4.4 SOCIOECONOMIC IMPACTS

4.4.1 Physical Impacts

Construction activities at the BBNPP site will cause temporary and generally localized physical impacts such as increased noise, vehicle exhaust, and dust. This section addresses these potential impacts as they might affect people (the local public and workers), buildings, transportation routes, and the aesthetics of areas located near the plant site.

A description of the BBNPP site, location and surrounding community characteristics is provided in Section 2.1, Section 2.2, and Section 2.5. Chapter 3 describes the proposed facility including its external appearance.

As discussed below, the BBNPP site is located in a rural area, relatively remote from nearby population centers and communities. As a result, the potential for direct physical impacts to the surrounding communities from plant construction is expected to be SMALL.

4.4.1.1 The Public and Workers

People who work at or live near the BBNPPsite will be subject to physical impacts resulting from construction activities. Onsite construction workers will be impacted the most, with workers at the existing adjacent operating units subject to slightly reduced, similar impacts. People living or working adjacent to the site will be impacted significantly less due to site access controls and distance from the construction site where most activities will occur. Transient populations and recreational visitors will be impacted the least for similar reasons and the limited exposure to any impacts of construction.

4.4.1.2 Noise

Section 2.7 provides information and data related to the background noise levels that exist at the construction site.

Noise levels in the site area will increase during construction primarily due to the operation of vehicles; earth moving, materials-handling, and impact equipment; and other tools. Pile driving will occur during some construction activities.

Typical noise levels from equipment that is likely to be used during construction are provided in Table 4.4-1 (Beranek, 1971). Onsite noise levels that workers will be exposed to are controlled through appropriate training, personnel protective equipment, periodic health and safety monitoring, and industry good practices. Good practices such as maintenance of noise limiting devices on vehicles and equipment, and controlling access to high noise areas, duration of emission, or shielding high noise sources near their origin will limit the adverse effects of noise on workers. Non-routine activities with potential to adversely impact noise levels such as blasting will be conducted during weekday business hours and will utilize good industry practices that further limit adverse effects.

The exposure of the public to adverse effects of noise from construction activities will be reduced at the source by many of the same measures described above and the additional distance, interposing terrain, and vegetation which provide noise attenuation. Typically, noise generated by construction equipment decreases by approximately 6 dBA for each doubling of distance (Harris, 1979). For instance, if the maximum noise levels produced by construction are 90 dBA at a reference distance of 50 ft (15 m), then at 100 ft (30 m) that noise level will be reduced to 84 dBA. Because the nearest residence is greater than 2000 ft (610 m) away from the center of construction, the estimated noise is expected to be less than the acceptable sound level of 65 dB (CFR, 2012). As a result, the noise effects from construction will be SMALL. The construction noise analysis report is provided in COLA Part 11L.

Traffic noise in the local area will increase as additional workers commute, and materials and waste are transported to and from the construction site. Noise impacts will occur primarily during shift changes and will not be extraordinary given the source and nature of vehicle noise and the normally varying nature of transient vehicle noise levels. Additionally, localized impacts will be reduced as distance from the construction site increases and traffic diverges outward.

In summary, good noise control practices on the construction site, and the additional attenuation provided by the distance between the public and the site, will limit noise effects to the public and workers during construction so that its impact will be small and temporary. Construction noise generation is directly linked with the conduct of construction activities which will end as the facility enters operation.

4.4.1.3 Dust and Other Air Emissions

Construction activities will result in increased air emissions. Fugitive dust and fine particulate matter will be generated during earth moving and material handling activities. Vehicles and engine-driven equipment (e.g., generators and compressors) will generate combustion product emissions such as carbon monoxide, oxides of nitrogen, and to a lesser extent, sulfur dioxides. Painting, coating and similar operations will also generate emissions from the use of volatile organic compounds (VOCs).

To limit and mitigate releases, emission-specific strategies, plans and measures will be developed and implemented to ensure compliance within the applicable regulatory limits defined by the primary and secondary National Ambient Air Quality Standards in 40 CFR 50 (CFR, 2007a) and the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61 (CFR, 2007b). For example, a dust control program will be incorporated into the Storm Water Pollution Prevention Plan. A routine vehicle and equipment inspection and maintenance program will be established to minimize air pollution emissions. Emissions will be monitored in locations where air emissions could exceed limits (e.g. the concrete batch plant). Air quality and release permits and operating certificates will be secured where required.

The Pennsylvania Department of Labor and Industry (PADOLI) implements occupational health and safety regulations that set limits to protect workers from adverse conditions including emissions of airborne contaminants (PADOLI, 1953). If localized emissions result in limits being exceeded, corrective and protective measures will be implemented to reduce emissions (or otherwise protect workers in some cases) in accordance with the applicable regulations.

Implementation of controls and limits at the source of emissions on the construction site will result in reduction of impacts offsite. For example, the dust control program will limit dust due to construction activities to the extent that it is not expected to reach the BBNPP Project Boundary.

Transportation and other offsite activities will result in emissions due largely to use of vehicles. Activities will generally be conducted on improved surfaces and any related fugitive dust emissions will be minimized. As with noise, impacts will be reduced as distance from the site increases.

In summary, air emission impacts from construction are expected to be SMALL because emissions will be controlled at the sources where practicable, maintained within established regulatory limits that were designed to minimize impacts, and distance between the construction site and the public will limit offsite exposures. Construction air emissions impacts are temporary because they will only occur during the actual use of the specific construction equipment or conduct of specific construction activities, and surfaces will be stabilized upon completion of construction activities.

4.4.1.4 Buildings

The primary buildings in the immediate area with the potential for impact from construction are the residences located 220 ft (67 m) or more to the northwest of the limits of disturbance of the site, and those associated with SSES, which is located approximately 1 mile (1.6 km) to the east. Related information about historic properties and the impacts of construction on them is provided in Section 2.5.3 and Section 4.1.3.

Many existing SSES onsite buildings related to safety of the existing facility were constructed to meet seismic qualification criteria which make them resistant to the effects of vibration and shock similar to that which could occur during construction. Other SSES onsite facilities were constructed to the appropriate building codes and standards which include consideration of seismic loads. Regardless of the applicable design standard, construction activities will be planned, reviewed, and conducted in a manner that ensures no adverse effect on the operating nuclear units and that SSES buildings are adequately protected from adverse impact.

Construction activities are not expected to affect other offsite buildings due to their distance from the construction site.

The impact of construction activities on nearby buildings will be SMALL and temporary because of the design of SSES buildings and the administrative programs that will ensure no adverse interaction with the operating units, while offsite buildings are located at distances that isolate them from potential interaction.

4.4.1.5 Transportation Routes

The major transportation routes in the area are described in Section 2.5.2.

The current Luzerne County highway system contains the major Interstates 80 and 81. Interstate 80, the closest to the proposed plant, runs east-west along the southern end of Luzerne County and is a four-lane divided road built to accommodate large volumes of passenger vehicles and freight transport. These highways provide access to traffic and shipping routes for BBNPP via their intersection with U.S. Highway 11. U.S. Highway 11 is a well maintained two-lane paved road oriented northeast-southwest. Traffic will increase substantially on U.S. Highway 11 during peak construction periods and will be at its greatest during shift changes. Construction workers will use U.S. Highway 11 and Interstates 80 and 81 in the area around the site to commute to work. Additionally, public roadways will be used to transport construction materials and equipment to the site, although most heavy equipment and plant components will be brought in by rail. Impact on area transportation resources will generally decrease with increased distance from the site as various routes are taken by individual vehicles.

A transportation study was performed to identify potential routes, both highway and rail, that could support the shipment of materials for the BBNPP. This study found that significant improvements made to the rail and roadway networks since the 1970's and early 80's are sufficient to ship the necessary construction material(s) to the site. An access road will be built to connect BBNPP with U.S. Highway 11. The existing rail spur will be extended from the existing SSES plant to BBNPP. Use of rail spur during construction is not expected to directly impact traffic flow on U.S. Highway 11 as there are no at-grade rail crossings along this route in the vicinity of BBNPP and SSES. However, rail deliveries would have the potential to create temporary congestion during SSES shift changes because the rail spur crosses access ways that serve SSES. Measures suggested to avoid these impacts included scheduling shipments over the rail spur to avoid shift changes.

Pennsylvania Department of Transportation (PennDOT) Guidelines (PennDOT, 2009) require that the traffic impact study (KLD, 2011) and associated mitigation measures, if any, must be identified and agreed to by the applicable PennDOT Regions before the applicant submits the final Highway Occupation Permit (HOP) engineering plans for review. PennDOT guidelines also require the involvement of local government in the traffic impact study review process. The HOP is required to make any change to the public right of way, such as the addition of the site access road to the Bell Bend property. Any mitigation measures identified and agreed upon by PennDOT in the final approved traffic impact study will be required as part of the HOP process.

An additional study of traffic related to construction activities (KLD, 2011) was performed to assess the impacts on capacity and level of service (LOS) and to identify potential mitigation actions, if needed. The study found that mitigation will be required to maintain an acceptable level of service on U.S. Highway 11 and at nearby intersections. Table 4.4-2 provides the projected levels of service at key intersections (Figure 4.4-1) during construction of BBNPP as compared to the future no-build traffic condition. Measures suggested to mitigate excess construction traffic impacts include: installation of signals at the entrance to the BBNPP access road; realignment of lanes on U.S. Highway 11 to facilitate entrance to the site; the provision of additional entrance and exit lanes on the access road at the intersection of U.S. Highway 11; and signal retiming, restriping, thru lanes, temporary traffic signals, parking restrictions, and/or other measures at intersections affected by construction traffic. Table 4.4-10 provides a summary of the mitigation measures and the corresponding improvement in level of service.

A water intake pump house along with discharge piping will be constructed for BBNPP. The BBNPP Intake Structure will be located south of the existing SSES plant intake on the west bank of the Susquehanna River. Construction of the intake and discharge will occupy a portion of the river due to construction of sheetpile, but these structures are sufficiently small such that access to upstream and downstream areas by boaters should not be impeded. Furthermore, the cofferdams will be removed prior to operations.

Thus, the potential impacts to the surrounding communities from construction related traffic are expected to be SMALL.

4.4.1.6 Aesthetics

The BBNPP will be separated from the currently operating SSES facilities by a distance of approximately 1 mile (1.6 km). Construction activities that might affect visual aesthetics will largely be limited to those seen from the new construction access road and from Market Street and Beach Grove Road, which pass to the west and north along the perimeter of the site. Some residential properties located west of the site are expected to experience the most direct aesthetic impacts.

As detailed and illustrated in Section 3.1, the proposed building structures that might impact the aesthetic qualities of the area as they reach the tree line during construction are the reactor building, turbine building, and the two natural draft cooling towers. Of the buildings listed, the two cooling towers, at approximately 475 ft (145 m), and the reactor building at approximately 204 ft (62 m), will be the highest structures. Most other new buildings will not be visible because they will be obscured by the taller structures and will generally exist below the tree line.

Visual impacts of construction are expected to be SMALL, because of the topography that includes forests and rolling terrain, and since the BBNPP site is about a 1 mi (1.6 km) from U.S. Highway 11 to the east and south. However, to limit and mitigate aesthetic impacts, the following design and layout concepts will be included:

- Locating plant facilities outside the existing wetland areas and waterbodies and preserving the site's natural hydrology.
- Locating the new intake structure, pump house, and discharge piping near the existing facilities on the river shoreline.
- Minimizing tree removal by locating plant facilities in either cleared fields or lightly forested areas where feasible.
- Transporting excavated and dredged material to an on-site spoils area outside designated wetlands.
- Adding a new access road to provide a direct route to BBNPP and thereby minimizing the impacts to local roads and the disruption of existing traffic patterns from construction and operation of the plant.
- Creating an exterior for new structures that is compatible with the color and texture of the surrounding area.
- Where feasible, replanting and reseeding of cleared areas with native trees and vegetation.

The existing 500 kV transmission system and the PJM Interconnection, LLC, planned upgrades being installed independent of BBNPP construction will serve the offsite needs of BBNPP, requiring no new construction of offsite transmission towers. New transmission towers and transmission lines will be constructed onsite to connect BBNPP to the existing SSES 500 kV switchyard and a new 500 kV switchyard to the north of the site. These new lines will be built on land currently owned by SSES and will be consistent with existing onsite facilities.

In summary, aesthetic impacts are expected to be SMALL and temporary, because the BBNPP site is set back from, and only limited portions of the construction will be visible from, publicly accessible areas. Most construction activities will be shielded from public view and construction activities are by nature temporary.

4.4.1.7 References

Beranek, 1971. Noise and Vibration Control, Leo L. Beranek, ed., 1971.

CFR, 2007a. Title 40, Code of Federal Regulations, Part 50, National Primary and Secondary Ambient Air Quality Standards, 2007.

CFR, 2007b. Title 40, Code of Federal Regulations, Part 61, Standards for Performance for New Stationary Sources, 2007.

CFR, 2012. Title 24, Code of Federal Regulations, Part 51, Subpart B Noise Abatement and Control, 2012.

Harris, 1979. Handbook of Noise Control, 2nd edition, McGraw Hill, 1979.

KLD, 2011. Traffic Impact Study Related to the Proposed Construction and Operation of the Bell Bend Nuclear Power Plant - Preliminary Findings Report, KLD Engineering, P.C., October 2011.

PADOLI, 1953. General Safety Law, Act Number 174 (May 18, 1937), P.L. 654, Pennsylvania Department of Labor and Industry, as amended June 28, 1951 and July 13, 1953.

PennDOT, 2009. Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits, Pennsylvania Department of Transportation, Bureau of Highway Safety and Traffic Engineering, January 28, 2009.

4.4.2 Social and Economic Impacts

This analysis presents information about the potential impacts to key social and economic characteristics that could arise from the construction of the power plant at the BBNPP site. The analysis was conducted for the 50 mi (80 km) comparative geographic area and for the region of influence (ROI), Luzerne County and Columbia County, Pennsylvania, where appropriate and as described in Section 2.5.2. The discussion focuses on potential impacts to population settlement patterns, housing, employment and income, tax revenue generation, and public services and facilities.

4.4.2.1 Study Methods

Changes in regional employment can result in impacts to the region's social and economic systems. An estimate of direct full-time equivalent (FTE) personnel that would be needed to construct the new unit was determined and is provided in Table 4.4-3. "Direct" jobs are those new construction employment positions that would be located on the BBNPP site. "Indirect jobs" are positions created off of the BBNPP site as a result of the purchases of construction materials and equipment, and the new direct workers' spending patterns in the ROI. Examples of indirect jobs that could be generated include carpenters and other construction jobs, barbers, restaurant personnel, gas station and auto repairs jobs, convenience store cashiers, dry cleaning and laundry jobs, and so forth.

To estimate indirect employment that would be generated by construction of the power plant, a regional multiplier was generated by the RIMS II software and provided by the Regional Economic Analysis Division of the U. S. Bureau of Economic Analysis (BEA, 2008). This model, based upon the construction industry in the ROI, generated a multiplier of 1.3866 indirect jobs created for each direct job. This multiplier was then applied to the estimated peak number of new direct FTE workers to estimate the peak number of indirect jobs that will be created in the ROI.

This analysis evaluates two potential in-migration impact scenarios for the construction workforce: an assumed 20% of the peak construction workforce moving into the ROI with their families for the duration of construction; and a second scenario with 35% moving into the ROI. These scenarios were selected because they are representative of the range of in-migration levels that the NRC found in studies they conducted in 1981 of nuclear power plant construction workforces. The NRC (NRC, 1981) conducted a study of 28 surveys of construction workforce characteristics for 13 nuclear power plants. They found that 17% to 34% of the total construction workforces at most of these nuclear power plants (the 75th percentile) had moved their families into the study areas for each power plant.

They then conducted a more detailed analysis of in-migrants and found that the most common in-migration levels (again for the 75th percentile) for the construction/labor portion of the workforce ranged from 11% to 29%. Additionally, an analysis of the craft labor portion of the workforce showed that pipefitters, electricians, iron workers, boilermakers, and operating engineers were the most likely non-managerial staff to in-migrate into an area, and general laborers, carpenters, and other types of construction workers were the least likely to in-migrate (NRC, 1981).

For managerial and clerical staff the in-migration levels ranged from 40% to 58%. Of the managerial staff alone (i.e., excluding clerical staff), most sites had in-migration rates of 58% to 76% (NRC, 1981).

The potential demographic, housing, and public services and facilities impacts are only discussed for the two-county region of influence, because those impacts are an integral part of, and derive from the impacts of, the in-migrating construction workforce. Impacts to employment and tax revenues are discussed for the 50 mi (80 km) comparative geographic area and the ROI, because of the construction labor pool that would be drawn from, and the collection and distribution of income and sales tax revenues throughout, the state.

4.4.2.2 Construction Labor Force Needs, Composition and Estimates

4.4.2.2.1 Labor Force Availability and Potential Composition

There would be an estimated maximum 3,950-FTE person workforce constructing the BBNPP power plant from 2012 to 2018, representing a significant increase in the overall employment opportunities for construction workers. In comparison, Luzerne County had 8,164 construction jobs in 2006 and Columbia County had 2,134 construction jobs (USCB, 2006a). As shown in Table 4.4-3, this peak is estimated to last for about 12 months, from about the third quarter of the fourth year of construction through about the second quarter of the fifth year. Over the course of the entire construction period, staffing needs are estimated to increase relatively steadily from the third quarter of the first year until the peak is reached. Once the peak has passed, the staff levels again would drop steadily until the last 5 months of construction, when employment levels would drop significantly.

Relatively recent studies have shown that the availability of qualified workers to construct the power plant might be an issue, particularly if several nuclear power plants are built concurrently nationwide. Competition for this labor could increase the size of the geographic area, beyond the middle eastern seaboard, from which the direct construction labor force would have to be drawn for BBNPP. In its study of the construction labor pool for nuclear power plants, the U.S. Department of Energy (DOE, 2004a) stated that, "A shortage of qualified labor appears to be a looming problem…The availability of labor for new nuclear power plant construction in the U.S. is a significant concern."

These workforce restrictions are most likely to occur with "managers, who tend to be older and close to retirement, and skilled workers in high-demand, high-tech jobs." The Department of Energy (DOE, 2005) anticipates that qualified boilermakers, pipefitters, electricians, and ironworkers might be in short supply in some local labor markets. Labor force restrictions can be exacerbated by the fact that portions of the labor force might have to have special certifications for the type of work that they are doing, and because they might have to pass NRC background checks (DOE, 2004a). DOE also found that, "recruiting for some nuclear specialists (e.g., health physicists, radiation protection technicians, nuclear QA engineers/ technicians, welders with nuclear certification, etc.) may be more difficult due to the limited number of qualified people within these fields" (DOE, 2004b). However, meeting these needs can be accomplished by hiring traveling crafts workers from other jurisdictions or regions of the country, which is a typical practice in the construction industry.

Estimates about the composition of the BBNPP construction workforce (i.e., types of personnel needed) have not been developed for the power plant. However, existing studies of other nuclear power plant construction sites provide an indication about the potential composition of the BBNPP construction workforce. As shown in Table 4.4-4 (DOE, 2005), during the peak construction period an estimated 67% (2,635) of the construction workforce could be craft labor. Other less prevalent construction personnel could include about 8% (328) of BBNPP's operation and maintenance staff, 7% (265) site indirect labor, and 6% (229) Nuclear Steam Supply System vendor and subcontractor personnel.

In reviewing only the potential craft labor force component of the entire construction workforce as provided in Table 4.4-5 (DOE, 2005), the greatest levels of employment during the peak of construction could be about 18% (474) electricians and instrument fitters, 18% (474) iron workers, 17% (448) pipefitters, 10% (264) carpenters, and 10% (264) of general laborers. Table 4.4-6 shows the percentage of each of these craft labor categories that would be needed during seven phases of construction. Carpenters, general laborers, and iron workers would comprise the greatest proportions of the workforce during the concrete formwork, rebar installation, and concrete pouring phase of construction. Iron workers would continue to constitute the greatest portion of the workforce during the installation of structural steel and miscellaneous iron work. General laborers and operating engineers would be most needed during the earthwork and clearing of the site, including excavation and backfilling. The installation of mechanical equipment would primarily require pipefitters and millwrights. Pipefitters would also be the primary craft labor category working during installation of piping. Electricians would be the most prevalent during installation of the power plant instrumentation and the electrical systems (GIF, 2005).

As discussed in Section 2.5.2, there were at least 49,179 paid employees in the 50-mile area involved in the construction industry in 2006 (USCB, 2006e). Of this amount, 12,735 were involved in construction of buildings, 4,404 in heavy and civil engineering construction and 31,347 in specialty trades. As detailed in Table 2.5-12, these three categories included a minimum of 377 employees associated with industrial building construction, 1,694 with highway, street and bridge construction, 1,315 with poured concrete structure contractors, 225 with steel and pre-cast concrete contractors, 4,994 with electrical contractors, 7,076 with plumbing and HVAC contractors; and 3,651 with site preparation contractors.

Discussions with labor union representatives in the 50-mile area indicate that, in August 2009, total union worker membership among those union locals providing data was 4,698, including 3,383 electricians and line workers, 600 pipefitters and plumbers, and 715 iron workers. There were a total of 1,374 unemployed union workers, including 603 journey lineman and 409 apprentices/equipment operators, 120 pipefitters and plumbers, and 242 iron workers.

This sector-specific information on construction employment available from the U.S. Census Bureau, which is representative of the 50-mile area, and anecdotal data provided by labor unions within the same region, suggests that a significant portion of the BBNPP construction workforce could potentially be staffed by workers within the 50-mile area.

4.4.2.3 Demography

As state above, it is estimated that a peak of 3,950 FTE employees would be required to construct BBNPP. As shown in Table 4.4-7 under the 20% in-migration scenario, an estimated peak of 688 construction workers would migrate into the ROI along with about 1,018 family members, for a total of 1,706. Of these, the total estimated direct in-migration would be about 829 people (48.6%) into Luzerne County and 878 people (51.4%) into Columbia County. As shown in Table 4.4-8 under the 35% in-migration scenario, an estimated peak of 1,204 direct workers would migrate into the ROI along with about 1,782 family members, for a total of 2,986 people. Of these, the total estimated direct peak in-migration would be about 1,450 people (48.6%) into Luzerne County and 1,536 people (51.4%) into Columbia County.

In addition, it is estimated that a maximum of 954 indirect jobs would be created within the ROI under the 20% scenario and 1,670 indirect workforce jobs would be created under the 35% scenario (multiplying 3,440 ROI peak direct workers by the BEA indirect employment/ economic multiplier of 1.3866, (BEA, 2008)). An estimated 532 to 930 indirect jobs located within the ROI could be filled by the spouses and other family members of the direct workforce. The remaining 423 to 739 indirect jobs likely would be filled by existing unemployed residents, a maximum of 7.0% of the 10,491 unemployed within the ROI in 2006, underemployed area residents, or new in-migrants. If all of these remaining indirect jobs were filled by new in-migrants, it would only represent 278 to 486 households with 688 to 1,205 people.

A maximum potential in-migration, assuming all indirect workers in-migrate, of up to 2,395 people into the ROI under the 20% scenario, or up to 4,191 people under the 35% scenario, would only represent a 0.6% to 1.1% increase in the total ROI population of 378,034 people in 2006. Table 4.4-9 shows the cumulative workforces that would be accessing the BBNPP site on a daily basis as well as the surrounding ROI during normal SSES operations, planned outages, and construction of the BBNPP facility. Because these percentage changes are small, it is concluded that the impacts to population levels in the ROI would be SMALL, and would not require mitigation.

During the last four years of construction, 363 operations personnel will be on-site. Based upon the existing SSES operational workforce, approximately 87.1 % would in-migrate into the two-county ROI. Approximately 42.3% of the existing SSES operational workforce resides in Luzerne County and 44.8% resides in Columbia County. Therefore, of the 316 workers who would in-migrate, approximately 154 workers and their families would in-migrate into Luzerne County, and 163 workers and their families would in-migrate into Columbia County.

In addition to the direct jobs created by the operational positions, an additional 690 indirect jobs would be created within the ROI (multiplying 363 operational workers by the BEA indirect employment/economic multiplier of 1.9011 (BEA, 2008)). Assuming 244 of the indirect jobs would be filled by the spouses of direct workers as shown in Table 5.8-2, a total of 1,366 people would in-migrate into the ROI as a result of direct and indirect employment. This represents a 0.4% increase on the total population of 378,034 (in 2006).

A search was conducted for the presence of other nuclear power plants within 100 mi (160 km) of the BBNPP site. Figure 4.4-2 shows the resulting locations. The figure contains four overlapping zones each with 50 mi (80 km) radii. The zones include as their centers the surrounding nuclear power plant sites. The other power plants include SSES Units 1 and 2 to the east, Limerick Units 1 and 2 to the southeast, Peach Bottom Units 2 and 3 to the south, and Three Mile Island Unit 1 to the southwest. As can be seen in the figure, the BBNPP site's 50 mi (80 km) radius overlaps slightly with the 50 mi (80 km) zones of each of these facilities. The cumulative effect of a proportion of the construction workforce originating from within 50 mi (80 km) of BBNPP and potentially drawing employees from these other four power plants, or adding significantly to the total employment levels for these types of facilities in these areas, would be SMALL, and would not require mitigation.

4.4.2.4 Housing

The in-migrating construction workforce would likely either rent or purchase existing homes, or would rent apartments and townhouses. Non-migrating (i.e., weekly or monthly) workers would likely stay in area hotels, motels, bed and breakfasts (B&Bs), or at area campgrounds and recreational vehicle (RV) parks. Of the estimated maximum 966 direct and indirect households migrating into the ROI to construct BBNPP under the 20% scenario, and the 1,690 households in the 35% scenario, it is estimated that 429 to 821 households (42%) would reside in Luzerne County and 497 to 869 (45%) would reside in Columbia County. This would represent a maximum of 5.7% to 10.0% of the 16,817 total housing units vacant in the ROI in 2000. It would represent 4.6% to 8.1% of the 20,796 units vacant in 2006. Thus, the ROI, and each county within it, have enough housing units available to meet the needs of the workforce, based upon 2000 and 2006 housing information.

In addition to the construction workforce, 316 operational personnel and their families will in-migrate to the ROI during the last four years of construction. Similar to the construction workforce, the in-migrating operations workers would likely either rent or purchase existing homes, or would rent apartments and townhouses. Of the 550 direct and indirect households migrating into the ROI as calculated in Table 5.8-2, it is estimated that 268 households would reside in Luzerne County and 284 within Columbia County. The total number of housing units needed in the ROI would represent 3.3% of the total 16,817 vacant units located in the ROI in 2000.

An example of what housing impacts could occur is provided by the construction of the original SSES units. Construction of the original SSES units resulted in the modular home developments along Route 93 toward Orangeville, in Salem Township, and in Berwick. Additional development occurred in the Hazleton/Conyngham Valley and the Wilkes-Barre/ Scranton areas. Much of the management and engineering teams moved to the area for relatively long periods of time. More temporary housing that was utilized by some of the construction workforce included motels, located from Benton to Bloomsburg, and camping. In some cases, such as with the members of the electricians union, workers commuted in groups of 12 or more people to the site each day. Many of the pipefitters likely originated and commuted from the Philadelphia area on a weekly basis.

In addition to the above housing units, there are a total of 30 apartment and townhouse complexes providing one to three bedroom rental units in the ROI. Most of these facilities are located in Luzerne County, including 25 apartment and townhouse complexes. These rental complexes could be used to house part of the in-migrating workforce and might be a viable option to purchasing more costly single-family homes.

The ROI contains a total of 9,149 mobile home units. Of this amount, 5,855 are located within Luzerne County and 3,294 are within Columbia County (USCB, 2000b-2000j). The condition of these units is unknown; however, the availability of mobile home units provides an additional opportunity for worker housing within the ROI.

Weekly or monthly commuters might elect to stay at one of the 96 hotels/motels/B&Bs facilities, providing about 3,600 rooms for rent in the ROI. Luzerne County has 49 hotel/motel facilities with 2,300 rooms and Columbia County has 47 facilities with 1,300 rooms. Because the hotels and motels are operating at or near capacity during the summer vacation season, from about April through August (see Section 2.5.2), the portions of the workforce that might want to stay on a weekly or monthly basis and then commute home might compete with existing users. During the remainder of the year, enough units would likely be available to meet the needs of the weekly or monthly commuters.

Because significantly more housing units are available than would be needed, the in-migrating workforce alone should not result in an increase in the demand for housing, or in increases in housing prices or rental rates. Also, construction is not scheduled to begin until 2012, providing adequate time for private developers to construct additional new homes and apartment complexes if the economy in the ROI expands, in general, and demand warrants it. In addition, for about seven months out of the year there are noticeable quantities of vacant motel and hotel units that could be used by weekly and monthly commuters. Thus, because of the available housing, it is concluded that the impacts to area housing would be SMALL, and would not require mitigation.

4.4.2.5 Employment and Income

4.4.2.5.1 50 mi (80 km) Comparative Geographic Area

As stated above, it is estimated that a peak of 3,950 direct construction employees would build BBNPP. Under the 20% peak in-migration scenario described above, it is implicit that the remaining 80% (3,160) either would be commuting from a reasonable distance on a daily basis or would stay at area hotels/motels and would be weekly/monthly commuters to the job site. Under the 35% in-migration scenario, an estimated 65% (2,570) of the peak direct construction workers would be daily or weekly/monthly commuters. The greatest proportion of these workers would likely commute from within or near the Scranton, Pittsburgh, and Philadelphia, Pennsylvania areas; New York, New York metropolitan area; Baltimore, Maryland, and Washington D.C. metropolitan areas. However, a portion of these workers also would likely originate from throughout the northeastern and the remainder of the U.S. The greater the distance that they would commute, and the longer that they are employed on the construction site, the more likely they would be to commute from home on a weekly or monthly basis and stay in area motels, or become in-migrants into the ROI, as described in the housing section above. Because the employment opportunities and income would be spread over the 50 mi (80 km) radius, and an even larger geographic area and basis of comparison outside of the region, the beneficial impacts would be SMALL and would not require mitigation.

4.4.2.5.2 Two-County Region of Influence

Direct construction workforce employment is already discussed in the demography section above. In addition to the 3,950 direct workforce, a peak of 954 indirect workforce jobs would be created in the ROI under the 20% scenario and 1,670 indirect jobs would be created under the 35% scenario (Table 4.4-7 and Table 4.4-8). This would result in a peak increase of 1,642 to 2,874 employed people in the ROI, depending upon the scenario selected. The peak increase in employment would range from 797 to 1,396 people in Luzerne County and 845 to 1,478 people in Columbia County. Unemployed or underemployed members of the labor force could benefit from these increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. These increases would result in a noticeable but small impact to the area economy, representing a maximum 0.9% increase in the 151,869 total labor force in Luzerne County in 2000 and 4.6% in the 32,403 total labor force in Columbia County (USCB, 2000).

It is estimated that the direct construction workforce would receive average salaries of $34.00/hour/worker (two-thirds of the estimated $50 per hour, including benefits), or about $70,720 annually. This would result in an annual salary expenditure, for the peak construction workforce of 3,950 people, of $279.3 million. The average annual salary for the direct workforce would be significantly more than the $52,370 mean earnings in Luzerne County in 2006 and the $48,437 mean earnings in Columbia County. Based upon the peak 35% scenario in-migration levels, Luzerne County would experience an estimated $41.4 million increase in annual income during peak construction and Columbia County would receive an estimated $43.8 million annually. The construction workforce also will have the opportunity to receive overtime pay at a rate of 1.5 times the wage rate for hours over 40 per week. As previously indicated, the average wage rate per hour is $34.00 per hour with an average annual salary of $70,720. This is based on the assumption of a 40 hour work week. The construction workforce has the potential to earn up to 20 hours per week in overtime pay. Over the course of one year, this would amount to an additional 1,040 hours of work. The average rate for overtime pay is $51.00 per hour. At this rate, a construction worker could earn an additional $53,040, or a total of$123,760 annually.

In addition, the working spouses of the direct construction workers, who filled indirect jobs created by the power plant, would contribute substantially to individual household incomes. Assuming that the average indirect worker earned $17,870, which is the 2006 median of average annual income for service workers in selected occupations in the Scranton-Wilkes Barre MSA (BLS, 2006), the 954 indirect workers under the 20% scenario would generate $17.05 million in additional annual salaries within the ROI, and the 1,670 indirect workers under the 35% scenario would generate $29.8 million in additional annual salaries.

In addition to the direct construction workforce, 316 operational personnel would in-migrate to the ROI during the last four years of construction. This workforce would receive average annual salaries of $77,135 annually, excluding benefits. This would result in an annual salary increase of $24.4 million within the ROI. The average annual salary would be significantly more than the $52,370 mean earnings in Luzerne County in 2006 and the $48,437 mean earnings in Columbia County.

Due to the operational workforce, an additional 690 indirect jobs would be created. Assuming that the average indirect service worker earned $17,870 (the 2006 median of average annual income for service workers in selected occupations in the Scranton-Wilkes Barre MSA) (BLS, 2006) and that 601 indirect workers would reside in the ROI, an additional $10.7 million in annual income would be generated in Columbia and Luzerne Counties.

The additional direct and indirect workforce income would result in additional expenditures and economic activity in the ROI. Construction of SSES was noted to have benefitted restaurants; car dealerships; golf courses/clubs; sand, gravel, and aggregate businesses; firms providing nitrogen and oxygen gases; lumber suppliers; and other similar businesses. Because of the overall significant number of construction and indirect jobs that would be created, existing lower income levels found in the ROI, and the general out-migration occurring (an indicator of lower economic opportunity), the beneficial impacts to employment and income from construction of the BBNPP facility would be MODERATE, and would not require mitigation.

4.4.2.6 Tax Revenue Generation

4.4.2.6.1 50 mi (80 km) Comparative Geographic Area

State income taxes would be generated by the in-migrating residents, although the amount cannot be estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors. It is estimated that the 50 mi (80 km) radius and the state, excluding the two county ROI, would experience a $230.7 million increase in annual wages from the direct workforce under the 20% scenario (i.e., 80% of the construction workforce in the 50 mi (80 km) area) and $194.2 million under the 35% scenario (i.e., 65% of the construction workforce in the 50 mi (80 km) area). Relative to the existing total wages for the region and the 50 mi (80 km) radius, it is concluded that the potential increase in state income taxes represent a SMALL economic benefit.

Additional sales taxes also would be generated by the power plant and the in-migrating residents. PPL Bell Bend, LLC, would directly purchase materials, equipment, and outside services, which would generate additional state sales taxes. Also, in-migrating residents would generate additional sales tax revenues from their daily purchases. The amount of increased sales tax revenues generated by the in-migrating residents would depend upon their retail purchasing patterns, but would only represent a SMALL benefit to this revenue stream for the region and the 50 mi (80 km) radius.

Overall, although all tax revenues generated by the BBNPP and the related workforce would be substantial in absolute dollars, as described above, they would be relatively small compared to the overall tax base in the region and the Commonwealth of Pennsylvania. Thus, it is concluded that the overall beneficial impacts to state tax revenues would be SMALL.

4.4.2.6.2 Two-County Region of Influence

In 2008, PPL Susquehanna, LLC, paid approximately $1.2 million in real estate taxes to Luzerne County for SSES Units 1 and 2 and surrounding properties. PPL Susquehanna, LLC, also paid approximately $2.7 million in real estate taxes to the Berwick School District. In 2008, PPL Bell Bend, LLC, will generate approximately $30,000 in total property taxes in its current, substantially undeveloped state. Based on a countywide property reassessment in 2008, the 2009 real estate taxes are expected to increase significantly on these properties. Additional real estate tax increases are expected once BBNPP secures the approvals for the required rezoning for the properties that will make up the BBNPP site. Taxes will also escalate during the time frame between the commencement of construction and commercial operation of the plant in 2018. Those increases will be based on the reassessed value determined by the County Assessor based on the percentage of work completed. It is anticipated that these reassessments will occur annually until construction is complete, at which time a final assessment will be determined. This total property tax paid during construction will represent a significant increase in revenues for Salem Township, the Berwick Area School District, and Luzerne Country.

These increased property tax revenues would either provide additional revenues for existing public facility and service needs or for new needs generated by the power plant and associated workforce. The increased revenues could also help to maintain or reduce future taxes paid by existing non-project related businesses and residents, to the extent that project-related payments provide tax revenues that exceed the public facility and service needs created by BBNPP. However, the payment of those taxes often lags behind the actual impacts to public facilities and services, or the time needed to plan for and provide the additional facilities or services. Thus, it is concluded that these increased power plant property tax revenues would be a LARGE economic benefit to Luzerne County.

Some additional real estate tax revenue will be generated from the in-migrating population of direct and indirect workers and their families. However, any increase in tax revenues is not expected to be significant, because the existing supply of vacant housing available to meet the needs of the in-migrating workers is anticipated to be adequate. As the existing owners of these housing units likely pay real estate taxes currently, the purchase or rental of these units by in-migrating workers will have little impact on overall real estate tax revenues within the ROI.

Additional state income taxes would be generated by the in-migrating residents. Although the amount cannot be accurately estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors, tax revenue data from the Pennsylvania Department of Revenue can be used to project potential tax revenue impacts within the ROI. In 2006, the Commonwealth of Pennsylvania collected $10,261.6 million in income taxes. Based on the 2006 total number of households (4,845,603), this amounts to approximately $2,118 annually per household. As indicated in Table 4.4-7 and Table 4.4-8, a peak of 3,950 direct construction employees will build BBNPP. Under the 20% in-migration scenario, an estimated 688 workers and their families will locate within the ROI. Based upon this amount, approximately $1,457,184 will be generated annually in income taxes by the 688 households. Under the 35% in-migration scenario, an estimated 1,204 workers and their families will locate within the ROI. Therefore, approximately $2,550,072 will be generated annually in income taxes by the 1204 households.

As with the 50 mi (80 km) comparative geographic area, additional sales taxes also would be generated within the ROI by the power plant and the in-migrating residents. However, these purchases would be much smaller within the ROI. The amount of increased sales tax revenues generated by the in-migrating residents would depend upon their retail purchasing patterns, but would only represent a small benefit to this revenue stream for the Commonwealth of Pennsylvania.The amount of increased sales tax revenues generated by the in-migrating residents would depend upon their retail purchasing patterns, but would only represent a small benefit to this revenue stream for the Commonwealth of Pennsylvania. In 2006-2007, the state collected $8,590.8 million from sales tax (PDR, 2008). Based upon the 2006 total number of households (4,845,603), approximately $1,773 in sales taxes will be generated annually per household (USCB, 2006b and c). As indicated in Table 4.4-7and Table 4.4-8, a peak of 3,950 direct construction employees will build BBNPP. Under the 20% in-migration scenario, an estimated 688 workers and their families are expected to in-migrate into the ROI. Based upon this amount, approximately $1,219,824 in annual sales taxes will be generated by the 688 households. Under the 35% in-migration scenario, an estimated 1,204 workers and their families are expected to in-migrate into the ROI. Therefore, approximately $2,134,692 in annual sales taxes will be generated by the 1,204 households.

Additional income and sales tax also will be generated within the ROI by the 316 in-migrating operational personnel and their families during the last 4 years of construction and 601 indirect workers. Based upon the 2006 state income and sales tax collections, approximately $669,288 in annual income taxes and $560,268 in annual sales taxes will be generated by the in-migrating households of 316 direct workers; and approximately $495,612 in annual income taxes and $405,522 in annual sales taxes will be generated by the 234 households of indirect workers as noted in Table 5.8-2.

It is estimated that Luzerne County will experience a $41.4 million increase in annual wages from the direct construction workforce and $11.6 million from the direct operational workforce. Columbia County would experience an estimated annual increase of $43.8 million from the direct construction workforce and $12.5 million from the direct operational workforce. Relative to the existing total wages for the ROI, it is concluded that the potential increase in income taxes represent a SMALL economic benefit to the jurisdictions.

Overall, although all tax revenues generated by the BBNPP and the related workforce would be substantial, as described above, they would be relatively small compared to the overall tax base in the ROI. Thus, it is concluded that the overall beneficial impacts to tax revenues would be SMALL.

4.4.2.7 Land Values

Studies have found varying impacts to residential and commercial land values for facilities that are visible and have greater perceived risks such as nuclear power plant sites, potentially less visible but also greater perceived risks of contaminated and brownfield sites, highly visible but lower perceived risk sites such as transmission lines, and for highly visible but low perceived human risk sites such as windfarm energy facilities.

Other studies of potential impacts to property values have had varied results, depending on the type of facility being studied, including facilities that are more visible and could have greater risks such as nuclear power plants, facilities that are potentially less visible but also have greater risks such as landfills and hazardous waste sites, and highly visible facilities but with potentially less perceived risk such as electrical transmission lines and windfarm facilities. For instance, a Maryland Department of Natural Resources (MDNR, 2006) study of the effects of large industrial facilities showed that residential property values were not adversely affected by their proximity to the Calvert Cliffs Nuclear Power Plant site. Overall, Maryland power plants have not been observed to have negative impacts on surrounding property values (MDNR, 2006). Similarly, studies of the property value impacts of the Three Mile Island nuclear power plant accident showed that nearby residences were not significantly affected by the accident.

However, studies of the impacts to residential property values from low-level radioactive waste landfills in Ohio, from leaks at a nuclear facility in Ohio, and along potential nuclear shipment routes in Nevada show that these facilities and activities have a negative impact on housing values within a limited distance from the facility, typically within 3 miles. Even within this limited distance, the impacts on property values decrease rather quickly as one gets farther from the facility.

Evaluations of potentially less visible but also perceived greater risk facilities such as hazardous waste and Superfund sites (e.g., underground storage tanks, existing and former manufacturing facilities, and so forth) generally show similar results. A study of underground storage tanks in Ohio showed that proximity to non-leaking or unregistered leaking tanks did not affect property values, but registered leaking tanks affected property values within 300 feet of the sites. Studies of Superfund sites in Ohio, Texas, Pennsylvania, and the southeastern U.S. showed that property values were negatively affected by the facilities. The negative impacts were particularly noticeable during periods with significant media coverage and public concern, with the properties close to the facilities most affected. Again, the greater the distance from the facilities, the less the impacts on property values. Also, once there was a reduction in media attention and public concern, or after site cleanup, property values sometimes recovered from their losses. Similar results were found for landfills in Ohio and Maryland.

Electrical transmission lines and windfarm facilities can be highly visible but might have a smaller perceived risk to area residents than nuclear and hazardous waste facilities. Although three early studies found that tall electrical transmission lines did not affect nearby residential or agricultural property values, later studies showed that they did have a negative effect on property values. The most common reason given by one study was the visual impact of the transmission line, followed by the perceived health risk (Blinder, 1979) (Delaney and Timmons, 1992). One study (Colwell, 1990) showed that over time the negative impacts to property values decreased, indicating a reduced concern about the facilities.

Studies of potential impacts to property values from windfarm facilities have had mixed results. A study of an existing windfarm in New York and a potential windfarm facility in Illinois showed that there was no impact to nearby residential property values. However, another study of impacts at existing facilities showed that property values increased faster near the facilities than in control areas, likely because of the perception that they represented "green" benefits to the environment.

Overall, these studies show that the impacts of various types of facilities can have a negative impact on residential property values, typically within 1 to 3 miles (1.6 to 5 km) of a facility. However, they also show that the impacts might be less where other facilities already exist, and over time these negative impacts could decrease. The three property owners that live within as little as 1,400 feet (426 m) from the proposed BBNPP facility would likely see reduced property values. However, because there is an existing nuclear power plant next to the BBNPP site, it has been there for a number of years, and most residents and recreational users are located 1 mi (1.6 km) or more away from the site, the overall impacts to land values likely would be minimal and not require mitigation. Thus, overall, it is concluded that the impacts to land values would be SMALL, and would not require mitigation.

4.4.2.8 Public Services

The increased population levels could place some additional daily demands on police services, fire suppression and EMS services, constrained medical services, and schools. No impacts would occur to area political and social structures. As shown in Section 2.5.1, population levels in the ROI without the BBNPP project are estimated to decline by 11,928 people from 2000 to 2010, and another 6,727 people from 2010 to 2020, thus somewhat reducing the need for public services. This loss of population would be offset somewhat by the potential total direct and indirect in-migration of 2,395 people into the ROI for the 20% scenario and 4,191 people into the ROI for the 35% scenario for construction of BBNPP, and the potential total direct and indirect in-migration of 1,366 people into the ROI during the last four years of construction due to preliminary commissioning and operational activities. Also, because the addition of BBNPP-related population is so much less than the general projected out-migration of population, there should still be an overall reduced need for public services. Thus, these services should have enough capacity to accommodate the increased demand and impacts would likely be SMALL.

Police

An accepted standard for police officers is 1.5 officers per 1,000 people (Layton and Gloo, 2007). If an additional 2,698 people in-migrate into Luzerne County under the 35% scenario due to the construction of BBNPP and preliminary commissioning and operational activities, the impact would be minimal on law enforcement capacity (rising from the 469.5 officers currently needed to 473.6 with the project). Based upon this standard, Luzerne County had a sufficient number of officers in 2006 because 550 officers were already in the county.

Despite this standard, the Luzerne County Sheriffs Office and 37 other police departments in the county may not have sufficient staff levels to simultaneously respond to a potential emergency and offsite evacuation in the event of an emergency. The departments might need additional funding, staff, facilities, and equipment. For instance, a representative of the Salem Township Police Department suggested that the construction of the BBNPP would require the addition of equipment and response materials particular to the facility. Additional staff may be required, particularly to address traffic concerns.

Columbia County also had a sufficient number of officers in 2006. If an additional 2,858 people in-migrate into Columbia County under the 35% scenario due to the construction of BBNPP and preliminary commissioning and operational activities, the impact would be minimal on the capacity (rising from 97.5 officers currently needed to 101.8 with the project) of the local officers, because the county already has 106 officers.

Existing law enforcement services in Luzerne County and Columbia County appear to be adequate to meet current daily needs within their jurisdictions. As described in Section 4.4.2.6 above, the significant new tax revenues generated in Luzerne County by construction of BBNPP would provide additional funding to expand or improve services and equipment to meet the additional daily demands created by the plant. Columbia County would also experience increased revenues from construction of the power plant, but to a much lesser extent. However, some departments still might not have enough staff and equipment to respond to an emergency situation, including offsite evacuation. Although the BBNPP facility would somewhat increase the need for these services, additional tax funds would be available to pay for these needs. Thus, it is concluded that there would be a SMALL impact on the law enforcement departments and additional mitigation would not be required.

<u>EMS and Fire Suppression Services</u>

In 2005, the United States had a rate of 3.82 firefighters per 1,000 people (Karter, 2006). An accepted standard used for determining the appropriate amount of firefighters within a community is 1 firefighter for every 1,000 people (CCS, 2009).

Luzerne County has 2,391 firefighters and an existing ratio of 7.64 firefighters per 1,000 people. If an additional 2,698 people in-migrate to this county, the number of firefighters needed would be 316, which is far less than the existing number of firefighters. In addition, Columbia County has 967 firefighters and an existing ratio of 14.87 firefighters per 1,000 people. If an additional 2,858 people in-migrate to this county, approximately 68 firefighters would be needed, which is far less than the existing number of active firefighters.

Thus, both jurisdictions appear to be doing an excellent job of meeting the needs of their residents. For instance, a representative from the Salem Township Volunteer Fire Company suggested that the department is able to serve the needs of their residents, but felt that additional volunteers are always needed, regardless of the introduction of new facilities. He also felt that improvements to ensure that the building is capable of handling new types of equipment also are necessary. A representative of the Berwick Fire Department, however, expressed some concerns regarding truck traffic carrying hazardous substances to the site because of an incident that occurred in July of 2008. Construction of the power plant generally would create additional needs beyond those that already exist. In addition, Emergency

Management office staff would be affected by having to conduct emergency planning activities for the new power plant.

These fire and emergency response departments would be supplemented by a BBNPP onsite emergency response team, which would include a fire brigade. The BBNPP staff will also include an onsite emergency response team and emergency medical technician (EMT) responders. An emergency management plan will be developed for BBNPP, similar to that which already exists for SSES Units 1 and 2, that would address PPL Bell Bend, LLC and agency responsibilities, reporting procedures, actions to be taken, and other items should an emergency occur at BBNPP.

Similar to police services, the existing fire and emergency medical services in Luzerne County and Columbia County appear to be adequate to meet current daily needs within their jurisdictions. As previously described, the significant new tax revenues generated would provide additional funding to expand or improve services and equipment to meet the additional daily demands created by the plant. Thus, it is concluded that there would be a SMALL impact on the fire and law enforcement departments and additional mitigation would not be required.

Medical Services

As indicated in Section 2.5.2.9.6, the two counties currently have fewer physicians when compared to the state, while Columbia County exceeds the ratio for the number of beds. If 2,698 people in-migrated into Luzerne County during construction, the ratio of physicians would be reduced from 2.52 per 1,000 people to 2.50; and the number of beds would be reduced from 3.11 per 1,000 people to 3.08. An additional nine hospital beds and nine physicians could be needed for the project in-migrating population in Luzerne County to meet the state-wide ratios for Pennsylvania (USCB, 2008).

If 2,858 people in-migrated into Columbia County during construction, the ratio of physicians would be reduced from 1.56 per 1,000 people to 1.49. The number of beds would be reduced from 6.30 per 1,000 people to 6.04. No additional hospital beds and nine additional physicians could be needed for the project in-migrating population in Columbia County to meet the state-wide ratios for Pennsylvania (USCB, 2008).

The in-migrating population to the two-county ROI would have little impact on altering the current ratios. For this reason, the impacts from the construction of the BBNPP would likely be SMALL.

Educational System

As described above, an estimated 469 to 821 new households would in-migrate into Luzerne County for construction of BBNPP. It is estimated that these new households would have a maximum of 259 to 453 children, assuming in-migration of the entire indirect workforce, with most of them likely to be school aged (assuming 0.48 children per household). This would represent an increase of 1.1% to 2.0% in the 42,000 students enrolled in the county during 2005-2006. The increased annual real estate taxes (Section 4.4.2.6.2) that would be paid to Luzerne County and the Berwick Area School district during construction of BBNPP would provide additional funds to meet the educational needs of children for the in-migrating construction workforce. If enrollment levels were to increase as a result of constructing the power plant, the district might seek assistance in recruiting additional teachers and could install modular classrooms. A representative of the Berwick Area School District confirmed that capital investments related to infrastructure might not be needed. Because the percentage increase is not great and additional tax revenues would provide funding to meet new project-related impacts to the school system and the Berwick Area School District, it is estimated that the impacts would be SMALL, and would not require additional mitigation.

The in-migration of an estimated 497 to 869 new households into the Columbia County from construction of the BBNPP could place greater demands on the public school systems of Columbia County. It is estimated that these new households would have a maximum of 274 to 480 children, assuming in-migration of the entire indirect workforce, with most of them likely to be school aged (assuming 0.48 children per household). This would represent an increase of 4.6% to 8.0% in the 10,800 students enrolled in the county during 2005-2006. Although the school district would receive some additional funding from real estate taxes generated by these new households (likely to be minimal because adequate housing units are already available in the county and those units are already being taxed), they would not receive additional funding directly from the power plant, except for the Berwick Area School District, because BBNPP does not pay property taxes to Columbia County.

Therefore, because there would be some additional demands placed on the public school systems of Columbia County, without the benefit of significant additional tax revenue, the impacts of the power plant would be MODERATE. However, any additional mitigation that might be required in County schools, such as the installation of a modular/temporary classrooms, the renovation or reconfiguration of existing classroom space, or the retention of additional teaching staff, would likely be associated with those communities in closest proximity to BBNPP, which are served primarily by the Berwick Area School District. As discussed in Section 4.4.2.6, the Berwick Area School District, which includes communities located in both Columbia and Luzerne Counties, would receive local tax and revenue benefits from the construction of BBNPP. These additional revenues would be available to the Berwick Area School District to supplement existing sources of funding for operating expenses and capital improvements.

4.4.2.9 Public Facilities

As discussed above, there is a sufficient quantity of vacant housing units in Luzerne County and Columbia County to meet the housing needs of the in-migrating direct construction workforce for BBNPP, so no new housing units would likely be required. The excess capacity in the water and sewage services and the lack of new construction resulting from the power plant would result in no effects to those services. Additional details about water and sewage capacity are provided below. Although an increase in the population would likely place additional demands on area recreational facilities, the facilities appear to have enough capacity to accommodate the increased demand and impacts would likely be SMALL. In the following discussion, additional details are provided about the capacity of the existing recreational facilities. Area highways, roads, and schools would have increased use levels resulting in MODERATE impacts. These impacts are described in Section 4.4.1.

<u>Water</u>

As noted in ER Section 4.4.2.3, approximately 4,191 people would in-migrate into Luzerne and Columbia counties due to plant construction and 1,366 due to preliminary commissioning and operational activities during construction, or a total of 5,557. Each of these individuals would generate an additional need for water. Based upon an approximation of 100 gallons per day (gpd) of water needed per person standard, the estimated in-migrating construction workforce into each of the counties could result in the following additional need for water:

- Luzerne County - 2,698 people would require 269,800 gpd

- Columbia County - 2,858 people would require 285,800 gpd

This would result in a potential total of 555,600 gpd of water needed to meet the needs of the in-migrating construction workforce and their families in the two-county ROI. This amount represents 1.6% of the current total capacity of 34.0 million gpd, as indicated in ER Table 2.5-29 (excluding systems for which design capacity information is not available). As indicated by the representatives from the various authorities, the existing systems should be able to easily provide this additional amount of water.

Sewage

As previously indicated, approximately 5.557 people may in-migrate into Luzerne and Columbia counties during plant construction. Each person has the potential to generate 150 gallons per day of waste water, as indicated in Section 2.5.2.9.2. As a result, the following additional waste water generation could occur:

- Luzerne County - 2,698 people would require 404,700 gpd
- Columbia County - 2,858 people would require 428,700 gpd

This would result in a potential total of 833,400 gpd of waste water generated by the in-migrating construction workforce and their families in the two-county ROI. This amount represents 1.16% of the current total capacity of 71.8429 million gpd, as indicated in ER Table 2.5-31. As indicated by the representatives from the various authorities, the existing systems should be able to treat this additional amount easily.

Recreation

As indicated in Section 2.5.2.6, the existing ratio for state parkland is 58.7 acres per 1,000 people, which is much greater than a suggested standard of 10 acres for every 1,000 people (Williams and Dyke, 1997). If an additional 5,557 people in-migrate to the two-county ROI, this ratio declines slightly to 57.8 acres per 1,000 people. This ratio, however, does not indicate the true capacity of the facilities because county, local, and other open spaces would be available in addition to state parks. According to a Rickett's Glen State Park representative, average annual visitor numbers are approximately 750,000 to 800,000 per year, and the park could easily handle an additional 3,000 people.

4.4.2.10 References

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4.4.3 Environmental Justice Impacts

This section describes the potential disproportionate adverse socioeconomic, cultural, environmental, and other impacts that construction of BBNPP could have on low income and minority populations within two geographic areas. The first geographic areas is a 50 mi (80 km) radius of the BBNPP power plant, where there is a potential for disproportionate employment, income, and radiological impacts, compared to the general population (NRC, 1999). This analysis also evaluates potential impacts within the region of influence (ROI), most of which is encompassed within a 20 mi (32 km) radius of the power plant site, where more localized potential additional impacts could occur to transportation/traffic, aesthetics, recreation, and other resources, compared to the general population. It also highlights the degree to which each of these populations would disproportionately benefit from construction of the proposed power plant, again compared to the entire population is also discussed.

Section 2.5.1 provides details about the general population characteristics of the study area. Section 2.5.4 provides details about the number and locations of minority and low income populations within a 50 mi (80 km) radius of the BBNPP site, and their related reliance on subsistence uses.

4.4.3.1 Minority and Low Income Populations and Activities

Luzerne County and Columbia County have been defined as the ROI because 87% of the current SSES Units 1 and 2 operational workforce resides there, and it is assumed that the in-migration construction workforce for BBNPP would also primarily reside in and impact this geographic area.

Because the power plant site is currently located on lands owned by SSES, and onsite access to these lands is restricted, no minority or low income residences would be removed or relocated within the ROI. Additionally, the distance of the plant from area residents, in general, is great enough so that these populations would only be affected minimally by construction of the power plant (i.e., noise, air quality, and other disturbances from the footprint of the facility)

4.4.3.1.1 50 Mile (80 km) Comparative Geographic Area

Employment and Income

There would be an estimated maximum 3,950 person workforce constructing the BBNPP power plant from 2012 to 2018, representing a minor increase in the overall employment opportunities for construction workers in: the 50 mi (80 km) comparative geographic area, in which there are a total of 79,804 construction workers in the 22 county area in 2000 (USCB, 2000a); and the state, where a total of 339,363 construction workers were employed in 2000 (USCB, 2000a). Unemployed or underemployed members of minority and low income groups could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders), are hired as part of the construction workforce, and have adequate transportation to access the construction site.

The greatest concentrations of minority populations within the comparative geographic area, but outside of the ROI, primarily reside toward the edges of the 50 mi (80 km) radius in: Lehigh County (located southeast of the BBNPP site with 54 aggregate minority census blocks); Lycoming County (located west-northwest of the BBNPP site with 8 aggregate groups); and Monroe County (located east of the BBNPP site with 6 aggregate groups). Similarly, the greatest concentrations of low income populations are located in: Lehigh County (13 census block groups); Lycoming County (9 census block groups); Monroe County (9 census block groups); Lackawanna County (located toward the edge of the 50 mi (80 km) radius northeast of the BBNPP site with 6 census block groups); and Northumberland County (located southwest of the BBNPP site with 5 census block groups) (Section 2.5.4). Given that the peak construction workforce would represent only about 4.9% of the construction workforce in the 50 mi (80 km) radius in 2000, and 1.2% of the construction workforce in the Commonwealth of Pennsylvania, the beneficial impacts of these potential new employment opportunities likely would be SMALL.

In addition, because of the demand for such skills, low income and minority construction workers from the comparative geographic area that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs to work on the BBNPP. As discussed in Section 2.5.2 and Section 4.4.2, the BBNPP construction workforce average annual salary would be about $70,720, compared to the mean earnings of $64,352 in the Commonwealth of Pennsylvania in 2006 (USCB, 2006c). The beneficial impacts of these increased income levels for low income and minority populations likely would be SMALL.

There are no unique minority or low income populations within the comparative geographic area that would likely be disproportionately adversely impacted by the construction of the proposed power plant because they are located more than 20 mi (32 km, or outside of the ROI) from the BBNPP site where no environmental impacts (e.g., noise, air quality, water quality, changes in habitat, aesthetic, etc.) would likely occur.

4.4.3.1.2 Two-County Region of Influence

Employment and Income

Unemployed or underemployed members of minority and low income groups within the ROI also could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. The beneficial impacts of increased employment opportunities are likely to be more noticeable for minority and low income populations within the ROI, because of the potential hiring levels relative to the smaller existing ROI construction workforce, which would represent 39.0% of the 10,139 construction workforce and 2.1% of the total workforce base of 184,124 employed civilians in the ROI in 2000 (USCB, 2000b) (USCB, 2000c). The minority populations located within the ROI primarily reside in: Wilkes-Barre, which is about 26 mi (42 km) from the BBNPP site; Nanticoke, which is about 16 mi (26 km) from BBNPP site; and Dallas, which is about 24 mi (39 km) from the BBNPP site; and the area located northeast of the BBNPP site on, or just off of, U.S. Highway 11. The low income populations are scattered throughout the Berwick, Bloomsburg, Wilkes-Barre, Nanticoke, and Hazleton areas. Because of the overall significant number of construction jobs that would be created and the general out-migration currently occurring, which is an indicator of lower economic opportunity, the beneficial impacts of these potential new employment opportunities likely would be MODERATE.

In addition, impacts on area businesses, and potentially related increased opportunities to obtain higher paying indirect jobs, could be realized from increased economic activity resulting from BBNPP's purchase of materials from businesses within the ROI. The beneficial impacts of these potential new indirect employment opportunities likely would be SMALL.

As stated in Section 2.5.2 and Section 4.4.2 the BBNPP Construction workforce average annual salary would be about $70,720 compared to the mean earnings of $52,370 in Luzerne County and $48,437 in Columbia County in 2006 (USCB, 2006a) (USCB, 2006b) and both were significantly less than that for the state or the U.S. Because of the demand for such skills, the proportion of low income and minority construction workers from the ROI that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs to work on the BBNPP. Because of the overall significant number of construction jobs that would be created, lower income levels found in the ROI, and the general out-migration currently occurring, the beneficial impacts of these potential new employment opportunities likely would be MODERATE.

4.4.3.2 Subsistence Activities

The types and levels of subsistence activities occurring in the two-county ROI (i.e., Luzerne County and Columbia County) are described in Section 2.5.4. As discussed in this section, wildlife and fish harvesting are important parts of the food gathering activities for minority and low income residents. Susquehanna River sediments would be disturbed and turbidity would likely increase during construction of the water intake and outfall for the BBNPP. These activities could disturb current subsistence catch rates of resident finfish (e.g., muskellunge, northern pike, walleye, yellow perch, largemouth and smallmouth bass, native brook trout, and other species) to the extent that they are occurring near the BBNPP site. Although these activities could disturb traditional subsistence catch rates of finfish, to the extent that they are occurring on the Susquehanna River near the BBNPP intake and outfall sites, the impacts would likely be SMALL for all members of the general public and, thus, would not represent a disproportionate impact to minority or low income populations.

As stated in Section 4.3.1, white-tail deer, turkey, rabbit, squirrel, waterfowl, and other wildlife populations are abundant throughout Pennsylvania, including those areas in the vicinity of the BBNPP site. These populations represent a valuable resource for hunters. Construction of the BBNPP project might affect habitat for some of these species, but adequate similar habitat should be available in the surrounding area, so that overall population and harvest levels would not be affected.

In addition, it is assumed that collection of plants for ceremonial purposes and as a food source (i.e., culturally significant plants, berries, or other vegetation) could be occurring in the two county region of influence. Again, minority and low income populations might be conducting these collection activities in the vicinity of the BBNPP site, or could be harvesting greater quantities of plants, than the general population.

For safety and security reasons the general public is not allowed uncontrolled access to the BBNPP site. Thus, no ceremonial or subsistence gathering of culturally significant plants, berries, or other vegetation occurs on the site and no impacts would occur.

4.4.3.3 References

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Table 4.4-1— Typical Noise Levels of Construction Equipment

Equipment Type	Noise Level, db(A)			
	Peak[a]	**at 50 ft (15.2 m)**	**at 220 ft (67 m)[a]**	**at 1600 ft (488 m)[b]**
Earthmoving				
Loaders	104	73-86	60 - 73	43 – 56
Dozer	107	87-102	74 - 89	57 – 72
Scraper	93	80-89	67 - 76	50 – 59
Graders	108	88-91	75 - 78	58 – 61
Dump trucks	108	88	75	58
Heavy trucks	95	84-89	71 - 76	54 – 59
Materials Handling				
Concrete mixer	105	85	72	55
Crane	104	75-88	62 - 75	45 – 58
Forklift	100	95	82	65
Stationary				
Generator	96	76	63	46
Impact				
Pile driver	105	95	82	65
Jack hammer	108	88	75	58

Note: dBA = A-weighted decibel
a. Distance from the limit of disturbance to nearest residence
b. Distance from centerline reactor building to nearest residence

Table 4.4-2— Projected Level of Service at Key Intersections With and Without Construction of BBNPP
(Page 1 of 2)

Int. No.	Penn DOT	County	Municipality	Intersection	AM LOS Delay (sec/veh)		PM LOS Delay (sec/veh)	
					FNB	Const	FNB	Const
1	3-0	Columbia	South Center	U.S. 11 and S.R 2028	B (14.9)	**E (59.8)**	C (23.1)	**E (62.1)**
2			Briar Creek	U.S. 11 and Briar Creek Plaza Driveways	A (6.6)	**C (21.4)**	C (20.9)	**E (61.2)**
3			Berwick	U.S. 11 (Front Street) and Eaton Street	A (1.1)	A (0.8)	A (2.3)	**F (No-Gap)**
4				U.S. 11 (Front Street) and Poplar Street	C (27)	**F (176.3)**	D (40)	**F (144.9)**
5				U.S. 11 (Front Street) and Orchard Street	A (6.7)	**B (16.9)**	B (17.7)	**D (48.6)**
6				U.S. 11 (Front Street) and S.R. 93 (Orange Street)	A (5.9)	B (11.1)	B (11)	**D (51.7)**
7				U.S. 11 (Second Street) and LaSalle Street	B (11.8)	B (11.4)	B (14.1)	C (22.9)
8				U.S. 11 (Second Street) and Oak Street	A (6.2)	A (5.5)	A (8)	B (10.7)
9				U.S. 11 (Second Street) and Mulberry Street	A (4.8)	A (3.1)	A (5.7)	A (6.3)
10				U.S. 11 (Front Street) and Mulberry Street	A (6.1)	A (2.1)	A (8)	B (10.4)
11				S.R. 1025 (Market Street) and Third Street	A (9.6)	A (8)	B (12.8)	B (15.2)
12				U.S. 11 (Second Street) and Market Street	A (9.7)	**B (19.8)**	B (11.7)	B (18.1)
13				U.S. 11 (Front Street) and Market Street	B (14.2)	**E (63)**	B (15.3)	**C (30.6)**
14				U.S. 11 (Second Street) and Pine Street	A (6)	A (5)	A (8.6)	B (16.6)

Table 4.4-2— Projected Level of Service at Key Intersections With and Without Construction of BBNPP
(Page 2 of 2)

Int. No.	Penn DOT	County	Municipality	Intersection	AM LOS Delay (sec/veh)		PM LOS Delay (sec/veh)	
					FNB	Const	FNB	Const
15	4-0	Luzerne	Nescopeck	S.R. 93 (Third Street) and S.R. 339 (Broad Street)	B (14.1)	C (23.3)	B (12.3)	**C (22.3)**
16				S.R. 93 (Third Street) and Dewey Street	A (4.6)	A (4.4)	A (3.7)	A (5.3)
17			Salem Township	U.S. 11 and Bell Bend Site Entrance		**F (no-gap)**		**F (no-gap)**
18				U.S. 11 and SSES Site Entrance	E (47.1)	**F (no-gap)**	A (5.2)	**F (129.3)**
19			Shickshinny	U.S. 11 (S. Main Street) and S.R. 239	A (7.8)	**C (22.5)**	A (9.4)	**E (69.3)**
20				U.S. 11 (Main Street) and S.R. 239 (Union Street)	B (14.7)	**F (110.8)**	B (15.5)	**F (108.9)**
21			Nanticoke	U.S. 11 and S.R. 29 (Mill Street)	C (23.6)	**D (36)**	C (26.3)	**F (270.8)**
22				U.S. 11 and County Bridge	D (49.5)	C (22.6)	C (24.2)	**F (155.3)**
23				U.S. 11 (E. Poplar Street) and S.R. 29	A (2.9)	F (108.9)	D (30.3)	**F (325.1)**

Notes:
A = Free flow
B = Reasonably free flow
C = Stable flow
D = Approaching unstable flow
E = Unstable flow
F = Forced or breakdown flow
FNB corresponds to Future Year No-Build Condition. Const corresponds to Future Year Construction without any mitigation. LOD Delays include SSES outage impacts.
Yellow highlighted cells indicate cases in which the change in LOS is higher than the acceptable level of LOS degradation.

Table 4.4-3— Estimated Average FTE Construction Workers, by Construction Year/Quarter at the BBNPP

Year / Quarter of Construction	Average FTE Construction Workforce
Year 1:	
1	350
2	800
3	1,250
4	1,600
Year 2:	
1	1,900
2	2,200
3	2,500
4	2,800
Year 3:	
1	3,050
2	3,200
3	3,350
4	3,500
Year 4:	
1	3,683
2	3,867
3	3,950
4	3,950
Year 5:	
1	3,950
2	3,917
3	3,700
4	3,400
Year 6:	
1	3,050
2	1,967
3*	768*
Note: The third "quarter" of construction year 6 has only two months; the length of the total construction period is estimated to be 68 months.	

Table 4.4-4— Total Peak Onsite Nuclear Plant Construction Labor Force Requirements (based on an average of single power plants)

Personnel Description	DOE Percent of Total Peak Personnel, Average Single Unit	DOE Peak Total Personnel, Average Single Unit	Estimated BBNPP Total Peak Workforce Composition
Craft Labor	66.7%	1,600	2,635
Craft Supervision	3.3	80	130
Site Indirect Labor	6.7	160	265
Quality Control Inspectors	1.7	40	67
NSSS Vendor and Subcontractor Staffs	5.8	140	229
EPC Contractor's Managers, Engineers, and Schedulers	4.2	100	166
Owner's O&M Staff	8.3	200	328
Start-Up Personnel	2.5	60	99
NRC Inspectors	0.8	20	32
Total Peak Construction Labor Force	100.0 %	2,400	3,950

Notes:

EPC = Engineering, Procurement, and Construction
O&M = operation and maintenance
NRC = Nuclear Regulatory Commission
NSSS = Nuclear Steam Supply System
Percentages and numbers may total slightly more or less than the total due to rounding.

Table 4.4-5— Peak Onsite Nuclear Power Plant Construction Craft Force Requirements (based on an average of single power plants)

Craft Personnel Description	DOE Percent of Peak Craft Labor Personnel, Average Single Unit	DOE Peak Craft Labor Personnel, Average Single Unit	Estimated BBNPP Peak Craft Workforce Composition
Boilermakers	4.0 %	60	105
Carpenters	10.0	160	264
Electricians/Instrument Fitters	18.0	290	474
Iron Workers	18.0	290	474
Insulators	2.0	30	53
Laborers	10.0	160	264
Masons	2.0	30	53
Millwrights	3.0	50	79
Operating Engineers	8.0	130	211
Painters	2.0	30	53
Pipefitters	17.0	270	448
Sheetmetal Workers	3.0	50	79
Teamsters	3.0	50	79
Total Craft Labor Force	100.0 %	1,600	2,635
Notes: Percentages and numbers may total slightly more or less than the total due to rounding.			

Table 4.4-6— Nuclear Power Plant Craft Labor Force Composition by Phases of Construction (in percent)

Craft Labor	Percentage of Craft Labor Force by Construction Phase						
	Concrete Formwork, Rebar, Embeds, Concrete	**Structural Strength Steel, Misc. Iron & Architectural**	**Earthwork Clearing, Excavation, Backfill**	**Mechanical Equipment Installation**	**Piping Installation**	**Instrument Installation**	**Electrical Installation**
Boilermakers				15			
Carpenters	40	5					2
Electricians/Instrument Fitters						70	96
Iron Workers	20	75		10			
Laborers	30	5	60				1
Millwrights				25			
Operating Engineers	5	15	35	12	15	2	1
Pipefitters				35	80	28	
Teamsters			5	3	5		
Others	5						
Total Percentage of Craft Labor Force	100	100	100	100	100	100	100

Table 4.4-7— Estimates of In-Migrating Construction Workforces in Luzerne County and Columbia County, 20% In-Migration Scenario, from 2012-2017

In-migration Characteristics	Luzerne County	Columbia County	Total ROI
Direct Workforce:			
Maximum Direct Workforce			3,950
Percent of Current SSES Units 1 & 2 Workforce Distribution	42.3%	44.8%	87.1%
Estimated In-migrating Direct Workforce (@ 20% assumption)	334	354	688
In-migrating Direct Workforce Population (@2.48 people/ household)	829	878	1,706
Indirect Workforce:			
Estimated Distribution of Peak Direct Workforce	334	354	688
Peak Indirect Workforce (@1.3866 BEA multiplier)	463	491	954
Indirect Workforce Needs That Could Be Met by Direct Workforce Spouses (@52.2% working females 16 years old and older)	258	273	532
Remaining, Unmet Indirect Workforce Need	205	217	423
Number of Indirect Households Meeting Unmet Need (@1.522 Workers/Households)	135	143	278
In-migrating Indirect Workforce Population (@2.48 people / household)	334	354	688
Total In-migrating Direct and Indirect Workforce People:	1,163	1,232	2,395

Notes:

1. Estimated construction employment multiplier of 1.3866 for the two county ROI. (BEA, 2008)
2. U.S. Census Bureau 2000 census data indicates that the Commonwealth of Pennsylvania had 2.48 people per household.
3. U.S. Census Bureau 2000 census data indicates that, within the Commonwealth of Pennsylvania, 52.2% of households had a working female 16 years old or older (assumed to be a spouse).
4. Numbers estimated for the ROI may vary slightly due to rounding to the nearest whole number.

Table 4.4-8— Estimates of In-Migrating Construction Workforces in Luzerne County and Columbia County, 35% In-Migration Scenario, from 2012-2017

In-migration Characteristics	**Luzerne County**	**Columbia County**	**Total ROI**
Direct Workforce:			
Maximum Direct Workforce			3,950
Percent of Current SSES Units 1 & 2 Workforce Distribution	42.3%	44.8%	87.1%
Estimated In-migrating Direct Workforce (@ 35% assumption)	585	619	1,204
In-migrating Direct Workforce Population (@2.48 people/ household)	1,450	1,536	2,986
Indirect Workforce:			
Estimated Distribution of Peak Direct Workforce	585	619	1,204
Peak Indirect Workforce (@1.3866 multiplier)	811	859	1,670
Indirect Workforce Needs That Could Be Met by Direct Workforce Spouses (@52.2% working females 16 years old and older)	452	478	930
Remaining, Unmet Indirect Workforce Need	359	380	739
Number of Indirect Households Meeting Unmet Need (@1.522 Workers/Household)	236	250	486
In-migrating Indirect Workforce Population (@2.48 people / household)	585	620	1,205
Total In-migrating Direct and Indirect Workforce People:	2,035	2,156	4,191

Notes:

1. Estimated construction employment multiplier of 1.3866 for the two county ROI. (BEA, 2008)
2. U.S. Census Bureau 2000 census data indicates that the Commonwealth of Pennsylvania had 2.48 people per household.
3. U.S. Census Bureau 2000 census data indicates that, within the Commonwealth of Pennsylvania, 52.2% of households had a working female 16 years old or older (assumed to be a spouse for this analysis).
4. Numbers estimated for the ROI may vary slightly due to rounding to the nearest whole number.

Table 4.4-9— Total Work Force Potential During BBNPP Construction, SSES Units 1 and 2 Operations, and SSES Outage Periods

Workforce Groups	Workforce Potential	Total
SSES Units 1 and 2 Operations and Outage		
Units 1 & 2 Operations	1,247	
Units 1 & 2 Outage Workers	1,400 [1]	
Maximum Existing Operational Workforce		2,647
BBNPP Construction		
Peak BBNPP Direct Construction Workforce Accessing Site Daily	3,950 [2]	
Cumulative SSES Units 1 & 2, Outage, plus Peak Direct Construction Workforce		6,597
Indirect In-Migration (35% scenario)	2,987 [3]	
Cumulative Peak Operations, Construction & Outage Workforce		9,584

Notes:

1. Outage workforces would be rotated across years so that an outage would occur for only one unit at a time, usually scheduled for each March.
2. This is the estimated peak construction workforce that would access the BBNPP site on a daily basis.
3. Under the 35% scenario, a maximum of 1,204 of the peak construction workers, 1,670 indirect workers (assumed to be spouses), and 1,317 other family members would in-migrate into the ROI.

Table 4.4-10— Summary of Level of Service (LOS) at Selected Intersections Following Mitigation
(Page 1 of 3)

Int. No.	Penn DOT	County	Municipality	Intersection	Mitigation Measures	AM LOS(delay)		PM LOS(delay)	
						FNB	Const	FNB	Const
1	3-0	Columbia	South Center	U.S. 11 and S.R 2028	Add Thru Lane on RT 11 NB	B (14.9)	B (10.8)	C (23.1)	C (27.5)
2			Briar Creek	U.S. 11 and Briar Creek Plaza Driveways	Add Thru Lane on RT 11 SB	A (6.6)	C (21.5)	C (20.9)	B (16.2)
3			Berwick	U.S. 11 (Front Street) and Eaton Street	New Traffic Signal		B (11.9)		C (30.4)
4				U.S. 11 (Front Street) and Poplar Street	Restriping on Poplar Street	C (27)	D (36.8)	D (40)	B (17.2)
5				U.S. 11 (Front Street) and Orchard Street		A (6.7)	A (8)	B (17.7)	D (49.1)
6				U.S. 11 (Front Street) and S.R. 93 (Orange Street)		A (5.9)	B (11.5)	B (11)	D (45.7)
7				U.S. 11 (Second Street) and LaSalle Street		B (11.8)	A (8.3)	B (14.1)	B (12.6)
8				U.S. 11 (Second Street) and Oak Street		A (6.2)	A (7.4)	A (8)	A (7.7)
9				U.S. 11 (Second Street) and Mulberry Street		A (4.8)	A (3.4)	A (5.7)	A (6)
10				U.S. 11 (Front Street) and Mulberry Street		A (6.1)	B (12.1)	A (8)	A (8.4)
11				S.R. 1025 (Market Street) and Third Street		A (9.6)	A (8.8)	B (12.8)	B (12.8)
12				U.S. 11 (Second Street) and Market Street	Restriping on Market Street	A (9.7)	A (6.3)	B (11.7)	B (14)
13				U.S. 11 (Front Street) and Market Street	Restrict Parking on Front Street	B (14.2)	B (16.3)	B (15.3)	A (8.8)
14				U.S. 11 (Second Street) and Pine Street		A (6)	A (7.6)	A (8.6)	B (15.9)

Table 4.4-10— Summary of Level of Service (LOS) at Selected Intersections Following Mitigation
(Page 2 of 3)

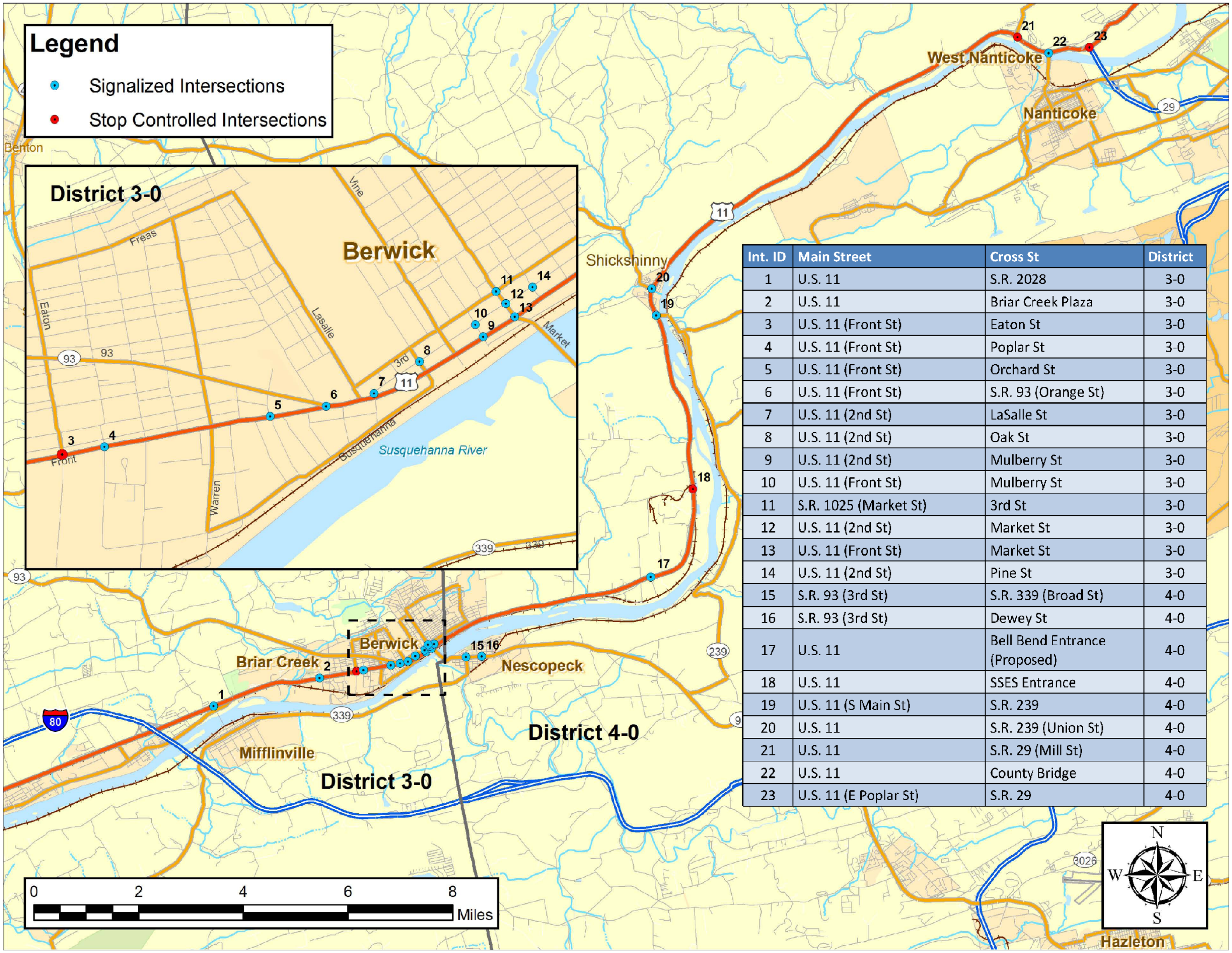
Int. No.	Penn DOT	County	Municipality	Intersection	Mitigation Measures	AM LOS(delay)		PM LOS(delay)	
						FNB	Const	FNB	Const
15	4-0	Luzerne	Nescopeck	S.R. 93 (Third Street) and S.R. 339 (Broad Street)		B (14.1)	C (22.6)	B (12.3)	B (16.4)
16				S.R. 93 (Third Street) and Dewey Street		A (4.6)	A (4.6)	A (3.7)	A (4.3)
17			Salem Township	U.S. 11 and Bell Bend Site Entrance	Proposed Site Access Road		C (20.2)		B (19.6)
18				U.S. 11 and SSES Site Entrance	Temporary Traffic Signal		D (35.2)		D (35.2)
					Add Thru Lane on SB U.S. 11				
19			Shickshinny	U.S. 11 (S. Main Street) and S.R. 239	Add Thru Lane on SB U.S. 11	A (7.8)	A (5.6)	A (9.4)	B (10.8)
					Add Thru Lane on NB U.S. 11				
					Add Right turn bay on S.R. 239 onto U.S. 11				
20				U.S. 11 (Main Street) and S.R. 239 (Union Street)	Restrict Parking on U.S. 11 SB	B (14.7)	B (14.9)	B (15.5)	B (18)
21			Nanticoke	U.S. 11 and S.R. 29 (Mill Street)	Modify intersection to provide un-interrupted flow for NB U.S. 11	C (23.6)	C (29.5)	C (26.3)	C (21.5)
22				U.S. 11 and County Bridge	Add Thru Lane on U.S. 11 NB	D (49.5)	B (14.1)	C (24.2)	C (31.1)
					Make U.S. 11 NB 2 lanes to intersection with S.R. 29				
23				U.S. 11 (E. Poplar Street) and S.R. 29	Temporary Traffic Signal		C (23.3)		B (16.8)
					Restrict left turn from SB U.S. 11 onto NB U.S. 29				

Table 4.4-10— Summary of Level of Service (LOS) at Selected Intersections Following Mitigation
(Page 3 of 3)

Int. No.	Penn DOT	County	Municipality	Intersection	Mitigation Measures	AM LOS(delay)		PM LOS(delay)	
						FNB	Const	FNB	Const

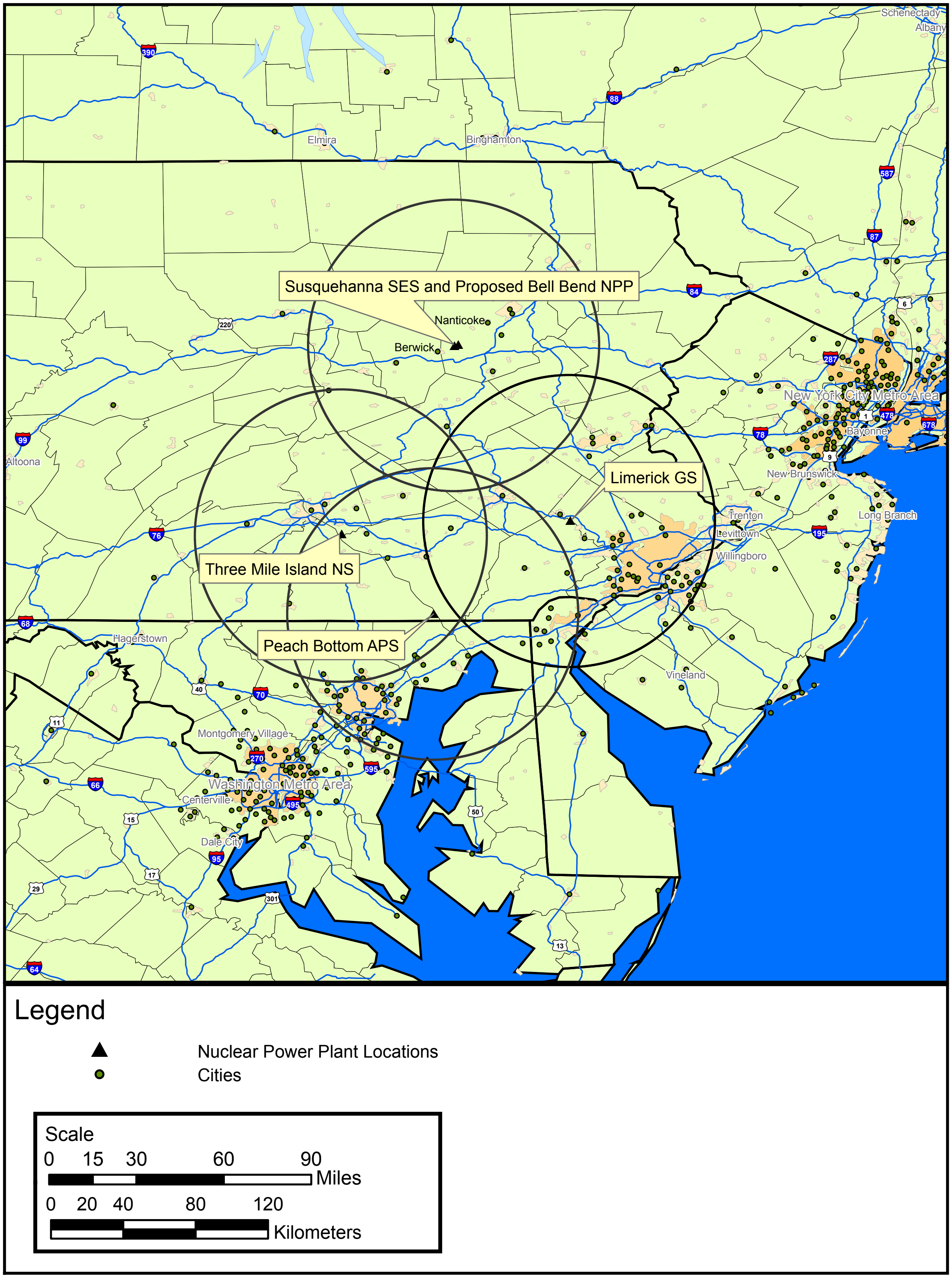
Notes:
A = Free flow
B = Reasonably free flow
C = Stable flow
D = Approaching unstable flow
E = Unstable flow
F = Forced or breakdown flow
"Delay" is average vehicle delay in (seconds/vehicle).
FNB corresponds to Future Year No-Build Condition. Const corresponds to Future Year Construction with mitigation in place. LOD Delays include SSES outage impacts.
Yellow highlighted cells indicate cases in which the proposed mitigation does not fully address the impact.
Blue highlighted cells indicate locations that involve no significant infrastructure changes.

Figure 4.4-1— BBNPP Traffic Impact Assessment Study Area



Int. ID	Main Street	Cross St	District
1	U.S. 11	S.R. 2028	3-0
2	U.S. 11	Briar Creek Plaza	3-0
3	U.S. 11 (Front St)	Eaton St	3-0
4	U.S. 11 (Front St)	Poplar St	3-0
5	U.S. 11 (Front St)	Orchard St	3-0
6	U.S. 11 (Front St)	S.R. 93 (Orange St)	3-0
7	U.S. 11 (2nd St)	LaSalle St	3-0
8	U.S. 11 (2nd St)	Oak St	3-0
9	U.S. 11 (2nd St)	Mulberry St	3-0
10	U.S. 11 (Front St)	Mulberry St	3-0
11	S.R. 1025 (Market St)	3rd St	3-0
12	U.S. 11 (2nd St)	Market St	3-0
13	U.S. 11 (Front St)	Market St	3-0
14	U.S. 11 (2nd St)	Pine St	3-0
15	S.R. 93 (3rd St)	S.R. 339 (Broad St)	4-0
16	S.R. 93 (3rd St)	Dewey St	4-0
17	U.S. 11	Bell Bend Entrance (Proposed)	4-0
18	U.S. 11	SSES Entrance	4-0
19	U.S. 11 (S Main St)	S.R. 239	4-0
20	U.S. 11	S.R. 239 (Union St)	4-0
21	U.S. 11	S.R. 29 (Mill St)	4-0
22	U.S. 11	County Bridge	4-0
23	U.S. 11 (E Poplar St)	S.R. 29	4-0

Figure 4.4-2— Cumulative Overlapping 50 mi (80 km) Zones for Nuclear Power Plants Surrounding BBNPP



4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

This section discusses the exposure from the normal operation of Susquehanna Steam Electric Station (SSES) Units 1 and 2 to construction workers building the Bell Bend Nuclear Power Plant (BBNPP).

4.5.1 Site Layout

The physical location of BBNPP relative to the existing SSES Units 1 and 2 is presented in Figure 4.5-1. BBNPP will be located approximately 5000 ft (1524 m) west of SSES. BBNPP and SSES will have separate protected areas (See Section 3.1).

4.5.2 Radiation sources at BBNPP

During the construction of BBNPP, the construction workers will be exposed to radiation sources from the routine operation of SSES Units 1 and 2. Sources that have the potential to expose construction workers are listed in Table 4.5-1. They are characterized as to location, inventory, shielding, and typical local dose rates. They are also characterized in terms of potential to expose BBNPP construction workers. Only those with significant potential are analyzed in detail. Interior, shielded sources are not included. Figure 4.5-2 and Figure 4.5-3 show the locations of these sources.

These sources are discussed in the Offsite Dose Calculation Manual (ODCM) (PPL, 2006a), the annual Radiological Effluent Release Report (SSES, 2007), the Radiological Environmental Operating Report (PPL, 2006b), and the Final Safety Analysis Report (SSES, 2006a). The eight main sources of radiation to BBNPP construction workers are gaseous effluents, liquid effluents, the Independent Spent Fuel Storage Installation (ISFSI), the Condensate Storage Tanks (CSTs), the Low Level Radioactive Waste Handling Facility (LLRWHF), the SEALANDS, the Steam Dryer Storage Vault, and the Turbine Building. These are discussed below.

Airborne effluents are released via four rooftop vents: two on the reactor building and two on the turbine building. The releases are reported annually to the NRC. Doses to the general population are also reported annually.

Effluents from the liquid waste disposal system produce small amounts of radioactivity in the discharge to the Susquehanna River. All waterborne effluents are released in batch mode and are sampled and analyzed prior to release. Waterborne effluents from the site are released into the cooling tower blowdown line for dilution prior to release in the Susquehanna River (SSES, 2006a).

There are five sources of direct radiation that could contribute to construction workers dose: the Independent Spent Fuel Storage Installation (ISFSI), the Low Level Radioactive Waste Handling Facility (LLRWHF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. There are three sources identified that are not significant contributors to construction worker dose. These are listed in Table 4.5-1 along with a brief discussion (SSES, 2006a).

There are five sources of skyshine radiation that could contribute to construction workers dose: the Condensate Storage Tanks (CSTs), the Low Level Radioactive Waste Handling Facility (LLRWHF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. They are also listed in Table 4.5-1.

4.5.3 Historic Dose Rates

The historical annual dose rates reported to the NRC are summarized in Table 4.5-2.

4.5.4 Projected Dose Rates at BBNPP

Annual doses from all sources combined were calculated for each 99 ft (30 m) by 97 ft (30 m) foot square on the plant grid. For purposes of dose calculation, a 100% occupancy is assumed. (For purposes of collective dose calculations, the occupancy for construction workers is 2,200 hours per year.) The doses are the sum of the dose rates from the eight main sources; gaseous effluents, liquid effluents, the Independent Spent Fuel Storage Installation (ISFSI), the Condensate Storage Tanks (CSTs), the Low Level Radioactive Waste Handling Facility (LLRWHF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. Figure 4.5-4 shows the site map with isodose contours that represent the average annual dose rates during construction, assuming an ISFSI filled to license capacity. Table 4.5-13 shows the maximum dose rate for each of the nine construction zones.

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The number of workers (in terms of Full Time Equivalents) and their location by zone are given in Table 4.5-3. The details of the collective dose calculations are given in the following discussion. Dose rates from all sources combined were calculated for each square on the plant grid. The dose rates were the sum of the dose rate from the eight main sources and assume 100% occupancy.

The equation for dose rate during year t at location x,y on the plant grid is:

$$\dot{D}_{x,y} = \dot{D}_{gas} + \dot{D}_{liq} + \dot{D}_{ISFSI,t} + \dot{D}_{CST} + \dot{D}_{LLRWHF} + \dot{D}_{SEA} + \dot{D}_{SD} + \dot{D}_{TB}$$

where the terms are explained in the ER Sections.

The equation for the average dose rate in a zone is:

$$\bar{\dot{D}}_z = \frac{1}{N_z} \sum_{(\text{all x,y in z})} \dot{D}_{x,y}$$

where N_z is the number of squares in the zone.

The equation for collective dose for the construction period is:

$$D = \frac{2200}{8760} \sum_t \sum_z \bar{\dot{D}}_z FTE_{z,t}$$

where $\frac{2200}{8760}$ = fraction of work hours per year, $\bar{\dot{D}}_z$ is defined as above, and $FTE_{z,t}$ is the full time equivalent in zone z during year t, or

$FTE_{z,t} = P_Z C_t$

The probability of a worker in each zone, P_Z, reflects the average construction worker and is based on an approximation of how much time the average worker spends in each zone, as shown in Table 4.5-16. The spatial distribution of zones on the site is shown (with labeled and color coded areas) in Figure 4.5-4. There are many locations where construction workers are not expected to perform work activities, so they are not marked in the figure. These areas that are marked are chosen because of planned activities at those locations.

4.5.4.1 Gaseous Dose Rates

The construction worker dose due to SSES gaseous effluents depends upon the airborne effluents release and the atmospheric transport to the worker. The releases, which flow out of the SSES Units 1 and 2 plant vents, are reported annually to the NRC. Doses to the general population are also reported annually. The releases are modeled as ground level releases, which is conservative as it does not take credit for the height of the releases. Although there are two reactor building and two turbine building vents, the Radioactive Effluent Release Reports (e.g., SSES, 2007) only give a total release. The releases were conservatively modeled assuming the vent closest to the workers.

The annual dose rate from gaseous effluents to construction workers on the BBNPP site is bounded by the following equation:

$$\dot{D}_{(j),\ gas} = c_{(j)}\, r^{b} \quad \text{(mrem/year)}$$

where,

c(j) = dose type coefficient,

j = dose type (TEDE, total body, organ, or thyroid),

r = distance from the release point to the target in feet = $\sqrt{(N - N_s)^2 - (E - E_s)^2}$

N,E = location of receptor on plant grid in feet,

Ns,Es = location of source on plant grid in feet, and

b = fitting parameter for atmospheric dispersion model = -1.6925.

The c(j) are documented in Table 4.5-4. The equation is based on annual average, undecayed, undepleted ground level x/Qs without credit for building wake from Susquehanna Steam Electric Station site meteorology for the years 2001 to 2007 (see ER Table 2.7-158) which are modeled as

$$\frac{X}{Q}(r) = 38.603r^{-1.6925}$$

where r is defined as above. The equation also assumes the most limiting gaseous effluent releases from the period 2001 through 2011. The model is based upon 100% occupancy.

Gaseous release rates are shown in Table 4.5-5. Based on these, dose rates were calculated for the years 2001 through 2011 for an onsite location with a known x/Q using the Regulatory

Guide 1.109 (NRC, 1977) method with Total Effective Dose Equivalent (TEDE) calculations done according to Federal Guidance Reports 11 (EPA, 1988) and 12 (EPA, 1993). Using this methodology, the highest dose rates occurred in the year 2002.

4.5.4.2 Liquid Dose Rates

In their Annual Radiological Effluent Release Reports, SSES provides an estimate of the actual dose to the public from radioactive liquid and gaseous effluents. This is done, in part, to demonstrate compliance with the ALARA design objectives of 10 CFR 50 Appendix I (which include 3 mrem per year to the total body as the objective for liquid effluents). The SSES dose estimates for the years 2001 through 2011 are summarized in Table 4.5-2, and indicate continued compliance with the design objectives of Appendix I. During the BBNPP construction period, the occupancy rate of construction workers (who will be considered members of the public) may increase to as much as 2200 hours per year in the shoreline area. The dose to construction workers from liquid effluents under this occupancy rate was projected, and the results are shown in Table 4.5-8. These results are based on releases and dilutions in Table 4.5-6 and Table 4.5-7. Table 4.5-8 shows that if SSES liquid release quantities equivalent to or greater than those detected in 2010 were anticipated to occur during any year during the future construction period, then measures would have to be taken to ensure compliance with the Appendix I objectives.

For the projection of BBNPP construction worker dose due to the shoreline exposure from SSES liquid effluents, it is conservatively assumed that in all six years of construction the SSES liquid releases are equivalent to that which would lead to a construction worker dose equal to the 3 mrem per year objective of Appendix I, given a 2200 hour per year occupancy rate.

4.5.4.3 ISFSI Dose Rates

For the purposes of this calculation the ISFSI is broken into north and south pieces. The north piece is assumed filled in 2010. Loading of the south piece is assumed to begin in 2009. The dose rate from the ISFSI is:

$$D_{ISFSI,t} = k[f_N(t)\varpi_N e^{-\mu r_N} + f_s(t)\varpi_s e^{-\mu r_s}]$$

where, D = annual dose,

ϖ_I = the solid angle between the ISFSI and receptor in steradians = $\pi\left(1 - \frac{r_i}{\sqrt{R^2 + r_i^2}}\right)$

k = fitting parameter = 1500 mrem/sr,

$f_i(t)$ = function describing loading with time dependence = $a_i + b_i t$,

μ = effective removal coefficient in air in ft^{-1} = 0.002056 ft^{-1},

r_i = distance from ISFSI piece i to receptor in ft = $\sqrt{(N - N_i)^2 + (E - E_i)^2}$

t = time in years,

a_i = fitting parameter.

a_N = -233.88

a_S = -253.79

b_i = fitting parameter,

$b_N = 0.177\ yr^{-1}$

$b_S = 0.126\ yr^{-1}$

R = effective source radius = 116.52 ft, and

N_I, E_I = State plane coordinates of source and receptor

N_N = 341550 ft

N_S = 341450 ft

$E_N = E_s$ = 2,440,600 ft.

The equation is based upon TLD measurements in the vicinity of the ISFSI combined with an assumption that the ISFSI is filled to license capacity throughout the construction period. It was also assumed that no radiological decay would occur in the ISFSI source term during the construction period. These results are bounding for any loading of the ISFSI up to and including the full licensed capacity of 105 Horizontal Storage Modules (HSMs).

Figure 4.5-5 shows the effect of distance on dose and compares this to TLD measurements. Figure 4.5-6 shows a satellite image of the ISFSI, Figure 4.5-7 shows the locations of the TLDs. The effect of time on dose is shown in Figure 4.5-8. And the basic input data to the time equation (the load history and projections) are shown in Table 4.5-9.

4.5.4.4 Condensate Storage Tank Dose Rate

The Unit 1 Condensate Storage Tank (CST) is shielded on the west side by the Unit 1 Turbine Building, on the east by the Diesel Generator Building wall, on the north by the Refueling Water Storage Tank, and on the south by the Unit 1 Reactor Building (see Figure 4.5-2 and Figure 4.5-3). The Unit 2 CST is shielded on the west by the Unit 2 Turbine Building and on the north by the Unit 2 reactor Building. It is partially shielded on the east and south by an overflow berm which extends 10.5 ft (3.2 m) above grade, which means that 21.5 ft (6.6 m) is exposed above the berm height. When a line is projected from the top of the Unit 2 CST over the berm wall, it converges with grade 575 ft (175 m) from the CST, which means direct radiation is absorbed by the ground beyond that point. Since construction workers will spend the majority of their time on the BBNPP property west of SSES and the remaining time further than 575 ft (175 m) east or south of the CSTs, additional analysis for the direct dose from the CSTs is not required. The skyshine dose rate from the Condensate Storage Tank is represented by the equation

$$\dot{D}_{CST} = 2E\text{-}05e^{-0.0018r}$$

where $\dot{D}_{CST}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This equation is based on the source terms listed in Table 4.5-10 (SSES, 2006a) and a source material of water with a density of 62 lb/ft^3 (1 g/cm^3). The effect of distance on dose is shown in Figure 4.5-9.

4.5.4.5 LLRWHF Dose Rate

The Low Level Radioactive Waste Handling Facility (LLRWHF) provides temporary storage for low level radioactive waste materials produced at SSES. It stores dry active waste, dewatered waste, and solidified waste. It is also used to temporarily store pieces of contaminated plant equipment and radioactive material. The LLRWHF source term, shown in Table 4.5-11, was conservatively developed based on 10,000 sq ft (283 m^2) of storage in containers with a maximum dose rate of 100 µGy/hr (10 mR/hr) at 6.56 ft (2 m), the maximum allowable per 49 CFR 173.411, (CFR, 2008). The storage containers are condensate demineralizer radwaste containers in linear storage modules. The facility has a 23 x 2 module orientation to the east and a 7 x 2 module orientation to the south. The more conservative 23 x 2 was used in calculating the direct dose to construction workers.

The dose rate from the LLRWHF is

$$\dot{D}_{LLRWHF} = 15068653r^{-2.3}$$

where $\dot{D}_{LLRWHF}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in feet. The effect of distance on dose is shown in Figure 4.5-10.

4.5.4.6 Sealand Container Dose Rate

The area due west of the Unit 2 cooling tower was selected as an area to store actual or potentially contaminated material in containers such as SEALAND containers. The area is surrounded by dirt embankments to the west, north, and south. The Unit 2 cooling tower lies to the east. It is estimated that 80 SEALAND containers can be stored in the area. The dose rate from the SEALAND Containers is

$$\dot{D}_{SEA} = 5.7055e^{-0.0006r}$$

where $\dot{D}_{SEA}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in feet. The source term used to develop the equation is given in Table 4.5-12. It is based on the restriction that the dose rate on the exterior of each SEALAND container shall not exceed 20 µGy/hr (2 mR/hr). The dirt embankment is assumed to provide 3 ft (0.91 m) of shielding with a density of that for dry packed earth (i.e., 93.6 lb/ft^3 (1.5 g/cm^3)). The effect of distance on dose is shown in Figure 4.5-11.

4.5.4.7 Steam Dryer Storage Vault Dose Rate

The original SSES Units 1 and 2 steam dryers, which have been replaced, are stored on site in a concrete storage facility located east of the LLRWHF. Prior to placement in storage, the steam dryers were cut into halves. Each half was placed inside its own steel box with one inch (2.54 cm) thick walls. The dose rate from the steam dryer storage vault is

$$\dot{D}_{SD} = 14.37e^{-0.003r}$$

where $\dot{D}_{SD}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This is based on 708.3 Ci of Co-60 which is based on surveys performed by SSES. The effect of distance on dose is shown in Figure 4.5-13.

4.5.4.8 Turbine Building Dose Rate

The N –16 present in the reactor steam in the primary steam lines, turbines, and moisture separators provides a dose contribution to locations outside the plant structure as a result of the high energy gamma rays which it emits as is decays. The following equipment components, located on or above the Turbine Building Operating Floor are considered in this analysis:

- High pressure turbine inlet piping
- High pressure turbines
- Moisture separators
- Low pressure turbines
- 42 inch cross-around piping from the moisture separators to the CIVs
- Combined intermediate valves and piping to low pressure turbines

Sources below the operating floor are not considered. Typically, these sources are pipes of smaller volume than the equipment above the Operating Floor, and hence, of smaller N –16 inventory. Their dose rate contributions are bounded by the equipment above the Operating Floor because the floor provides additional shielding to limit their contribution.

The dose rate from the turbine building is

$$\dot{D}_{TB} = 0.8744e^{-0.0009r}$$

where $\dot{D}_{TB}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This was developed using source terms based upon component volume, the density of the source within the volume (i.e., water or steam), and the N –16 concentration listed in Table 12.2-11 of the Susquehanna Steam Electric Station Final Safety Analysis Report (SSES, 2006a). The effect of distance on dose for both direct and skyshine sources is shown in Table 4.5-14.

4.5.5 Compliance with Dose Rate Regulations

BBNPP construction workers are, for the purposes of radiation protection, members of the general public. This means that the dose rate limits are 100 mrem/year (1 mSv/yr). The construction workers (with the exception of certain specialty contractors loading fuel or using industrial radiation sources for radiography) do not deal with radiation sources.

There are three regulations that govern dose rates to members of the general public. Dose rate limits to the public are provided in 10 CFR 20.1301 (CFR, 2007a) and 10 CFR 20.1302 (CFR, 2007b) and 10 CFR 50, Appendix I (CFR, 2007c). Compliance with 10 CFR 20.1302 is discussed in Section 4.5.7. The design objectives of 10 CFR 50, Appendix I apply relative to maintaining dose as low as reasonably achievable (ALARA) for construction workers. Also, 40 CFR 190 (CFR, 2007d) applies because it is referred to in 10 CFR 20.1301. Note that 10 CFR 20.1001, 20.1201, 20.1203, 20.1204 and 20.1205 do not apply to the general public, but only to radiation workers. Thus, they will not be considered here.

4.5.5.1 10 CFR 20.1301

The 10 CFR 20.1301 regulations limit annual doses from licensed operations to individual members of the public to 100 mrem (1 mSv) total effective dose equivalent (TEDE). In addition, the dose rate from external sources to unrestricted areas must be less than 2 mrem (20 µSv) in any one hour. This applies to the public both outside and within controlled areas. Given that the relevant sources are relatively constant in time, the hourly limit is met if the annual limit is met.

Dose rates in each 99 ft (30 m) by 97 ft (30 m) block of the plant grid are calculated and the array of dose rates searched for the maximum in the construction zones. The maximum dose rates by zone are given in Table 4.5-13. For an occupational year, i.e., 2200 hours on site, the maximum dose would be on Confers Lane west of SSES Unit 1 Cooling Tower where the dose is 16.2 mrem (162 µSv). This assumes the worker stood on Confers Lane for all working hours in one year. This is less than 100 mrem (1 mSv), thus, it meets the criterion and therefore construction workers can be considered to be members of the general public, for the purpose of radiation protection.

4.5.5.2 10 CFR 50, Appendix I

The 10 CFR 50, Appendix I criteria (CFR, 2007c) apply only to effluents. The purpose of the criteria are to assure adequate design of effluent controls (in this case at SSES Units 1 and 2). The annual limits for liquid effluents are 3 mrem (30 µSv) to the total body and 10 mrem (100 µSv) to any organ. Table 4.5-14 shows that these criteria are met for liquid effluents with regard to BBNPP construction workers.

For gaseous effluents, the pertinent limits are 10 mrad (100 µGy) to air gamma and 20 mrad (200 µGy) to air beta without credit for occupancy. If the air dose limits are not met then the limits become doses to real people (with occupancy credit allowed) of 5 mrem (50 µSv) to the total body and 15 mrem (150 µSv) to organs including skin.

Table 4.5-14 shows the TEDE dose limit for whole body assuming full-time occupancy. There is no dose rate to a construction worker that exceeds the limits. Therefore, the criteria have been met. Note that BBNPP occupational zones, during construction, are treated, for purposes of these criteria, as unrestricted areas.

4.5.5.3 40 CFR 190

The 40 CFR 190 (CFR, 2007d) criteria apply to annual doses, called dose rate here because the units are in mrem per year, received by members of the general public exposed to nuclear fuel cycle operations, i.e., nuclear power plants. Therefore, these regulations apply to BBNPP construction workers on the plant site just as they apply to members of the general public who live offsite. The most limiting part of the regulations states, "The annual dose equivalent (shall) not exceed 25 millirem (per year) to the whole body." In the case of SSES effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met.

Table 4.5-13 shows that the maximum dose rate in any of the construction zones is less than 25mrem/2,200 hours (250 μSv/2,200 hours). The units are expressed to be clear that an occupancy of 2,200 hours is assumed. The use of 2,200 hours assumes the worker works 40 hours per week for 50 weeks per year and works 10% overtime per year. Note, that this dose rate is for the maximum dose rate locations. The actual dose is expected to be considerably smaller. Therefore, the requirements of 40 CFR 190 will be met for all construction workers.

4.5.6 Collective Doses to BBNPP Workers

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The total worker collective dose for the combined years of construction is 10.3 person-rem (1.03E-01 person-Sieverts). This is a best estimate based upon the worker census and occupancy projections shown in Table 4.5-15 , and Table 4.5-16 . The breakdown of collective dose by construction year and occupancy zone is given in Table 4.5-17 . This assumes 2200 hours per year occupancy for each worker.

4.5.7 Radiation Protection and ALARA Program

Due to the exposure from SSES normal operations, there will be a radiation protection and ALARA program for BBNPP construction workers. This program will meet the guidance of Regulatory Guide 8.8 to maintain individual and collective radiation exposures ALARA. This program will also meet the requirements of 10 CFR 20.1302.

Since the construction workers are not radiation workers, but, for the purposes of radiation protection, are members of the general public, individual monitoring and training of construction workers on BBNPP is not required. Construction workers will be treated, for the purposes of radiation protection, as if they were members of the general public in unrestricted areas. However, they are exposed to effluent radioactivity and direct radiation sources from SSES Units 1 and 2. The most important reason for the ALARA program is that these source levels may vary over time from the projections made here. There may also be additional sources, unaccounted for by the above projections.

Some features of the BBNPP Construction ALARA Program will be:

- The BBNPP ALARA Committee will operate in parallel with the SSES Units 1 and 2 ALARA Committee. The Committee will meet quarterly, will review monitoring, and review worker does rate and dose projections. The Committee will be empowered to stop work if the "general public" status of any construction worker(s) is jeopardized. The Committee will publish a dose and dose rate report for construction workers.
- BBNPP radiation protection personnel will report to the Committee. The Radiation Protection Department will be in charge of radiation monitoring, worker census and source census. It will use this data to project worker doses and dose rates on a monthly basis into the next quarter and will report to the Committee.
- The SSES ODCM and other SSES processes such as the ISFSI projected loading process, will be updated to link dose-important SSES activities to the projected BBNPP construction worker ALARA dose.
- The Committee will periodically identify and direct construction management to control the occupancy of areas where dose rates can be high enough that workers might exceed 40 CFR 190 limitations.
- The Committee will establish a radiation monitoring program to assure 40 CFR 190 regulations are met for BBNPP construction workers. It is expected that monitoring will

require either special instruments and/or measurements closer to sources and projected by calculation further out to where workers will be.

- The Committee will require, before any high dose rate evolutions, such as the transport of fuel to the ISFSI or transport of highly radioactive components, that the BBNPP ALARA evaluation be revised.
- Consumption of onsite agricultural products such as plants and fish will be prohibited.
- The program will survey the radiation levels in construction areas and will survey radioactive materials in effluents released to construction areas to demonstrate compliance with dose limits for BBNPP workers.
- The program will comply with the annual dose limit in 10 CFR 20.1301 by measurement or calculation to verify that the total effective dose equivalent to the individual worker likely to receive the highest dose from any onsite operation does not exceed the annual dose limit.

4.5.8 References

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CFR, 2007c. Code of Federal Regulations, Title 10 CFR 50, Appendix I, Numerical Guides for Design Objectives and Limiting Condition for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents, 2007.

CFR, 2007d. Title 40, Code of Federal Regulations, Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations, 2007.

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SSES, 2006a. PPL Susquehanna, LLC, "Susquehanna Steam Electric Station Final Safely Analysis Report, Revision 62," December 2006.

SSES, 2006b. PPL Susquehanna, LLC, "Susquehanna Steam Electric Station Units 1 & 2 Radioactive Effluent Release Report and Offsite Dose Calculation Manual for 2005 Annual Report," ADAMS Accession No. ML061210159

SSES, 2005. PPL Susquehanna, LLC, "Susquehanna Steam Electric Station Units 1 & 2 Radioactive Effluent Release Report, 2004 Annual Report."

SSES, 2004. PPL Susquehanna, LLC, "Susquehanna Steam Electric Station Units 1 & 2 Radioactive Effluent Release Report, 2003 Annual Report," ADAMS Accession No. ML041280097.

SSES, 2003. PPL Susquehanna, LLC, "Susquehanna Steam Electric Station Units 1 & 2 Radioactive Effluent and Waste Disposal Report, 2002 Annual Report."

SSES, 2002. PPL Susquehanna, LLC, '"Susquehanna Steam Electric Station Annual Effluent & Waste Disposal Report for January - December 2001."

Table 4.5-1— Radiation Sources at SSES Units 1 and 2

Source	Location on Plant Grid	Radioactive Inventory	Shielding	Dose Rate	Significance to BBNPP Workers
Unit 1 and Unit 2 Reactor Building Vents	N 341, 175 E 2, 442, 100	Gaseous effluents characterized in RETS	N/A (Airborne)	150 µSv/yr/unit (15 mrem/yr/unit)	The gaseous effluents from reactor building and turbine building vents are contributors to the dose to construction workers.
Unit 1 and Unit 2 Turbine Building Vents	N 341, 175 E 2,441,833	Gaseous effluents characterized in RETS	N/A (Airborne)	150 µSv/yr/unit (15 mrem/yr/unit)	
Liquid Waste Management System	N/A	Liquid Effluents characterized in RETS	N/A (waterborne)	<30 µSv/yr (3 mrem/yr/unit) total body <100 µSv/yr (10 mrem/yr) organ	Direct source
Refueling Water Storage Tank (RWST)	N341,424, E2,442,000.5	Liquid Waste	Shielded by neighboring buildings	<15 µSv/hr (1.5 mR/hr) contact	No impact because shielded by Turbine building
Condensate Storage Tanks (CSTs)	U1 N341,371, E2,442,007.5 U2 N340,979.0, E2,442,007.5	Liquid Waste	Shielded by neighboring buildings	Turbine Building shields direct dose to construction workers from the CSTs	Direct source
Low Level Radwaste Handling Facility	N341,400. E2,440,500	Temporary storage for low level radioactive waste and radioactive material	Concrete walls	<100 µSv/yr (10 mR/hr) at 6.6 ft (2 m)	Direct source.
Temporary Laundry Facility	Southwest of Unit 2 Turbine Building	Contaminated laundry	Shielded by neighboring buildings	<79.4 µSv/hr (7.94 mR/hr) at 1 ft (0.305 m) perimeter	No impact.
BB-10-0242 ISFSI	N341,500 E2,440,600	Spent fuel	Concrete walls	<700 µSv/hr (70 mrem/hr) on surface	Time dependent source.
BB-10-0242 Turbine shine due to N –16 in the reactor steam	N 341,175 E 2,441,833	N –16	Shielding around each turbine train and a roof slab over each moisture separator	<5 µSv/hr (0.5 mrem/hr)	Skyshine source.
BB-10-0242 SEALAND Containers	N340,750, E2,441,050	LSA boxes, barrels, shield blocks, turbine rotor stands, etc.	Shielded by dirt embankment	< 20 µSv/hr (2 mR/hr) at exterior surface	Direct and skyshine source.
Steam Dryers	N341,060.3, E 2,440,653.5	Original steam dryers	Concrete walls	< 5 µSv/yr (0.5 mrem/hr)	Direct and skyshine source.
Dry Active Waste Reduction System Facility	N341,700, E2,441,900	Equivalent of 30 mCi (1.11E+09 Bq)Co-60 max.	None	Negligible	No impact because of low activity.
For the purposes of this table and for the purpose of providing dual units, 1 mR/hr is assumed equal to 1 mrem/hr, i.e. 1 mR/hr = 10 µSv/hr.					

Table 4.5-2— Historical All-Source Compliance for Offsite General Public

Maximum Offsite Doses for 40CFR190 Compliance from Gas and Liquid Releases as Reported to the NRC in Annual Effluent Reports						
	Dose in mrem/year (µSv/yr)			Dose of Fraction of 40CFR190 Limit		
Year*	WB	Thyroid	Limiting Organs	WB	Thyroid	Limiting Organs
2011	1.19E+00 (1.19E+01)	1.19E+00 (1.19E+01)	1.46E+00 (1.46E+01)	4.76E-02	1.59E-02	5.84E-02
2010	2.29E+00 (2.29E+01)	2.31E+00 (2.31E+01)	7.47E+00 (7.47E+01)	9.16E-02	3.08E-02	2.99E-01
2009	1.03E+00 (1.03E+01)	1.03E+00 (1.03E+01)	1.03E+00 (1.03E+01)	4.12E-02	1.37E-02	4.12E-02
2008	5.49E-01 (5.49E+00)	5.49E-01 (5.49E+00)	5.50E-01 (5.50E+00)	2.20E-02	7.32E-03	2.20E-02
2007	8.25E-01 (8.25E+00)	8.24E-01 (8.24E+00)	8.28E-01 (8.28E+00)	3.30E-02	1.10E-02	3.31E-02
2006	5.22E-01 (5.22E+00)	5.27E-01 (5.27E+00)	5.27E-01 (5.27E+00)	2.09E-02	7.03E-03	2.11E-02
2005	8.34E-01 (8.34E+00)	8.38E-01 (8.38E+00)	8.38E-01 (8.38E+00)	3.34E-02	1.12E-02	3.35E-02
2004	1.22E+00 (1.22E+01)	1.22E+00 (1.22E+01)	1.22E+00 (1.22E+01)	4.88E-02	1.63E-02	4.88E-02
2003	1.20E+00 (1.20E+01)	1.21E+00 (1.21E+01)	1.21E+00 (1.21E+01)	4.80E-02	1.61E-02	4.84E-02
2002	1.30E+00 (1.30E+01)	1.29E-00 (1.29E+01)	1.31E+00 (1.31E+00)	5.20E-02	1.72E-02	5.24E-02
2001	2.15E-01 (2.15E+00	2.18E-01 (2.18E+00)	2.23E-01 (2.23E+00)	8.60E-03	2.91E-03	8.92E-03
2000	1.68E-01 (1.68E+00)	1.73E-01 (1.73E+00)	1.73E-01 (1.73E+00)	6.72E-03	2.31E-03	6.92E-03
1999	9.80E-02 (9.80E-01)	9.80E-02 (9.80E-01)	9.80E-02 (9.80E-01)	3.92E-03	1.31E-03	3.92E-03
1998	1.38E-01 (1.38E+00)	1.38E-01 (1.38E+00)	1.38E-01 (1.38E+00)	5.52E-03	1.84E-03	5.52E-03
1997	1.63E-01 (1.63E+00)	1.63E-01 (1.63E+00)	1.63E-01 (1.63E+00)	6.52E-03	2.17E-03	6.52E-03
1996	5.64E-01 (5.64E+00)	5.64E-01 (5.64E+00)	5.64E-01 (5.64E+00)	2.26E-2	7.52E-03	2.26E-2
1995	2.31E-01 (2.31E+00)	2.31E-01 (2.31E+00)	(2.31E-01) (2.31E+00)	9.24E-03	3.08E-03	9.24E-03
1994	1.41E-01 (1.41E+00)	1.41E-01 (1.41E+00)	1.41E-01 (1.41E+00)	5.64E-03	1.88E-03	5.64E-03
Maximum Value Any Year	2.29E+00 (2.29E+01)	2.31E+00 (2.31E+01)	7.47E+00 (7.47E+01)	9.16E-02	3.08E-02	2.99E-01

* The doses for the years 2000 through 2011 are calculated based on individually reported whole body, thyroid, and organ doses in SSES annual effluent reports. The doses for the years 1994 through 1999 are presented as summarized in the SSES annual effluent reports, with the maximum organ dose being conservatively substituted for the total body and thyroid doses.

Table 4.5-3— FTE for BBNPP Construction Workers by Year of Construction

Zone	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
B	0.5	2.3	4.0	4.0	4.0	3.2
C	353.1	1516.9	2660.0	2660.0	2660.0	2138.0
L	10.6	45.6	80.0	80.0	80.0	64.3
O	85.0	365.0	640.0	640.0	640.0	514.4
P	10.6	45.6	80.0	80.0	80.0	64.3
R	10.6	45.6	80.0	80.0	80.0	64.3
S	35.0	150.5	264.0	264.0	264.0	212.2
T	35.0	150.5	264.0	264.0	264.0	212.2
W	1.6	6.8	12.0	12.0	12.0	9.6
By Year	542.2	2328.9	4084.0	4084.0	4084.0	3282.5

Table 4.5-4— Gaseous Dose Rate Type and Coefficients

Dose Type	Pathway	Methodology	c(j)
TEDE	All	ICRP26	1259244
Total Body	External	ICRP2	692594.5
Skin	External	ICRP2	845547.4
Organ I & P	I & P	ICRP2	721931
Total Body	All	ICRP2	813007.5
Thyroid	All	ICRP2	812811.5
Organ	All	ICRP2	826407

Table 4.5-5— Historic Gaseous Releases For 2001 Through 2011

(Page 1 of 2)

Nuclide	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)	2007 Ci (Bq)	2008 Ci (Bq)	2009 Ci (Bq)	2010 Ci (Bq)	2011 Ci (Bq)
H-3	1.29E+02 (4.77E+12)	1.37E+02 (5.07E+12)	1.56E+02 (5.77E+12)	1.60E+02 (5.92E+12)	8.61E+01 (3.19E+12)	5.87E+01 (2.17E+12)	8.94E+01 (3.31E+12)	5.99E+01 (2.22E+12)	3.75E+01 (1.39E+12)	3.10E+01 (1.15E+12)	4.70E+01 (1.74E+12)
N-13							5.81E+01 (2.15E+12)			2.33E+00 (8.62E+10)	
Ar-41		9.68E+00 (3.58E+11)	3.37E-03 (1.25E+08)	8.07E+00 (2.99E+11)			5.59E+00 (2.07E+11)			9.42E-03 (3.49E+08)	
Cr-51	6.48E-03 (2.40E+08)	3.31E-03 (1.22E+08)	1.09E-03 (4.03E+07)	2.52E-04 (9.32E+06)	2.22E-04 (8.21E+06)	2.07E-04 (7.66E+06)	2.90E-04 (1.07E+07)			1.41E-04 (5.22E+06)	1.61E-04 (5.96E+06)
Mn-54	5.96E-04 (2.21E+07)	1.21E-03 (4.48E+07)	2.61E-04 (9.66E+06)	2.74E-04 (1.01E+07)	2.33E-04 (8.62E+06)	1.93E-04 (7.14E+06)	1.23E-04 (4.55E+06)		5.27E-05 (1.95E+06)		
Co-57					3.11E-06 (1.15E+05)						
Co-58	4.43E-05 (1.64E+06)	5.62E-05 (2.08E+06)	9.42E-06 (3.49E+05)	9.93E-06 (3.67E+05)	2.43E-05 (8.99E+05)	1.09E-05 (4.03E+05)	6.86E-06 (2.54E+05)			4.20E-06 (1.55E+05)	
Co-60	2.27E-04 (8.40E+06)	1.48E-03 (5.48E+07)	8.83E-05 (3.27E+06)	1.79E-04 (6.62E+06)	2.54E-04 (9.40E+06)	3.82E-04 (1.41E+07)	5.86E-04 (2.17E+07)	4.06E-05 (1.50E+06)	1.58E-04 (5.85E+06)	2.00E-05 (7.40E+05)	7.08E-05 (2.62E+06)
Fe-59	6.40E-05 (2.37E+06)	2.32E-04 (8.58E+06)			1.69E-05 (6.25E+05)						
Zn-65								2.36E-05 (8.73E+05)			
Kr-85m			7.68E-04 (2.84E+07)	6.02E-01 (2.23E+10)			5.06E-01 (1.87E+10)			3.00E-04 (1.11E+07)	
Kr-87			5.44E-03 (2.01E+08)				7.20E-02 (2.66E+09)			1.98E-03 (7.33E+07)	
Kr-88			3.01E-01 (1.11E+08)	2.48E-01 (9.18E+09)		6.94E-01 (2.57E+10)	5.31E+00 (1.96E+11)			1.04E-03 (3.85E+07)	
Kr-89			6.03E-02 (2.23E+09)								
Sr-90		2.95E-05 (1.09E+06)									
Nb-95	5.39E-06 (1.99E+05)			4.11E-06 (1.52E+05)	6.43E-06 (2.38E05)		2.33E-06 (8.62E+04)				
Ag-110m	1.18E-05 (4.37E+05)	2.32E-06 (8.58E+04)									
I-131					9.71E-06 (3.59E+05)	1.41E-05 (5.22E+05)	2.32E-06 (8.58E+04)				

Table 4.5-5— Historic Gaseous Releases For 2001 Through 2011

(Page 2 of 2)

Nuclide	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)	2007 Ci (Bq)	2008 Ci (Bq)	2009 Ci (Bq)	2010 Ci (Bq)	2011 Ci (Bq)
I-133					1.28E-05 (4.74E+05)						
Xe 133			2.36E+04 (8.73E+06)	6.04E-01 (2.23E+10)			5.58E-01 (2.06E+10)				
Xe-133m	1.27E-01 (4.70E+09)										
Xe 135	6.65E+00 (2.46E+11)		2.84E-03 (1.05E+08)			4.13E-02 (1.53E+09)	3.39E-02 (1.25E+09)			9.78E-04 (3.62E+07)	
Xe 135m			1.52E-02 (5.62E+08)				2.05E-01 (7.59E+09)			6.18E-03 (2.29E+08)	
Xe 137			1.52E-01 (5.62E+09)				2.38E+00 (8.81E+10)			9.42E-02 (3.49E+09)	
Xe 138			6.73E-02 (2.49E+09)				7.93E-01 (2.93E+10)			2.30E-02 (8.51E+08)	
Cs 137		3.23E-06 (1.20E+05)									
Ce 141	1.76E-06 (6.51E+04)										
Ce 144	6.97E-06 (2.58E+05)				1.48E-05 (5.48E+05)						
Ba-La 140					8.73E-06 (3.23E+05)						
As 76	6.26E-03 (2.32E+08)	1.86E-03 (6.88E+07)									
Na 24	2.52E-04 (9.32E+06)	8.08E-05 (2.99E+06)									
Tc 99m	1.05E-03 (3.89E+07)	1.78E-04 (6.59E+06)									

Table 4.5-6— Historic Liquid Releases for 2001 through 2011
(Page 1 of 2)

Nuclide	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)	2007 Ci (Bq)	2008 Ci (Bq)	2009 Ci (Bq)	2010 Ci (Bq)	2011 Ci (Bq)
Ar-41			5.68E-07 (2.10E+04)								
Ba-131			1.46E-05 (5.40E+05)								
Ce-141						1.61E-06 (5.96E+04)					
Co-58	4.28E-04 (1.58E+07)	2.92E-04 (1.08E+07)	3.42E-04 (1.26E+07)	2.03E-04 (7.51E+06)	5.33E-05 (1.97E+06)	3.25E-05 (1.20E+06)	1.88E-05 (6.95E+05)	2.47E-04 (9.15E+06)	1.06E-03 (3.91E+07)	1.78E-02 (6.60E+08)	3.65E-03 (1.35E+08)
Co-60	3.90E-03 (1.44E+08)	3.27E-03 (1.21E+08)	5.14E-03 (1.90E+08)	1.32E-03 (4.88E+07)	9.01E-04 (3.33E+07)	2.67E-04 (9.89E+06)	2.94E-04 (1.09E+07)	7.85E-04 (2.90E+07)	7.38E-03 (2.73E+08)	5.05E-02 (1.87E+09)	1.67E-02 (6.19E+08)
Cr-51	1.25E-02 (4.61E+08)	1.15E-02 (4.27E+08)	8.16E-03 (3.02E+08)	2.67E-03 (9.86E+07)	8.43E-04 (3.12E+07)	7.08E-04 (2.62E+07)	1.00E-05 (3.70E+05)	5.21E-04 (1.93E+07)	1.49E-04 (5.51E+06)	1.95E-02 (7.22E+08)	6.04E-04 (2.23E+07)
Cs-137				6.57E-07 (2.43E+04)		4.45E-05 (1.64E+06)	7.61E-07 (2.82E+04)			6.56E-04 (2.43E+07)	
F-18	1.82E-07 (6.72E+03)			1.96E-07 (7.25E+03)							
Fe-55	3.89E-03 (1.44E+08)	6.45E-03 (2.39E+08)	9.07E-03 (3.36E+08)	1.95E-02 (7.22E+08)							
Fe-59	3.03E-05 (1.12E+06)	6.12E-04 (2.26E+07)	1.29E-04 (4.77E+06)	4.90E-05 (1.81E+06)	4.63E-06 (1.71E+05)	1.24E-05 (4.58E+05)		6.96E-05 (2.58E+06)	1.02E-05 (3.77E+05)	3.02E-04 (1.12E+07)	2.06E-06 (7.62E+04)
H-3	2.44E+01 (9.04E+11)	6.61E+01 (2.45E+12	7.75E+01 (2.87E+12)	6.21E+01 (2.30E+12)	7.40E+01 (2.47E+12)	8.29E+01 (3.30E+12)	7.05E+01 (2.61E+12)	3.30E+01 (1.22E+12)	2.29E+01 (8.47E+11)	5.73E+01 (2.12E+12)	5.18E+01 (1.92E+12)
I-133					2.45E-07 (9.07E+03)						
Kr-88											5.74E-06 (2.12E+05)
Mn-54	3.44E-03 (1.27E+08)	7.68E-03 (2.84E+08)	5.34E-03 (1.98E+08)	1.29E-03 (4.77E+07)	2.95E-04 (1.09E+07)	1.40E-04 (5.17E+06)	7.31E-05 (2.70E+06)	4.22E-04 (1.56E+07)	1.27E-04 (4.72E+06)	1.43E-02 (5.28E+08)	7.47E-05 (2.76E+06)
Na-24	2.48E-06 (9.18E+04)									2.41E-03 (8.92E+07)	
Nb-95			6.81E-07 (2.52E+04)	2.66E-06 (9.84E+04)				5.30E-06 (1.96E+05)	1.14E-06 (4.22E+04)	2.26E-05 (8.35E+05)	6.66E-07 (2.46E+04)
P-32	1.18E-05 (4.36E+05)	3.06E-05 (1.13E+06)									
Rh-105								3.53E-05 (1.31E+06)			

Table 4.5-6— Historic Liquid Releases for 2001 through 2011
(Page 2 of 2)

Nuclide	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)	2007 Ci (Bq)	2008 Ci (Bq)	2009 Ci (Bq)	2010 Ci (Bq)	2011 Ci (Bq)
Sb-124	9.07E-07 (3.36E+04)		2.96E-06 (1.10E+05)	9.12E-07 (3.37E+04)	3.32E-06 (1.23E+05)	1.22E-05 (4.51E+05)		2.17E-06 (8.03E+04)	1.13E-06 (4.18E+04)	8.10E-05 (3.00E+06)	
Sb-125										2.19E-05 (8.10E+05)	
Sn-117m			8.93E-07 (3.30E+04)								
Ta-182			9.76E-06 (3.61E+05)			4.38E-06 (1.62E+05)				5.26E-06 (1.95E+05)	2.75E-06 (1.02E+05)
Tc-99m						1.17E-06 (4.33E+04)	1.04E-06 (3.85E+04)			9.56E-05 (3.54E+06)	
Zn-65	1.20E-04 (4.42E+06)	4.28E-06 (1.58E+05)	4.63E-05 (1.71E+05)	3.61E-06 (1.34E+05)	1.88E-04 (6.96E+06)	9.77E-05 (3.61E+06)	4.17E-05 (1.54E+06)	3.45E-04 (1.27E+07)	7.11E-05 (2.63E+06)	5.76E-03 (2.13E+08)	1.81E-03 (6.69E+07)
Xe-133		1.59E-04 (5.86E+06)	9.46E-05 (3.50E+06)	4.64E-05 (1.72E+06)	1.19E-04 (4.41E+06)	3.03E-05 (1.12E+06)	2.45E-05 (9.05E+05)				4.98E-06 (1.84E+05)
Xe-135m		4.97E-06 (1.84E+05)									
Xe-135	7.52E-07 (2.78E+04)	1.31E-04 (4.85E+06)	6.63E-05 (2.45E+06)	4.74E-05 (1.75E+06)	1.42E-04 (5.27E+06)	9.96E-05 (3.68E+06)	4.60E-05 (1.70E+06)	1.89E-06 (6.99E+04)			2.10E-06 (7.77E+04)

Table 4.5-7— Historic Dilutions for Input to LADTAPII

Year	1st Quarter L (ft^3)	2nd Quarter L (ft^3)	3rd Quarter L (ft^3)	4th Quarter L (ft^3)	Total L (ft^3)	Release Duration (min)	Flow Rate L/ min (ft^3/sec)
2011	1.71E+08 (6.04E+06)	2.34E+08 (8.26E+06)	3.18E+08 (1.12E+07)	8.09E+07 (2.86E+06)	8.04E+08 (2.84E+07)	1.96E+04	4.10E+04 (2.41E+01)
2010	8.23E+07 (2.91E+06)	2.18E+08 (7.70E+06)	3.98E+08 (1.41E+07)	5.30E+07 (1.87E+06)	7.51E+08 (2.65E+07)	2.62E+04	2.87E+04 (1.69E+01)
2009	4.97E+07 (1.76E+06)	1.16E+08 (4.10E+06)	2.65E+07 (9.36E+05)	3.20E+07 (1.13E+06)	2.24E+08 (7.91E+06)	7.30E+03	3.07E+04 (1.81E+01)
2008	4.49E+07 (1.59E+06)	9.15E+07 (3.23E+06)	4.43E+07 (1.56E+06)	1.42E+08 (5.01E+06)	3.23E+08 (1.14E+07)	9.34E+03	3.46E+04 (2.03E+01)
2007	2.17E+07 (7.66E+05)	1.34E+08 (4.73E+06)	1.01E+08 (3.57E+06)	1.43E+08 (5.05E+06)	4.00E+08 (1.41E+07)	1.51E+04	2.65E+04 (1.56E+01)
2006	1.43E+08 (5.05E+06)	1.03E+08 (3.64E+06)	9.69E+07 (3.42E+06)	2.63E+08 (9.29E+06)	6.06E+08 (2.14E+07)	1.88E+04	3.22E+04 (1.90E+01)
2005	8.91E+07 (3.15E+06)	2.43E+08 (8.58E+06)	1.63E+08 (5.76E+06)	7.86E+07 (2.78E+06)	5.74E+08 (2.03E+07)	1.81E+04	3.17E+04 (1.87E+01)
2004	1.04E+08 (3.67E+06)	1.54E+08 (5.44E+06)	1.17E+08 (4.13E+06)	2.18E+07 (7.07E+05)	3.97E+08 (1.40E+07)	1.15E+04	3.45E+04 (2.03E+01)
2003	9.05E+07 (3.20E+06)	6.54E+07 (2.31E+06)	2.13E+08 (7.52E+06)	1.38E+08 (4.87E+06)	5.07E+08 (1.76E+07)	1.49E+04	3.40E+04 (2.00E+01)
2002	7.70E+07 (2.72E+06)	2.07E+08 (7.31E+06)	1.58E+08 (5.58E+06)	1.33E+08 (4.70E+06)	5.75E+08 (2.03E+07)	1.90E+04	3.03E+04 (1.78E+01)
2001	6.84E+07 (2.42E+06)	6.39E+07 (2.26E+06)	3.36E+07 (1.19E+06)	2.20E+07 (7.77E+05)	1.88E+08 (6.64E+06)	6.28E+03	2.99E+04 (1.76E+01)

Table 4.5-8— Historic Shoreline Dose

Year	Worker Dose with 2200 hr/yr occupancy mrem/yr (µSv/yr))
2001	3.58E-01 (3.58E+00)
2002	3.14E-01 (3.14E+00)
2003	4.07E-01 (4.07E+00)
2004	1.03E-01 (1.03E+00)
2005	7.40E-02 (7.40E-01)
2006	2.40E-02 (2.40E-01)
2007	2.90E-02 (2.90E-01)
2008	6.10E-02 (6.10E-01)
2009	6.11E-01 (6.11E+00)
2010	4.60E+00 (4.60E+01)
2011	1.04E+00 (1.04E+01)

NOTE: All doses in this table are based on occupancy factors that are conservatively appropriate for the projection of future construction worker dose.

Table 4.5-9— Historic and Projected Loading of SSES ISFSI

Year	Bundles Added	# of Bundles Total	HSMs (est. 2008)	HSMs (est. 2012)
1999	208	208	4	4
2000	208	416	8	8
2001	468	884	17	17
2002	416	1300	25	25
2003	0	1300	25	25
2004	409	1709	32	32
2005	244	1953	36	36
2006	305	2258	41	41
2007	305	2563	46	46
2008	427	2990	53	52
2009	366	3356	59	58
2010	732	4088	71	67
2012	0	4088	71	Note a
2012	488	4576	79	Note a
2013	488	5064	87	Note a
2014	0	5064	87	Note a
2015	488	5552	95	Note a
2016	488	6040	103	Note a
2017	122	6162	105	Note a

Note a: The 2012 ISFSI load estimate does not predict loads for 2011 through 2016.

Table 4.5-10— Condensate Storage Tank Source Terms
(Page 1 of 2)

Isotope	Curies (Bq)
Br 83	2.75E-02 (1.02E+09)
Br 84	2.42E-02 (8.95E+08)
I 131	3.80E-02 (1.41E+09)
I 132	2.18E-01 (8.07E+09)
I 133	2.39E-01 (8.84E+09)
I 134	2.90E-01 (1.07E+10)
I 135	3.07E-01 (1.14E+10)
Cr 51	5.66E-05 (2.09E+06)
Mc 56	2.97E-03 (1.10E+08)
Co 58	5.67E-04 (2.10E+07)
CO 60	5.68E-05 (2.10E+07)
Sr 89	3.78E-04 (1.40E+07)
Sr 91	9.45E-03 (3.50E+08)
Sr 92	8.54E-03 (3.16E+08)
Mo 99	2.41E-03 (8.92E+07)
Tc 99m	2.35E-02 (8.70E+08)
Te 132	5.40E-03 (2.00E+08)
Cs 138	2.87E-02 (1.06E+09)
Ba 139	2.56E-02 (9.47E-08)
Ba 140	1.12E-03 (4.14E+07)
Ba 141	4.72E-03 (1.75E+08)
Ba 142	1.78E-03 (6.59E+07)
Np 239	2.62E-02 (9.69E+08)
Cs 140	9.75E-03 (3.61E+08)
Y 92	3.44E-03 (1.27E+08)
Cs 139	2.91E-02 (1.08E+09)
Sr 93	7.89E-04 (2.92E+07)
Y 93	1.71E-04 (6.33E+06)
La 141	1.89E-03 (6.99E+07)
Br 85	1.77E-03 (6.55E+07)
Tc 101	1.32E-03 (4.88E+07)
Cs 134	9.08E-05 (3.36E+06)
Cs 136	6.20E-05 (2.29E+06)
Cs 137	1.36E-04 (5.03E+06)
Na 24	1.97E-04 (7.29E+06)
Ni 65	1.77E-05 (6.55E+05)
W 187	3.11E-04 (1.15E+07)
Cs 141	4.44E-04 (1.64E+07)
Sr 94	1.09E-05 (4.03E+05)
Y 94	2.85E-05 (1.05E+06)
Y 95	1.06E-05 (3.92E+05)
Rb 91	1.05E-02 (3.89E+08)
Rb 90	2.03E-02 (7.51E+08)
Rb 89	1.42E-02 (5.25E+08)
Rb 88	2.13E-03 (7.88E+07)
La 142	1.23E-03 (4.55E+07)

Table 4.5-10— Condensate Storage Tank Source Terms
(Page 2 of 2)

Isotope	Curies (Bq)
Y 91m	5.11E-03 (1.89E+08)
Y 91	1.46E-05 (5.40E+05)
Sr 90	2.61E-05 (9.66E+05)
La 140	6.12E-05 (2.26E+06)

Table 4.5-11— LLRWHF Source Term

Isotope	Activity in Ci (Bq)
Ba 137m	2.59E-02 (9.58E+08)
Cr 51	3.17E-04 (1.17E+07)
Fe 59	9.49E-04 (3.51E+07)
Mn 54	1.66E-01 (6.14E+09)
Co 58	3.49E-03 (1.29E+08)
Cs 134	9.88E-03 (3.66E+08)
I 129	1.09E-03 (4.03E+07)
Sb 124	2.32E-05 (8.58E+05)
Co 60	1.12E+00 (4.14E+10)
Fe 55	1.40E+00 (5.18E+10
I 131	8.45E-06 (3.13E+05)
Zn 65	5.67E-02 (2.10E+09)

Table 4.5-12— SEALAND Container Source Term

Isotope	Activity in Ci (Bq)
Ba 137m	3.15E-04 (1.17E+07)
Co 58	2.95E-03 (1.09E+08)
Co 60	1.51E-01 (5.59E+09)
Cs137	3.33E-04 (1.23E+07)
Fe 55	4.00E+00 (1.48E+11)
Fe 59	5.35E-03 (1.98E+08)
I 129	1.30E-05 (4.81E+05)
Mn 54	2.26E-01 (8.36E+09)
Nb 95	3.10E-04 (1.15E+07)
Ni 59	2.21E-04 (8.18E+06)
Ni 63	1.33E-02 (4.92E+08)
Sb 125	5.62E-04 (2.08E+07)
Sr 89	4.74E-06 (1.75E+05)
Sr 90	2.42E-06 (8.95E+04)
Tc 99	7.07E-06 (2.62E+05)
Y 90	2.42E-06 (8.95E+04)

Table 4.5-13— Maximum Dose Rate by Zone for 2200 Hours for All Sources

Zone	Zone Description	Maximum Dose Rate mrem/2200 hours (μSv/ 2200 hours)
B	Batch Plant	1.58 (15.8)
C	Construction on main structures	0.37 (3.7)
L	Laydown	7.50 (75.0)
O	Office/Trailer	1.06 (10.6)
P	Parking	.67 (6.7)
R	Roads	16.37 (163.7)
S	Shoreline, tunnel, barge, in/out flow	3.33 (33.3)
T	Tower/Basin	0.38 (3.8)
W	Warehouse	0.93 (9.3)

Table 4.5-14— Maximum Annual Dose Rates from SSES Effluents, by Zone

Maximum Dose Rate (mrem/year) Assuming Full Time Occupancy - Effluents Only				
Zone	**Zone Description**	**Gaseous Effluents Whole Body Dose mrem/yr (uSv/yr)**	**Gaseous Effluents Organ Dose mrem/yr (uSv/yr)**	**Liquid Effluents TEDE mrem/yr (uSv/yr)**
B	Batch Plant	2.21 (22.1)	2.30 (23.0)	0.00 (0.0)
C	Construction on main structures	.40 (4.0)	.42 (4.2)	0.00 (0.0)
L	Laydown	1.38 (13.8)	1.44 (14.4)	0.00 (0.0)
O	Office/Trailer	1.43 (14.3)	1.49 (14.9)	0.00 (0.0)
P	Parking	0.67 (6.7)	0.70 (7.0)	0.00 (0.0)
R	Roads	2.50 (25.0)	2.61 (26.1)	0.00 (0.0)
S	Shoreline, tunnel, barge, in/out flow	.54 (5.4)	0.57 (5.7)	11.95 (119.5)
T	Tower/Basin	0.41 (4.1)	0.43 (4.3)	0.00 (0.0)
W	Warehouse/Shops	.96 (9.6)	1.00 (10.0)	0.00 (0.0)

Table 4.5-15— Projected Construction Worker Census

Year of Construction	Construction Workers On Site
Year 1	531
Year 2	2281
Year 3	4000
Year 4	4000
Year 5	4000
Year 6	3215

Table 4.5-16— Occupancy by Construction Zone

Zone Description	Zone Code	Conservative Occupancy Fractions Used in Calculation
Batch Plant	B	0.001
Construction on main structures	C	0.665
Laydown	L	0.020
Office/Trailer	O	0.160
Parking	P	0.020
Roads	R	0.020
Shoreline, tunnel, barge, in/out flow	S	0.066
Tower/Basin	T	0.066
Warehouse/Shops	W	0.003
	TOTAL	1.021

Table 4.5-17— Collective Dose to BBNPP Construction Workers

		Collective Dose by Zone person-rem and (person-Sv)						
Zone	**Zone Description**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**By ZONE**
B	Batch Plant	7.24E-04 (7.24E-06)	3.11E-03 (3.11E-05)	5.45E-03 (5.45E-05)	5.45E-03 (5.45E-05)	5.45E-03 (5.45E-05)	4.38E-03 (4.38E-05)	2.46E-02 (2.46E-04)
C	Construction on main structures	1.10E-01 (1.10E-03)	4.74E-01 (4.74E-03)	8.31E-01 (8.31E-03)	8.31E-01 (8.31E-03)	8.31E-01 (8.31E-03)	6.68E-01 (6.68E-03)	3.74E+00 (3.74E-02)
L	Laydown	8.09E-03 (8.09E-05)	3.48E-02 (3.48E-04)	6.10E-02 (6.10E-04)	6.10E-02 (6.10E-04)	6.10E-02 (6.10E-04)	4.90E-02 (4.90E-04)	2.75E-01 (2.75E-03)
O	Office/Trailer	2.72E-02 (2.72E-04)	1.17E-01 (1.17E-03)	2.05E-01 (2.05E-03)	2.05E-01 (2.05E-03)	2.05E-01 (2.05E-03)	1.65E-01 (1.65E-03)	9.23E-01 (9.23E-03)
P	Parking	4.06E-03 (4.06E-05)	1.74E-02 (1.74E-04)	3.06E-02 (3.06E-04)	3.06E-02 (3.06E-04)	3.06E-02 (3.06E-04)	2.46E-02 (2.46E-04)	1.38E-01 (1.38E-03)
R	Roads	1.00E-02 (1.00E-04)	4.30E-02 (4.30E-04)	7.54E-02 (7.54E-04)	7.54E-02 (7.54E-04)	7.54E-02 (7.54E-04)	6.06E-02 (6.06E-04)	3.40E-01 (3.40E-03)
S	Shoreline, tunnel, barge, in/out flow	1.28E-01 (1.28E-03)	5.48E-01 (5.48E-03)	9.61E-01 (9.61E-03)	9.61E-01 (9.61E-03)	9.61E-01 (9.61E-03)	7.73E-01 (7.73E-03)	4.33E+00 (4.33E-02)
T	Tower/Basin	1.19E-02 (1.19E-04)	5.11E-02 (5.11E-04)	8.96E-02 (8.96E-04)	8.96E-02 (8.96E-04)	8.96E-02 (8.96E-04)	7.20E-02 (7.20E-04)	4.04E-01 (4.04E-03)
W	Warehouse	1.16E-03 (1.16E-05)	5.00E-03 (5.00E-05)	8.76E-03 (8.76E-05)	8.76E-03 (8.76E-05)	8.76E-03 (8.76E-05)	7.04E-03 (7.04E-05)	3.95E-02 (3.95E-04)
By Year	By YEAR-->	3.01E-01 (3.01E-03)	1.29E+00 (1.29E-02)	2.27E+00 (2.27E-02)	2.27E+00 (2.27E-02)	2.27E+00 (2.27E-02)	1.82E+00 (1.82E-02)	1.03E+01 (1.03E-01)

Figure 4.5-1— Site Layout

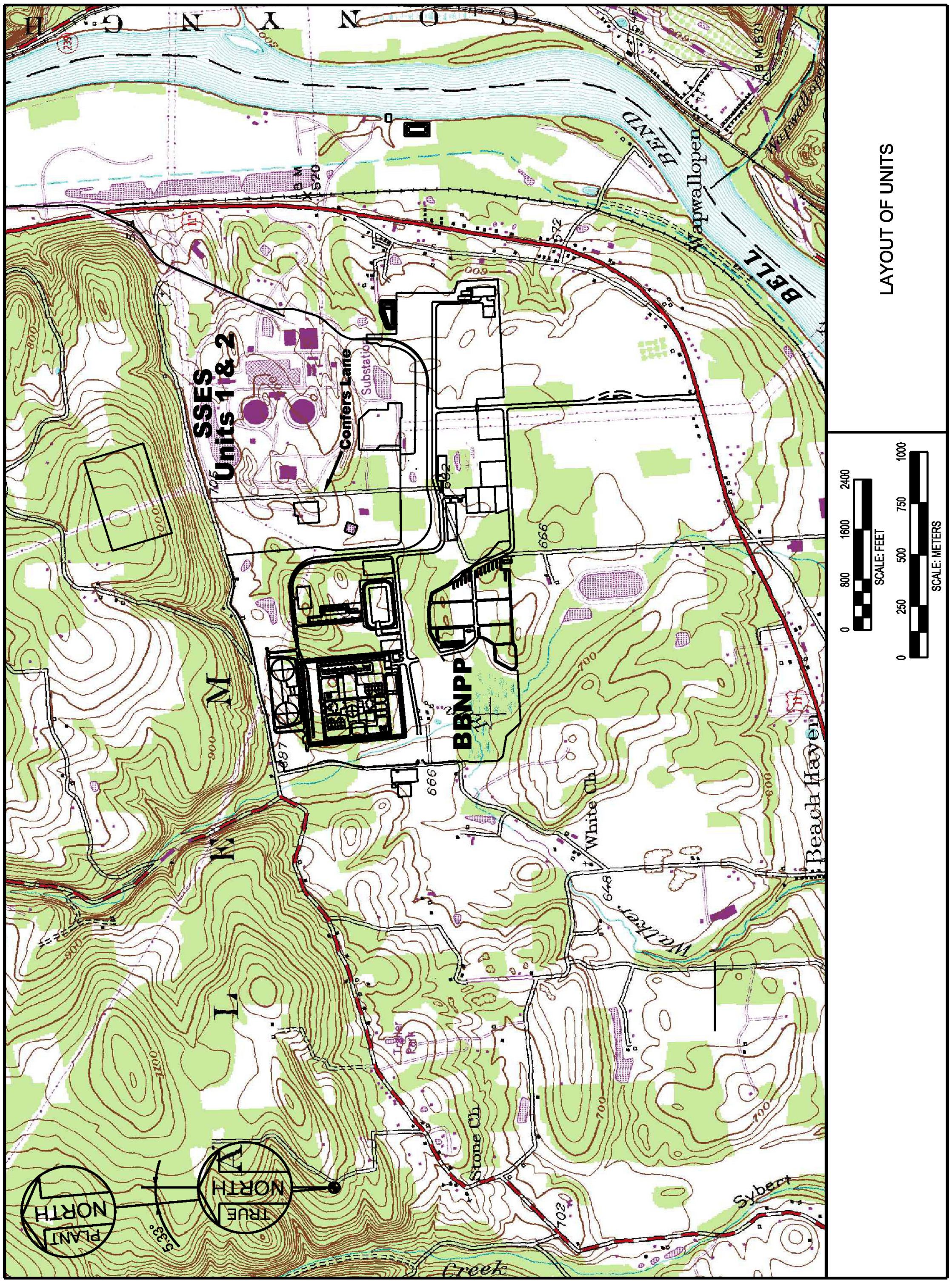


Figure 4.5-2— CST and RWST Locations on Plant Grid

(Background image for illustration purposes only. Pertinent information is labeled in red)

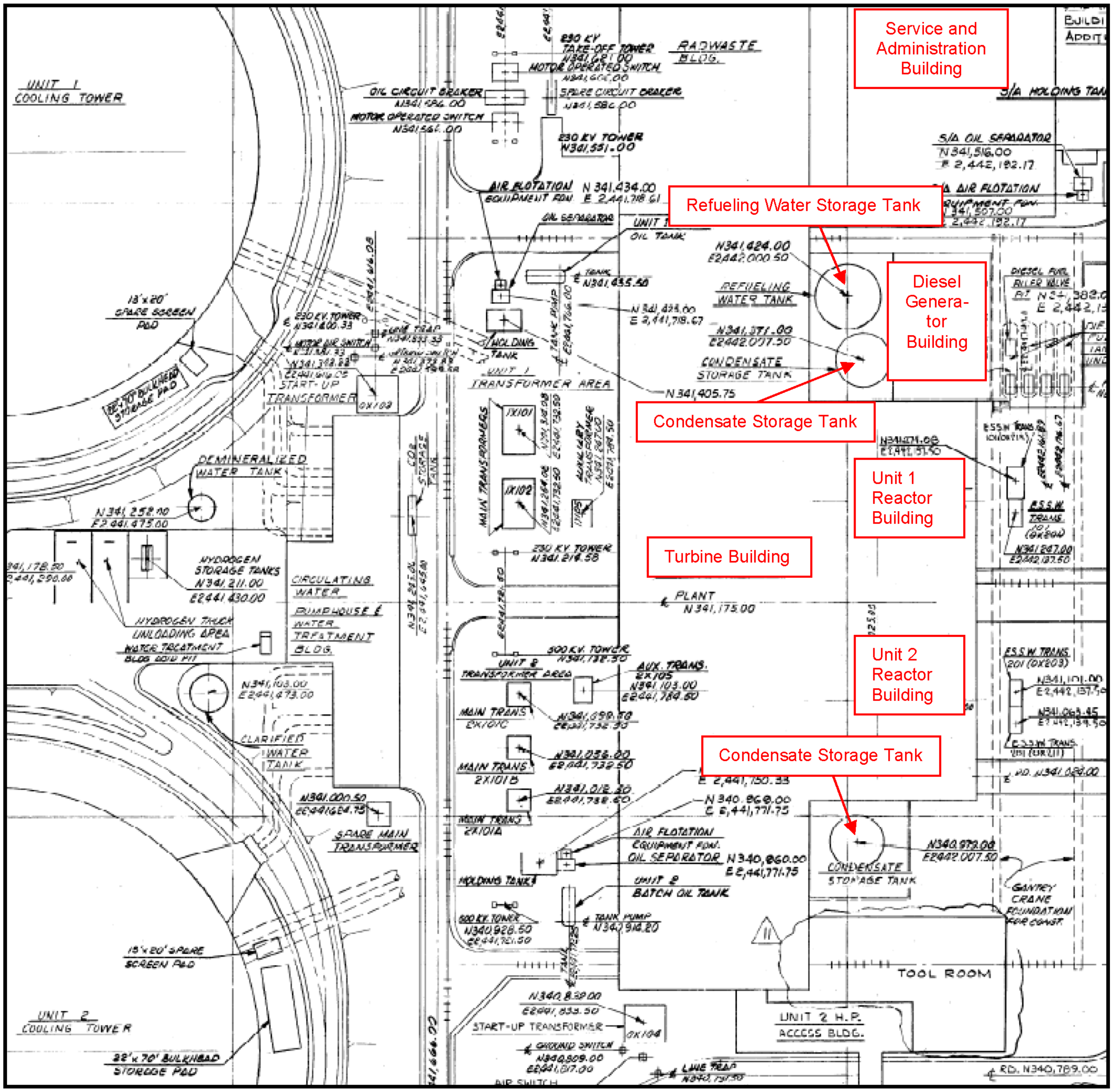


Figure 4.5-3— Source Locations

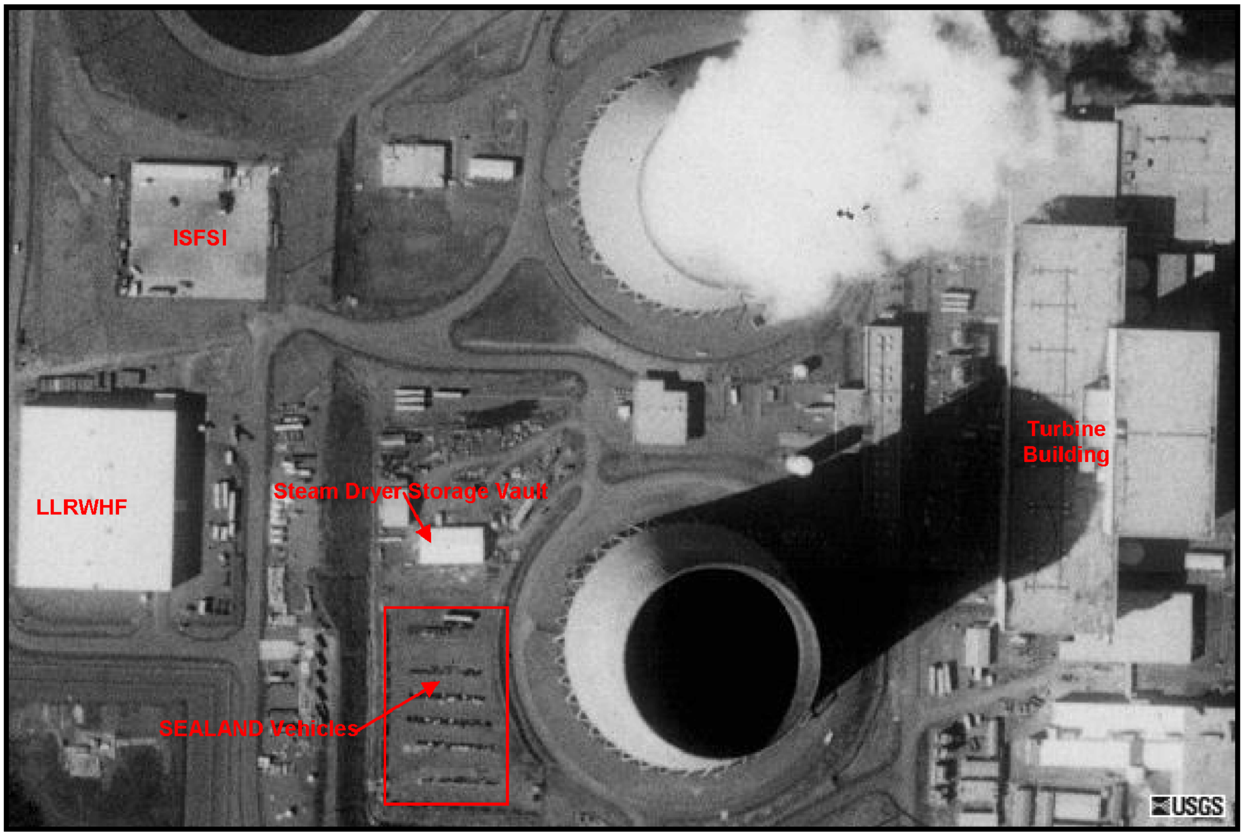


Figure 4.5-4— Average Dose Rate Contours Asuming an ISFSI Filled to License Capacity
Background image for illustration purposes only. Illegible data is not pertinent.

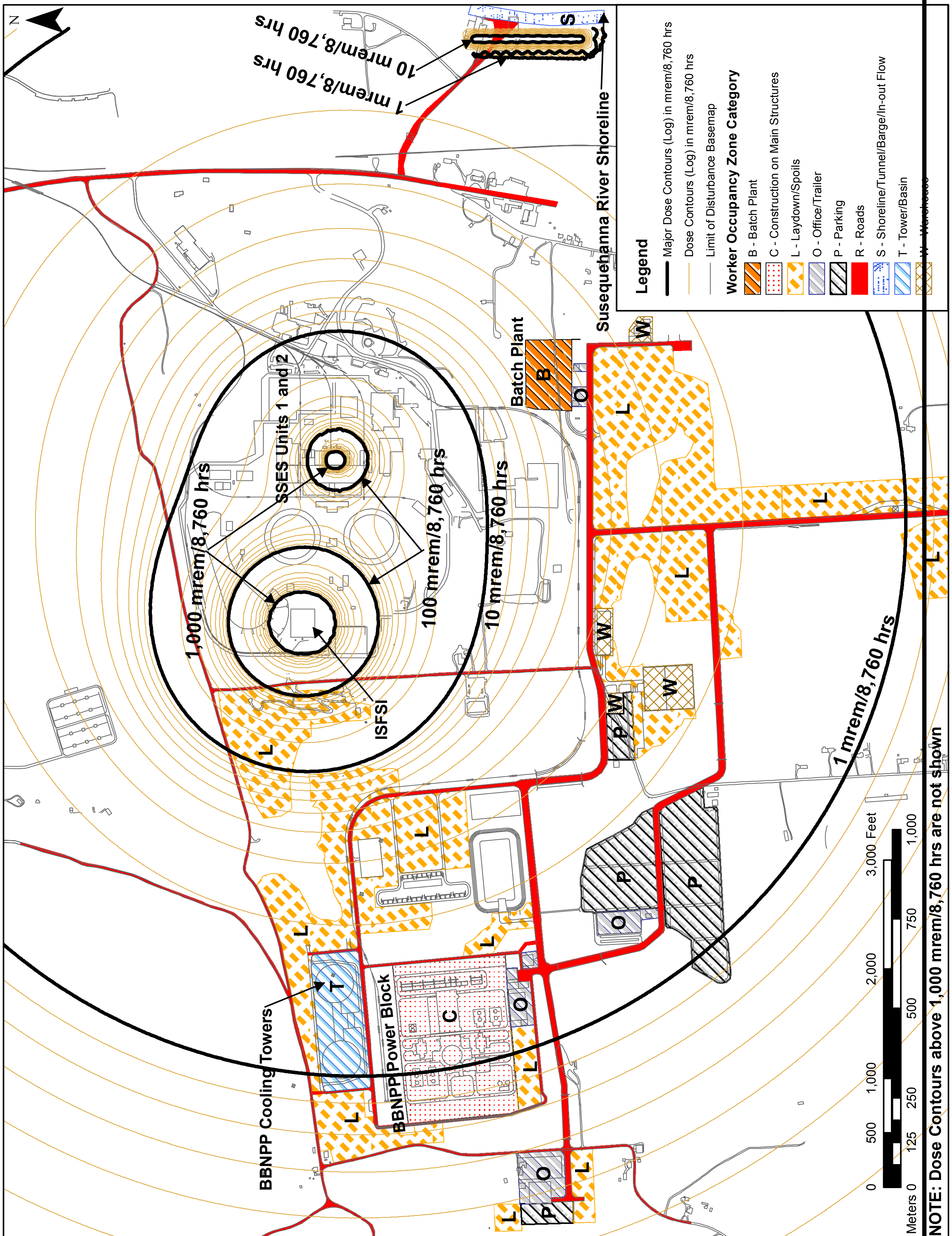


Figure 4.5-5— ISFSI Equation over Distance compared to TLD 13S2 in 2007

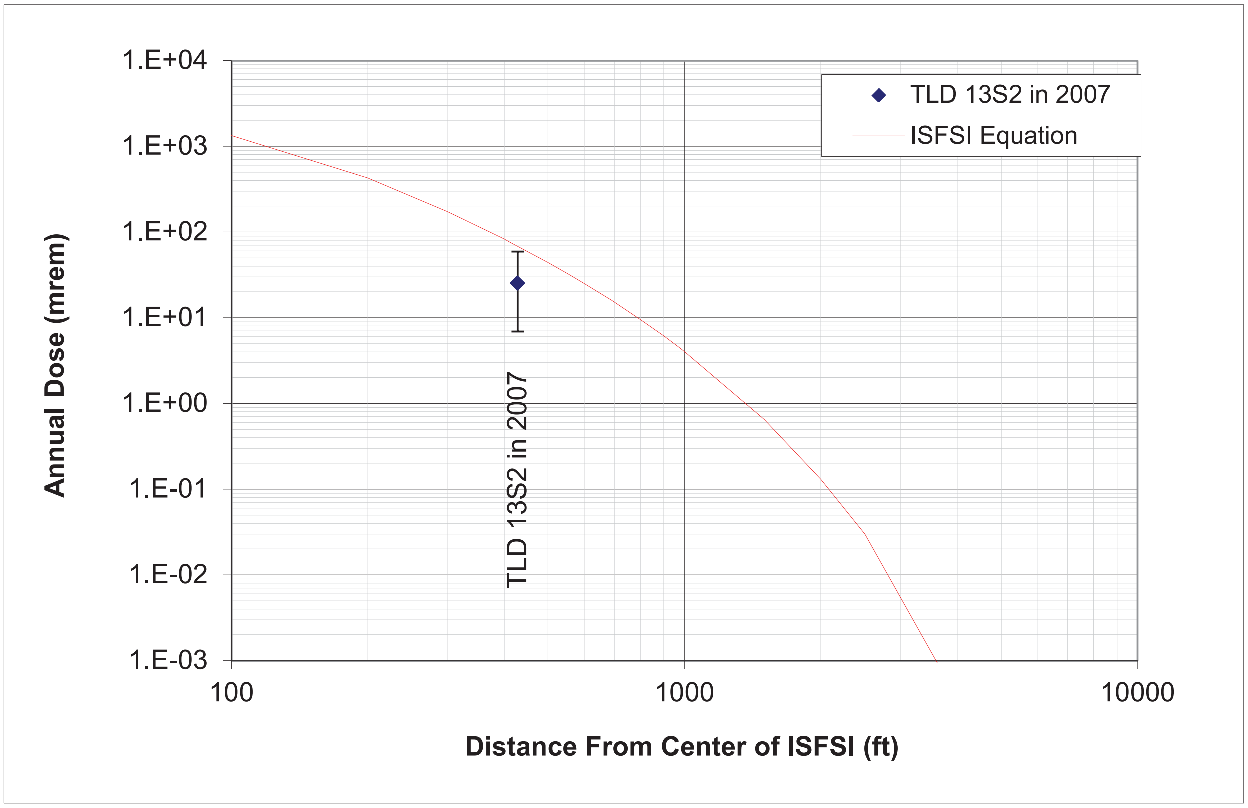


Figure 4.5-6— ISFSI Satellite Image

Figure 4.5-7— SSES ISFSI (blue border) with TLDs and Grid

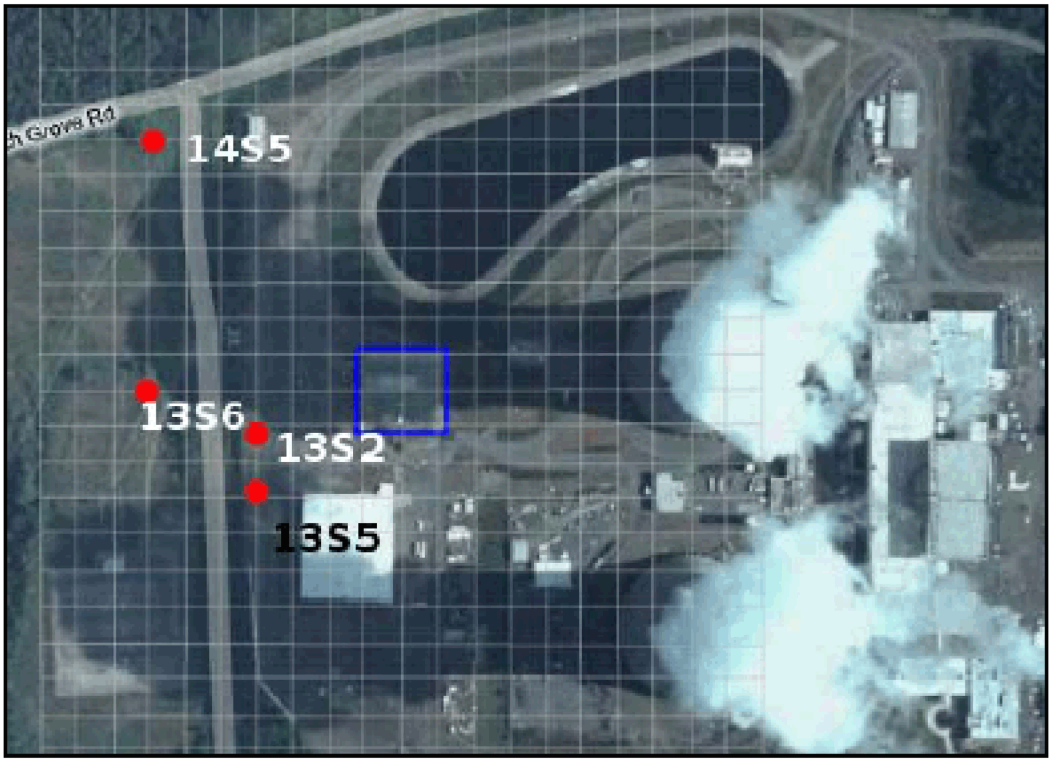


Figure 4.5-8— ISFSI Equation over Time Compared to Net TLD 13S2

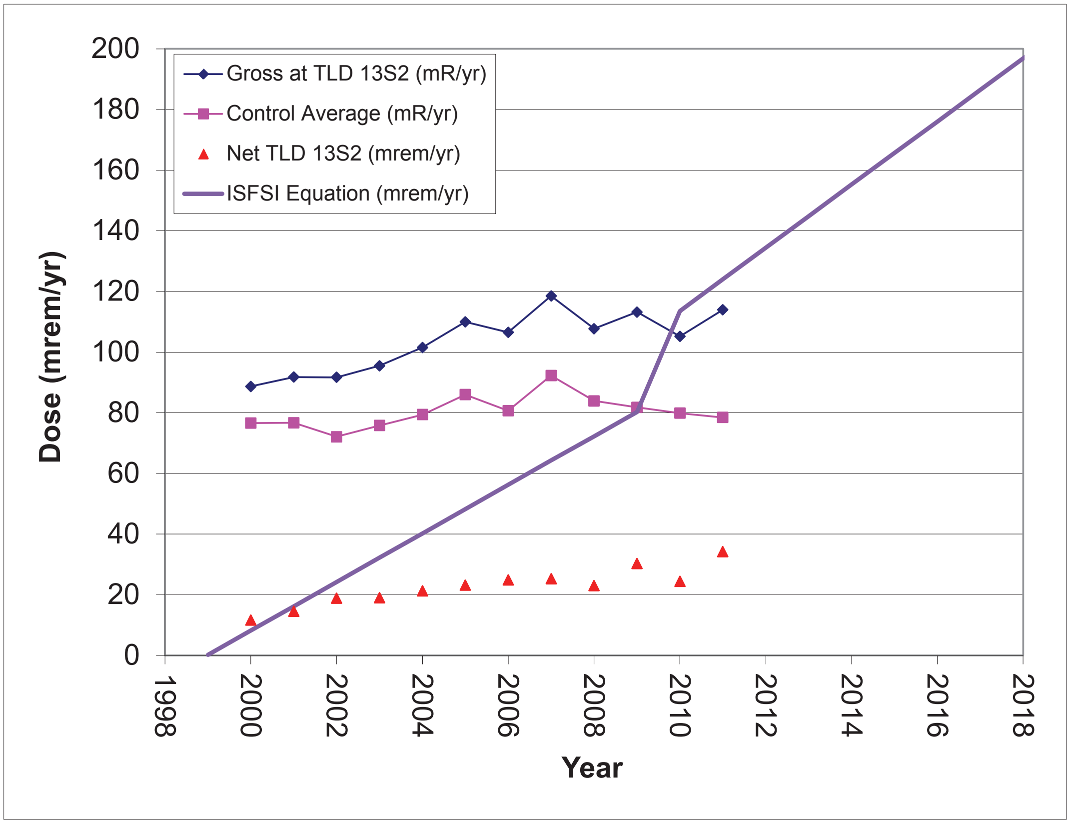


Figure 4.5-9— Dose vs Distance for CSTs

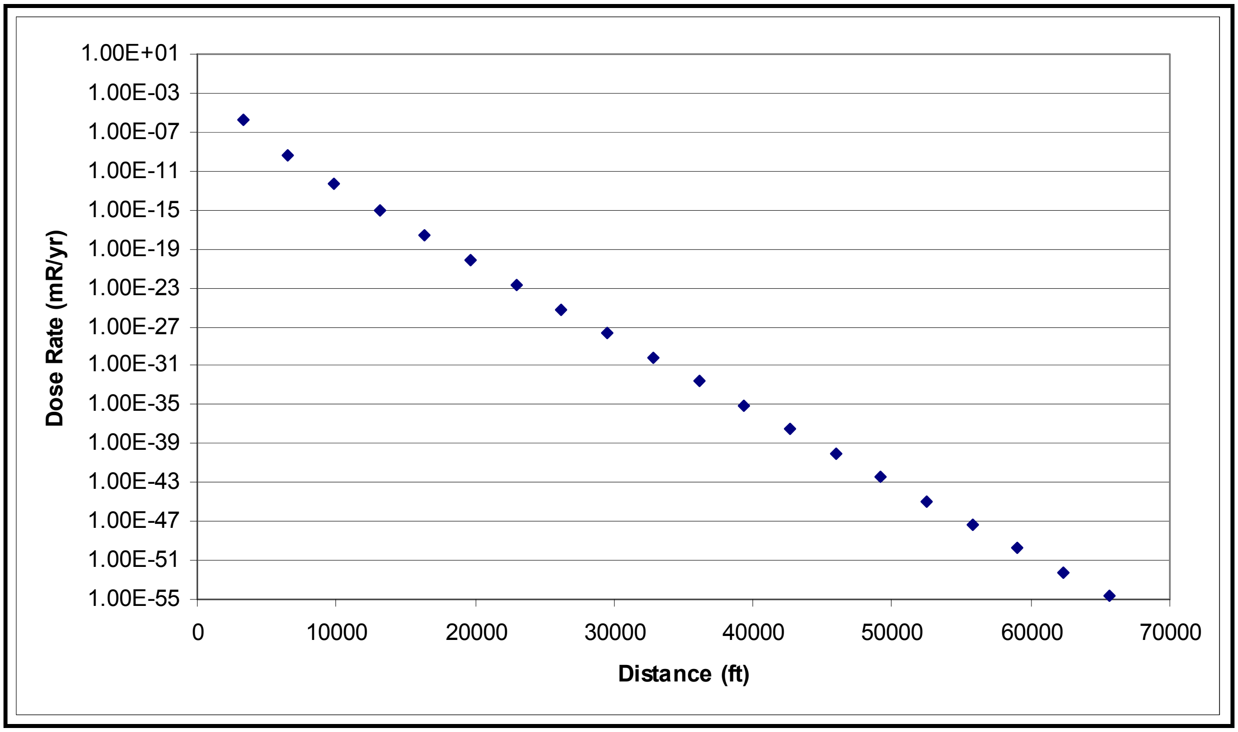


Figure 4.5-10— Dose vs Distance for LLRWHF

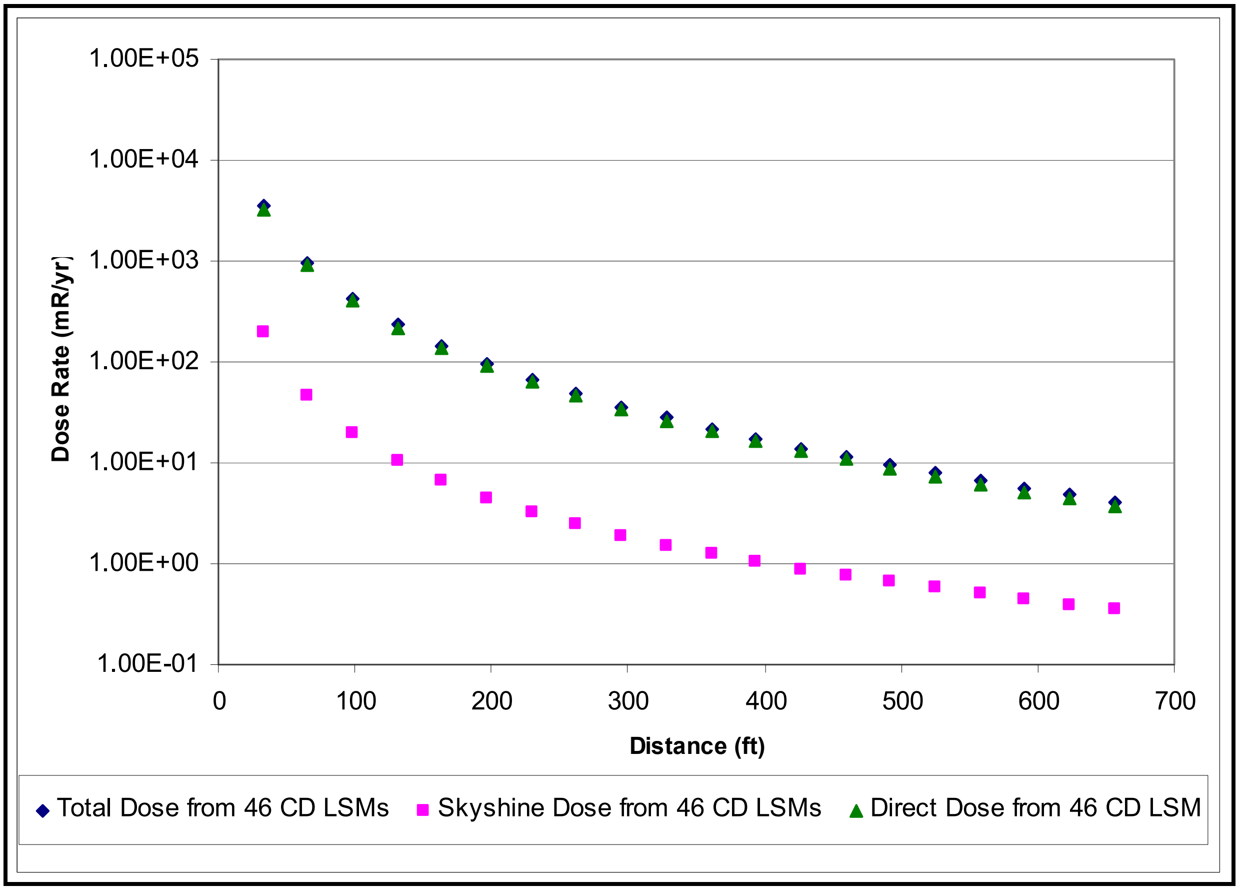


Figure 4.5-11— Dose vs Distance for SEALAND Containers

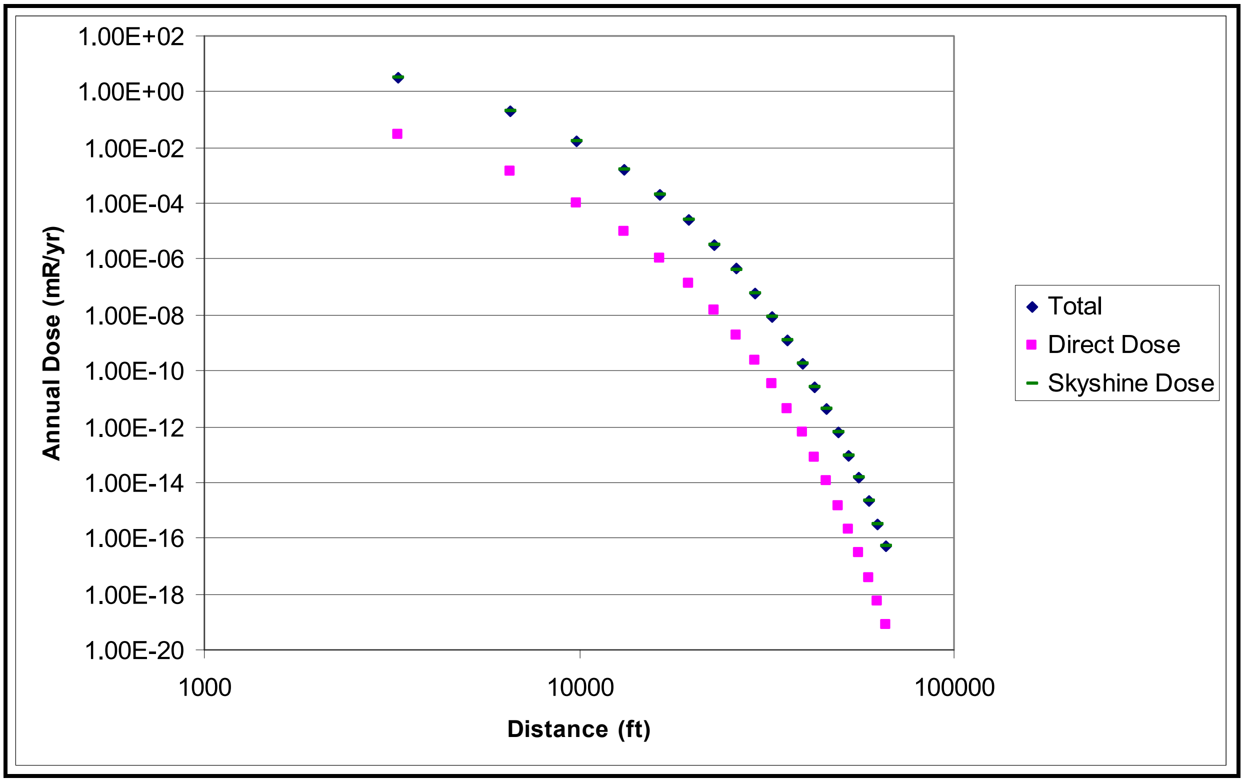


Figure 4.5-12— Dose vs Distance for Steam Dryer Storage Vault

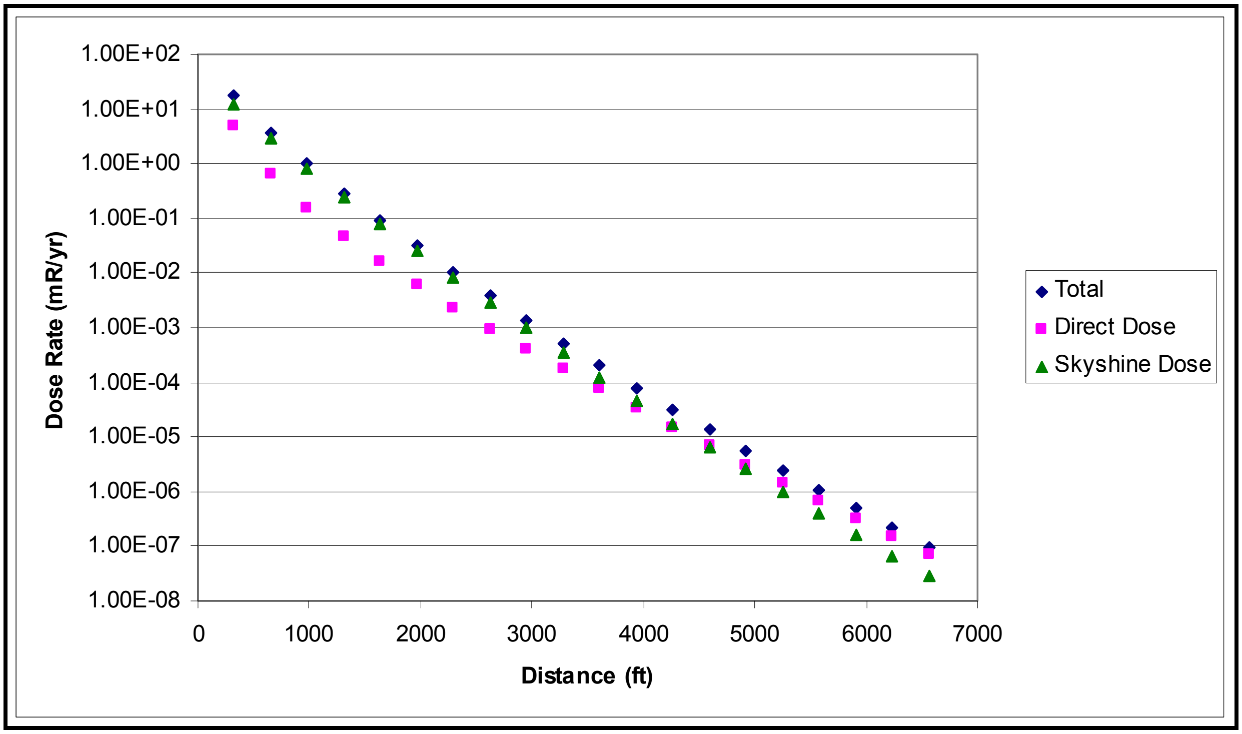
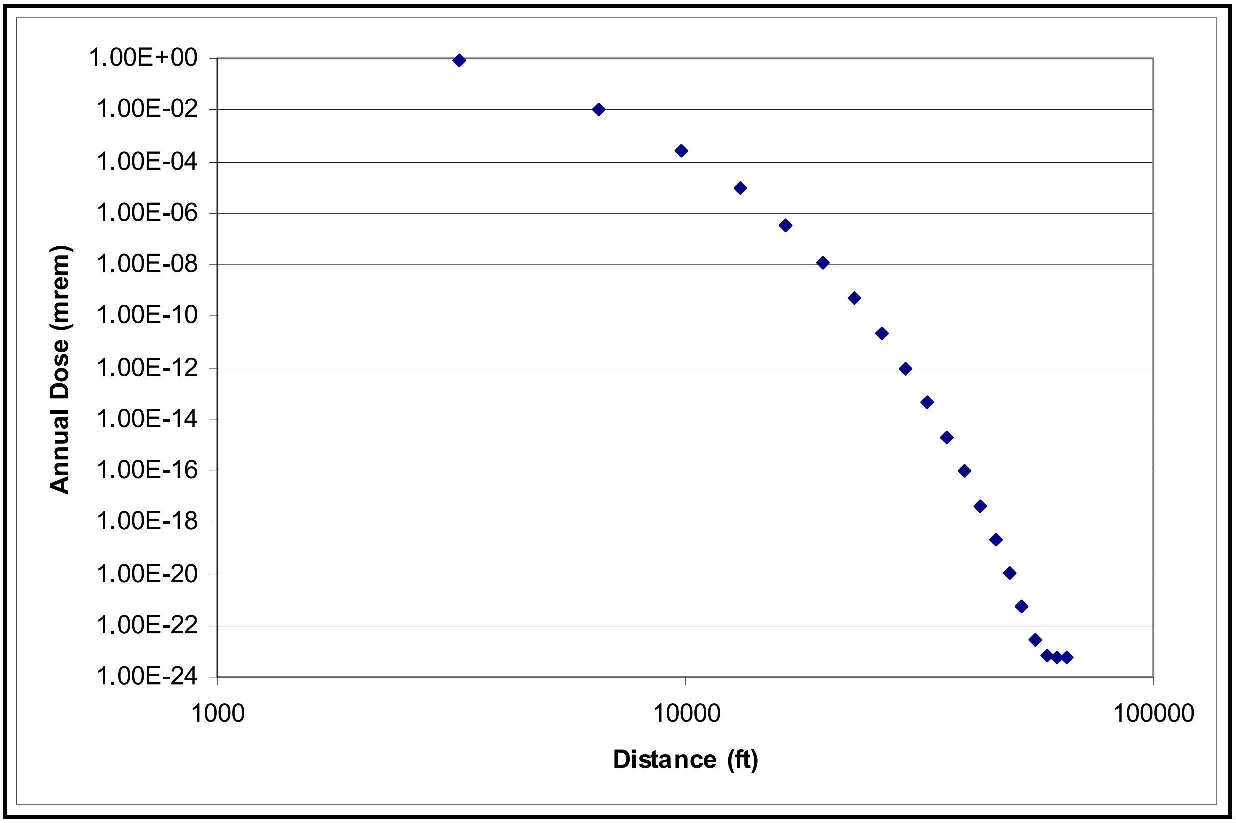


Figure 4.5-13— Dose vs Distance for Turbine Building



4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

In general, potential impacts will be mitigated through compliance with applicable federal, Pennsylvania, and local laws and regulations enacted to prevent or minimize adverse environmental impacts that may be encountered such as air emissions, noise, storm water pollutants, and spills. Principal among these will be the National Pollutant Discharge Elimination System (NPDES) Individual Permit for Discharge of Stormwater Associated with Construction Activities and the Corps of Engineers 404 Permit to minimize sediment erosion and protect water quality. The Site Resource Management Plan will address affected site lands and waters. Also included will be required plans such as a Storm Water Pollution Prevention Plan (SWPPP) and associated Best Management Practices (BMPs) as well as administrative actions such as a Traffic Management Plan.

Programs/procedures for BBNPP will be based on those already established for SSES, including relevant reporting and record keeping requirements.

Table 4.6-1 lists the potential impacts associated with the construction activities described in Section 4.1 through Section 4.5 and Section 4.7. The table identifies, from the categories listed below, which adverse impact may occur as a result of construction activities and its relative significance rating (i.e., [S]mall, [M]oderate, or [L]arge) following implementation of associated measures and controls. Table 4.6-1 also includes a brief description, by ER Section, of each potential impact and the measures and controls to mitigate the impact, if needed.

- Erosion and Sedimentation
- Air Quality (dust, air pollutants)
- Wastes (effluents, spills, material handling)
- Surface Water
- Groundwater
- Land Use
- Water Use and Quality
- Terrestrial Ecosystems
- Aquatic Ecosystems
- Socioeconomic
- Aesthetics
- Noise
- Traffic
- Radiation Exposure
- Other (site specific (i.e., non-radiological health impacts))

Based on existing site conditions, Susquehanna Steam Electric Station programs and procedures, as well as the measures and controls proposed, the potential adverse impacts identified from the construction of BBNPP are anticipated to be SMALL, if any, for all categories evaluated except noise, wetlands, and socioeconomics, which are expected to be MODERATE, but manageable with mitigation.

Table 4.6-2 provides estimates of the percentage of impacts attributable to "construction" and to "preconstruction," as well as a summary of the basis for the estimates. The estimated construction related impacts presented in the table were based primarily on two factors, namely the area associated with the construction of SSCs and the labor hours associated with the construction of SSCs. Information related to these two factors is provided as follows:

- Construction Area - During construction, land disturbance will be contained within a Limit of Disturbance (LOD) of approximately 687 ac (278 ha). Of these developed areas, approximately 69 ac (28 ha) will be occupied by SSCs, 11.0 ac (4.5 ha) for the ESWEMS Retention Pond and Pump House, 5.2 ac (2.1 ha) for the 500 kV BBNPP Switchyard, and 52.6 ac (21.3 ha) for the Power Block. It is assumed that preconstruction activities of clearing/grubbing/site preparation will impact land area to be occupied by both SSCs and non SSC structures/activities; therefore, this results in an allocation of a 95% (659 ac) land area impact due to preconstruction and a 5% (35 ac) land area impact during construction.

- Labor Hours - Based on construction estimates for all phases of development of the BBNPP, the estimated labor hours associated with the construction of SSCs is approximately 50% of the total labor hours associated with the development of the entire BBNPP plant site.

Other factors that were considered where applicable include the following:

- Construction Duration - Estimates of impacts generally associated with construction activities were estimated to be related to construction of SSEs 50% of the time and to preconstruction activities 50% of the time.

- Water Usage - The quantity of water to be used for preconstruction is estimated to be 45% of the total water requirements in Table 4.2-1. Preconstruction activities were assumed to begin at the start of Year 1 and extend ten months into Year 3 to align with the assumption that preconstruction activities comprise 50% of time of construction. The water usage predicted for the first 34 months of the 68 month BBNPP construction period is allocated to preconstruction activities. That usage totals 45% of the total volume in Table 4.2-1.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 1 of 12)

ER Reference Section	Potential Impact Category and Description															Proposed Measures and Controls or Mitigating Circumstances
4.1 Land Use Impacts	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	
						S										
4.1.1 The Site and Vicinity	Clearing, grading, excavation, and re-contouring. (ES) (AQ) (L) (A)															Comply with Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities, including U.S. Environmental Protection Agency (USEPA) effluent limitations.
																Obtain and comply with required agency programs listed in Table 1.3-1.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (W) (AE)															Use site Resource Management Plan and Best Management Practices (BMPs - silt fences, vegetative stabilization, infiltration beds, and other controls) to protect and mitigate resources such as wetlands and surface water systems in vicinity.
																Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
																Obtain individual Corps of Engineers 404 Permit.
	Soil stockpiling and disturbance to natural drainage channels. (ES) (SW) (L) (AE)															Implement Post Construction Stormwater Management (PCSM) Plan including erosion and sediment control plan, as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements.
	Removal of existing trees and vegetation. (L) (TE) (A)															Use site Resource Management Plan and comply with BMP requirements.
																Chip unmerchantable trees and spread as wood chips, and/or disposed of at an offsite landfill.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 2 of 12)

<table>
<tr><th>ER Reference Section</th><th colspan="15">Potential Impact Category and Description</th><th>Proposed Measures and Controls or Mitigating Circumstances</th></tr>
<tr><td rowspan="4"></td><td colspan="15"></td><td>Restore acreage following construction to the maximum extent possible.</td></tr>
<tr><td colspan="15">Construction of temporary and permanent structures.
(L) (TE) (A)</td><td>Place construction footprint wholly within a dedicated nuclear power plant site.</td></tr>
<tr><td colspan="15">Release of fuel, oils, or other chemicals.
(SW) (GW) (W) (TE) (AE)</td><td>Implement Spill Prevention, Control, and Countermeasures (SPCC) Plan.</td></tr>
<tr><td colspan="15">Heavy equipment transported to the site.
(A) (N) (T)</td><td>Construct new site access, perimeter roads, and a rail spur.</td></tr>
<tr><td>4.1.2 Transmission Corridors and Offsite Areas</td><td colspan="15">-The existing transmission lines have sufficient capacity to carry the total output of the existing Susquehanna Steam Electric Station, as well as BBNPP; as a result, there will be no new offsite transmission lines or rights-of-way disturbance.
(L)</td><td>Continue existing transmission corridor maintenance policies and practices to protect terrestrial and aquatic ecosystems.</td></tr>
<tr><td>4.1.3 Historic Properties (and Cultural Resources)</td><td colspan="15">Disturbance of potentially eligible archaeological resources.
(L)</td><td>Consult with State Historic Preservation office (SHPO) on results of any additional cultural resources investigations required by SHPO in order to identify measures to avoid, minimize, or mitigate any adverse effects.</td></tr>
<tr><td rowspan="2">4.2 Water-Related Impacts</td><td>Erosion/Sediment (ES)</td><td>Air Quality (AQ)</td><td>Wastes (WS)</td><td>Surface Water (SW)</td><td>Groundwater(GW)</td><td>Land Use (L)</td><td>Water Use & Quality (W)</td><td>Terrestrial Ecosystems (TE)</td><td>Aquatic Ecosystems (AE)</td><td>Socioeconomic (S)</td><td>Aesthetics (A)</td><td>Noise (N)</td><td>Traffic (T)</td><td>Radiation Exposure (R)</td><td>Other (site specific) (O)</td><td rowspan="2"></td></tr>
<tr><td>S</td><td></td><td></td><td>S</td><td>S</td><td></td><td>S</td><td></td><td></td><td></td><td>S</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">4.2.1 Hydrologic Alterations</td><td colspan="15" rowspan="2">Erosion, sediment, and storm water runoff (from onsite building, utilities, and road construction activities).
(ES) (SW) (W) (AE)</td><td>Implement PCSM plan, including erosion and sediment control plan, as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activitiess requirements.</td></tr>
<tr><td>Monitor construction effluents and storm water runoff.</td></tr>
</table>

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 3 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Susquehanna River turbidity/sediment effects (from dredging and installation of the Intake and Discharge Structures). (ES) (SW) (W) (AE)	Comply with Corps of Engineers 404 Permit requirements.
	Temporary use of groundwater. (GW)	Use offsite water supply, as needed.
	Temporary dewatering activities. (W) (AE)	Comply with 25 PA Code, Chapter 102 for dewatering activities.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
		Use groundwater flow barriers.
		Monitor perched water and groundwater levels.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Shift of the glacial outwash aquifer recharge area(s). (ES) (SW) (GW) (W)	Install infiltration beds.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.
4.2.2 Water Use Impacts	Erosion, sediment, and storm water runoff (from onsite building, utilities, and road construction activities). (ES) (SW) (W) (AE)	Implement PCSM plan, including erosion and sediment control plan, as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements.
		Monitor construction effluents and storm water runoff.
	Temporary use of groundwater. (GW)	Use offsite water supply, as needed.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 4 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Reduction and/or increase in available pervious (infiltration) areas. (ES) (SW) (L)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Direct runoff into infiltration beds.
		Use offsite water supply, as needed.
	Temporary dewatering activities. (W) (AE)	Comply with 25 PA Code, Chapter 102 for dewatering activities.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
		Use groundwater flow barriers.
		Monitor perched water and groundwater levels.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Increasing sediment loads into Walker Run. (ES) (SW) (W) (AE)	Implement PCSM, including erosion and sediment control plan, as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements.
	Shift of the glacial outwash recharge area(s). (ES) (SW) (GW) (W)	Install infiltration beds.
	Creating a local and temporary glacial outwash aquifer depression. (L) (TE) (A)	Complete construction, after which the glacial outwash aquifer water level is expected to recover.
		Use groundwater flow barriers.
		Install infiltration beds.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 5 of 12)

ER Reference Section	Potential Impact Category and Description															Proposed Measures and Controls or Mitigating Circumstances
4.3 **Ecological Impacts**	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	
				S		S		S	M		S	S				
4.3.1 Terrestrial Ecosystems	Loss of vegetation (i.e., red maple, river birch, black cherry, spice bush, skunk cabbage and Canada goldenrod) and some of the existing habitat for important fauna (i.e., Indiana bat, eastern small-footed myotis, northern myotis, Allegheny woodrat, bald eagle, peregrine falcon, osprey, redbelly turtle, timber rattlesnake, eastern hognose snake, eastern spadefoot, northern cricket frog, long dash, mulberry wing, Baltimore checkerspot, white-tailed deer, black bear, wild turkey, etc.), as well as forest cover. (ES) (L) (TE) (A)															Implement PCSM plan, including erosion and sediment plan (silt fences, vegetative stabilization, infiltration beds, and other controls) as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements.
																Review BBNPP historic survey database to identify important terrestrial species; conduct new surveys, as needed.
																Use site Resource Management Plan and BMPs (may include restoration), to protect resources.
																Design construction footprint to account for important habitat.
																Minimize lighting, as practicable and allowed by regulation.
																Limit tree cutting activities, if needed, to times and sizes that will not affect fauna habitat.
																Restore acreage or mitigate, where needed, following construction to the extent practicable.
	Disturbance (temporary and permanent) of trees. (L) (TE) (A)															Preserve aesthetically outstanding tree clusters, as practical; harvest merchantable timber; use or recycle other woody material, as appropriate; and develop reforestation plan.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 6 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Install infiltration beds, a temporary sedimentation pond, and use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Conduct wetland mitigation, and enhancement where needed, per State and Federal permits.
		Propose program to remove invasive species, replace native tree/shrub species, and install stabilization measures, including in-stream habitat enhancements, at waterways within project boundary.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
		Implement monitoring and corrective action plan following construction of wetland mitigation features per regulatory agency direction.
	Disturbance (temporary and permanent) of the Susquehanna Riverlands Environmental Preserve in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Conduct wetland mitigation, and enhancement, where needed, per State and Federal permits.
	Limited mortality of wildlife (e.g., avian collisions with man-made structures). (TE)	Use site Resource Management Plan and BMPs to protect resources.
		Monitor and maintain records of environmental data, as needed, per 10 CFR 50.36b
		Reduce cooling tower lighting, as practicable, and use flashing lights instead of flood lights.
	Temporary displacement of mobile wildlife (TE).	Minimize noise as practicable, especially noises that are loud, sudden, and unpredictable.
	Release of fuels, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 7 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.3.2 Aquatic Ecosystems	Disturbance (temporary and permanent) of wetlands and surface water (dewatering Canal, Susquehanna River bank and bottom substrate, etc.) in vicinity; however, onsite wetlands are not substantively distinguishable from other wetlands in the site vicinity and streams within the construction zone contain no rare or unique aquatic species, with the exception of two species of mussel classified as rare that are found in the Susquehanna River. (ES) (SW) (L) (W) (AE) (A)	Review BBNPP historic survey database to identify important aquatic species; conduct new surveys, as needed.
		Implement SPCC Plan.
		Use site Resource Management Plan and BMPs to protect resources.
		Consult with PA Fish and Boat Commission regarding construction footprint impact to mussel species of special concern.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Temporary sediment and silt increases in surface water systems. (ES) (SW) (W)	Implement PCSM plan, including erosion and sediment control plan (silt fences, vegetative stabilization, dust suppression, the construction of new impoundments, and other controls), as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements.
		Install infiltration beds and s temporary sedimentation pond.
	Temporary turbidity increase. (SW) (W)	Comply with Corps of Engineers 404 Permit requirements.
		Construct cofferdams around work areas where appropriate.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 8 of 12)

<table>
<tr><th>ER Reference Section</th><th colspan="15">Potential Impact Category and Description</th><th>Proposed Measures and Controls or Mitigating Circumstances</th></tr>
<tr><td rowspan="2"></td><td colspan="15" rowspan="2">Limited mortality of fish and insects (i.e., resulting from sedimentation and surface water modifications).
(AE)</td><td>Implement PCSM, including erosion and sediment plan (silt fences, vegetative stabilization, dust suppression, the construction of new impoundments, and other controls), as part of the Individual NPDES Permit for Discharge of Stormwater Associated with Construction Activities requirements; comply with BMP requirements.</td></tr>
<tr><td>Install infiltration beds and a temporary sedimentation pond.</td></tr>
<tr><td rowspan="2">4.4 Socioeconomic Impacts</td><td>Erosion/Sediment (ES)</td><td>Air Quality (AQ)</td><td>Wastes (WS)</td><td>Surface Water (SW)</td><td>Groundwater(GW)</td><td>Land Use (L)</td><td>Water Use & Quality (W)</td><td>Terrestrial Ecosystems (TE)</td><td>Aquatic Ecosystems (AE)</td><td>Socioeconomic (S)</td><td>Aesthetics (A)</td><td>Noise (N)</td><td>Traffic (T)</td><td>Radiation Exposure (R)</td><td>Other (site specific) (O)</td><td rowspan="2"></td></tr>
<tr><td></td><td>S</td><td>S</td><td></td><td></td><td>S</td><td></td><td></td><td></td><td>M</td><td>S</td><td>S</td><td>S</td><td></td><td></td></tr>
<tr><td rowspan="6">4.4.1 Physical Impacts</td><td colspan="15" rowspan="4">Equipment and non-routine noise.
(N)</td><td>Comply with applicable PA Department of Environmental Protection (DEP) and Salem Township noise restrictions.</td></tr>
<tr><td>Comply with applicable Occupational Safety and Health Administration (OSHA) noise-exposure limits.</td></tr>
<tr><td>Implement appropriate training, personal protective equipment, health and safety monitoring and other good industry noise control practices.</td></tr>
<tr><td>Maintain noise limiting devices on vehicles and equipment and shield high noise sources near their origin; conduct non-routine activities such as blasting during weekday business hours.</td></tr>
<tr><td colspan="15" rowspan="2">Air emissions (dust and volatiles) increase.
(AQ)</td><td>Comply with applicable USEPA and PA DEP air quality regulations.</td></tr>
<tr><td>Implement routine vehicle/equipment inspection and maintenance program.</td></tr>
</table>

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 9 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
		Implement measures to comply with Ambient Air Quality Standards (NAAQS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulatory limits.
		Obtain required permits and/or operating certificates.
	Local and regional temporary traffic increase. (AQ) (T)	Heavy plant equipment will be brought to the site on rail when possible.
		Install new site perimeter and access road.
		Provide traffic mitigation measures, where needed, such as installing signals at the BBNPP entrance access road, realigning lanes on U.S. 11, adding new entrance and exit lanes on the access road at the intersection of U.S. 11, retiming signals, restriping, and adding thru lanes, temporary traffic signals, parking restrictions, and/or other measures at intersections affected by construction traffic.
	Site aesthetically altered due to plant construction; construction activities visible, but temporary. (L) (A)	Use low points in topography to create lowest visual profile practicable and place new structures on the river shoreline near existing structures.
		Minimize tree and vegetation removal and, where feasible, use native trees and vegetation during post-construction restoration.
		Add a new access road.
		Cover exteriors of structures, where practicable, with a compatible color of the surrounding area.
4.4.2 Social and Economic Impacts	Influx of large construction work force. (W) (S) (T)	Small aggregate socioeconomic impacts anticipated; mitigation not required.
	Public services need (employment, housing, emergency services, schools, land use) increase. (S) (T)	Small to moderate aggregate socioeconomic impacts anticipated; mitigation not required, with the possible exception of schools. Additional local tax revenue would be generated from BBNPP to offset impacts to schools.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 10 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Traffic volume increase. (T)	Small traffic impact due to mitigation measures, such as installing signals at the BBNPP entrance access road, realigning lanes on U.S. Highway 11, adding new entrance and exit lanes on the access road at the intersection of U.S. Highway 11, retiming signals, restriping, and adding thru lanes, temporary traffic signals, parking restrictions, and/or other measures at intersections affected by construction traffic.
	Spending and tax revenue increase. (S)	Large beneficial impact to property tax revenues; small beneficial impact for other types of tax revenues. No mitigating measures or controls required.
4.4.3 Environmental Justice Impacts	No disproportionate adverse impacts to minority or low-income populations. (S)	None necessary.
4.5 Radiation Exposure to Construction Workers	Erosion/Sediment (ES): Air Quality (AQ): Wastes (WS): Surface Water (SW): Groundwater(GW): Land Use (L): Water Use & Quality (W): Terrestrial Ecosystems (TE): Aquatic Ecosystems (AE): Socioeconomic (S): Aesthetics (A): Noise (N): Traffic (T): Radiation Exposure (R): S Other (site specific) (O):	
	SSES Units 1 and 2 gaseous effluents exposure. (AQ) (SW) (TE) (AE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	Independent Spent Fuel Storage Installation (ISFSI) direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 11 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Low Level Radioactive Waste Handling Facility (LLRWHF) direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	SEALAND containers direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	Steam dryer storage vault direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	Turbine building direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
4.7 Non-Radiological Health Impacts	Erosion/Sediment (ES) Air Quality (AQ) Wastes (WS) Surface Water (SW) Groundwater(GW) Land Use (L) Water Use & Quality (W) Terrestrial Ecosystems (TE) Aquatic Ecosystems (AE) Socioeconomic (S) Aesthetics (A) Noise (N) Traffic (T) Radiation Exposure (R) Other (site specific) (O): S	

Table 4.6-1— A Summary of Measures and Controls to Limit Adverse Impacts During Construction
(Page 12 of 12)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Risk to workers from accidents and occupational illnesses. (O)	Implement site-wide Safety and Medical Program, including safety policies, safe work practices, as well as general and topic-specific training.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
(Page 1 of 8)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts (%)		Basis of Estimate
		Construction[(b)]	Preconstruction	
Section 4.1 Land Use Impacts				
Section 4.1.1 The Site and Vicinity				
Section 4.1.1.1 The Site	S - Land Use	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously..
Section 4.1.1.2 The Vicinity	S - Land Use	95	5	Estimates are based on the activities for the construction of BBNPP and supporting facilities that will take place above the tree line and will thus be visible from nearby roadways.
Section 4.1.2 Transmission Corridors and Offsite Areas	S - Land Use	0	100	Transmission corridors are not included in the definition of construction of SSC's. There are no offsite areas associated with the project that are included in the definition of construction of SSC's.
Section 4.1.3 Historic Properties	S - Land Use	5	95	The impact of historic properties will apply primarily to preconstruction activities since they will be identified and mitigation plans established prior to land clearing, grading, installation of drainage, erosion and other environmental mitigation measures, construction of temporary roads and laydown areas, etc. There is some small potential for discovery of historic properties during the construction-related excavations.
Section 4.2 WaterRelated Impacts				
Section 4.2.1 Hydrologic Alterations				
Section 4.2.1.1 Description of Surface Water Bodies and Groundwater Aquifers				N/A
Section 4.2.1.2 Construction Activities	S - Erosion and Sediment S - Surface Water S - Groundwater	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.2.1.3 Water Sources and Amounts Needed for Construction	S - Surface Water	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.2.1.4 Surface Water Bodies Receiving Construction Effluents that Could Affect Water Quality	S - Erosion and Sediment S - Surface Water	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.1.5 Construction Impacts	S - Erosion and Sediment S - Surface Water S - Groundwater	55	45	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.1.6 Identification of Surface Water and Groundwater Users				N/A
Section 4.2.1.7 Proposed Practices to Limit or Minimize Hydrologic Alterations				N/A
Section 4.2.1.8 Compliance with Applicable Hydrological Standards and Regulations				N/A
Section 4.2.1.9 Best Management Practices				N/A
Section 4.2.2 Water Use Impacts				
Section 4.2.2.1 Description of the Site and Vicinity Water Bodies				N/A
Section 4.2.2.2 Hydrologic Alterations and Related Construction Activities	S - Erosion and Sediment S - Surface Water S - Groundwater	50	50	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.2.2.3 Physical Effects of Hydrologic Alterations	S - Erosion and Sediment S - Surface Water S - Groundwater	50	50	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.2.4 Water Quantities Available to Other Users	S - Surface Water S - Water Use S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.2.5 Water Bodies Receiving Construction Effluents	S - Surface water S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.2.6 Baseline Water Quality Data				N/A
Section 4.2.2.7 Potential Changes to Surface Water and Groundwater Quality	S - Surface water S - Groundwater	55	45	These estimates are based on the water usage over the time period of construction. The assumption is made that the disturbed land will be stabilized so as to prevent erosion and that potential changes to water quality will be associated with water usage and consequent runoff potential during active preconstruction and construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.2.8 Surface Water and Groundwater Users				N/A
Section 4.2.2.9 Predicted Impacts on Water Users	S - Water Use S - Surface water S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts (%)		Basis of Estimate
		Construction[(b)]	Preconstruction	
Section 4.2.2.10 Measures to Control Construction Related Impacts	S - Erosion and Sediment S - Surface water S - Water Use S - Groundwater	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.2.2.11 Consultation with federal, state, and local environmental organizations				N/A
Section 4.2.2.12 Compliance with Water Quality and Water Use Standards and Regulations				N/A
Section 4.2.2.13 Water Quality Requirements for Aquatic Ecosystems and Domestic Users				N/A
Section 4.3 Ecological Impact				
Section 4.3.1 Terrestrial Ecosystems				
Section 4.3.1.1 Vegetation	S - Terrestrial Ecosystems	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.3.1.2 Fauna	S - Terrestrial Ecosystems	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.3.1.3 Wetlands	M - Aquatic Ecosystem	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction and the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1. Direct physical disturbances to wetlands will occur primarily during preconstruction; however, wetlands will experience water quality and hydrologic impacts throughout construction.
Section 4.3.1.4 Other Projects Within the Area with Potential Impacts				N/A
Section 4.3.1.5 Consultation				N/A
Section 4.3.1.6 Mitigation Measures				N/A
Section 4.3.2 Aquatic Ecosystems				

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts (%)		Basis of Estimate
		Construction[(b)]	Preconstruction	
Section 4.3.2.1 Impacts to Impoundments and Streams	S - Surface Water S - Aquatic Ecosystem	50	50	These estimated are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.3.2.2 Impacts to Surface Water Bodies	S - Aquatic Ecosystem	50	50	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit. The majority of these construction impacts are temporary. No important fish species or unique habitats are present in the river and thus none will be affected by the construction of BBNPP.
Section 4.3.2.3 Impacts on the Transmission Corridor and Offsite Areas	S - Aquatic Ecosystem	0	100	Transmission corridors are not included in the definition of construction of SSC's. There are no offsite areas associated with the project that are included in the definition of construction of SSC's
Section 4.3.2.4 Summary				N/A
Section 4.4 Socioeconomic Impacts				
Section 4.4.1 Physical Impacts				
Section 4.4.1.1 The Public and Workers				N/A
Section 4.4.1.2 Noise	M - Noise	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.3 Dust and Other Air Emissions	S - Air Quality	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.4 Buildings	S - Other (Site Specific)	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.5 Transportation Routes	S - Transportation and roads	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.4.1.6 Aesthetics	S - Other (Site Specific)	95	5	Estimates are based on the visual aesthetic impact from construction of the BBNPP. The reactor building, turbine hall, and two natural draft cooling towers are expected to affect the aesthetics around the site. However, effects will be limited due to the topography that includes forests and rolling terrain. Additionally, mitigation measures will be implemented.
Section 4.4.2 Social and Economic Impacts				
Section 4.4.2.1 Study Methods				N/A
Section 4.4.2.2 Construction Labor Force Needs, Composition and Estimates				N/A
Section 4.4.2.3 Demography				N/A
Section 4.4.2.4 Housing	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.2.5 Employment and Income	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.2.6 Tax Revenue Generation	L - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.
Section 4.4.2.7 Land Values	S - Socioeconomic	100	0	Estimates are based on the presumption that preconstruction activities have no impact on land values; only permanent structures as will be developed during construction may be perceived to impact land values.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.4.2.8 Public Services	S-M -Socioeconomic	50	50	Public services availability is based on the ability of the emergency services to respond simultaneously to an emergency as well as offsite evacuation. For the educational system, estimates are based on the workforce estimated to be necessary for each phase of construction. Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.
Section 4.4.2.9 Public Facilities	S-M - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.
Section 4.4.3 Environmental Justice Impacts				
Section 4.4.3.1 Minority and Low Income Populations and Activities	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.3.2 Subsistence Activities	S - Socioeconomic	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.5 Radiation Exposure to Construction Workers				
Section 4.5.1 Site Layout				N/A
Section 4.5.2 Radiation Sources at BBNPP	S - Rad Exp to Constr Wkrs	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.5.3 Historical Dose Rates				N/A
Section 4.5.4 Projected Dose Rates at BBNPP				N/A
Section 4.5.5 Compliance with Dose Rate Regulations				N/A
Section 4.5.6 Collective Doses to BBNPP Workers	S - Effluent and Wastes S - Rad Exp to Constr Wkrs	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.

Table 4.6-2— Summary of Construction and Preconstruction Related Impacts
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.5.7 Radiation Protection and ALARA Program				N/A

Notes:
a) The qualitative significance levels of (S)MALL, (M)ODERATE, or (L)ARGE have been assigned based on deployment and effective implementation of mitigation measures and controls required by local, state and federal regulations.
b) "Construction," as defined in 10 CFR 50.2 "Definitions" refers to the construction of "safety-related structures, systems, or components (SSCs) of a facility"

4.7 NONRADIOLOGICAL HEALTH IMPACTS

4.7.1 Public Health

Members of the public can potentially be put at risk by construction of a new power generation unit. Nonradiological air emissions and dust can migrate offsite through the atmosphere to nearby residences or businesses. BBNPP non-radiological air emmissions will meet required PaDEP air permit limits. Noise can also propagate offsite. The increase in traffic from commuting construction workers and deliveries can result in additional air emissions and traffic accidents. Section 4.4.1, "Physical Impacts, addresses these potential impacts to the public from construction activities.

4.7.2 Occupational Health

Construction of a new power generation unit and associated transmission lines would involve risk to workers from accidents or occupational illnesses. These risks could result from construction accidents (e.g., falls and burns), exposure to toxic or oxygen-replacing gases, and other causes.

During construction of BBNPP, PPL Bell Bend, LLC will provide a safety and medical program with associated personnel to promote safe work practices and respond to occupational injuries and illnesses. The safety and medical program will utilize an industrial safety manual providing a set of work practices with the objective of preventing accidents due to unsafe conditions and unsafe acts. These safe work practices address hearing protection, confined space entry, personal protective equipment, respiratory protection, heat stress, electrical safety, excavation and trenching, scaffolds and ladders, fall protection, chemical handling, storage, and use, and other industrial hazards. The safety and medical program provides for employee training on safety procedures. Site safety and medical personnel are provided to handle construction accidents and occupational illnesses.

Contractors, including construction contractors, will be required to review all safety policies/ safe work practices applicable to their work with site personnel. The contractors will be required to comply with site safety, fire, radiation, security polices, procedures, safe work practices, and federal and state regulations.

The Bureau of Labor Statistics maintains records of a statistic known as total recordable cases (TRC), which are a measure of annual work-related injuries or illnesses that include death, days away from work, restricted work activity, medical treatment beyond first aid, and other criteria. The 2006 nationwide TRC rate published by the Bureau of Labor Statistics for utility system construction is 5.4 per 100 workers (BLS, 2008a). A similar statistic for the Commonwealth of Pennsylvania is 4.1 per 100 workers (PLDI, 2007). PPL Bell Bend, LLC has calculated the TRC incidence for the proposed construction site.

The number of injuries or illnesses that might occur during construction of BBNPP can be calculated as the product of the incidence rate and the number of full time workers divided by 100. The calcuated annual average numbers of injuries and illnesses that could be expected each year of construction, using both the nationwide and Pennsylvania TRC values, are as follows:

	TRC Incidence Based on US Rate	TRC Incidence Based on PA Rate
Average Annual	162	124

The Bureau of Labor Statistics published 2006 statistics for fatal occupational injuries (BLS, 2008b) and average employment (BLS, 2008a) that were used to calculate the nationwide annual rate of fatal occupational injuries for utility system construction. Using monthly construction employment predictions and the calculated rate 0.025%, it is estimated that 5 construction deaths could occur over the pre-construction and construction period of 68 months. PPL Bell Bend, LLC will require all construction contractors and subcontractors working at the construction site to comply with all safety procedures in order to prevent and/or minimize the number of deaths, injuries, and illness during the construction of BBNPP. Even with effective safety procedures, construction work carries the risk or injury, illness, and death. However, it is not expected that the construction of a new nuclear power generation facility will result in more construction deaths than other similarly sized non-nuclear heavy construction projects.

4.7.3 References

BLS, 2008a. Table 1, Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2006, Bureau of Labor Statistics, Website: http://www.bls.gov/iif/oshwc/osh/os/ostb1765.pdf, Date accessed: March 25, 2008.

BLS, 2008b. Table A-1, Fatal occupational injuries and even or exposure, All United States, 2006, Bureau of Labor Statistics, Website: http://www.bls.gov/iif/oshwc/cfoi/cftb0216.pdf, Date accessed: March 25, 2008.

PDLI, 2007. 2006 Pennsylvania Worker's Compensation and Workplace Safety Annual Report, Website: http://www.dli.state.pa.us/landi/lib/landi/bwc/publications/2006_annual_report.pdf, Date accessed: March 25, 2008.