The Backyard Option 1 system descriptions are contained in Appendix IX. The P&IDs associated with the system descriptions are contained in Appendix X. Each system description is shown with its associated P&IDs. The system descriptions provide basic functional descriptions of each of the selected systems. The P& IDs are functional representations of plant fluid systems, such as main steam, reheat steam, cooling systems etc. The purpose of the P&IDs is to provide information to allow the Owner and the Engineer to determine station interconnecting piping design requirements, instrumentation requirements and device requirements. Descriptions of CT, ST and the HRSG are provided elsewhere in this report.

3.2.8 Plant Equipment List

The Backyard Option 1 proposed combined cycle project major equipment summary list is shown in Appendix XI. This list is developed from the system descriptions and P&IDs. This list describes, in a list format, the major equipment and device scope of supply. Design conditions are listed only for those items that have been sized as a requirement for current cost estimating.

3.2.9 Electrical One-Line Diagrams

The Port Jefferson Backyard Option 1 power electric system has limited interface with the existing plant electrical systems. In this option, the new ST generator and single CT generator are connected to an expanded 138 kV switchyard. The electrical one line drawing for this option is found in Appendix XII. The CT is provided with a generator breaker between it and the step-up transformer. The step-up transformer is oil filled; forced air cooled 18 kV to 138 kV rated at 205 MVA and sufficient for the output of the CT generator capability under the various operating conditions. The ST generator is connected to the 138 kV switchyard through an SF-6 breaker which is located on the high side of the transformer and within the station boundary. In addition to station operation to connect this generator to the switchyard bus, it will also have trip capability to allow isolation of the station by the system operator.

The auxiliary power will be supplied to new equipment from a single 100% capacity auxiliary transformer that is fed from either the CTs during operation of this machine or back fed through the generator step-up transformer connected to the 138 kV switchyard. The new auxiliary transformer will be 18 kV to 4.16 kV oil filled, fan cooled and anticipated to be rated at 10 MVA to serve the CT / HRSG plant and ST generator loads.

3.2.10 Water and Wastewater

Water balances for the Port Jefferson Backyard Option 1 for both oil-fired operations and gas-fired operations are provided in Appendix XIII. On-site wells (primary source) and city water (secondary source) provide influent to the fire protection system, service water system, RO/ EDI system, and to leased, trailer-mounted, demineralizer systems. City water is the sole source of potable water. The leased demineralizer systems are used to supplement the installed RO/EDI system during periods of oil firing when demineralized water injection is required for CT NO_X control. The RO/EDI system provides treated water to the HRSG, inlet air cooler, and the CT on/off-line washing system.

The well/city water requirement for the Backyard Option 1 during gas-fired operation with the inlet air cooler in service is approximately 50 gpm (~ 30 gpm without the inlet air cooler in service). The new RO/EDI system will have two trains each rated at 50 gpm (two 100% trains). It is expected that this level of well water/city water demand for the new combined cycle facility for gas-fired operation will be offset by the savings in water demand from retiring Port Jefferson Unit 3 as part of the Backyard Option 1 re-powering.[20] During oil-fired operation the demand for well water/city water increases to approximately 300 gpm. Assuming 720 hours/year of oil-fired operation, the annual average well/city water demand for oil-fired operation is about 25 gpm.

Backyard Option 1 uses an ACC and thus does not require circulating water for plant cooling. With the retirement of Unit 3 as part of the Backyard Option 1 re-powering there would be a decrease in design circulating water flow from Port Jefferson Station of 102,000 gpm.

As shown in the water balances in Appendix XIII, much of the water supplied to the new facility is lost to evaporation (NO_X control for oil-firing and inlet air cooler for summer-time operation). Sanitary wastes will discharge to the municipal sewer system. Blowdown from the HRSG will discharge to the existing wastewater treatment facility just as boiler blowdown from existing Port Jefferson boilers is discharged. Other small wastewater streams from the new facility will be treated by the existing wastewater treatment facility at Port Jefferson, which currently has excess capacity (the retirement of Unit 3 will also provide additional excess treatment capacity at the station). Wastewater that will be treated by the existing facility includes a small quantity of equipment drains and inlet air cooler blowdown (~ 5 gpm) that will pass through an oil water separator before discharging to the existing on-site wastewater treatment plant. Intermittent off-line CT wash wastewater flows will pass through a water oil separator before discharging to the existing wastewater treatment plant.

3.3 Backyard Option 2

3.3.1 Conceptual Design

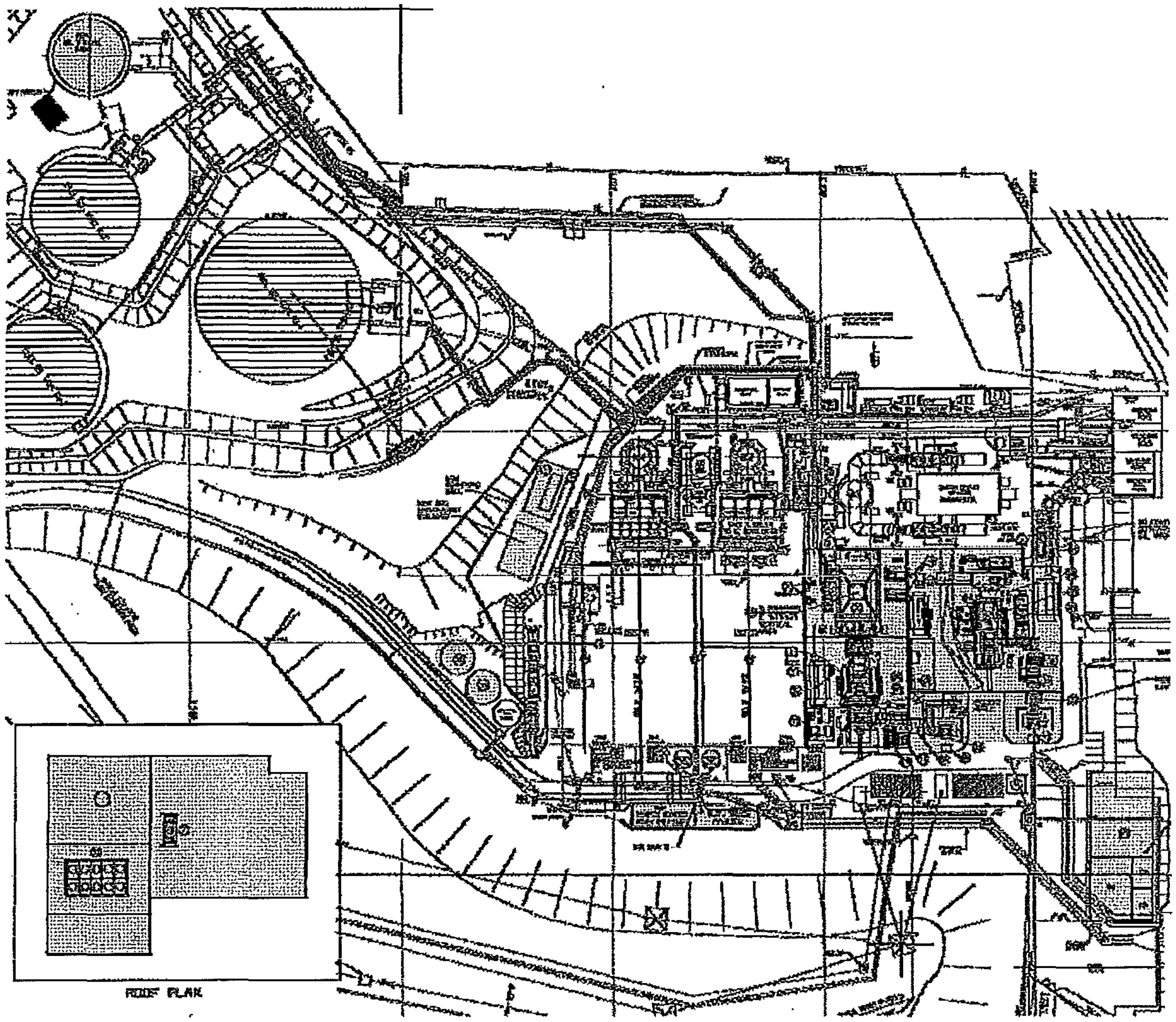
This section includes a summary description of Backyard Option 2 which is a backyard repowering in a 1 x 1 x 1 configuration using a MHI 501G CT with once through cooling. The plant utilizes a single MHI 501G CT (for study purposes). A vertical HRSG is provided for the CT in order to decrease required space. The HRSG is a three pressure with reheat design without supplemental firing. A new tandem compound single flow axial exhaust reheat ST will be provided. The ST will exhaust into a new seawater cooled condenser that will be tied into the existing Unit 3 circulating water system. The plant will have a nominal net capacity (ISO) of 379 MW.

Plot Plan

A plot plan showing the proposed arrangement of this option is shown in Exhibit 3-4. The new combined cycle equipment will be located in the area to be cleared through the demolition of the existing Units 1 and 2 and the existing service (administration) building which will be relocated. The existing soot blowing air receiver and oil drain tanks in the Units 1 & 2 area will require relocation. There are no other known interferences in this area.

[20] Although the retirement of Unit 3 is expected to offset the maximum demand for well/city water (gpm) from the Backyard Option 1 gas-fired operation, there may be a net increase in total annual water consumption (gallons/year) due to increased utilization of the new combined cycle unit versus the retired steam boiler.

Exhibit 3-4 Port Jefferson Backyard Option 2



Combustion Turbine and HRSG

The new CT will be purchased with all the necessary auxiliary equipment including evaporative type inlet cooler. The CT will have a DLN combustor for natural gas firing but will require water injection when firing kerosene. Similarly, the HRSG will be provided with all necessary auxiliary equipment including SCR and CO catalysts for air emissions control. The HRSG will be provided with an integral deaerator and new feedwater pumps. The HRSG will exhaust to a new 225 foot high, steel, single flue chimney mounted above the HRSG. The existing Unit 3 condensate tank will be reused. The new condensate pumps will pump to the new deaerator. New main steam, hot reheat, cold reheat, and LP steam piping will connect the new ST to the HRSG.

Steam Turbine

The new ST will be a tandem compound, single flow, axial exhaust design with a nominal capacity of 130 MW. Throttle steam conditions will be 1800 psig, 1050°F with 1050°F reheat. The ST has a hydrogen cooled electric generator. The ST will be purchased with all the necessary auxiliary equipment

Cooling Systems

The ST will exhaust axially into a new seawater cooled condenser. Circulating water (seawater) will be provided by a tie-in to the existing Unit 3 circulating water system supply and discharge lines. Since Units 3 and 4 are soon to be upgraded with new variable speed circulating water pumps and fine mesh screens in order to comply with 316b requirements, the new Unit 3 pumps and screens will be reused for the repowering configuration.

Electrical and Controls

The CT will be equipped with a generator breaker, auxiliary transformer, step-up transformer and a high side gas insulated breaker. The new CT auxiliary transformer will be sized to provide power for all new auxiliary equipment including equipment associated with the ST. The ST generator will connect to a new step-up transformer and high side gas insulated breaker. The step-up transformer will have a high side voltage of 138 kV. The new 4160 V switchgear associated with the CT will be housed in an enclosure located within the new turbine building.

A new distributed control system will be provided including HRSG controls, CT generator controls, boiler feed pump controls, computer for data acquisition and logging. The ST will be provided with a complete, fault-tolerant, EHC system including vibration probes, axial position probes and monitoring system. The new control system will include an uninterruptible power supply and battery system sized to supply power for emergency controls and safe plant shutdown.

Fuel Systems

The natural gas supply system is comprised of fuel gas piping, fuel gas compressors, and conditioning equipment including a scrubber, moisture separator, coalescing filters, filter /separator, metering equipment and fuel gas heaters. New gas piping from a connection point at the adjacent existing gas yard to the new unit facilities is included.

The kerosene supply includes new piping from the existing fuel dock to a new tank. Fuel barge located pumps will facilitate this transfer. An existing No. 6 oil tank will be demolished and replaced with a new 2,500,000 gallon kerosene storage tank sized for approximately five days operation. The new storage tank will be equipped with a containment barrier and distillate oil forwarding pumps and piping to the CT.

Other Systems

A new RO and electro deionization water treatment system will be provided. The system will consist of two 100% trains, each with a design capacity of 70 gpm. A new 615,000 gallon demineralized water storage tank will be provided. The tank will provide approximately 24 hours of storage when firing kerosene and approximately five days of storage with natural gas firing.

A new fire protection pump facility will be installed including main and backup fire pumps, a jockey pump. The existing Units 3 & 4 well water/firewater storage tank will continue to be utilized with backup from the existing 6 in. diameter city water main.

Aqueous (19%) ammonia for the SCR will be delivered in tanker trucks and stored in a 5,000 gallon ammonia storage tank. The tank will provide approximately five days storage with the unit operating on oil.

Process wastewater generated by the new plant will be directed to the existing wastewater treatment facility. Storm water runoff provisions will be integrated into the existing storm water infrastructure.

Buildings

New buildings associated with the repowering will include a combined CT/ST/HRSG building including administrative area, locker room, control room, and electronics room on the second floor; an auxiliary boiler building; a gas compressor building; a warehouse including electrical and mechanical shops; an RO building; and a fire pump house.

3.3.2 Performance / Heat Balance

Backyard Option 2 consists of one MHI M501G CT with a vertical HRSG providing steam to a new ST with an axial exhaust to a once through cooling sytem. The CT performance for Backyard Option 2 was predicted using data from Thermoflow's GTPro/GTMaster database, which MHI verbally confirmed was reasonable for predicting performance of their M501G machine. The HRSG was a vertical three pressure design that supplies steam to the ST which exhausts axially to a once through steam condenser that uses Port Jefferson Harbor for the circulating water source using the existing Unit 3 circulating water inlet and outlet canals. The Port Jefferson site is a tight site however the use of a vertical HRSG and the use of a once-through cooling system significantly reduces the required site area. The vertical HRSG and the axial flow once through cooling system are not considered to have a negative impact on performance as compared to standard designs, and the heat balances for the Backyard Option 2 are thermodynamically considered to be a relatively standard design.

The heat balances were performed for the 92°F, 59°F and 25°F temperatures while operating on natural gas and 92°F and 25°F temperatures while operating on fuel oil.

3.3.3 Construction Plan and Schedule

Backyard Option 2 is a configuration that ties into the existing Unit 3 once-through cooling system. All of the major components for Backyard Option 2 are situated substantially over Units 1 and 2 which would be demolished prior to construction. Unit 3 may remain in service during most of the construction period. The final tie-in to the Unit 3 once-through cooling water system will be completed just prior to commissioning the new condenser and associated components. It is expected that some of the piles supporting the existing structures will be re-used and supplemented with additional new piles as required.

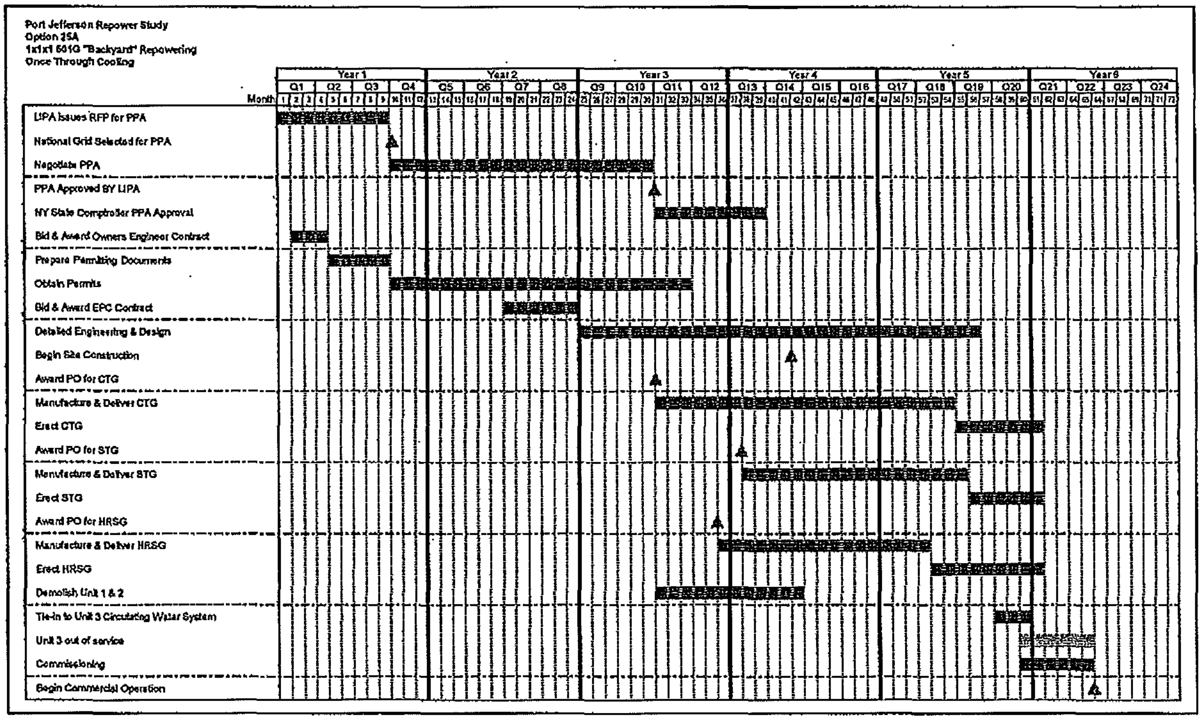
There is some space available to receive and store new equipment on the hilltop plateau area on the southwest side of the site; however, additional off-site storage space will have to be found as well since a large portion of this area will be required for construction craft parking.

The Port Jefferson power block site is extremely compact and the use of large cranes during construction will be severely limited. This will also result in an extremely inflexible construction sequence with little chance for suitable work-around plans should component deliveries or other site construction activities be delayed. A modularized construction approach whereby major portions of the plant are fabricated in a factory or other remote fabrication facility should be considered. The plant is located on the shores of Port Jefferson Harbor and ideally situated to receive barge shipments of large components. Some shoreline modifications would likely be required however a modularized approach could reduce the site construction time. Unlike the horizontal HRSG employed in Backyard Option 1, the configuration of a vertical HRSG does not initially appear to lend itself to being transported after being fully assembled although this should not be discounted until it is studied in more depth.

Once Units 1 and 2 are demolished, it will be necessary to test the soils in the construction areas for contamination and completely remediate any contaminants that are found.

A summary level project schedule for Port Jefferson Backyard Option 2 is provided in Exhibit 3-5 Exhibit 3-5 below and in Appendix VIII. The schedule includes current delivery durations for major equipment, the sequence for obtaining the PPA and the sequence for obtaining the required permitting as well as the demolition, construction and commissioning sequences. The schedule assumes that an Owner's Engineer will be employed at the onset to prepare the documents necessary for permitting and to prepare the package to solicit bids for the EPC contractor. It is assumed that an EPC contractor will prepare and submit bid packages for the major equipment such as the CT, HRSG and ST. Orders for this equipment will not be placed until after LIPA approval of the PPA. Contractual arrangements with the EPC contractor should include equitable terms to protect both National Grid and the contractor should LIPA delay or not approve the PPA, or should other unforeseen project development events occur.

Exhibit 3-5 Project Schedule for Port Jefferson Backyard Option 2



3.3.4 Commissioning Schedule

The commissioning program is expected to take about six months. During this time, the various plant systems will be tested and placed in service, the HRSGs will be cleaned and prepared for operation and the CTs will be tuned and adjusted for optimum operation. Once satisfactory quality steam is available, the ST will be tested. Certain plant performance testing will also be conducted to verify that the major equipment is functioning as specified.

3.3.5 Demolition Requirements

Prior to the start of site construction it will be necessary to demolish Units 1 and 2 as well as the administration building. Due to the proximity to Unit 4 and the LM 6000 CT plant, both which will remain in operation, extreme care must be taken to ensure the process does not disturb the operating units.

Much of the insulation and some of the building siding that remains in the areas to be demolished of Units 1 and 2 is expected to be asbestos based. Prior to demolition, it will be necessary to properly abate all asbestos.

Early in the commissioning period, the new once-through cooling water must be connected to the cooling water intake and discharge structures currently serving Unit 3. Considerable rough-in work can be accomplished prior to making the final connections thus leaving Unit 3 in service for as long as possible. Demolition of Unit 3 is expected to consist of removal of short sections of the existing Unit 3 cooling water lines to allow the new cooling water pipes to be connected to the existing intake and discharge structures. The Unit 3 cooling water lines that remain will be capped and abandoned in place.

3.3.6 Conceptual Foundation Plan

Stone & Webster Consultants has done a limited review of geotechnical and pile location plans for the existing structures at Port Jefferson. This information indicates that at least the major structures at the sites are on pile supported foundations. If this project does go ahead to detailed engineering, a complete geotechnical/environmental investigation with borings must take place to form the basis of any detailed Civil/Structural design. For purposes of this repowering study we are assuming that all major equipment and structure foundations will be pile supported.

The major equipment such as the CT and generator, the HRSG, the ST and generator and water cooled condenser will all be located on pile supported mat type foundations. The major building structures such as the HRSG building, the CT building, and ST building, will be supported on individual column pile caps and grade beams. The chimney, transformers, and auxiliary boiler will all be founded on pile supported mat foundations. All tanks will be supported on concrete mat foundations with or without piles depending on the size of the tank and the loads. All pipe racks will be supported on individual column spread footings with or without piles as required.

The balance of the yard structures will most likely be supported on concrete slab construction with deepened perimeter frost walls. All foundations will be carried to an elevation below the frost line and be designed in accordance with the American Concrete Institute as well as state and local codes.

3.3.7 System Descriptions and P&IDs

Stone & Webster Consultants prepared system descriptions and P&IDs for the major plant systems listed below.

1. Main Steam
2. Cold Reheat
3. Hot Reheat
4. Low Pressure Steam
5. Auxiliary Steam
6. Steam Turbine Exhaust
7. Condensate
8. Feedwater
9. Fuel gas
10. Aqueous Ammonia
11. Component Cooling Water
12. Instrument & Service Air
13. Plant Makeup Water Treatment
14. Plant Waste Water Treatment
15. CTG Auxiliary Services

The Backyard Option 2 system descriptions are contained in Appendix IX. The P&IDs associated with the system descriptions are contained in Appendix X. Each system description is shown with its associated P&IDs. The system descriptions provide basic functional descriptions of each of the selected systems. The P& IDs are functional representations of plant fluid systems, such as main steam, reheat steam, cooling systems etc. The purpose of the P&IDs is to provide information to allow the Owner and the Engineer to determine station interconnecting piping design requirements, instrumentation requirements and device requirements. Descriptions of CT, ST and the HRSG are provided elsewhere in the report.

3.3.8 Plant Equipment List

Backyard Option 2 proposed combined cycle project major equipment summary list is shown in Appendix XI. This list is developed from the system descriptions and P&IDs. This list describes, in a list format, the major equipment and device scope of supply. Design conditions are listed only for those items that have been sized as a requirement for current cost estimating.

3.3.9 Electrical One-Line Diagrams

The Backyard Option 2 power electric system is independent of the existing plant electrical systems. The nomenclature of electrical equipment shown on the one line diagram considers this option as Unit 5 to the station. . The electrical one line drawing for Backyard Option 2 is found in Appendix XII. In this option, the new ST generator and single CT generator are connected to an expanded 138 kV switchyard. The CT is provided with a generator breaker between it and the step-up transformer. The step-up transformer is oil filled; forced air cooled 18 kV to 138 kV rated at 305 MVA and sufficient for the output of the CT generator capability under the various operating conditions. A new circuit breaker is installed in the switchyard to allow the generator to be isolated from the grid by the system operator. The ST generator is connected to the 138 kV switchyard through an SF-6 breaker located on the high side of the transformer and within the station boundary. The ST generator output is stepped up to transmission voltage through an oil filled, forced air cooled 18 kV to 138 kV rated at 150 MVA. In addition, an existing oil circuit breaker no. 1340, in the switchyard is reused to allow isolation of the station by the system operator.

The auxiliary power will be supplied to new equipment from a single 100% capacity auxiliary transformer that is fed from either the CT generator during operation of this machine or back fed through the generator step-up transformer connected to the 138 kV switchyard. The new auxiliary transformer will be 18 kV to 4.16 kV oil filled, fan cooled and anticipated to be rated at 10 MVA to serve the CT / HRSG plant and ST generator loads.

3.3.10 Water and Wastewater

Water balances for Port Jefferson Backyard Option 2 for both oil-fired operations and gas-fired operations are provided in Appendix XIII. On-site wells (primary source) and city water (secondary source) provide influent to the fire protection system, service water system, RO/EDI system, and to leased, trailer-mounted, demineralizer systems. City water is the sole source of potable water. The leased demineralizer systems are used to supplement the installed RO/EDI system during periods of kerosene firing when demineralized water injection is required for CT NO_X control. The RO/EDI system provides treated water to the HRSG, inlet air cooler, and the CT on/off-line washing system.

The well/city water requirement for Backyard Option 2 during gas-fired operation with the inlet air cooler in service is approximately 70 gpm (~ 40 gpm without the inlet air cooler in service). The new RO/EDI system will have two trains each rated at 70 gpm (two 100% trains). It is expected that this level of well/city water demand for the new combined cycle facility for gas-fired operation will be offset by the savings in city water demand by the retirement of Unit 3.[21] During kerosene-fired operation the demand for well/city water increases to approximately 470 gpm. Assuming 720 hours/year of kerosene -fired operation, the annual average incremental city water demand for oil-fired operation is about 40 gpm.

Backyard Option 2 uses once through cooling with a circulating water maximum design flow of 54,000 gpm. This represents a 47% reduction in the maximum design flow from the existing unit (Unit 3).

As shown in the water balances in Appendix XIII, much of the water supplied to the new facility is lost to evaporation (NO_X control for oil-firing and inlet air cooler for summer-time operation). Sanitary wastes will discharge to the municipal sewer system. Blowdown from the HRSG will discharge to the existing wastewater treatment facility just as boiler blowdown from existing Port Jefferson boilers is discharged. Other small wastewater streams from the new facility will be treated by the existing wastewater treatment facility at Port Jefferson, which currently has excess capacity (the retirement of Unit 3 will also provide additional excess treatment capacity at the station). Wastewater that will be treated by the existing facility includes a small quantity of equipment drains and inlet air cooler blowdown (~ 5 gpm) that will pass through an oil water separator before discharging to the existing on-site wastewater treatment plant. Intermittent off-line CT wash wastewater flows will pass through a water oil separator before discharging to the existing wastewater treatment plant.

3.4 Technical Supporting Studies

3.4.1 Electric Transmission Upgrades

National Grid completed an analysis of a transmission upgrade requirements and dynamic reactive power costs for a full range of repowering options at Port Jefferson as part of the re-powering study. The analysis performed assumed a repowering in service date of 2016 and further assumed that a series of transmission reinforcement projects required to support system load growth and already in the planning or construction stage would be completed. These projects include the Heartland Town Square project, the NUSCO interconnection at 450 MVA and the new Caithness 309 MW combined cycle plant. The cost of these projects is not included in the re-powering cost estimates because they need to be done regardless of what re-powering option is finally agreed to.

The study results indicate that Port Jefferson should be able to accommodate up to 250 MW of additional generation at the 138 kV bus with little or no additional system reinforcement. This will allow the addition of the new plants when the shutdown of Unit 3 is taken into consideration. Stone & Webster Consultants therefore has included no monies in the cost estimate for electric transmission upgrades for the Backyard Options 1 and 2. Stone & Webster Consultants has however included under Owners Costs, $2 million for modifications to the Port Jefferson Substation ring bus for backyard Options 1 and 2 and the costs for 138 kV underground cable from the step-up transformer high side breakers to the switchyard in the amount of $1.675 million for backyard Option 1 and $2.075 million for backyard Option 2.

National Grid's analysis concluded that no dynamic reactive support is required to compensate for the incremental MW capacity added by Backyard Options 1 or 2 and Stone & Webster Consultants has included no costs for any such support.

[21] Although the retirement of Unit 3 is expected to offset the maximum demand for well/city water (gpm) from Option 25A gas-fired operation, there may be a net increase in total annual water consumption (gallons/year) due to increased utilization of the new combined cycle unit versus Unit 3.

3.4.2 Natural Gas Upgrades

Natural Gas is supplied to Port Jefferson by National Grid US Gas Distribution ("National Grid Gas"). The gas supply to the existing Port Jefferson Energy Center (2 x LM 6000) is purchased on a fully interruptible contract basis and the existing Units 3 and 4 steam units have no gas contracts and have been assumed to be fully interruptible for the purpose of this study. National Grid will require a 30 day interruptible gas supply for the new Backyard Options combined cycle plant. Therefore the gas requirements for each repowering option represent both an increase in gas demand and an upgrade in the type of service. Also, the current 100 psig minimum pressure supplied to the Port Jefferson Energy Center would be increased to a minimum of 170 psig to the new combined facility and gas compressors would be provided on site to further increase the supply pressure to the Backyard Options 1 and 2 CTs. The cost of the gas compression facility is included in the Backyard Options 1 and 2 capital cost estimates.

For the purpose of the gas supply upgrade determination, National Grid estimated a maximum hourly load of 1900 Dt/hr at a minimum pressure of 170 psig for single new GE7FA CT, along with 1800 Dt/hr for operation of a single existing steam unit (Unit 3 or 4), and 800 Dt/hr for the existing Port Jefferson Energy Center (2 x LM 6000) for a total gas demand of 4500 Dt/hr for this configuration. National Grid then used this information in an in-house study to define the requisite gas supply upgrade modifications and an estimate of the associated capital costs. This formed the basis for National Grid's Application 1, Case 2 Study that was provided to Stone & Webster Consultants on February 28, 2008. This case is nominally representative of the expected operating mode for Stone & Webster Consultants' Backyard Option 1 and resulted in an estimated capital cost of $38.2 million. This included an additional 14,780 feet of 12 inch diameter, 350 psig main looping the existing 12 inch main to Port Jefferson at $11.1 million, plus an additional 8,000 feet of 24 inch diameter 450 psig main looping the existing 24 inch main along the Long Island expressway at $14 million, $750K for additional metering, and 32.36% FIT (tax).

For backyard Option 2, National grid used the same analysis described above for backyard Option 1 but with a gas consumption of 2890 Dt/hr for the larger M501G gas turbine. This resulted in a maximum total gas demand of 5490 Dt/hr. This demand required 14,780 feet of 20 inch diameter 350 psig main looping the existing 12 inch main to Port Jefferson at $20.7 million plus 18,700 feet of 24 inch diameter 450 psig main looping the existing 24 inch main along the Long Island Expressway at $32.7 million for a total of $54.4 million. Adding $750K for additional metering and 32.36% FIT resulted in a total estimated capital cost of $80 million.

The $38.2 million and $80 million costs for gas supply upgrades have been included as a part of "Owner's Costs" in the capital cost estimate.

3.4.3 Distillate Fuel System

While Port Jefferson will be normally fueled by natural gas, the CTs will be capable of operation on kerosene. This is only expected to be required in the event of interruption or reduced capacity of the natural gas supply to the plant and for the purpose of analysis considered to last only five days. The plant requirements for kerosene are a nominal 306,000 gallons per day and 424,000 gallons per day for Backyard Options 1 and 2, respectively at the maximum plant output. An on-site storage capacity of 2 million gallons and 2.5 million gallons for Backyard Option 1 and 2, respectively is provided to meet this requirement.

The supply for both the initial fill of this storage, as well as periodic replenishment of fuel used in periodic tests of the back-up fuel system will be via barge delivery to the existing barge dock facility that currently serves Units 3 and 4.

New kerosene piping will be provided from the dock to the new kerosene storage tank that replaces one of the existing heavy oil tanks. Forwarding pumps will be provided to pump the light oil from the tank to the CT.

Periodic testing of the kerosene operation is projected to be performed on a quarterly basis for four hours. This will consume approximately 51,000 gallons of kerosene and 71,000 gallons of kerosene for Backyard Options 1 and 2 respectively.

3.4.4 SCR Ammonia System

For all of the National Grid repowering options, SCR are used to reduce the emissions of NO_x. These systems reduce NO_x by reacting ammonia with NO_x on the surface of a catalyst to selectively reduce the NO_x to nitrogen and water. Ammonia will be delivered, stored and handled at the sites to meet the requirements of the SCRs for both oil and gas firing.

In very high concentrations, Ammonia is toxic to humans and can cause lung damage if inhaled. Accordingly the handling and storage of ammonia is covered by federal regulations for the prevention and detection of accidental releases of hazardous chemicals that could harm the public. Specifically, the U.S. EPA regulations in Title 40, Part 68 of the Code of Federal Regulations (40 CFR 68) govern facilities that store or use extremely hazardous substances in quantities above certain concentrations. These regulations, known as the "Chemical Accident Prevention Provisions", apply to ammonia storage and use. According to these regulations, a Risk Management Program (which varies in detail depending on accident history and the analysis of a worst case accident scenario) is required for ammonia solutions with a concentration of 20% or greater when stored in quantities that exceed 20,000 pounds.

Ammonia is readily available in three standard concentrations in the US including anhydrous ammonia (no dilution), a 29% aqueous solution and a 19% aqueous solution. For the National Grid repowering projects the 19% aqueous solution was selected as the design basis for the SCRs and storage/handling systems. This very low concentration presents a minimal hazard to the public and operating staff. Because of the very low concentration, a risk management plan is not required by EPA regulations.

The vapor pressure that results from the weak 19% aqueous solution is low enough so that storage in atmospheric tanks (such as API 620 or 650 tanks) could be considered. However, many plants using 19% aqueous ammonia have opted to use storage tanks designed for 50 psig pressure in accordance with the requirements of the ASME Section VIII design Code. The National Grid repowering projects will use this type of pressure tank for ammonia storage. These very robust tanks provide an extra measure of security against accidental spills. Also, they eliminate concerns with the release of ammonia vapor due to venting that are encountered with atmospheric tanks. The tanks will have provisions to eliminate vapor releases that might result in the unlikely event that the safety relief valve operates.

The design of the storage facility at Port Jefferson, for receiving, storing and handling will be such that the risk of an accidental leak is reduced. A containment that surrounds the storage tank and delivery area is provided to collect any leakage in the event of a spill or release of ammonia. The containment will be protected by concrete or pole barriers to prevent vehicular breach of the containments. Spilled ammonia in the storage tank area will be collected and drained to a covered collection area. An ammonia vapor detection system will be installed to allow rapid detection and quick response to any accidental spill of ammonia.

The 19% aqueous ammonia solution will be delivered to the site in tanker trucks which are typically of 6,000 gallons capacity. An ammonia off-loading area will be provided in order to safely unload the contents of the tanker truck into the storage tank. The truck discharge line connects to the fill line and the truck vent connects to a vapor return line, to ensure pressure equalization between the tanker truck and the tank. This arrangement prevents over-pressurization and eliminates vapor releases.

Exhibits 3-6 and 3-7 below show the estimated ammonia consumption quantities (based on 19% aqueous ammonia) and the storage tank sizes for each of the repowering options for both natural gas and oil firing.

Exhibit 3-6 Ammonia Consumption and Storage for Natural Gas Firing

	Port Jefferson	
	Backyard Option 1	Backyard Option 2
Consumption Rate (gph)	35	43
Tank Size (gal)	9,000	11,000
Tank Size (days)	10	10

Exhibit 3-7 Ammonia Consumption and Storage for Kerosene Firing

	Port Jefferson	
	Backyard Option 1	Backyard Option 2
Consumption Rate (gph)	61	75
Tank Size (gal)	8,000	9,000
Tank Size (days)	5	5

3.5 Environmental Studies

3.5.1 Cooling System Options

During Phase I the relative costs and performance of five alternative cooling options that could be included in the plant design were evaluated. These options included:

- Once Through Cooling
- Substratum Intake Systems
- Natural Draft Cooling Towers
- Mechanical Draft Cooling Towers, and
- Air Cooled Condensers

In addition to evaluating cost and performance for each cooling option, a general description of each cooling system option was provided as well as a review of other issues such as noise, aesthetics, licensing, air emissions, water source and consumption requirements, and potential impacts on impingement and entrainment mortality. The Phase I report provides the rationale for selecting once through cooling and ACC as cooling options for plant designs selected for further review in Phase II.

In Phase II of this project, more detailed cost and performance estimates were developed for the two selected cooling systems; the once through cooling and the air cooled condenser. In addition, as part of the Phase II study, Stone & Webster Consultants compared the circulating water flow of the existing facility to the circulating water flow for each of the selected re-powering options. Backyard 1, due to ACC, does not require circulating water for plant cooling. Therefore, with the retirement of Port Jefferson Unit 3, Backyard 1 will result in a decrease in design circulating water flow rate at Port Jefferson of 102,000 gpm. Backyard 2 has a full load design circulating water flow rate of 54,000 gpm, therefore with the retirement of Port Jefferson Unit 3, Backyard 2 will result in a decrease in design circulating water flow rate at Port Jefferson of 48,000 gpm. Due to the addition of the CT with each re-powering option, which produces power but does not require cooling water, the change in station design circulating water flow rates per megawatt of station generating capacity is further decreased as summarized in Exhibit 3-8 below.

Exhibit 3-8 Station Design Circulating Water Flow Rates

	Cooling Method	Existing Facility (gpm/MW)	Re-Powered Option (gpm/MW)	Percent Decrease
Backyard Option 1	ACC	583	228	61%
Backyard Option 2	OT	583	283	51%

The potential change in station annual cooling water flows due to re-powering is also affected by the projected unit capacity factors for the existing units that remain operating, as well as the new re-powered unit.

Preliminary modeling conducted by National Grid, indicates that Backyard 2 (once through cooling) results in reductions in impingement mortality and entrainment roughly equivalent to existing reduction proposals for once through cooling options at Port Jefferson.

The potential use of SIS water to supplement once through cooling may have potential to enhance impingement and entrainment reductions even further. The SIS draws in surface water filtered through a natural sand bed via underwater well fields and is primarily an alternative method to maintain once-through cooling but also eliminate entrainment and impingement in the process of delivering the circulating cooling water. Potential benefits of the SIS include improvements in noise levels, aesthetics, and heat rate impacts when compared to air cooled condensers. Compared to conventional once through cooling the SIS may result in reduced marine macrofouling of the intake, piping, and condenser water boxes and may result in heat rate improvements in summer months due to cooler water supply from the SIS than conventional once through cooling surface water supplies.

The SIS technology has been evaluated in a feasibility study for Port Jefferson and is currently undergoing pilot scale demonstration at the Shoreham test site. At the end of the demonstration program, the capital costs of constructing individual wells and the required number of wells to supply supplemental cooling water for Backyard Option 2 can be evaluated with more certainty.

3.5.2 Air Quality Assessment (Backyard Options 1 and 2)

Air quality dispersion modeling has been conducted to determine the potential ambient air quality impacts of two options being considered by National Grid for the re-powering of Port Jefferson. The two options consist of Backyard Option 1 (1x1x1 7FB with ACC) and Backyard Option 2 (1x1x1 501G with ACC). The new units would be dual fuel capable (i.e., natural gas or low sulfur kerosene) requiring the analysis of the impacts of both fuels. The ambient air quality impacts of the operation of the existing units at Port Jefferson are also analyzed for comparison with the re-powering unit impacts to estimate the air quality improvements of the re-powering options.

The air quality impacts of criteria pollutant emissions from the existing and re-powering units at Port Jefferson are examined using the latest version of the AMS/EPA / AERMOD modeling program. AERMOD is currently the EPA-preferred refined model for use in the near field (i.e., <50 km) according to the EPA "Guideline on Air Quality Models" (Appendix W to 40 CFR Part 51).[22] The model was executed for each of the two re-powering cases at Port Jefferson. The existing plant operations are also modeled in order to determine before and after re-powering plant air quality impacts. The AERMOD runs are made using five years of recent hourly surface meteorological data from MacArthur Airport in Islip, NY and upper air data from Brookhaven, NY. Existing background air quality data available from the NYSDEC are also used in the analysis. The criteria pollutants examined include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM) with aerodynamic diameter less than a nominal 10 micrometers (PM_{10}), and PM less than 2.5 micrometers ($PM_{2.5}$).

3.5.2.1 Project Overview

Port Jefferson is located on Beach Street on Long Island Sound in Port Jefferson, New York. The station currently consists of two 45 MWe units, which are no longer operating (i.e., Units 1 and 2), two nominal175 MWe units (i.e., Units 3 and 4) operating on no. 1, no. 2, or no. 6 fuel oils or natural gas, and two GE LM6000 CTs. In addition, a 15 MWe black start CT is maintained on site to meet load demand and emergency power requirements. Only Units 3 and 4 and the GE LM6000 CTs are evaluated for air quality impacts in this analysis as the other units either do not currently operate or operate very infrequently.

Two re-powering options are being considered for Port Jefferson consisting of Backyard Option 1 (1x1x1 7FB with ACC) and Backyard Option 2 (1x1x1 501G with ACC). The intent of this modeling analysis is to determine at what stack height compliance with the NAAQS can be achieved for the two re-powering options as well as to determine the air quality impacts before and after the re-powering.

The approach used in this dispersion modeling analysis consists of a three-step process as follows:

- Step 1: Perform refined modeling for different stack heights for the re-powering options using AERMOD to determine compliance with the NAAQS;
- Step 2: Perform refined modeling for the existing units using AERMOD to determine current air quality impacts; and
- Step 3: Compare the before and after re-powering air quality impacts to estimate air quality improvements due to the re-powering.

The section provides details on the modeling analysis.

3.5.2.2 Emission Source Parameters

Emission Sources

The following Port Jefferson emission sources are included in the dispersion modeling analyses of the existing units and the two re-powering options:

[22] U.S. Environmental Protection Agency, "Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions". Appendix W to Part 51, Title 42 of the Code of Federal Regulations (42CFR51), November 9, 2005.

- Two 175 nominal MWe Gas/Oil Fired Boilers (Units 3 & 4);
- Two 40 MWe GE LM6000 CTs;
- Re-powering Backyard Option 1 - One GE Model 7251 FB CT; and
- Re-powering Backyard Option 2 - One MHI Model M501G2 CT.

All existing units are modeled to combust both natural gas and fuel oil and the re-powering units are also modeled to combust both natural gas and low sulfur kerosene. The existing units are assumed to operate simultaneously at full capacity while the re-powering units are evaluated at both full load and minimum load conditions to ensure that maximum impacts are obtained. Annual impacts are based on all of the units operating at a 100% annual capacity factor.

This analysis covers routine emissions during normal operation of the units at the facility. Startups and shutdowns or equipment malfunctions are not considered in this analysis.

Stack Gas Parameters

Operational parameters and stack flue gas characteristics for the existing Port Jefferson sources are shown in Exhibit 3-10 while those for the re-powering units are shown in Exhibit 3-11. The stack gas parameters reflect full load operation for the existing units while both full and minimum load parameter values are provided for the re-powering units.

Emission Rates

The emission rates of SO_2, NO_x, CO, PM_{10}, and $PM_{2.5}$ from the existing Port Jefferson sources are also shown in Exhibit 3-9. The emission rates for the existing units are based on a combination of permitted values and AP-42 emission factors,[23] along with the maximum heat input rates to each unit. The re-powering unit emissions are given in Exhibit 3-10 and are based on a review of recent permit limits for similar facilities utilizing these turbine models and consideration of the uncontrolled combustion turbine emission rates and post-combustion pollution control equipment (e.g. SCR and CO catalyst) capabilities.

[23] U.S. Environmental Protection Agency, "AP-42, Compilation of Air Pollutant Emission Factors". Chapter 3.1, Stationary Gas Turbines, Supplement F, April 2000.

Exhibit 3-9 Port Jefferson Existing Unit Stack Gas Parameters and Emission Rates

Parameter	Unit 3		Unit 4		LM6000s (each)	
X-coord. (m)	661,679.0		661,649.0		661,717.0	
Y-coord. (m)	4,534,775.5		4,534,751.5		4,534,790.5	
Base Elevation (m)	4.88		4.88		4.88	
Stack Height (m)	129.54		129.54		80.77	
Stack Diameter (m)	3.10		3.10		4.31	
Exit Temperature (°K)	431.5		431.5		672.0	
Exit Velocity (m/s)	34.8		34.8		33.2	
Heat Input (MMBtu/hr)	1,889		1,889		455	
Fuel Oil Consumption (gal/hr)	13,492		13,492		3,500	
Natural Gas Consumption (scf/hr)	1.85×10^6		1.85×10^6		0.45×10^6	
Pollutant Emission Rate (g/s)	Unit 3		Unit 4		LM6000s (each)	
	Oil	Gas	Oil	Gas	Oil	Gas
SO_2	190.4	0.14	190.4	0.14	1.74	0.20
NO_x	71.4	47.6	71.4	47.6	1.4	0.53
CO	45.2	19.6	45.2	19.6	4.36	1.54
PM_{10}	23.8	1.77	23.8	1.77	1.02	0.20
$PM_{2.5}$	15.9	1.77	15.9	1.77	1.02	0.20

Assumptions:

1. Short-term impact modeling assumes all units at full load;
2. Annual impact modeling assumes all units operate at 100% annual capacity factor;
3. Emission rates from Title V permits, except CO and $PM_{2.5}$ emissions from AP-42.
4. PM emissions include filterable and condensable fractions.
5. LM6000 stack diameter is the equivalent diameter of the two adjacent flues within the same concrete shell.

Exhibit 3-10 Port Jefferson Re-powering Unit Stack Gas Parameters and Emission Rates

Parameter	Backyard Option 1 (GE 7FB)		Backyard Option 2 (MHI 501G)		Backyard Option 1 (GE 7FB)	Backyard Option 2 (MHI 501G)
Load	Full				Minimum	
UTM X-coord. (m)	661,679.0		661,729.0		661,679.0	661,729.0
UTM Y-coord. (m)	4,534,775.5		4,534,736.7		4,534,775.5	4,534,736.7
Base Elevation (m)	4.57		4.57		4.57	4.57
Stack Height (m)	68.58		68.58		68.58	68.58
Stack Diameter (m)	5.49		6.71		5.49	6.71
Fuel	Oil	Gas	Oil	Gas	Oil	Oil
Exit Temperature (°K)	412.0	361.5	416.5	358.2	407.6	413.7
Exit Velocity (m/s)	24.99	20.12	22.98	17.74	15.64	17.13
Heat Input (MMBtu/hr)	2,170	1,884	2,940	2,562	1,316	1,912

Pollutant Emission Rate (g/s)	Backyard Option 1		Backyard Option 2		Backyard Option 1	Backyard Option 2
Load	100%				50%	
Fuel	Oil	Gas	Oil	Gas	Oil	Oil
SO_2	11.2	0.4	15.2	0.6	6.8	9.9
NO_x	8.8	1.7	11.9	2.4	5.3	7.7
CO	2.7	1.1	7.2	1.4	1.6	4.7
PM_{10}	13.7	2.6	18.5	3.6	8.3	12.1
$PM_{2.5}$	13.7	2.6	18.5	3.6	8.3	12.1

Assumptions:

8. Annual impact modeling assumes all units operate at 100% annual capacity factor;
9. The stack height shown is the shortest of several examined.
10. All turbines fire natural gas or low sulfur kerosene at 0.04% sulfur;
11. Emission rates from permits of similar units.
12. PM emissions include filterable and condensable fractions.

3.5.2.3 Project Site Characteristics

Port Jefferson is located on Beach Street on Long Island Sound in Port Jefferson, New York. The site is located in the coastal plain of Long Island Sound. Port Jefferson is located approximately 220 kilometers from the nearest PSD Class I area; Lye Brook Wilderness Area in Vermont to the north of the station.

Attainment Status

Port Jefferson is located in the federally designated New Jersey-New York-Connecticut Interstate Air Quality Control Region. This area of New York is currently in attainment of all ambient air quality standards except for $PM_{2.5}$ and ozone, which is classified as "Subpart 2/Moderate" non-attainment for the eight-hour standard.

Ambient air quality data for New York are available from a monitoring network operated by the NYSDEC. Monitoring data on the criteria pollutants are collected at many sites within the state. Monitoring stations located in NYSDEC Region 1 are primarily used to characterize the background air quality concentrations for the Port Jefferson and Northport areas. The monitoring station in Eisenhower Park is used for SO_2 and NO_2 background data as it is the most representative due to its proximity to the station. The monitoring station in Babylon is used for $PM_{2.5}$ background data while a monitoring station in New York City is conservatively used for PM_{10} background data as there is no current PM_{10} data collection on Long Island. A monitoring station in New York City is also used as a source of CO background data as CO monitoring on Long Island was terminated in the year 2000. The annual average and second highest short term average concentrations (3 and 24 hours) for the period 2004- 2006 are used to obtain the necessary background pollutant concentrations for this analysis. These background concentrations are presented in Exhibit 3-11.

Exhibit 3-11 Ambient Air Quality Monitoring Data Representative of Port Jefferson (2004 - 2006)

Pollutant	Averaging Time	Location	Background(1) (µg/m³)	NAAQS (µg/m³)
SO_2	Annual	Eisenhower Park	10.5	80
	24-hr		60.2	365
	3-hr		112.6	1,300
NO_2	Annual	Eisenhower Park	37.6	100
CO	8-hr	New York City	2,860	10,000
	1-hr		6,180	40,000
PM_{10}	24-hr	New York City	60.0	150
$PM_{2.5}$	Annual	Babylon	12.0	15
	24-hr		31.9	35

Notes:

1. Values are the highest annual average and highest second highest short-term averages for the period 2004 - 2006.

Land Use

In processing meteorological data for use in the AERMOD dispersion model, the AERMET pre-processor code requires the specification of three surface characteristics: surface roughness length (z_o), albedo (r), and Bowen ratio (B_o). The surface roughness length is related to the height of obstacles to the wind flow and is, in principle, the height at which the mean horizontal wind speed is zero based on a logarithmic profile. The surface roughness length is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and, together with albedo and other meteorological observations, is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

The EPA has developed a computer program called AERSURFACE[24] that is a tool to aid modelers in obtaining realistic and reproducible surface characteristic values, including albedo, Bowen ratio, and surface roughness length, for input to the AERMET meteorological data pre-processor. The tool uses publicly available national land cover datasets and look-up tables of surface characteristics that vary by land cover type and season.

AERSURFACE requires the input of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92), which it uses to determine the land cover types for the user-specified location. AERSURFACE matches the NLCD92 land cover categories to seasonal values of albedo, Bowen ratio, and surface roughness. Values of surface characteristics are calculated based on the land cover data for

[24] U.S. Environmental Protection Agency, "AERSURFACE User's Guide", EPA Publication No. EPA-454/B-08-001, January 2008.

the area surrounding the site of the surface meteorological data collection. For this application, the land use data were obtained for the area surrounding MacArthur Airport in Islip, NY and used in AERSURFACE to generate values of albedo, Bowen ratio, and surface roughness as a function of the four seasons (i.e. winter, spring, summer, and fall) and for each of six 60-degree directional sectors. This approach of generating surface characteristics at the site of the surface meteorological data collection is consistent with EPA guidance.

Topography

Nearby hills are most prominent to the east and northeast on the other side of Port Jefferson Harbor and from the southeast through the south with lesser hills to the southwest of the station. Port Jefferson Harbor is directly north of the station with areas to the west and northwest having elevations that do not exceed 30 meters (msl). The terrain elevations reach 50 meters at a distance of approximately 1,200 meters from the station to the east and southeast and 80 meters at a distance of 2,000 meters to the east and southeast. The highest elevation within 15 km of the station is 85 meters at a distance of approximately 2,200 meters to the east-southeast.

3.5.2.4 Air Dispersion Modeling

The NYSDEC "DAR-10/NYSDEC Guidelines on Dispersion Models Procedures for Air Quality Impact Analysis" dated May 9, 2006[25] was consulted in selecting the appropriate methodology for this analysis. As this guideline does not yet address specifics on the use of the AERMOD model, the EPA "Guideline on Air Quality Models" (Appendix W to 40 CFR Part 51) was also consulted. The assessment includes: 1) GEP stack height analysis; 2) a surface characteristics determination; 3) meteorological data pre-processing; 4) terrain pre-processing; and 5) refined modeling. The surface characteristics determination is performed using the EPA program AERSURFACE and is discussed in detail Section 4.2. Meteorological data pre-processing is performed using the EPA AERMET program[26] and terrain data pre-processing is performed using the EPA AERMAP program.[27] Refined modeling is performed at full load operation for the existing units and for full and half load for the turbines to evaluate compliance with NAAQS. Refined modeling utilizes the AERMOD model, Version 07026[28] with both topographic and downwash considerations as necessary along with five years (2003-2007) of hourly meteorological data collected at MacArthur Airport in Islip, NY and concurrent upper air data collected at Brookhaven, NY.

AERMOD is a steady-state plume dispersion model for the analysis of pollutant concentrations from a variety of sources. AERMOD simulates transport and dispersion from multiple sources based on an updated characterization of the atmospheric boundary layer. Sources may be located in rural or urban areas and receptors may be located in simple or complex terrain. AERMOD accounts for building wake effects and plume downwash. Sequential meteorological data is processed to estimate concentrations for averaging times from one hour to one year. AERMOD is appropriate for: 1) point, volume, and/or area sources; 2) surface, near-surface, and elevated releases; 3) rural or urban areas; 4) simple and complex terrain; and 5) for transport distances over which steady-state assumptions are appropriate (i.e., up to 50 km). AERMOD has replaced the ISC3 as the preferred Gaussian plume model for near-field dispersion.

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[25] New York State Department of Environmental Conservation, Impact Assessment and Meteorology Section, Bureau of Stationary Sources, "DAR-10/NYSDEC Guidelines on Dispersion Models Procedures for Air Quality Impact Analysis", May 9, 2006.

[26] U.S. Environmental Protection Agency, "User's Guide for the AERMOD Meteorological Preprocessor (AERMET)", EPA Publication No. EPA-454/B-03-002, November 2004.

[27] U.S. Environmental Protection Agency, "User's Guide for the AERMOD Terrain Preprocessor (AERMAP)", EPA Publication No. EPA-454/B-03-003, October 2004.

[28] U.S. Environmental Protection Agency, "User's Guide for the AMS/EPA Regulatory Model - AERMOD". EPA Publication No. EPA-454/B-03-001, September 2004.

Good Engineering Practice (GEP) Stack Height Determination

A GEP stack height calculation is performed for the purpose of identifying the stack height that avoids building downwash considerations in the dispersion modeling analysis. The GEP stack height is evaluated in accordance with EPA published procedures.[29] The GEP stack height calculation is performed using the following equation:

$$H_g = H_b + 1.5\ L$$

where:

H_g = GEP stack height (m)

H_b = height of nearby building (m)

L = lesser dimension of building height or maximum projected width (m)

The GEP stack height determination is based upon dimensions of nearby buildings by reviewing a plot plan of the station and tabulating the height and maximum projected width of buildings located within five times the lesser of the building height or width from the stack. Both the height and width of nearby buildings are determined from the frontal area of the structure, projected onto a plane perpendicular to the direction of the wind. The frontal area is the plane projection upwind from the stack that results in the greatest GEP height. For plane projections with multiple heights and widths, each combination of height and the lesser dimension (height or width) are evaluated for each segment of the structure to determine which one results in the greatest GEP stack height. Adjacent and nearby structures whose plane projections upwind from the source are overlaying are considered as one structure. Likewise, structures that are close together are considered as one structure if their projected separation distance is less than their smallest dimension.

The building dimension information from the Port Jefferson plot plan indicates that the dominant structures relative to the GEP stack height determination for the existing units are the Units 3 and 4 boiler buildings. The GEP analysis is performed with the aid of the EPA "Building Profile Input Program"[30] with the PRIME plume rise algorithm (BPIPPRM) which performs the calculations of the above referenced guideline using coordinates of the corners of the significant structures relative to the stacks in question. It shows that the GEP stack height for the existing units is 407.5 ft. Since the Units 3 and 4 stacks are 425 ft tall, there is no building downwash effect on the existing unit emissions.

For Backyard Option 1, all of the existing Unit 3 structures will be demolished whereas only the Unit 3 boiler building and stack will be demolished for Backyard Option 2. The removal of these structures and the placement of the turbine stacks for each re-powering option are considered in the BPIPPRM runs to determine the GEP stack heights. The GEP stack heights for Backyard Options 1 and 2 were determined to be 332 ft and 321 ft, respectively. Building downwash is accounted for in the AERMOD model runs for less than GEP stack heights evaluated in the analysis using the direction-specific building dimensions obtained from the BPIPPRM output.

[29] U.S. Environmental Protection Agency, "Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)". EPA Publication No. EPA-450/4-80-023R, 1985.

[30] U.S. Environmental Protection Agency, "User's Guide to the Building Profile Input Program", EPA Publication No. EPA-454/R-93-038, revised February 8, 1995.

Modeling Approach

Refined modeling utilizes the AERMOD model with both topographic and downwash considerations as necessary along with five years (2003 – 2007) of hourly surface meteorological data collected at Mac Arthur Airport in Islip, NY and concurrent upper air data collected at Brookhaven, NY.

Model Options

AERMOD modeling options are specified as follows in accordance with EPA "Guideline on Air Quality Models".[31] The options include:

- regulatory default switch used;
- stack-tip downwash;
- calms processing used;
- missing data processing;
- no SO_2 decay;
- 1-, 3-, 8-, 24- hour and annual averaging times; and
- no flagpole receptors.

Meteorological Data

The AERMOD model requires hourly surface meteorological data and twice-daily upper air data for calculating downwind concentrations. The data required for each hour of simulation are:

- wind speed;
- wind direction;
- temperature;
- cloud cover;
- ceiling height; and
- vertical profiles of pressure and temperature.

Port Jefferson does not have an on-site meteorological monitoring program. Therefore, the meteorological data used in the analysis consist of 2003 - 2007 hourly surface observations taken at MacArthur Airport in Islip, NY along with concurrent upper air data from Brookhaven, NY. These are the meteorological data that are most representative of the station. MacArthur Airport in Islip is located approximately 10 miles south of Port Jefferson and Brookhaven is situated approximately 10 miles east of Port Jefferson. These distances from the station support the spatial representativeness of the data since it places it in the same synoptic flow regime as well as most mesoscale systems as that of the station. In addition, an earlier study performed by TRC indicated that the meteorological data collected at the Farmingdale airport were representative of conditions at MacArthur Airport located some 15 miles east of Farmingdale.

The 2003 – 2007 hourly surface observations concurrent upper air data were processed through the AERMET program[32] for the purpose of performing a quality assurance check of the data, to calculate parameters needed in the AERMOD model, and to merge the surface and upper air data to create vertical profiles of temperature and pressure.

[31] U.S. Environmental Protection Agency, "Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions", Appendix W to Part 51, Title 42 of the Code of Federal Regulations (42CFR51), November 9, 2005.
[32] U.S. Environmental Protection Agency, "User's Guide for the AERMOD Meteorological Preprocessor (AERMET)", EPA Publication No. EPA-454/B-03-002, November 2004.

Receptor Data

The receptor grids used in the AERMOD modeling of Port Jefferson are generated using the EPA AERMAP program[33] and U.S.G.S. 7.5 minute series Digital Elevation Maps (DEM) files for the area. The receptors are arranged as polar grids with a radial for every 10 degrees azimuth of wind direction (i.e., 36 radials). Downwind rings of 100-meter spacing from 100 meters to 2,000 meters, 250-meter spacing from 2.25 to 5 kilometers, and 1,000-meter spacing from 6 to 15 kilometers are used. Additional discreet receptors are placed along the fence-line of each station at a spacing of approximately 50 meters.

Model Runs

AERMOD model runs are performed for each re-powering option for both natural gas and low sulfur kerosene firing at full and minimum load in order ensure that the maximum impacts are obtained. Model runs are executed for a few different stack heights to determine the optimum height that meets the NAAQS. Compliance with the NAAQS is determined by maximum predicted ground level air pollutant concentrations that are below the SILs. It is not absolutely necessary for predicted impacts to be below the SILs but the process of demonstrating compliance with the NAAQS through a cumulative impact analysis has become so onerous in terms of obtaining and verifying stack parameters and emission rates from other sources that it is desirable to be below the SILs. It should be noted that the SILs for $PM_{2.5}$ have only been proposed by the EPA and probably will not be finalized until late in 2008. Therefore, for the purpose of this study, the current SILs for PM_{10} are being used as the compliance criteria for $PM_{2.5}$ impacts as the EPA proposal includes three possible sets of SILs, one of which is the current set of PM_{10} SILs.[34]

AERMOD model runs are also performed for the existing station operation in order to compare the current air quality impacts of the station with those of the repowering options.

3.5.2.5 Modeling Results

Repowering Modeling

The results of the AERMOD modeling for Port Jefferson as a function of stack height are summarized in Exhibit 3-12 and 3-13 for the Backyard Option 1 and Option 2 turbines, respectively. The tables provide the maximum predicted ground-level concentrations due to pollutant emissions from the two re-powering options for oil firing. The concentrations shown are the higher of the full or minimum operating load operating scenarios. Included in the tables are the background pollutant concentrations that are most representative of the Port Jefferson area, taken from ambient air quality monitoring data provided by the NYSDEC for the years 2004 to 2006. The NAAQS and SILs for each pollutant and averaging time are also provided for comparison with the turbine impacts plus the background concentrations.

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[33] U.S. Environmental Protection Agency, "User's Guide for the AERMOD Terrain Preprocessor (AERMAP)", EPA Publication No. EPA-454/B-03-003, October 2004.

[34] The proposed SILs for $PM_{2.5}$ are 5.0, 4.0 and 1.2 $\mu g/m^3$ (24-hour) and 1.0, 0.8, and 0.3 ug/m^3 (annual average). The modeling analysis also determines the stack height which would satisfy a "low" 24-hour $PM_{2.5}$ SIL value of 2.0. The current Connecticut DEP policy for modeling $PM_{2.5}$ recommends a 24-hour $PM_{2.5}$ SIL of 2.0, which is based on the NESCAUM recommendation.

Exhibit 3-12 Maximum Impacts for Backyard Option 1 at Minimum Load

Pollutant	Averaging Time	Stack Height	Maximum Impacts (ug/m³) Impact	Back-ground*	Total	NAAQS	SIL
Sulfur Dioxide	Annual	300	0.09	10.5	10.6	80	1
		250	0.11	10.5	10.6	80	1
		225	0.12	10.5	10.6	80	1
	24-hour	300	1.39	60.2	61.6	365	5
		250	1.80	60.2	62.0	365	5
		225	2.25	60.2	62.5	365	5
	3-hour	300	3.59	112.6	116.2	1,300	25
		250	4.33	112.6	116.9	1,300	25
		225	5.16	112.6	117.1	1,300	25
Nitrogen Dioxide	Annual	300	0.07	37.6	37.7	100	1
		250	0.09	37.6	37.7	100	1
		225	0.10	37.6	37.7	100	1
Carbon Monoxide	8-hour	300	0.71	2860	2860.7	10,000	500
		250	0.85	2860	2860.9	10,000	500
		225	0.95	2860	2860.8	10,000	500
	1-hour	300	2.09	6180	6182.1	40,000	2,000
		250	2.33	6180	6182.3	40,000	2,000
		225	2.35	6180	6182.3	40,000	2,000
PM_{10}	24-hour	300	1.69	60.0	61.7	150	5
		250	2.20	60.0	62.2	150	5
		225	2.75	60.0	62.7	150	5
$PM_{2.5}$	Annual	300	0.11	12.0	12.1	15	1
		250	0.14	12.0	12.1	15	1
		225	0.15	12.0	12.1	15	1
	24-hour	300	1.69	31.9	33.6	35	5
		250	2.20	31.9	34.1	35	5
		225	2.75	31.9	34.6	35	5

* Highest second highest monitored values for short-term averages and highest values for annual averages.

SO_2 and NO_2 from Eisenhower Park monitor	$PM_{2.5}$ from Babylon monitor
CO and PM_{10} from New York City monitor	

Exhibit 3-13 Maximum Impacts for Backyard Option 2 at Minimum Load

			Maximum Impacts (ug/m³)				
Pollutant	Averaging Time	Stack Height	Impact	Back-ground*	Total	NAAQS	SIL
Sulfur Dioxide	Annual	300	0.09	10.5	10.6	80	1
		250	0.11	10.5	10.6	80	1
		225	0.12	10.5	10.6	80	1
	24-hour	300	1.44	60.2	61.6	365	5
		250	1.90	60.2	62.1	365	5
		225	2.26	60.2	62.5	365	5
	3-hour	300	3.85	112.6	116.4	1,300	25
		250	4.64	112.6	117.2	1,300	25
		225	5.20	112.6	117.8	1,300	25
Nitrogen Dioxide	Annual	300	0.07	37.6	37.7	100	1
		250	0.09	37.6	37.7	100	1
		225	0.10	37.6	37.7	100	1
Carbon Monoxide	8-hour	300	1.42	2860	2861.4	10,000	500
		250	1.70	2860	2861.7	10,000	500
		225	1.89	2860	2861.9	10,000	500
	1-hour	300	4.69	6180	6184.7	40,000	2,000
		250	5.09	6180	6185.1	40,000	2,000
		225	5.32	6180	6185.3	40,000	2,000
PM_{10}	24-hour	300	1.75	60.0	61.8	150	5
		250	2.31	60.0	62.3	150	5
		225	2.75	60.0	62.8	150	5
$PM_{2.5}$	Annual	300	0.11	12.0	12.1	15	1
		250	0.14	12.0	12.1	15	1
		225	0.15	12.0	12.2	15	1
	24-hour	300	1.75	31.9	33.7	35	5
		250	2.31	31.9	34.2	35	5
		225	2.75	31.9	34.7	35	5

* Highest second highest monitored values for short-term averages and highest values for annual averages.

SO_2 and NO_2 from Eisenhower Park monitor	$PM_{2.5}$ from Babylon monitor
CO and PM_{10} from New York City monitor	

The modeling results indicate that all pollutant impacts are insignificant, demonstrating compliance with the NAAQS, for a stack height as low as 225 ft and that the impacts decrease with increasing stack height. The stack height, which would result in a $PM_{2.5}$ maximum impact below a SIL of 2.0 µg/m^3, increases to approximately 300 feet for each re-powering option. At the GEP stack height for each option, the 24-hr PM2.5 maximum impact would slightly exceed the lowest 24-hr PM2.5 SIL proposed by EPA (1.2 µg/m3). The corresponding maximum 24-hr PM2.5 impact for Option 23 is 1.5 µg/m3 and 1.6 µg/m3 for Option 25A. If EPA promulgates the lowest proposed 24-hr PM2.5 SIL then reductions to the oil-fired PM2.5 emission rate would be required to meet this level otherwise interactive source modeling would be required, which would increase the complexity of the air permitting process.

Existing Plant Modeling

The results of the refined modeling for the existing operations at Port Jefferson are summarized in Exhibit 3-14 for gas and oil firing. The table provides the highest annual and short-term concentrations for each pollutant. The SILs for each pollutant and averaging time are also provided for reference.

Before and After Impacts

Exhibit 3-15 provides a comparison of the highest impacts for Port Jefferson under current operating conditions (i.e., oil firing) versus the highest impacts for the re-powering options. The re-powering option impacts include the operation of Port Jefferson Unit 4 and the LM6000 CTs with Unit 3 assumed to be shut down. It should be noted that the maximum impacts for the current Port Jefferson units operation versus the highest impacts for the re-powering options do not occur at the same geographic location. The table shows that there would be an overall reduction in maximum air quality impacts following the repowering. The greatest reductions in maximum ground level impacts would be for SO_2 and CO impacts while the NO_2, PM_{10}, and $PM_{2.5}$ improvements would be of a lesser nature.

Exhibit 3-14 Maximum Impacts for Existing Port Jefferson Units

			Maximum Impacts (ug/m^3)			
Pollutant	Averaging Time		Stack Height	Gas	Background (ug/m^3)	NAAQS (ug/m^3)
Sulfur Dioxide	Annual		425	0.01	10.5	80
	24-hour		425	0.08	60.2	365
	3-hour		425	0.23	112.6	1,300
Nitrogen Dioxide	Annual		425	0.85	37.6	100
Carbon Monoxide	8-hour		425	11.2	2,860	10,000
	1-hour		425	24.2	6,180	40,000
PM_{10}	24-hour		425	0.45	60.0	150
$PM_{2.5}$	Annual		425	0.03	12.0	15
	24-hour		425	0.45	31.9	35

Exhibit 3-15 Before and After Maximum Impacts for Port Jefferson Firing Oil

Pollutant	Averaging Time	Maximum Impacts (ug/m³) Before	After		After - Before	
			Backyard Option 1	Backyard Option 2	Backyard Option 1	Backyard Option 2
Sulfur Dioxide	Annual	3.4	1.8	1.8	-1.6	-1.6
	24-hour	47.6	25.4	25.4	-22.2	-22.2
	3-hour	126.9	66.2	66.6	-60.7	-60.3
Nitrogen Dioxide	Annual	1.30	0.74	0.73	-0.56	-0.57
Carbon Monoxide	8-hour	25.6	14.9	15.7	-10.7	-9.9
	1-hour	77.9	45.5	47.8	-32.4	-30.1
PM_{10}	24-hour	6.1	5.0	4.9	-1.1	-1.2
$PM_{2.5}$	Annual	0.30	0.29	0.28	-0.01	-0.02
	24-hour	4.2	4.0	3.9	-0.2	-0.3

3.5.2.6 Effects of Re-Powering On Regional Air Quality

The reduction in regional air emissions due to re-powering options at Port Jefferson is a function of;

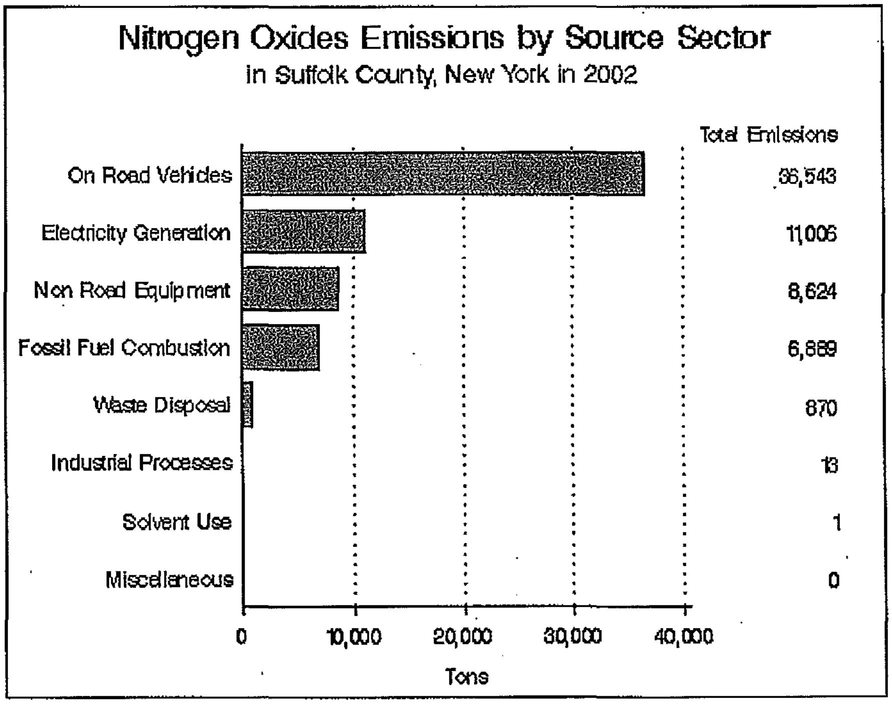
- Emissions added from the new re-powered unit
- Quantity of displaced energy from the new re-powered unit
- Source and emission rates of displaced energy, which is affected by generating technology, fuel, and emission control system of the displaced source
- Location of displaced energy

LIPA production modeling will forecast changes in certain regional emissions resulting from operation of new re-powered units and the displacement of energy from other regional emission sources.

The effect of the re-powering project at Port Jefferson on regional air quality relative to the non-attainment pollutants (i.e., ozone and PM2.5) is constrained by the relative contribution to total pollutant emission inventories by EGUs as well as the influence of long range transport of ozone, PM2.5 and their precursors.

Annual emissions of ozone precursor pollutants are 103,418 tons per year of NO_x and 140,870 tons per year of VOC for Suffolk and Nassau Counties combined for all source categories based on an EPA 2002 emissions inventory. Of the 2002 Suffolk and Nassau County emissions totals, the EGU contribution was 13,613 tons per year of NO_x (13%) and 248 tons per year of VOC (< 0.2%) while the on-road vehicle contributions were 60,003 tons per year of NO_x (58%) and 63,291 tons per year of VOC (45%). The contributions of the various source sectors to the NO_x and VOC emissions in Suffolk County and Nassau County for 2002 are depicted in Exhibits 3-16 and 3-17 respectively.

Exhibit 3-16 Suffolk County 2002 Emissions Inventory of NO_x and VOC



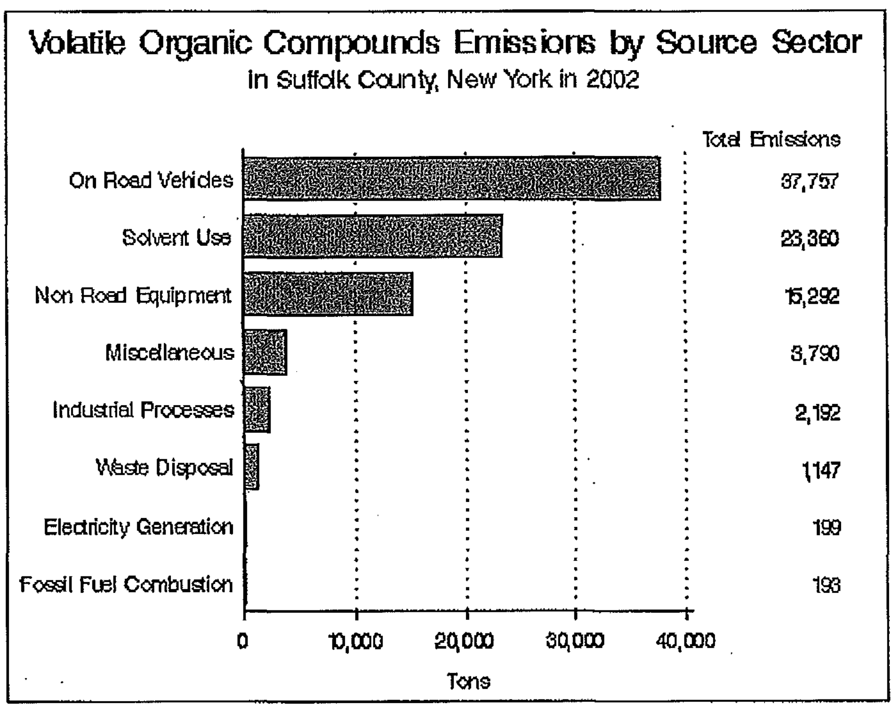
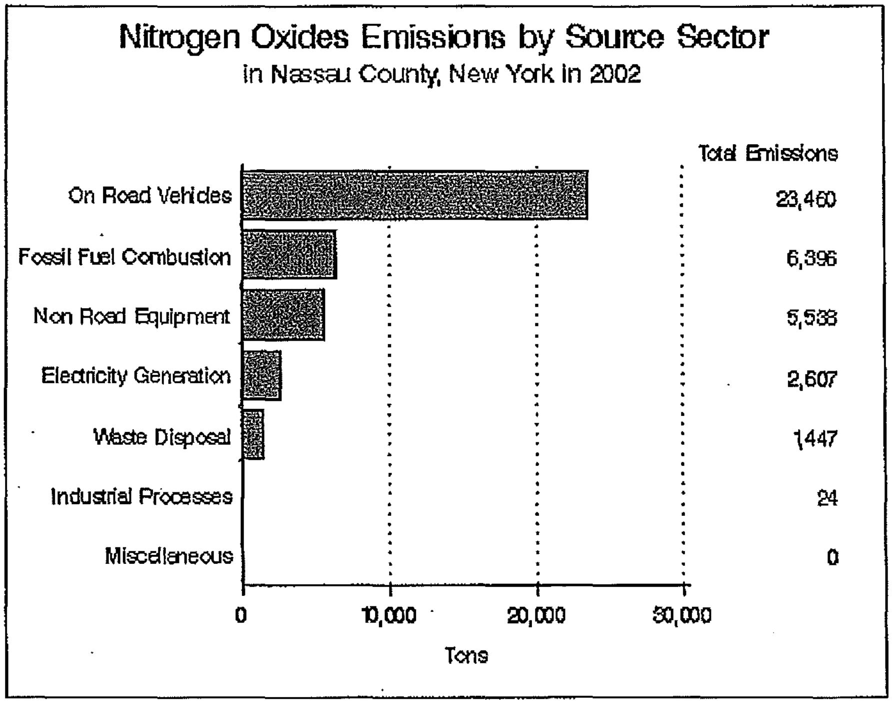
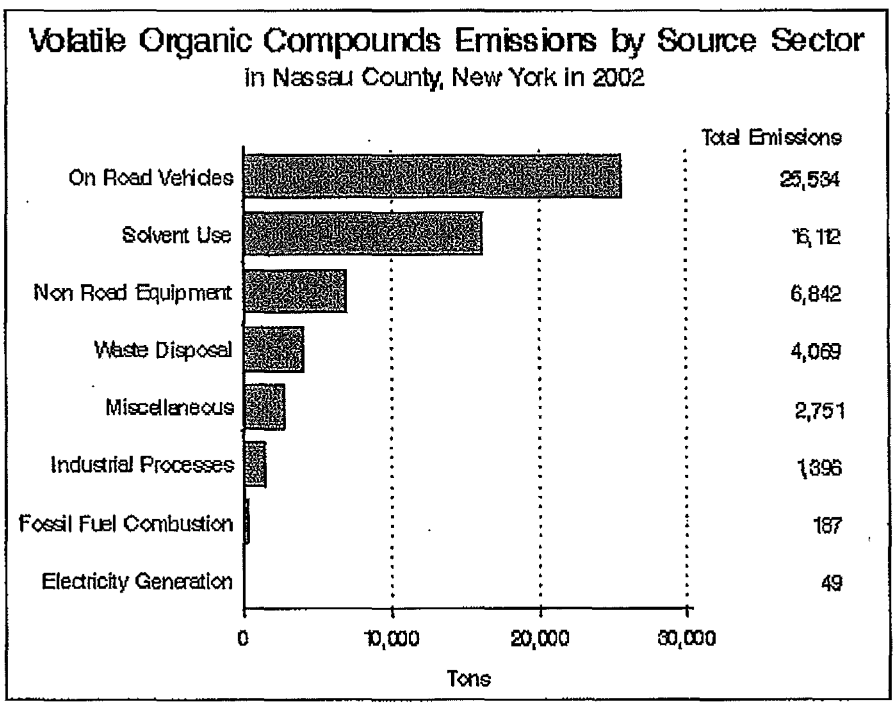


Exhibit 3-17 Nassau County 2002 Emissions Inventory of NO_x and VOC



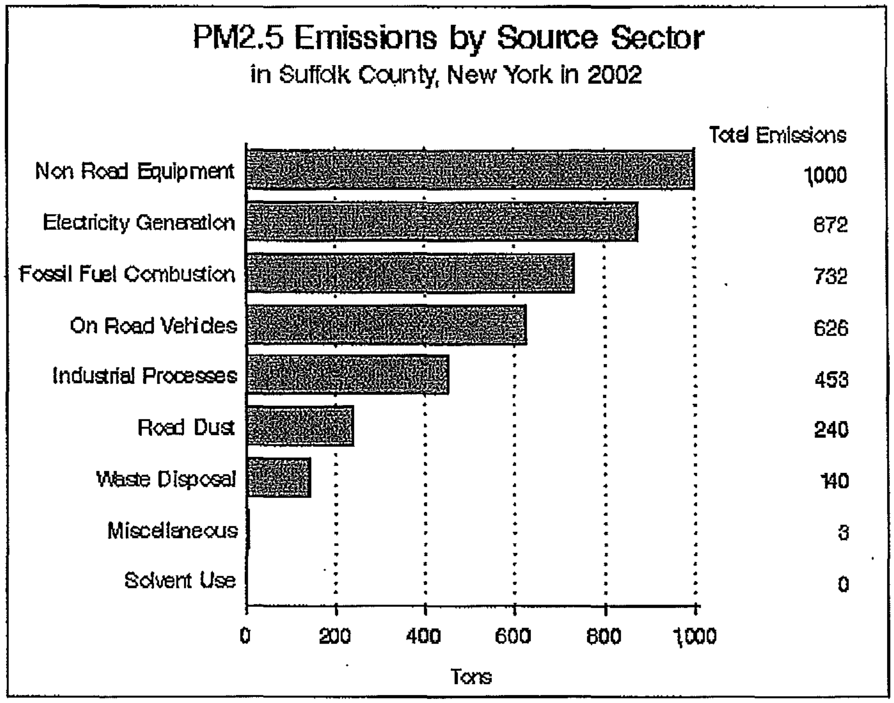


In addition to the Suffolk County emissions that contribute to ozone non-attainment on Long Island, long range transport of ozone from upwind states in the Midwest and Southeast are also significant contributors. In EPA's 1998 "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of

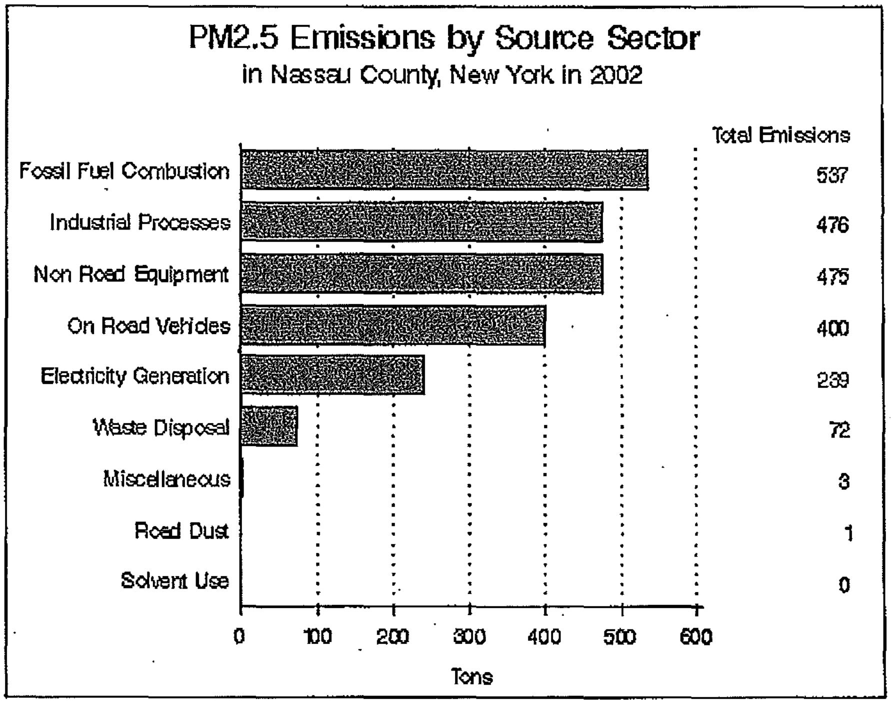
Ozone",[35] it was determined through atmospheric dispersion modeling that approximately 45 percent of the 1-hour ozone standard non-attainment problem in the New York Metropolitan Area was caused by upwind sources.

The combined PM2.5 emissions for Suffolk and Nassau Counties were 6,269 tons per year for all source categories based on the EPA 2002 emissions inventory. The EGU contribution to the 2002 PM2.5 emissions was 1,111 tons per year (18%) compared to 1,475 tons per year (24%) for non-road equipment. The contributions of the various source sectors to the PM2.5 emissions in Suffolk County and Nassau County for 2002 are depicted in Exhibit 3-18.

Exhibit 3-18 Suffolk and Nassau County 2002 Emissions Inventory of PM2.5



[35] U.S. Environmental Protection Agency, "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone", 63 FR 57356, Oct. 27, 1998.



LIPA production modeling will provide further insight into the potential reduction of EGU emissions in Suffolk and Nassau Counties due to re-powering projects at Port Jefferson. It is possible that some of the emission reductions, which would result from implementing re-powering options at Port Jefferson, would occur outside of Suffolk and Nassau Counties, depending upon the location of displaced energy sources. The production modeling will identify the sources and location of emitting sources that are projected to result in reduced generation due to potential re-powering projects at Port Jefferson.

3.5.2.7 Conclusions

The results of the modeling analysis show that both re-powering options will result in insignificant air quality impacts with a 225-ft stack, demonstrating compliance with the NAAQS. It also demonstrates that the re-powering project would result in an overall improvement in ground level air quality.

3.5.3 Noise Assessment (Backyard Options 1 and 2)

This Phase II noise assessment examined the noise output of the most significant components of the new proposed plant for Backyard Repowering Options 1 and 2 in order to determine their contribution to the total new plant noise level and the noise emissions relative to the existing environment.

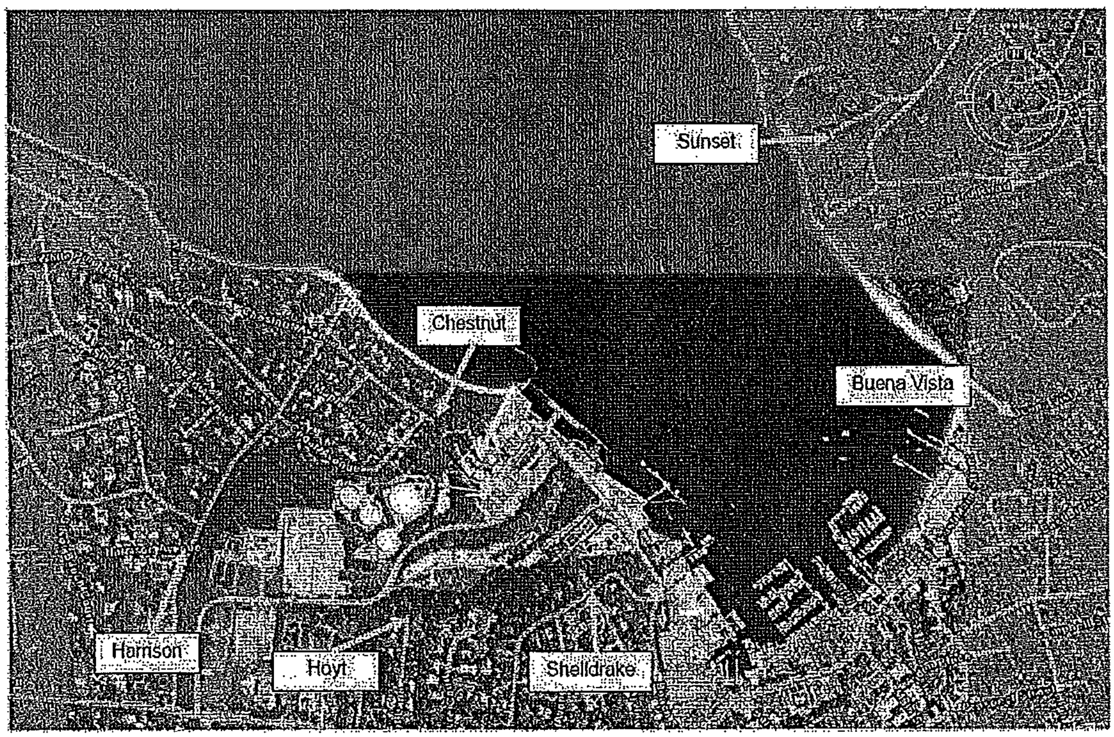
The Environmental Assessment (EA) that was prepared for the Port Jefferson Energy Center included a noise assessment for the new facility as well as a quantitative description of the existing noise environment.[36] The Port Jefferson Energy Center EA describes the land uses bordering the proposed site as being mostly residential, but with an industrial gravel operation on the south side. The report identified the nearest sensitive (residential) area approximately 400 feet to the northwest of the site on Chestnut Street. Other potentially noise sensitive areas, where noise was monitored, were identified as Harrison Avenue to the southwest, Hoyt Lane to the south, Shelldrake Avenue to the southeast, Port Jefferson marina, and Buena Vista Road and Sunset Path across the water; they are shown in Exhibit 3-21.

[36] TRC Environmental Corporation, Port Jefferson Energy Center Environmental Assessment, November 2001.

It is possible to describe existing ambient noise both in terms of L_{90}, the level exceeded for 90% of the time, or in terms of Leq, the equivalent continuous level of sound. Stone & Webster Consultants adopted the precedent of licensing applications for the Port Jefferson Energy Center and Caithness Long Island Energy Center[37] in following recommendations in a guidance document produced by the NYSDEC to use Leq as a descriptor of the sound, being *"an indication of the effects of sound on people"* and which advises that *"it is also useful in establishing the ambient sound levels at a potential noise source."* NYSDEC also recommends that sound levels should be determined at the key receptors. Stone & Webster Consultants adopted the NYSDEC Guidelines as a basis for design of noise mitigation requirements for Backyard Options 1 and 2.

Port Jefferson has a local noise ordinance *(Article VI Miscellaneous Performance Standards, 250-23 to 250-26)* based, not on a single sound level, but with different values according to the frequency of the sound. The noise ordinance is based on obsolete frequency values before the American and International standards were adopted and agreed upon for octave band frequencies for measuring sound, and it is therefore difficult to describe this ordinance in modern acoustical terms. The ordinance refers to noise measurements being determined *at "the property lines of the use creating such elements for noise".* Conformance with local noise ordinances will be addressed during licensing of the Port Jefferson re-powering options, if either of these options is selected for further project development.

Exhibit 3-19 Key Noise Receptors



The Port Jefferson Energy Center EA described existing noise sources in the immediate vicinity of the plant during the day as consisting of *"a combination of industrial noise (existing power generation*

[37] Caithness Long Island, LLC, Caithness Long Island Energy Center Final Environmental Impact Statement, June 2005.

facility and the Beach Street gravel site), natural sounds (birds, insects), and traffic (on Main and Broadway)." Across the water at Buena Vista and Sunset, it reports noise from the plant as being audible during the day and night, but that insect noise predominated during late night hours. The report made use of the lower of the daytime or late night measured noise levels, and are summarized in Exhibit 3-20.

Exhibit 3-20 Late Night Ambient Noise Levels

Location	Leq Sound Level (dBA)
Chestnut	55
Harrison	48
Hoyt	48
Shelldrake	50
Buena Vista	49
Sunset	48

NYSDEC advises that for residential areas, the source of noise *"should probably not exceed ambient noise by more than 6 dBA at the receptor."* For this Phase II assessment, a criterion of Ambient + 3 dBA has been adopted, rather than the full allowance, on the basis that such an increase would be barely perceptible.

It is a consequence of the addition of sound levels that the "Ambient + 3 dBA" criterion is achieved if the new plant creates the same level of sound as the existing ambient level. Hence the target for the new plant noise is at the levels shown in Exhibit 3-20.

The proposed layout of basic significant noise sources of the plant have been modeled using SoundPlan. Since the plant is at the conceptual design stage, typical plant noise levels from Shaw Stone & Webster's database have been used to model the units in order to quantify and mitigate the sound levels. Backyard Options 1 and2 were each modeled separately.

Topography

The site occupies a cleft between steep hills opening to the harbor, in which some of the power generation facility is built into the hillsides and faces northeastwards towards the harbor. The receptors are on higher ground around the plant, with Chestnut close to the northwest property line and looking down into the plant from a height of about 22 m (75 feet) at a distance of approximately 180 m (400 feet) from the center of the plant. Shelldrake and Hoyt are approximately 300 to 380 m (about 1100 feet) to the south. Harrison is about 25 m high (80 feet) to the southwest and is sheltered from the plant by higher ground in between. Buena Vista and Sunset are across the water at a distance of approximately 1000 m (about 3300 feet).

Noise Mitigation Approach

A balanced approach has been applied to the noise mitigation in order to spread the appropriate degree of noise control across all contributing items of the new plant, where technically possible. This prevents any one item of plant from requiring excessive and very costly noise reduction.

The analysis began with the allowable plant maximum at each receptor. The new plant was divided into approximately ten source components in order to determine the noise allowance for each source. This provided a guideline estimate of the necessary degree of noise control to be applied to each contributing item of new plant in order to achieve the required total noise mitigation for the new plant.