8.0 ELECTRICAL SYSTEM

8.1 DESIGN BASIS

The main generator (described in Chapter 10) will feed electrical power at 22 KV through isolated phase bus to two half-sized main power transformers.

The auxiliary power distribution system for Indian Point Unit No. 2 is essentially the same as that used in present day conventional plants. Two large auxiliary transformers supply power at 6.9 KV. One transformer, designated the unit auxiliary, is fed directly from the generator output. The other transformer, designated the station auxiliary, is supplied from the 138 KV Buchanan Substation.

8.2 NETWORK INTERCONNECTIONS

Electrical energy generated at 22 KV will be stepped up to 345 KV by the main generator transformers and delivered to Millwood switching station through a 345 KV, 25,000 MVA, 2000 Amp circuit breaker and one overhead 345 KV circuit which will be added to an existing tower line carrying two 138 KV circuits and a 345 KV tie to the Pennsylvania-Jersey-Maryland (PJM) system KV circuits. A one line diagram of the proposed system interconnections is shown on Figure 8-1.

The new bus and circuit breakers at Millwood will all be rated 345 KV, 25,000 MVA, 2000 Amp. The new unit will be connected through circuit breakers to two existing 345 KV feeders at Millwood which run north to the Pleasant Valley substation (which is the interconnection point between Con Edison and the Niagara Mohawk and Connecticut Light and Power systems) and south to Sprain Brook substation (which has connections to New York City and the 1000 MW unit at Ravenswood).

The Pennsylvania-Jersey-Maryland system tie will be connected through circuit breakers to these same two existing north-south circuits.

A 345/138 KV autotransformer will also connect one north-south 345 KV circuit to the 138 KV bus and transmission system at Millwood East.

The Indian Point No. 2 138/6.9 KV station startup transformer will be supplied from the 138 KV bus at Buchanan substation. Buchanan has connections to Indian Point No. 1 generator, the Lovett station of the Orange and Rockland system and the Consolidated Edison 138 KV transmission system via two overhead lines to Millwood East.

8.3 STATION DISTRIBUTION

The function of the Auxiliary Electrical System is to provide reliable power to those plant auxiliaries required during any normal or emergency mode of plant operation.

The design of the system is such that sufficient independence or isolation between the various sources of electrical power is provided to guard against concurrent loss of all auxiliary power.

Independence or isolation of supply to the various duplicate auxiliaries provided as engineered safeguards is maintained so a single bus fault will not result in the total loss of the plant's engineered safeguards systems.

The Auxiliary Electrical System is designed to provide a simple arrangement of buses requiring the minimum of switching to restore power to a bus in the event that the normal supply to it is lost.

The basic components of the station electrical system are shown on the Main Electrical One Line Diagram, Figure 8-2.

During startup, shutdown and hot standby, auxiliary power is supplied from the Station Auxiliary Transformer. When the generator is synchronized to the 345 KV system, auxiliary power is supplied primarily by the Unit Auxiliary Transformer. A small portion of the auxiliary load consisting of the motor driven feed water pump and two 6900/480 auxiliary transformers, remain on the Station Auxiliary Transformer at all times. The Station Auxiliary Transformer supplies two 6.9 KV bus sections (Nos. 5 and 6) through 2000 ampere, 500 MVA air circuit breakers. The Unit Auxiliary Transformer supplies 6.9 KV bus sections Nos. 1, 2, 3 and 4 through 1200 ampere, 500 MVA air circuit breakers.

The 6.9 KV bus section No. 5 can be connected to either 6.9 KV bus section No. 1 or No. 2 by a 1200 ampere, 500 MVA air circuit breaker. In a similar manner, 6.9 KV bus section No. 6 can be connected to either 6.9 KV bus section No. 3 or No. 4.

All major auxiliaries above approximately 300 HP are supplied from the 6.9 KV switchgear by 1200 ampere, 500 MVA air circuit breakers.

Each of 6.9 KV bus sections 1 through 4 supplies one reactor coolant pump and other auxiliaries as shown on the main one line diagram, Figure 8-1. The auxiliaries are divided between the four 6.9 KV buses to provide a high degree of diversity to minimize the possibility of plant trip due to loss of one 6.9 KV bus. After a reactor or turbine generator trip, the necessary auxiliaries on 6.9 KV bus sections 1, 2, 3 and 4 are transferred automatically to 6.9 KV bus

sections 5 and 6 by a dead transfer monitored by voltage relays which allow transfer after the residual bus voltage has decayed to about 33% of normal. This transfer time is on the order of two seconds so that the transfer will be completed before the reactor coolant pumps have begun to slow down.

Motors between 100 and 300 HP are supplied by 480 volt switchgear. This 480 volt system consists of four bus sections designated as Nos. 2, 3, 5 and 6. Each section is normally supplied by a 1500/2000 KVA ventilated, dry type 6900/480 volt transformer. The transformers are numbered to correspond with the bus section they supply.

Two of these transformers (Nos. 5 and 6) are normally supplied by the 138/6.9 KV Station Auxiliary Transformer. These bus sections normally supply most of the engineered safeguards equipment and are left on the outside source of power to avoid subjecting them to a transfer at the time when the equipment supplied by them may be called upon to operate. Complete duality of supply to engineered safeguards equipment is maintained. Additional safeguards equipment which may be used is supplied from 480 volt bus sections Nos. 2 and 3 which can be connected to bus sections Nos. 5 and 6 if required.

The 6900/480 volt transformers Nos. 2 and 3 are fed from bus sections Nos. 2 and 3 of the 6900 volt system, and normally supply 480 volt bus sections Nos. 2 and 3. The 480 volt buses can be interconnected by electrically operated tie breakers in case one of the normal 6900/480 KV transformers is out of service. Interlocks prevent energizing a bus section from more than one source of power in order to stay within switchgear rating.

Three of the 480 volt bus sections (Nos. 3, 5 and 6) can each also be supplied by an automatic starting diesel generator which will act as a back up to the normal source of supply to the bus section. If the normal supply to 480 volt bus section 3, 5 or 6 is lost, a diesel connected to that section will automatically start and energize the bus. If the supply to 480 volt bus section No. 2 is lost it can be interconnected to one of the other 480 volt bus sections.

For loss of all normal AC power to the 480 volt bus sections, the tie breakers between the sections allow any of the four to be supplied by diesel generators. The diesels will be sized so that any two of the three diesels will have sufficient capacity to supply the engineered safeguards load required for an acceptable post-blowdown containment pressure transient.

8.4 EMERGENCY POWER SOURCES

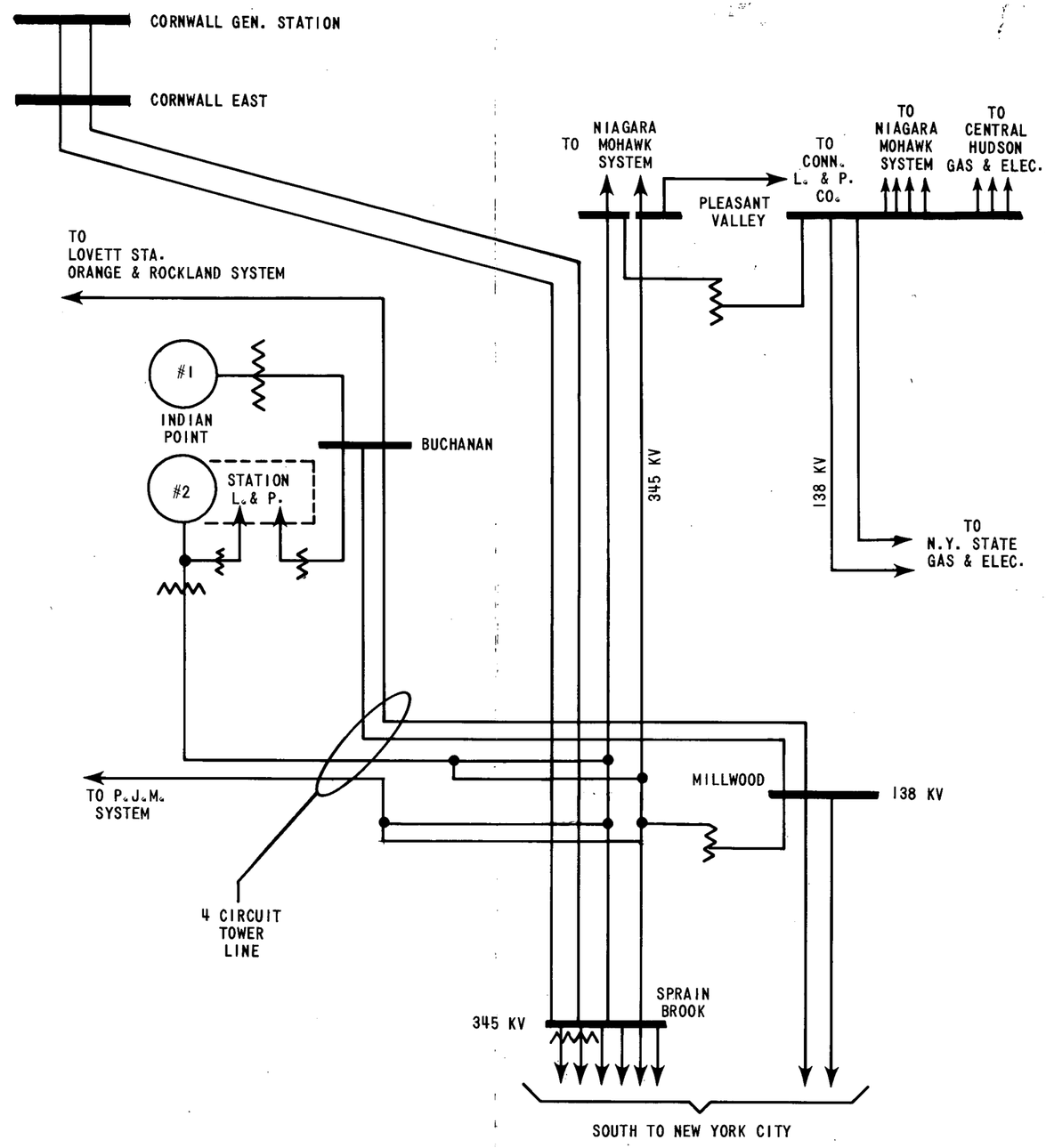
The 480 volt bus sections which supply power to the engineered safeguards equipment have the following alternate sources of power, to provide assurance of operation under all conditions.

1. All four buses can be supplied from the 138 KV Buchanan Substation.
2. Three buses can be supplied directly by automatically starting diesel generators.
3. All buses can be interconnected by tie breakers.
4. Automatic transfer is provided to an active bus if a diesel should fail to start.

Two 60 cell, lead acid, station type batteries are provided for power supply for control, emergency lighting and the inverters for critical 60 cycle instrument power.

8.5 TESTS AND INSPECTION

Periodic tests and inspections will be made on all breakers. Also, periodic start tests and routine maintenance procedures will be performed on the diesel-generator sets. The frequency and nature of these tests will be established during the system design when the components are selected.



SIMPLIFIED ONE LINE DIAGRAM PROPOSED SYSTEM INTERCONNECTIONS