Meets RG 1.78 Limit
Diesel Fuel	Not toxic threat	0.7%-6%	Confined	Explosion Analysis
Freon R-114	7,000 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit
Freon R-12	15,000 ppm	Not Flammable	No	Meets RG 1.78 Limit
Gasoline, Benzene	500 ppm STEL 300 ppm TWA	1.4%-7.6%	Vapor/ confined	Explosion Analyses
Halon 1301	40,000 ppm	Not Flammable	No	Meets RG 1.78 Limit
Hydrogen, Liquid	4,000 ppm	4%-75%	Vapor/ confined	Explosion Analyses
Nitrogen, Liquid	69,200 ppm	Not Flammable	BLEVE Explosion	Meets RG 1.78 Limit, Explosion Analysis
Oxygen, Liquid	683,700 ppm	Not Flammable	BLEVE Explosion	Meets RG 1.78 Limit, Explosion Analsysis
PCL-57 (1-hydroxyethlyidene-1,1-diphosp honic acid or HDEP)	500 mg/m^3	Not Applicable	No	Meets RG 1.78 Limit
Sodium Bisulfite Solution	100 ppm	Not Applicable	No	Meets RG 1.78 Limit
Sodium Hypochlorite, 12% (CWPH)	10 ppm	Not Applicable	No	Toxicity Analysis
Sulfur Hexafluoride, Compressed	1,000 ppm	Not Flammable	No	Meets RG 1.78 Limit
BBNPP				
Ammonium Hydroxide (28% solution)	300 ppm	15%-28%	Vapor/Confined[(2)]	Flammability/Explosion/Toxicity Analysis
Diesel Fuel	Not Toxic [(1)]	0.7%-6%	Confined [(2)]	Explosion Analysis
Dimethylamine (2% solution)	500 ppm	2.8%-14.4%	Vapor/Confined [(2)]	Flammability/Explosion/Toxicity Analysis
Gasoline	500 ppm STEL 300 ppm TWA	1.4%-7.6%	Vapor/Confined [(2)]	Flammability/Explosion/Toxicity Analysis
Hydrazine (35% solution)	50 ppm	9.3%-83.4%	Confined [(2)]	Toxicity/Explosion Analysis
Hydrogen Tank	4,000 ppm	4%-75%	Vapor/Confined [(2)]	Flammability/Explosion/Toxicity Analysis
Liquid Nitrogen	69,200 ppm	Not Flammable	BLEVE Explosion	Toxicity/Explosion Analysis
Sodium Hypochlorite	10 ppm as Cl_2	Not Applicable	No	Low Vapor Pressure
Argon	69,200 ppm	Not Flammable	No	Toxicity Analysis

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Table 2.2-5— {SSES Site and BBNPP Site Chemical Disposition}

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Material	Toxicity Limit	Flammability	Explosion Hazard?	Disposition
Argon-Methane (considered Methane)	5,000 ppm	4.4%-16.5%	Vapor/Confined [2]	Flammability/Explosion/Toxicity Analysis
Hydrogen Cylinder	4,000 ppm	4%-75%	Vapor/Confined [2]	Flammability/Explosion/Toxicity Analysis
Nitrogen Gas	69,200 ppm	Not Flammable	No	Toxicity Analysis
Oxygen	683,700 ppm	Not Flammable	No	Toxicity Analysis
Deposit Control Agent BL5323	-	Not Flammable	No	Toxicity Analysis
Sodium Bisulfite	100 ppm as SO_2	Not Flammable	No	Toxicity Analysis

Notes:

(1) Chemicals with vapor pressures less than 10 mmHg (0.0013 MPa) at 100°F (38°C) are not considered toxic or delayed vapor explosion hazards. The chemical will not enter the atmosphere fast enough to reach high enough concentrations to affect people or lead to delayed explosions.

(2) There are two types of explosion analyses: stationary confined explosions and delayed ignition vapor cloud explosions. The diesel and hydrazine are only analyzed for a stationary confined explosion, while ammonium hydroxide, hydrogen, dimethylamine, gasoline, and methane are analyzed for both types of explosions.

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Table 2.2-6— {Hazardous Material, Nearby Facilities, Disposition}
(Page 1 of 2)

Material (amount at location)	Bounding Location (Distance (mi)) (3)	Toxicity Limit	Flammability / Explosive Limits	Explosion Hazard?	Disposition (1)
Acetylene (16,000 lbs (7,257 kg))	Western International (1.5 mi (2.4 km))	2,500 ppm	2.5%-100%	Analyze (2)	Flammability/ Explosion Analysis/ Toxicity meets limit
Aluminum Chloride (55 gal (208 l))	Rad Woodwork (3.6 mi (5.7 km))	2 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit
Argon (24,166 lbs (10,962 kg))	Cheetah Chassis (4.6 mi (7.4 km))	69,200 ppm	Not Flammable	No	Meets RG 1.78 Limit
Boiler Treatment (55 gal (208 l))	Rad Woodwork (3.6 mi (5.7 km))	210 mg/m^3	Not Applicable	No	Meets RG 1.78 Limit
Brake Clean (small amount)	Riverview Block Inc (1.7 mi (2.7 km))	210 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit
Chlorine (100 lbs (45 kg)/ < 600 lbs (272 kg))	Delivery (1.3 mi (2.0 km))/ Shickshinny Sanitation (4.4 mi (7.0 km))	10 ppm	Not Flammable	No	Meets RG 1.78 Limit
Ferric Chloride (2,100 gal (7,949 l))	Wise Foods (5.1 mi (8.3 km))	210 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit
Freon 12 (R12, Dichlorodifluoro-methane) (<100,000,000 lbs (<4.5E7 kg))	Ed Spencer Auto Parts (2.6 mi (4.1 km))	15,000 ppm	Not Flammable	No	Meets RG 1.78 Limit
Gasoline (80,000 lbs (36,287 kg))	Postulated Truck (1.3 mi (2.0 km))	500 ppm STEL/ 300 ppm TWA	1.4%-7.6%	Analyze (2)	Flammability/ Explosion Analysis/ Toxicity meets limit
Propane (80,000 lbs (36,287 kg))	Postulated Truck (1.3 mi (2.0 km))	2100 ppm	2%-9.5%	Analyze (2)	Flammability/Explosion Analysis/ Toxicity meets Reg. Guide 1.78 limit
Hydrochloric Acid (6,519 lbs (2,957 kg))	CIBA (4.7 mi (7.6 km))	50 ppm	Not Flammable	No	Meets RG 1.78 Limit
Methyl Methacrylate (5,000 lbs (2,268 kg))	Castek (1.4 mi (2.2 km))	1,000 ppm	2.1%-12.5%	Bounded by Gasoline	Meets RG 1.78 Limit
Natural Gas (Methane) (540,000 lbs (244,940 kg))	Deluxe Building Systems (4.6 mi (7.4 km))	5,000 ppm	4.4%-16.5%	Analyze (2)	Flammability/ Explosion Analysis/ Toxicity meets limit
Nitric Acid (4,000 lbs (1,814 kg))	Wise Foods (5.1 mi (8.3 km))	25 ppm	Not Flammable	No	Meets RG 1.78 Limit
Nitrogen (50,000 lbs (72,680 kg))	Wise Foods (5.1 mi (8.3 km))	69,200 ppm	Not Flammable	No	Meets RG 1.78 Limit
Panel Adhesive (28,000 lbs (12,701))	Deluxe Building Systems (4.6 mi (7.4 km))	10 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit
Pesticides/Herbicides (50 gal (189 l))	Nescopeck Agway (3.3 mi (5.3 km))	210 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit

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Table 2.2-6— {Hazardous Material, Nearby Facilities, Disposition}
(Page 2 of 2)

Material (amount at location)	Bounding Location (Distance (mi)) (3)	Toxicity Limit	Flammability / Explosive Limits	Explosion Hazard?	Disposition (1)
Propane (254,000 lbs (115,213 kg))	Heller's Gas & Fireplaces (2.1 mi (3.3 km))	2,100 ppm	2%-9.5%	Analyze (2)	Flammability/ Explosion Analysis/ Toxicity meets limit
R 14 (<96,000,000 lbs (<4.3E7 kg))	Ed Spencer Auto Parts (2.6 mi (4.1 km))	69,200 ppm	Not Flammable	No	Meets RG 1.78 Limit
Styrene (750,000 lbs (340,194 kg) of resin)	Consolidated Container Co (4.8 mi (7.7 km))	700 ppm	1.1%-6.1%	Non-Explosive in Resin form	Meets RG 1.78 Limit
Zinc Chloride (815 lbs (370 kg))	Patriot Metals (4.5 mi (7.2 km))	50 mg/m^3	Not Flammable	No	Meets RG 1.78 Limit

Notes:
(1) Chemicals with vapor pressures less than 10 mmHg (0.0013 MPa) at 100°F (38°C) are not considered toxic or delayed vapor explosion hazards. The chemical will not enter the atmosphere fast enough to reach high enough concentrations to effect people or lead to delayed explosions.
(2) There are two types of explosion analyses: stationary confined explosions and delayed ignition vapor cloud explosions. The chemicals in this table that are identified as being explosion hazards are analyzed for both types of explosions.
(3) Distance from Hazard to center of BBNPP Containment.

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Table 2.2-7— {Hazardous Material, Transported Chemicals, Disposition}

Material	Transportation Route	Toxicity Limit	Flammability/ Explosive Limits	Explosion Hazard?	Disposition (1)
Sodium Chlorate	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Naphthalene, Molten	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Liquefied Petroleum Gases (Butane)	Canadian Pacific Railway	(2)	1.5%-9%	Analyze (2)(3)	Explosion, Flammability Analyses/ Toxicity/Meets Reg. Guide 1.78 limit
Chlorosilanes	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Ammonia, Anhydrous	Canadian Pacific Railway	300 ppm	16%-25%	Analyze (2)(3)	Explosion, Flammability Analyses/ Toxicity/Meets Reg. Guide 1.78 limit
Sodium Hydroxide	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Sulphur, Molten	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Phenol, Molten	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Gasoline, Benzene	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Potassium Hydroxide	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Acetone	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Ammonium Nitrate Fertilizer	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Terpene Hydrocarbons	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Methyldichlorosilane	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Ethyl Acetate	Canadian Pacific Railway	(2)	(2)	(2)	(2)
Gasoline	Truck on U.S. Route 11	500 STEL 300 TWA	1.4%-7.6%	Analyze (3)	Explosion, Flammability Analyses/ Toxicity/Meets Reg. Guide 1.78 limit
Propane	Truck on U.S. Route 11	2100 ppm	2%-9.5%	Analyze (3)	Explosion, Flammability Analyses/ Toxicity/Meets Reg. Guide 1.78 Limit
Chlorine	Truck on U.S. Route 11	10 ppm	Not Flammable	No	Meets Reg. Guide 1.78 Limit
Acetylene	Truck on U.S. Route 11	2,500 ppm	2.5%-100%	Analyze (3)	Explosion, Flammability Analyses/ Toxicity/Meets Reg. Guide 1.78 limit

Notes:
(1) Chemicals with vapor pressures less than 10 mmHg (0.0013 MPa) at 100°F (38°C) are not considered toxic or delayed vapor explosion hazards per Reg. Guide 1.78. The chemical will not enter the atmosphere fast enough to reach high enough concentrations to effect people or lead to delayed explosions.
(2) Ammonia is selected as the most toxic chemical that is transported by the Canadian Pacific Railway. All others are either less toxic or have a vapor pressure less than 10 mmHg (0.0013 MPa) at 100°F (38°C). Both ammonia and butane are selected as the bounding explosive chemicals. These are both gasses at standard conditions, and will therefore have a higher release rate and a higher concentration than the other explosive chemicals on the Canadian Pacific Railway.
(3) There are two types of explosion analyses: stationary confined explosions and delayed ignition vapor cloud explosions.

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Table 2.2-8— {Explosion Event Analysis}

Source Location	Pollutant Evaluated	Quantity	Distance to a BBNPP Safety Related Building	Distance to 1 psid peak overpressure
SSES	Hydrogen	10,017 lbs (4,544 kg)	0.70 mi (1.13 km)	0.34 mi (0.55 km)
	Diesel	1,940,072 lbs (880,002 kg)	0.85 mi (1.37 km)	0.42 mi (0.68 km)
	Oxygen BLEVE	85,500 lbs (38,782 kg)	0.70 mi (1.13 km)	0.10 mi (0.16 km)
	Nitrogen BLEVE	10,318 lbs (4,680 kg)	0.70 mi (1.13 km)	0.05 mi (0.08 km)
U.S. Route 11	Gasoline	80,000 lbs (36,287 kg)	0.98 mi (1.58 km)	0.72 mi (1.16 km)
	Acetylene	16,000 lbs (7,257 kg)	0.98 mi (1.58 km)	0.41 mi (0.66 km)
	Propane	80,000 lbs (36,287 kg)	0.98 mi (1.58 km)	0.72 mi (1.16 km)
Canadian Pacific Railway	Ammonia	196,234 lbs (89,010 kg)	1.63 mi (2.62 km)	1.00 mi (1.61 km)
	Butane	173,643 lbs (78,763 kg)	1.63 mi (2.62 km)	Bounded by ammonia
Heller's Gas & Fireplaces	Propane	254,000 lbs (115,213 kg)	1.78 mi (2.86 km)	1.07 mi (1.72 km)
Deluxe Building Systems	Natural Gas/ Methane	540,000 lbs (244,940 kg)	4.48 mi (7.21 km)	1.43 mi (2.30 km)
BBNPP	Ammonium Hydroxide (28% solution)	8500 gal (32,176 l)	(3)	184 ft (56 m)(1)
	Diesel Fuel	125,000 gal (473,177 l)	(3)	734 ft (224 m) (1)
	Dimethylamine (2% solution)	58 lbs (26 kg)	(3)	290 ft (88 m) (4)
	Gasoline	4,000 gal (15,142 l)	(3)	412 ft (126 m) (1)
	Hydrazine (35% solution)	350 gal (1,325 l)	(3)	115 ft (35 m) (4)
	Hydrogen	48.05 lbs (21.8 kg)	(3)	271 ft (83 m) (2)
	Argon-Methane (considered Methane)	11.8 lbs (5.4 kg)	(3)	164 ft (50 m) (2)
	Hydrogen	1.45 lbs (0.7 kg)	(3)	78 ft (24 m) (2)
	Liquid Nitrogen	11,300 gal (42,775 l)	(3)	360 ft (110 m) (2)

Notes:
(1) For chemicals that are liquids under standard conditions, the storage vessel was assumed to contain 100% chemical vapor at atmospheric pressure.
(2) For compressed or liquefied gasses, the entire content of the storage vessel was conservatively assumed as the explosive mass.
(3) The storage distance for on-site chemicals will be selected such that each chemical is further from any safety related building than the standoff distance in this table.
(4) For some chemicals in an aqueous solution, the entire mass of the chemical in solution was used as the explosive mass.

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Table 2.2-9— {Flammable Vapor Cloud Events (Delayed Ignition) Analysis}
(Page 1 of 2)

Source Location	Pollutant Evaluated	Quantity	Distance to a BBNPP Safety Related Building	Distance to 1 psid Peak Overpressure	Maximum Explosive Concentration at BBNPP Buildings(2)
SSES	Hydrogen	10,017 lbs (4,544 kg)	0.70 mi (1.13 km)	(2)	1.49%
U.S. Route 11	Gasoline	80,000 lbs (36,287 kg)	0.98 mi (1.58 km)	0.40 mi (0.64 km)	-
	Acetylene	16,000 lbs (7,257 kg)	0.98 mi (1.58 km)	0.79 mi (1.27 km)	-
	Propane	80,000 lbs 36,287 kg)	098 mi (1.58 kg)	0.75 mi (1.21 km)	-
Canadian Pacific Railway	Ammonia	196,234 lbs (89,010 kg)	1.63 mi (2.62 km)	1.2 mi (1.93 km)	-
	Butane	173,643 lbs (78,763 kg)	1.63 mi (2.62 km)	1.2 mi (1.93 km)	-
Heller's Gas & Fireplaces	Propane	254,000 lbs (115,212 kg)	1.78 mi (2.86 km)	1.1 mi (1.77 km)	-
Deluxe Building Systems	Natural Gas/ Methane	540,000 lbs (244,940 kg)	4.48 mi (7.21 km)	2.9 mi (4.67 km)	-
Transco Pipeline	Natural Gas/ Methane	Pipeline/ Proprietary	1.55 mi (2.49 km)	(2)	1.88%
UGI Pipeline	Natural Gas/ Methane	Pipeline	0.17 mi (0.28 km)	(2)	3.37%
Sunoco Pipeline	Gasoline	Pipeline	1.72 mi (2.77 km)	379 yards (347 m)	-
BBNPP	Ammonium Hydroxide (28% solution)	8500 gal (32,176 l)	(3)	735 ft (224 m)	-
	Dimethylamine (2% solution)	58 lbs (26 kg)	(3)	291 ft (89 m)	-
	Gasoline	18,647 lbs (8,458 kg)	(3)	1,386 ft (422 m)	-
	Hydrogen	48.05 lbs (21.8 kg)	(3)	990 ft (302 m)	-
	Argon-Methane (Considered Methane)	11.8 lbs (5.4 kg)	(3)	258 ft (79 m)	-
	Hydrogen	1.45 lbs (0.66 kg)	(3)	219 ft (67 m)	-

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Table 2.2-9— {Flammable Vapor Cloud Events (Delayed Ignition) Analysis}

(Page 2 of 2)

Source Location	Pollutant Evaluated	Quantity	Distance to a BBNPP Safety Related Building	Distance to 1 psid Peak Overpressure	Maximum Explosive Concentration at BBNPP Buildings(2)

Notes:

(1) For compressed or liquefied gasses, the entire content of the storage vessel was conservatively assumed as the available explosive mass.

(2) The plume rises high enough such that the concentration of the chemical is below the LEL at all BBNPP structures. Therefore, the concentration will be too low for a confined vapor cloud explosion to occur, and an unconfined vapor cloud explosion will not occur because there will be no ignition sources above BBNPP structures.

(3) On-site chemicals will always be further from any safety related building than the 1 psid standoff distance in this table.

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Table 2.2-10— {Toxic Vapor Cloud Analysis}

Source Location	Pollutant Evaluated	Quantity	Distance to the BBNPP MCR Air Intakes	Peak Concentration at the Air Intakes (ppm)	Peak MCR Concentration (ppm)
Susquehanna Steam Electricity Station Units 1 and 2 (SSES)	Sodium Hypochlorite	72,571 lbs (32,918 kg)	4,816 ft (1,468 m)	115	4.94 (6)
Canadian Pacific Railway	Ammonia	196,234 lbs (89,010 kg)	9,832 ft (2,997 m)	20,000	>300 (1)
Transco Pipeline	Natural Gas/ Methane	Pipeline/ Proprietary	8,776 ft (2,675 m)	>350,000	>5,000 (1)
UGI Pipeline	Natural Gas/ Methane	Pipeline	1,120 ft (341 m)	225,000	>5,000 (1)
Sunoco Pipeline	Gasoline	Pipeline	10,413 ft (3,174 m)	<100 (2)	<100 (2)
BBNPP	Ammonium Hydroxide (28% solution)	8,500 gal (32,176 l) of solution	>4,500 ft (1,372 m) (3)	71.4	10.6
	Dimethylamine (2% solution)	58 lbs (26 kg)	>33 ft (10 m) (3)	80,800	381
	Gasoline	18,647 lbs (8,458 kg)	>823 ft (251 m) (3)	82,000	500 (5)(6)
	Hydrazine (35% solution)	1,019 lbs (462 kg)	>4,500 ft (1,372 m) (3)	1.96	0.327
	Hydrogen Tank	48.05 lbs (21.8 kg)	>173 ft (53 m) (3)	803,000	4,000
	Liquid Nitrogen	53,181 lbs (24,123 kg)	>375 ft (114 m) (3)	12,900,000 (4)	69,000
	Argon	28 lbs (12.7 kg)	>33 ft (10 m) (3)	<69,200	<69,200
	Argon-Methane (considered Methane)	11.8 lbs (5.4 kg)	>33 ft (10 m) (3)	669,000	3,300
	Hydrogen Cylinder	1.45 lbs (0.7 kg)	>33 ft (10 m) (3)	659,000	3,250
	Nitrogen Gas	17.1 lbs (7.8 kg)	>33 ft (10 m) (3)	557,000	2,740
	Oxygen	23.4 lbs (10.6 kg)	>33 ft (10 m) (3)	<683,700	<683,700
	Deposit Control Agent BL5323	1,000 gal (3,785 l) of solution	>823 ft (251 m) (3)	Section 2.2.3.1.3	Section 2.2.3.1.3
	Sodium Bisulfite	2,102 lbs (953 kg)	>479 ft (146 m) (3)	11,600	100 (6)

Notes:
(1) More than two minutes elapse between the time when the chemical concentration reaches the odor threshold and the IDLH. Therefore a trained MCR operator will have enough time to don a respirator, per Regulatory Guide 1.78 (NRC, 2001).
(2) The outdoor concentration is less than 100 ppm for gasoline following a break of the Sunoco Pipeline. Therefore, the concentration of gasoline inside the MCR will also always be less than 100 ppm.
(3) Each of the chemicals onsite at BBNPP will be stored at a distance further from the MCR air intakes than the distances in this table. These distances are the minimum allowable: the concentrations listed for each chemical is the maximum given this worst case distance.
(4) For the near field effects of large gas releases, ALOHA may report the concentration larger than 1,000,000 ppm.
(5) The concentration in the control room is always less than the STEL (500 ppm for gasoline) and the 8 hour average concentration for the operators is less that the TWA (300 ppm for gasoline).
(6) These chemicals have concentrations less than the IDLH or short term exposure limits, but greater than the long term exposure limits. Therefore, operators are expected to don a respirator within 15 minutes of detection.

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Table 2.2-11— {Description of Pipelines}

Pipeline	Size	Fluid Carried	Age (years)	Maximum Allowable Operating Pressure	Depth of Burial	Isolation Valves	
						Location	Type (1)
Sunoco TAMA-King	6 in (15.2 cm)	Gasoline, Diesel Fuel, Heating Oil	77	1,100 psi (7.58 MPa)	2-3 ft (0.61-0.91 m)	a. St. John Road Station; b. Rucket Hill Road Station; c. Susquehanna River North Station; d. Luzerne Pump Station	Gate
Transco-Williams Line "B"	24 in (61 cm)	Natural Gas	43	1,200 psi (8.27 MPa)	3-5 ft (0.91-1.5 m)	Approximately every 10-20 mi (16-32 km)	N/A
Transco-Williams Line "C"	36 in (91 cm)	Natural Gas	24	1,200 psi (8.27 MPa)	3-5 ft (0.91-1.5 m)	Approximately every 10-20 mi (16-32 km)	N/A
Transco-Williams Line "D"	42 in (107 cm)	Natural Gas	1	1,200 psi (8.27 MPa)	3-5 ft (0.91-1.5 m)	Approximately every 10-20 mi (16-32 km)	N/A
UGI PNG	12 in (30.5 cm)	Natural Gas	27	318 psi (2.19 MPa)	3 ft (0.91 m)	At City Gate Station (U.S. Route 11 and Mingle Inn Road) and approximately 11,000 ft (3,353 m) from station.	Ball
UGI PNG	16 in (40.6 cm)	Natural Gas	12	310 psi (2.14 MPa)	3 ft (0.91 m)	At City Gate Station (U.S. Route 11 and Mingle Inn Road) and approximately 8,600 ft (2,621 m) from station.	Ball

Note:
(1) Williams Gas Pipeline - Transco declined to provide the type of isolation valve and cited "proprietary/security" reasons.

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Table 2.2-12— {Description of Highways}

Highway	Closest Approach	Access Point
U.S. Route 11	Approximately 1.3 mi (2.0 km) south of the site.	Access to the site from U.S. Route 11 is via North Market Street, Confers Lane, and Beach Grove Road.
Pennsylvania State Route 93	Approximately 2.5 mi (4.0 km) to the southwest.	No direct access.
Pennsylvania State Route 239	Approximately 1.9 mi (3.1 km) to the southeast	No direct access.
Interstate Highway I-80	Approximately 4.8 mi (7.7 km) to the south.	No direct access.
Interstate Highway I-81	Approximately 8.6 mi (13.8 km) to the southeast.	No direct access.

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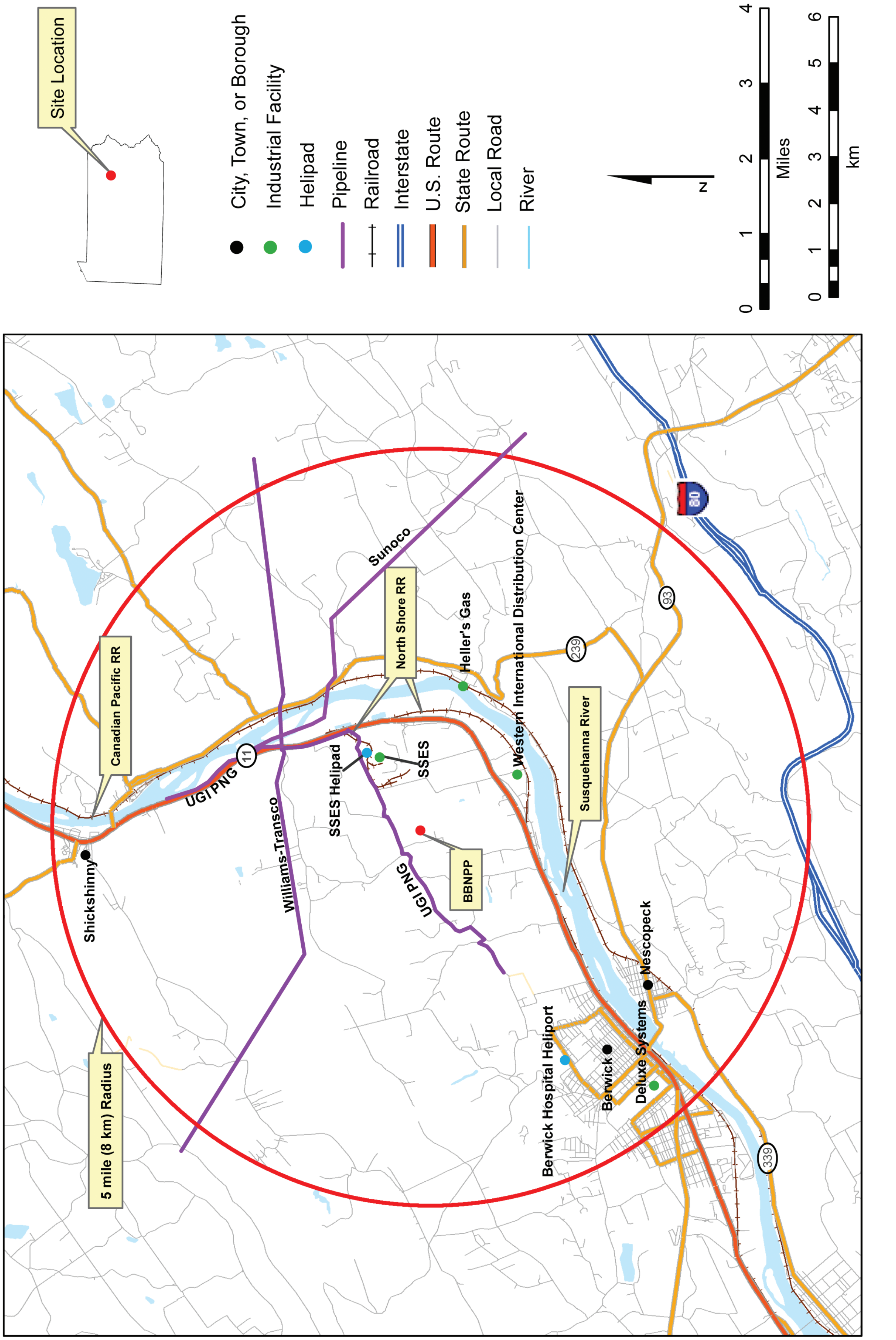
Figure 2.2-1— {Site Vicinity Map}



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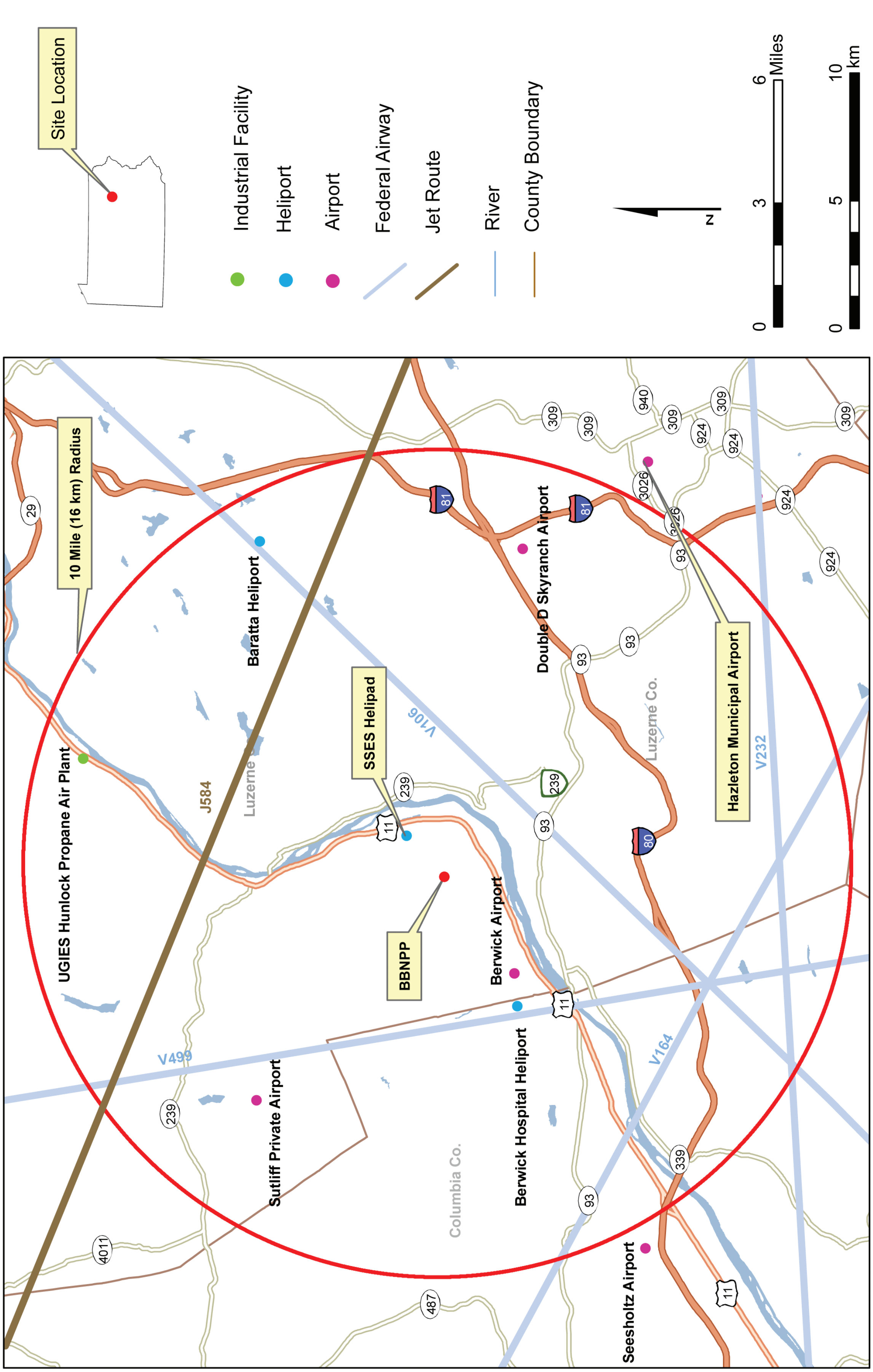

Figure 2.2-2— {Airports and Airway Routes within 10 mi (16 km) and Significant Facilities Between 5 mi and 10 mi (8 to 16 km) of the BBNPP Site}

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