ENGINEERING EVALUATION REPORT

ON

INDIAN POINT

NUCLEAR GENERATING UNIT NO. 3

FOR

POWER AUTHORITY OF THE STATE OF NEW YORK

SUMMARY

STONE & WEBSTER ENGINEERING CORPORATION

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Mr. George T. Berry
General Manager and Chief Engineer
Power Authority of the State of New York
10 Columbus Circle
New York, New York 10019

September 10, 1974

Dear Mr. Berry:

ENGINEERING EVALUATION REPORT
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
POWER AUTHORITY OF THE STATE OF NEW YORK

We are pleased to submit herewith the results of our independent engineering evaluation on the current status of Indian Point Nuclear Generating Unit No. 3. The report is presented in two parts, namely the summary document which states our findings in concise form and an appendix which contains supporting documentation.

We have identified several problem areas some of which will require corrective action. In those cases we have made appropriate recommendations. We believe all of these problems can be satisfactorily resolved for licensing and successful operation of the unit.

We have collaborated with Arthur Young in assessing the expenditures made by Con Ed for the design and construction of the plant prior to May 31, 1974. We have made an independent estimate of the work to be completed after that date and the costs thereof. These costs were combined to arrive at an estimate for the total cost to the Authority for obtaining a complete and operable plant. We estimate the cost including administration, overhead, interest during construction, nuclear fuel, insurance and financing charges at $510,000,000. This cost does not include an allowance for a cooling tower and an upgraded radwaste system. The cooling tower may be required by regulatory agencies and the Authority may choose to include the radwaste system to increase the plant's availability.

In preparing the cost estimate we have made a separate analysis of the cost of facilities that would be required to provide a completed plant that would operate essentially independent of adjacent Con Ed facilities. The cost of these facilities is included in the above quoted figure.

We have analyzed the additional construction still remaining to be completed, the scheduled preoperational testing and power ascension and estimate that the plant can be brought to commercial operation by December, 1975 if no unforeseen conditions arise.

We would be pleased to offer any further assistance which you may require in this matter.

Very truly yours,

W. F. Allen, Jr.

W. F. Allen, Jr.
President

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SEPTEMBER 1974

STONE & WEBSTER ENGINEERING CORPORATION

SUMMARY AND CONCLUSIONS

Stone & Webster Engineering Corporation has conducted an investigation and evaluation of Indian Point Nuclear Generating Unit 3 and found the engineering and construction to be adequate and to comply with applicable codes and Atomic Energy Commission (AEC) and other regulatory requirements in effect when the construction permit was issued.

There have been questions raised by the AEC which must be answered prior to the issuance of an operating permit. Their resolution may require changes to equipment already installed; hence prompt attempts at resolution are essential to preclude delay in completion and licensing. The principal areas of concern are major equipment supports.

In our opinion, all present licensing questions can be resolved, but continued effort must be exerted to prevent undue delay in the licensing process. Transfer of nuclear plant ownership has little precedent and many policies and procedures which would normally be known must be determined promptly to develop a timely plan for the Power Authority of the State of New York (PASNY) activities.

Independent plant operation by PASNY cannot be achieved, for the most part, prior to plant startup. Agreements must be made with Con Edison for interim sharing of facilities prior to plant transfer.

Assuming prompt resolution of licensing questions without major rework or backfit, construction and testing activities can be completed and the plant made ready for fuel loading by mid-1975. Close surveillance of construction and testing, and careful planning is, of course, essential to maintain this schedule. Based on historical knowledge of similar plants, we believe commercial operation can possibly be achieved by December 1975, if fuel loading is completed by mid-1975.

INTRODUCTION

Scope of the Report

Stone & Webster undertook this assignment on May 28, 1974 at the request of PASNY and in investigating the engineering, design, construction, permits, operations, quality assurance, scheduling, and environmental considerations employed 70 engineers and construction personnel. The findings in this report are considered to be of sufficient depth to warrant the conclusions reached.

Using the parameters set forth in the Final Safety Analysis Report, AEC Safety Evaluation Reports, the Technical Specifications, and the Environmental Report and our concept of good engineering, construction, and management practices, we assessed the following:

1. The physical plant - including our opinions as to percent completion, operability, anticipated reliability, aspects of public safety, redundant features, and overall quality of work.

2. The ultimate successful operability of the facility, with particular consideration to such areas as permits and licenses required by government agencies; separation criteria; possible future retrofitted hardware; equipment support criteria for piping and cable trays; outstanding "apparent deficiency" items set forth in AEC records; operator training, availability and qualifications; interdependence with existing units at the Indian Point site; compliance with applicable Codes; preoperational testing program status and adequacy; and external sources of power.

3. Estimated dates for fuel loading and operation, supported by our observations of construction completion, the status of procedures, and a preliminary operations progress network.

4. Comments or observations as regards existing nuclear fuel contracts. (A complete evaluation of the nuclear fuel contracts will be undertaken by PASNY.)

5. Quality assurance program adequacy and compliance thereto.

6. Facilities commonly shared with Indian Point Units 1 and 2 and an opinion on the degree of desirable separation.

7. Provide an estimate of the cost to complete the total facility to be verified upon receipt of supporting data from Arthur Young & Company and from PASNY.

Drawings, diagrams, specifications and other data were assembled and examined but we found it most expedient for the purposes of the report to concentrate our major effort at the plant site.

System reporting forms were developed for each mechanical system to facilitate gathering of data in an orderly manner. These forms provided for the recording of significant items, which included verification of compliance with specifications and drawings as well as acceptability of engineering, design, quality of construction, and convenience for operation and maintenance. We have also researched public documents and interviewed various Con Edison personnel both at the site and in the New York City offices in connection with acquisition of data to determine the status of Indian Point Unit 3.

The results of our review are summarized in this report and expanded in the Appendix.

Plant Description

The Indian Point site is on the east bank of the Hudson River and was an abandoned amusement park once operated by the Hudson River Day Line. Con Edison Company purchased this in the mid-1950's, when the site was zoned for heavy industrial use (as is the area immediately surrounding it).

The site occupies about 239 acres, of which approximately 35 acres are actively used for the power plants and related structures.

Existing nuclear power plant units on the site include No. 1 (rated 265 mWe net, including an oil-fired superheater), built between 1956 and 1962 and No. 2 (rated 873 mWe net), built between 1965 and 1973. Both units are now in operation. The construction permit for Unit 3 was issued in 1969. It has a rated capability of 3,025 mWt and 965 mWe net.

The site is in the Village of Buchanan, Westchester County, 24 miles north of New York City. The nearest city is Peekskill, 2.5 miles to the northeast, with a 1970 population of 19,000 as reported by the U.S. Bureau of the Census. Con Edison has transferred 14 acres of the site to the Village of Buchanan for a marina, and has plans for the development of another 80 acres of forest and lake into a visitors' center with landscaped public recreational facilities. The resident population within a one-mile radius was 745 in 1970. Approximately fifty people reside inside the 3,600-ft radius low population zone for Unit 3, and the minimum exclusion distance from the centerline of the Unit 3 reactor containment is 1,150 ft.

At the site, the Hudson River is a tidal estuary about 5,000 ft wide and has a maximum depth of 85 ft and an average depth of over 30 ft. Fresh water flow in the river is 50,000 cfs maximum and 3,500 cfs minimum. Tidal flow is 300,000 cfs, with an

average tidal range of 3 ft and a peak of 7.5 ft. The maximum salinity is 8,000 ppm (that of sea water is 32,000 ppm). Salt water intrusion reaches 30 miles above the site under minimum fresh water flow; but with an intermediate fresh water flow of 20,000 cfs, the salt water is driven below the Indian Point site.

The Penn Central Railroad is located on both banks of the Hudson River, but difficulties with the terrain have so far precluded a branch railroad connection to the site. U.S. Highway 9 on the east bank is about one mile from the site, with truck access roads provided to the plant. The minimum elevation of the developed site is about 15 ft.

The Hudson River provides barge access to the site with wharf facilities on the water front at Unit 1. The river is used for commercial ship and barge traffic, as well as by pleasure boats. Some 600 to 800 commercial craft pass the site each year.

Units 1 and 2 are located at the north-south center of the site on the river front and progress respectively from south to north. Unit 3 is located out of its natural order, to the south of Unit 1. The plant is surrounded on almost all sides by higher ground, 600 to 1000 ft above sea level. Structures are founded on rock, generally limestone. There has been no serious seismic activity at the site.

Progressing back from the river front for Unit 3 are the screenwell and pumphouse for condenser circulating and plant service water, the turbine generator building, and the reactor containment. Grouped about the foregoing are the primary auxiliary building, fuel building, waste treatment facilities, main and auxiliary transformers, and the diesel generator building. There are no buildings for an administration office or plant general services. Important structures are of reinforced concrete, except that the turbine generator building is a steel frame structure. The reactor containment is a steel-lined, reinforced concrete right cylinder with a hemispherical dome, 135 ft inside diameter and 219 ft high above the mat. The nuclear steam supply system is a pressurized light water reactor type, with 4 coolant loops. Each loop includes a steam generator and a motor-driven reactor coolant pump, but without loop isolation valves. The reactor core is of the three region type with rod cluster control utilizing boric acid as a chemical shim.

The turbine generator consists of one high pressure and 3 low pressure elements (6 exhaust flows - 44 in. last stage blades), with direct connected exciter, and with 6 moisture separator-reheaters without intercept valves. The turbine is rated 1,000,630 kW (1,068,000 kW maximum capability) at 715 psia steam pressure and 1 1/2 in. Hg abs condenser pressure. The generator is 1,125,600 kVA at 75 psig hydrogen pressure, .90 power factor, .50 short circuit ratio, 3 phase, 60 Hz, 22,000 volts, 1,800 rpm. Three single pass surface condensers, 3 third size motor-driven condensate pumps, air ejectors, 2 turbine-driven steam generator

feedpumps, and 6 stages of feedwater heating in three trains are provided.

Condenser circulating water is provided from the Hudson River by 6 motor-driven circulating water pumps. Six motor-driven service water pumps supply water for auxiliary cooling and certain other station services.

Favorable Considerations for Successful Operation

The nuclear steam supply system supplier, the architect-engineer, and the owner have had considerable experience with the design, construction, and operation of nuclear power plants.

Westinghouse developed the first pressurized water reactor and nuclear steam supply system, which was successful from the beginning. They have since designed and supplied more PWR reactors and nuclear steam supply systems than any other commercial supplier. Westinghouse designed and built Indian Point Unit 2, assisted by United Engineers and Constructors Inc. under the overall direction of Con Edison Company as owner. United Engineers and Constructors Inc. has had long experience in design of fossil fueled power plants and have been architect-engineers on numerous nuclear power plants. Con Edison Company has had experience since 1956 at Indian Point Units 1, 2, and 3 in the management of design and construction, the operation, and the ownership of nuclear power plants.

The same team engineered and is building Indian Point Unit 3 similar to, but slightly larger than, Indian Point Unit 2. The latter is now in operation, which lends credibility to the prospect of successful operation of Unit 3.

The design of Indian Point Units 2 and 3 is similar to that employed by Stone & Webster in the design and construction of Connecticut Yankee Atomic Power Plant. This plant was designed and constructed by Stone & Webster, with Westinghouse designing and furnishing the nuclear steam supply system. Design of this plant started in 1963. The plant went into operation in 1967 and has since been in successful operation with a plant availability factor of 79.69 percent. The plant capability is approximately 600 mWe and thus it is approximately two-thirds the size of Indian Point Unit 3. The successful operation of Connecticut Yankee Atomic Power Plant predicts similar performance for Indian Point Unit 3. The general plant layout and system interconnections of Indian Point Unit 3 follow a pattern similar to that employed by Stone & Webster in that era. This arrangement has been successful and its use in Indian Point Unit 3 is, therefore, favorable.

As already noted, Indian Point Unit 3 employs the pressurized water reactor principle. Practically all domestic installations are either pressurized water or boiling water reactor plants. Three domestic corporations produce pressurized water reactors,

but only one produces a boiling water reactor. These two types have received approximately equal commercial acceptance in the United States.

The financial situation, with respect to the acquisition of Indian Point Unit 3, should be favorable in that the construction of the plant was contracted for prior to the recent inflationary trend.

Transfer of Ownership

The formal transfer of Unit 3 ownership from Con Edison to PASNY involves consideration of which facilities are to be transferred, their state of completion, the degree of subsequent involvement of Con Edison, and the monetary compensation required. When PASNY becomes owner, it must consider the problems of completing construction, acquiring a staff, securing the necessary permits and licenses to operate, and undertake commercial operation of the unit.

EVALUATION OF PLANT DESIGN AND CONSTRUCTION

Class I systems were evaluated for compliance with the FSAR, piping, electrical and equipment specifications and codes, applicable AEC regulations and guides, system process flow diagrams, and electrical and piping drawings. In addition, all plant systems were examined for completion, operability, reliability and maintenance characteristics. We have determined that the systems and equipment to be incorporated in Unit 3 are generally of satisfactory design.

There are no major engineering or construction problems which affect unit reliability or safe operation with the exception of the items included in Section V of the Appendix to this report.

Mechanical Systems

For the most part, all major piping systems and associated equipment are installed, with only minor connections, instrument piping or small equipment items remaining to be completed. A large number of permanent pipe supports and restraints have not yet been installed on many systems. Very little thermal insulation work has begun, and none was installed on the nuclear systems. We found the condition of piping and equipment to be generally good but cleanliness and housekeeping to be only fair.

Instrumentation and Controls

The survey of instrumentation and controls was performed on an area basis. About 90 percent of the field mounted instruments have been installed, with 80 percent of the sensing lines run and cables to instruments terminated.

Instrument air headers have been completed in all areas except the Auxiliary Feed Pump Building and in the reactor containment, with 15 percent completed in the Primary Auxiliary Building. Pneumatic control tubing is 95 percent complete in the Turbine Building and 25 percent complete in the Primary Auxiliary Building.

The control room had 98 percent of the cable pulled with 91 percent terminated. The computer is in service and 20 percent of the control packages have been calibrated.

The design, construction, workmanship, accessibility, and quality of instruments was found to be favorable to successful plant operation.

Electrical

The electrical output of the plant is connected to the 345 kV system through two half-size main transformers, each rated 542 MVA, 20.3-345 kV, FOA, 3 phase. The auxiliary electrical system requirements for Unit 3 are provided by a 43 MVA, 22-6.9 kV unit transformer directly connected to the main generator leads and by a 138 kV feeder from Buchanan Substation which supplies the station auxiliary 138-6.9 kV transformer and by a 6.9 kV underground feeder from the Unit 1 area. These 6.9 kV sources tie to a six bus 6.9 kV switchgear which supplies power to the 6.9 kV motors and energizes the four 480 volt buses. Emergency power is provided by three diesel generators tied to the 480 volt system.

At present all the main and auxiliary transformers are practically 100 percent installed. All 6.9 kV and 480 volt switchgear and motors are almost completely installed and connected. The control board and computer system are approximately 95 percent complete. Cables, trays, conduit and penetrations are essentially complete. In summary, the electrical installation, overall, is approximately 95 percent complete.

Most of the installation is satisfactorily installed and presents a good appearance. There are exceptions where certain items may be improved, but most are minor and may be done without any difficulty. However, there are a few cases where studies are advisable to determine proper corrective measures. These cases are discussed elsewhere and involve relaying and protective measures to be taken with the 6.9 kV and 480 volt systems in connection with the periodic exercising of the diesel generators.

Consideration should be given to the purchase of an area in the Buchanan Switchyard for PASNY supply breakers.

Geotechnical

The geotechnical review for Unit 3 covered both an examination of Con Edison furnished data and documentation related to plant licensability, and a review of the Con Edison program for obtaining and analyzing additional data to supplement the earlier information.

Structural

The structural review for Unit 3 covered an examination of the structural portion of the unit for completion, a review of inside reactor containment equipment supports, and a review of seismic supports and pipe whip restraints.

Most of the structural work, such as concrete and steel, is complete. However, some walls have been left open to facilitate equipment installation and access; completion of this work will not affect plant start-up.

Work is currently in progress on field inspection of the primary equipment supports. It is noted that recent similar programs involving rework on supports at other power plant have resulted in delays in plant start-up.

The location and design of supports and pipe whip restraints has been found to be in general accordance with the FSAR criteria. However, if there are physical interferences, certain of these supports and restraints will have to be installed at different locations than indicated on the original design; these will require review and analysis to assure FSAR compliance.

SCHEDULE AND COST

Schedule

Con Edison, in their August 27, 1974 letter to the AEC Directorate of Regulatory Operations, stated that as of August 29, 1974 the plant construction is 94 percent complete.

As part of our scope of work in making an engineering evaluation of Unit 3, we have estimated a unit fuel loading date. Since there are so many uncertainties within the scope of this task, our projected fuel load date is only a rough estimate based on experience.

We developed a CPM network primarily to indicate a schedule for completion of start-up activities on Unit 3 by backfitting an existing Stone & Webster start-up schedule for a pressurized water reactor (PWR). This backfitting was accomplished by a combined review of available Unit 3 system process flow diagrams and reference to the Unit 3 test schedule.

The CPM network does not necessarily follow the existing test schedule for Unit 3, in sequence, but its main purpose is to reflect an opinion on the overall time period required to bring a plant of this type to the successful completion of fuel loading. We believe a complete PWR startup program can be accomplished within 16 to 18 months if permanent power is made available to the equipment in an orderly and prescribed manner, if the systems associated with that equipment are in a reasonable state of construction completion, if no major equipment failures occur, and if all necessary licenses and permits are received.

We have concluded from our evaluation of plant status that fuel loading could begin in July, 1975. Close surveillance of construction, testing, and careful planning is essential to achieve this date. To substantiate this estimate, we researched all Westinghouse pressurized water reactor plants that have loaded fuel since 1971, discounting Indian Point Unit 2, and found the average time span between cold hydro and fuel load to be approximately 8 months. Cold hydro has not been achieved and if this is achieved by November 1, 1974 fuel loading is projected in July 1975.

The above-mentioned 8-month period is somewhat longer than we indicate on our CPM. It does, however, appear to be a valid indicator for Unit 3 since a significant percentage of plant equipment has neither been operated nor subjected to any extensive trial operating period, considerable hanger work remains, and approximately 90 percent of the thermal insulation has not been installed. The question of materials availability and length of time required to install the insulation will have an adverse effect on the overall testing and start-up program.

A major item that could have significant impact on the fuel loading date that has not been factored into our projection is AEC acceptance of the primary equipment supports.

We project criticality and initial power generation, based on historical experience, to follow start of fuel loading by approximately 9 and 10 weeks, respectively.

CAPITAL REQUIREMENTS

Summary

The tabulation at the end of this section provides a basis for determining approximate cost to complete, reimbursement to Con Edison, and total financing requirements.

Many of the components tabulated are allowances. Other costs may require adjustment when more complete data are available from the auditors. Financing costs are not included. Interest costs incurred by Con Edison and PASNY are determined on the basis of transfer of ownership on March 15, 1975.

Westinghouse Contract

Separate contracts with Westinghouse for Units 2 and 3 were reformulated into one contract at one total price in December, 1971. The reformulated price includes scope changes and settlement of claims to date of the reformulated contract. The Con Ed records have been examined by Arthur Young. The records show that $233,503,000 of the total reformulated contract has been assigned by Con Edison to Indian Point 3. The basis for this apportionment is not stated in the contract. Nuclear fuel and nuclear insurance are not included in this contract. Other insurance is included. Sales and use tax are included only for temporary construction material and consumables (not plant components). Ad valorem taxes are not included. Spare parts are not included. Payments on the contract, as of May 31, 1974, total $110,502,297 plus $4,589,513 for scope changes.

In addition to expenditures as of May 31, 1974, changes totaling $2,440,780 have been billed. Additional costs for scope changes are considered to be covered by the contingency.

Other Con Edison Costs to May 31, 1974

These costs are related to Con Edison mark order 7EP42.

Con Edison Manual Labor	$2,981,750	
Con Edison Materials	155,955	
Sales Tax	19,650	
Benefits	1,994,942	
Real Estate Taxes	2,673,136	
Legal Expenses	229,811	
Engineering and Construction Supervision	4,493,656	
Administration and Supervisors G&A	4,239,604	
Subtotal		$16,788,504
Other Vendors and Services		5,873,923
Interest on Progress Payments (IDC)		42,534,151
Total		$65,196,578

Escalation

The Westinghouse contract includes escalation, on the assumption of commercial operation by mid-1974. Claims for additional escalation because of schedule stretchout may be considered to be included in the contingency discussed later.

Contingency

The contingency for this plant is limited to a degree by the fixed price contract with Westinghouse, but is essential to cover potential claims from other contractors, possible protracted labor stoppages, force majeure, effect of delays for any reason on productivity, and interest during construction, possible changes in scope, rework or backfitting because of changes in AEC interpretation of requirements (Westinghouse limits its liability to licensing to the same standards as Unit 2), outstanding unresolved claims, etc. Considering the range of possible events which the contingency must envelop, in determining capital requirements, $30,000,000 seems appropriate.

Additional PASNY Costs

Interest during construction on progress payments from March 15, 1975 to December, 1975, assuming borne by PASNY at 6 1/2 percent cost of money	$20,000,000
The following are allowances, unsupported by estimating data:	
Allowance for PASNY administrative and legal costs, including AEC license fees	$325,000
Operator training, consisting primarily of salaries and overhead of operators until commercial operation.	900.000
Allowance for spare parts and working capital	7,000,000
Insurance during construction and one year thereafter	4,350,000
Subtotal of above	$32,575,000

Shared and Independent Facilities

The estimated cost of independent facilities not included in plant cost, plus PASNY's share of the cost of facilities shared either temporarily or permanently, are the sum of the costs reported in Table VIII A1 and A2, plus 10 percent contingency for a total of $29,300,000. This figure excludes expenditures by Con Edison and the upgraded radwaste facility costs.

Allowance for Future Environmental Studies

To determine the total financing requirement, we have allowed $6,000,000 for future environmental studies.

Total Financing Requirement

The above costs are summarized to provide an estimate of total financing requirements, but not including financing costs. Fuel, interest on fuel fabrication, and fuel shipping costs are not included.

Expenditure to date	$188,000,000		
Estimate to complete	177,000,000		
Total construction cost, including contingency		$365,000,000	
Additional PASNY costs, including IDC		32,575,000	
Allowances for shared and independent facilities		29,300,000	
Fuel costs		67,000,000	
Environmental studies		6,000,000	
Total		$499,875,000	
Say			$500,000,000

Capital Requirement Summary

Expenditures Through May 31, 1974

1.	Con Edison Contract with Westinghouse	$110,502,297	
2.	Scope Changes to Westinghouse Contract	4,589,513	
3.	Other Vendors and Services	5,873,923	
4.	Con Edison I.D.C.	42,534,151	
5.	Other Expenditures	16,788,504	
6.	Additional Related Facilities	7,677,304	
	Total Expenditures to May 31, 1974	$187,955,692	
		say	$188,000,000

Estimate to Complete

1.	Con Edison Contract with Westinghouse	$123,000,410	
2.	Scope Changes to Con Edison with West. (not including unresolved claims)	2,440,780	
3.	Other Con Edison Costs, Including G&A, I.D.C., Etc., from June 1, 1974, to March 15, 1975	21,860,000	
4.	Contingency, Including Claims	30,000,000	
	Total Estimate to Complete after May 31, 1974	$177,301,190	
		Say	$177,000,000
	Total Construction Cost		$365,000,000

Total Construction Cost (from previous page)			$365,000,000
Additional PANSY Costs			
1.	I.D.C. from March 15, 1975 to December 1, 1975	$20,000,000	
2.	PASNY administrative cost, including license fees	325,000	
3.	Operator training allowance	900,000	
4.	Spare parts allowance and working capital	7,000,000	
5.	Insurance during construction and one year thereafter	4,350,000	
6.	Allowance for Independent and Shared Facilities	29,300,000	
7.	Allowance for Future Environmental Studies	6,000,000	
8.	Fuel Costs	67,000,000	
	Total Estimated Capital Requirement (not including Financing Costs)	$134,875,000	
	Say		$135,000,000
	Total Estimated Capital (not including Finance Costs)		$500,000,000
	Debt financing Charge		10,000,000
	Total Capital Requirements		$510,000,000

Note: This cost does not include funds for construction of a cooling tower or upgraded radwaste system, either or both of which may be required. We estimate the cooling tower would cost about $70,000,000 and the radwaste system would cost about $15,000,000 including contingencies. Also not included are costs for those items for resolution listed in Section V. We estimate these items could cost about $10,000,000.

COST OF GENERATION

Need

The costs of generation computed in this section are approximate values and are presented primarily so as to permit a comparison with the cost of power from other units to be completed on or after the date when Indian Point Unit 3 becomes operational. Construction of Unit 3 was started several years ago. Con Edison, in their August 27, 1974 letter to the AEC Directorate of Regulatory Operations, stated that as of August 29, 1974, the plant construction is 94 percent complete. The output from this unit is clearly needed to help supply the total electric power requirement of metropolitan New York.

Annual Fixed Costs

Acquisition by PASNY will unquestionably reduce the cost of power to be produced by this unit provided, as expected, PASNY is able to obtain the necessary funds for acquisition and completion of the unit through the sale of tax exempt bonds. We estimate that a total of approximately $510,000,000 of such bonds will have to be sold to reimburse Con Edison for its costs and to complete construction of the plant and ancillary facilities. The annual cost of interest and capital recovery, including an allowance for debt service coverage will be approximately $46,000,000.

If Con Edison retained ownership of the plant, its total annual fixed charges, comprised of a combination of return on investment, interest, depreciation, and taxes, assuming financing costs similar to those being used prior to its recent financial difficulties, would be approximately $85,000,000. We understand that because of present financial problems Con Edison would find it very difficult to obtain the necessary funds to complete the plant from any known source, regardless of rate.

Operating Costs

Contracts for the sale of power produced by Indian Point Unit 3 have not been negotiated. It is PANSY's intention to offer such power first to public agencies, with the remainder, if any, being offered next to Con Edison and then to other utilities. Since the public agencies in New York are expected to have a noncoincident peak load of 1,800 mW by 1977, nearly all the power to be produced from both Indian Point Unit 3 and Astoria Unit 6, which PASNY may also acquire, would be sold to such agencies.

We calculate that Indian Point Unit 3 will have a net heat rate of 10,695 Btu per kWhr. We estimate that the cost of nuclear fuel in 1977 will be about 23 cents per million Btu, compared to a cost of over $2.00 per million Btu for low sulfur oil. Each kWhr produced at Indian Point Unit 3 will require an expenditure of 2.5 mills for fuel. Each kWhr produced by fossil-fueled generation will cost more than 20 mills for fuel. Therefore,

Indian Point Unit 3 will naturally be scheduled to generate as much power as possible.

Transmission and other operating limitations in the system on a day-to-day basis may prevent full load operation, but we would expect that Indian Point Unit 3 would be scheduled as a base load plant. We have, nevertheless, conservatively assumed, for the purpose of computing cost of power, that it will operate at an annual plant capacity factor of 65 percent. As experience is gained in operating and maintaining the plant, and as the transmission system in New York is improved, we would expect the annual plant capacity factor to increase well above this value.

Indian Point Unit 3 is rated at 965 mW net power output. The Advisory Committee on Reactor Safeguards has recommended to the Atomic Energy Commission that Indian Point Unit 3 be initially limited to a net output of 2,760 mWt (873 mWe). The latter output at a 65 percent annual plant capacity factor would generate 4,971,000,000 kWhr per year. The annual fuel cost would be approximately $12,410,000.

It should be possible, after two or three years of operating experience, to increase the net output to 965 mW, its nominal rating. The Indian Point Unit 3 plant has been designed to operate at a new output of 1,033 mW. It may be possible to eventually increase its output to that figure.

Average Energy Cost

Addition of the annual charge for capital and operation and maintenance costs would add about 10.8 mills, for a total of about 13.3 mills. PASNY is also considering the acquisition of Astoria Unit 6 plant. Since Astoria Unit 6 is an oil-fired plant, its fuel costs are expected to be about 21.7 mills per kWhr. The total cost of power from that plant is expected to be about 31.2 mills. When the cost of power from Indian Point Unit 3 is combined with Astoria Unit 6 power, the average cost per kWhr would be about 21.8 mills. Accordingly, it should be possible for PASNY to arrange for delivery of power to public agencies over facilities owned by Con Edison at prices that are substantially lower than Con Edison could provide.

As discussed in Section VII and VIII, there is a possibility that a closed-cycle cooling system and/or an upgraded radwaste system might be required for Indian Point Unit 3. In the event a cooling tower is required, since Indian Point Unit 2 and Indian Point Unit 3 are nearly identical units discharging cooling water through a common discharge facility to the river, it would be appropriate to share the cost of such facilities if only one cooling tower is required for the site. The additional cost would increase the cost of power by about 1 to 2 mills/kWhr depending on facilities and division of cost.

PASNY has applied to the Federal Power Commission for a license to construct a 1,000,000 kW pump-storage plant in Schoharie County. Integrating the operation of such a plant with Astoria Unit 6 and Indian Point Unit 3 would make it possible to store energy not needed during off-peak periods for release during high load periods, thus enhancing the value of the output.

ITEMS REQUIRING RESOLUTION

We believe that the following items listed below could adversely affect the availability of Unit 3 for power generation. These items are discussed in detail in the Appendix (Section V) of this report. The items are not necessarily listed in their order of importance, but all are believed to be of major concern and require further consideration.

1. Shutdown from outside control room
2. Steam generator tube leakage
3. Turbine generator overspeed
4. Primary equipment supports
5. Turbine blading
6. Heat tracing
7. Temporary pump suction strainer
8. Check valve cover leakage
9. Reactor coolant pump thermal barrier leakage
10. In-Service Inspection (ISI)
11. Availability of demineralized water for start-up
12. Drain piping configuration
13. Fire protection system
14. 480 V switchgear - interrupting capacity
15. Relay protection
16. Emergency diesel generator capability
17. Sound powered intra-plant communications system
18. Turbine water induction
19. Turbine building ventilation

20. Auxiliary boiler feed pump area ventilation

21. Flange bolting

22. Pressurizer relief valve piping

23. Auxiliary boiler feed pump area access

24. Dynamic restraint of piping systems

25. Valves

26. System cleaning

27. ECCS analysis

28. Residual heat removal pump

29. Residual heat removal heat exchangers

30. Main coolant system RTD manifolds

31. Accessibility to valves, instruments and equipment

In addition to the items of concern listed above, we are also listing in the Appendix (Section V) other items presented to us by Con Edison in two groups. One group is entitled "Correction of Indian Point No. 2 Construction and Design Deficiencies on Indian Point No. 3," and the other group is entitled "Pre-criticality Plant Completion Items." In our opinion, all items can be resolved, and this listing will serve as a checklist for follow-up action.

ENVIRONMENTAL

The AEC, the Environmental Protection Administration (EPA), and the New York Department of Environmental Conservation (DECON), all have jurisdiction over water quality standards including those relating to intake and discharge from power plants.

In connection with Unit 3 there are potential problems with respect to meeting thermal criteria and problems relating to the entrainment and impingement of fish.

Con Edison, for several years, has been conducting comprehensive studies of the Hudson River with respect to both of these problems. The studies are continuing and are of such a nature that definitive findings will not be available until 1977 or later. Depending upon the outcome of these studies the present once through cooling facilities may have to be replaced by a closed cycle cooling system such as a cooling tower. The selection of an optimal system will require study of alternate systems. In the meantime it is expected that Unit 3, as is

already the case relative to Unit 2, will be allowed to operate using the existing once through cooling system.

In the event that closed cycle cooling is required, and assuming that this consists of a natural draft cooling tower, we estimate that it would cost about $60,000,000. If only one cooling tower is required at the Indian Point complex it might be appropriate to share such cost between Con Edison and PASNY.

The present liquid waste disposal system for non-radioactive waste is one of dilution. This method may not be acceptable to EPA and DECON. We have included an allowance in the cost estimate for a new waste treatment system.

The present Unit 3 liquid radwaste system does not have adequate capacity if the steam generators experience more than normal tube leakage. We have included an allowance in the cost estimate for an additional evaporator unit and expanded solid waste system. We believe these will fully comply with AEC requirements. It may be desirable to add additional upgrading of the radwaste system to improve the availability of the plant thereby increasing its dependable power output. Since this would be beyond licensing requirements, we have only suggested that such a system be considered.

Emergency diesel generators and auxiliary boilers are not anticipated to contribute any significant environmental impact.

SHARED AND INDEPENDENT FACILITIES

Unit 3 has been designed and is being constructed, staffed, and licensed as the third unit of a multi-unit facility all under the single ownership of Con Edison on a single site.

This design has been examined and an analysis made to determine those additions and modifications required in the plant facilities to accomplish a smooth and logical change of plant ownership from Con Edison to PASNY. It is recognized that a transition period will be required to accomplish this change and that certain ultimate physical facilities required for PASNY ownership will not be available in time for either fuel loading or commercial operation. In these cases utilization of either temporary facilities or Con Edison facilities, if existing, is recommended.

Factors considered in this analysis include:

1. Facilities required to operate Unit 3 as an independent facility, unrestricted by the method of operation or performance of Units 1 or 2.

2. Facilities required to provide a more reliable unit.

With all of the preceding taken into consideration, an overall plan has been developed and the facilities required to implement this plan have been identified. Details, including technical, cost and schedule information, are given in Section VIII of the Appendix to this report. It is concluded that PASNY can achieve independent ownership and operation of Unit 3 by implementation of this plan.

Following are our recommendations:

	Item	Suggested Disposition
1.	Land acquisition	Acquire 100 acres
2.	Access, parking, landscaping, grading, drainage, site fencing	Provide and install site boundary fencing
3.	Administration Building	Provide a new building
4.	Service Building	Provide a new building
5.	Warehouse	Provide a new warehouse
6.	Security plan facilities	Install a new guard house and security fence
7.	Emergency plan facilities	Coordinate with Con Edison plan and select emergency control center
8.	Radwaste (liquid, solid, gaseous) and steam generator blowdown treatment	Acquire and install one Con Edison 30 gpm evaporator
9.	Water Treatment (Makeup Water)	Install additional tankage and furnish a new complete water treatment plant
10.	Auxiliary Steam	Purchase and install two 50,000 lb/hr boilers
11.	City Water (Fire Protection, Auxiliary Boiler Feed, Potable Water)	Provide raw water storage
12.	Emergency Diesel Fuel Oil Supply	Add three storage tanks
13.	Station (Service) Air	Add a redundant compressor

14. Carbon Dioxide for Main Generator	Provide Cardox System
15. Hydrogen for Main Generator	Retain shared facilities
16. Sanitary Sewage Disposal System	Acquire and install package unit
17. Discharge Canal and Support Systems	Retain shared facilities
18. Chlorination System for Intake Structure	Install independent facility
19. Condensate Polishing System	Acquire and install independent facility
20. Offsite Power and Switchyard	Recommend modification
21. Normal Auxiliary Power	Recommend modification
22. Back-up Auxiliary Power (13.8 kV)	Recommend modification
23. Control of 345 kV and 138 kV Switching	Recommend modification for metering and switching
24. 345 kV System	Acquire facilities
25. 138 kV System	Acquire portion for Unit 3
26 13.8 kV Backup System	Acquire portion for Unit 3 plus transformer between the 6.9 and 13.8 kV breaker
27. Covered passageways and personnel facilities within Unit 3	Proceed with installation of controlled access corridors and personnel facilities
28. Intertie piping for the following services: Auxiliary steam Desuperheating water Demineralized water City water Station air Condensate Fire protection Sewage transport	Establish service charge arrangements including metering where necessary
29. Air Bubbler in Unit 3 screenwell	Acquire section for Unit 3

30. Fuel Building modifications and railroad siding facilities to accommodate large spent fuel cask	Recommend that study be performed

QUALITY ASSURANCE

Our evaluation of the Unit 3 quality assurance program was organized on the basis of the 18 criteria stated in Appendix B to 10CFR50. The evaluation consisted of sampling certain areas of Con Edison and WEDCO records. In general, it is our judgment that the requirements of Appendix B to 10CFR50 are satisfied. The WEDCO records revealed an effective and advanced quality program, one which was being implemented prior to the promulgation of Appendix B to 10CFR50.

Operations

Section XI in the Appendix to this report addresses in detail the current status of the Unit 3 programs by Con Edison in the areas of:

1. Staffing (Plant Personnel)
2. Personnel Training
3. Procedure Preparation

These programs appear adequate to permit plant licensing and operation.

Refer to Appendix Sections VI (Licensing) and VIII (Shared and Independent Facilities) for other relevant data.

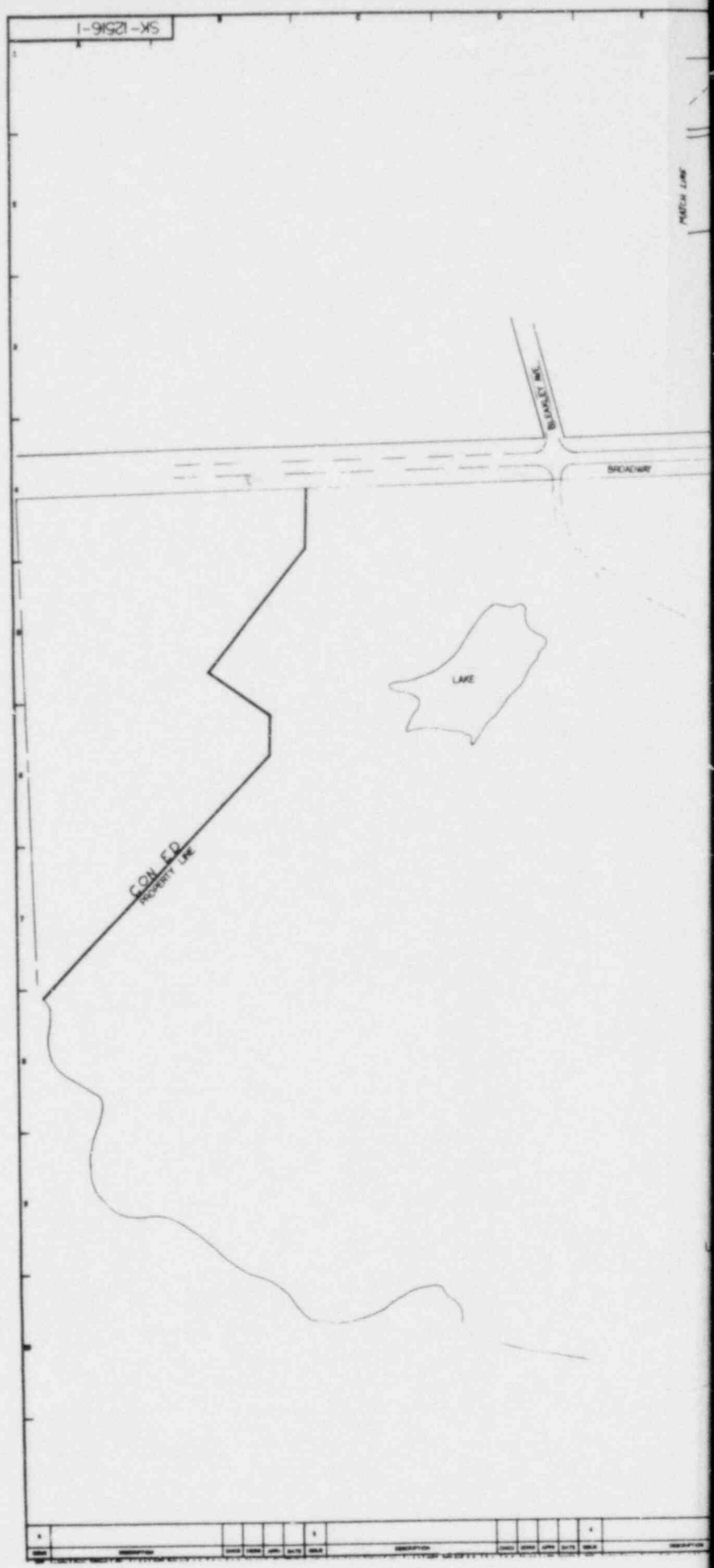
We recommend that PASNY immediately initiate and implement a program covering the following elements:

1. Initiate immediately a search for and examination of candidates for Station Manager.

2. Hire personnel presently assigned to the Unit 3 effort.

3. Hire a Training Coordinator whose responsibility effort with the new subsection heads, will be program development and central coordination of all training activities.

4. Consider leasing the services offered by the Con Edison Simulator training center to handle start-up training, retraining, and replacement training for operators.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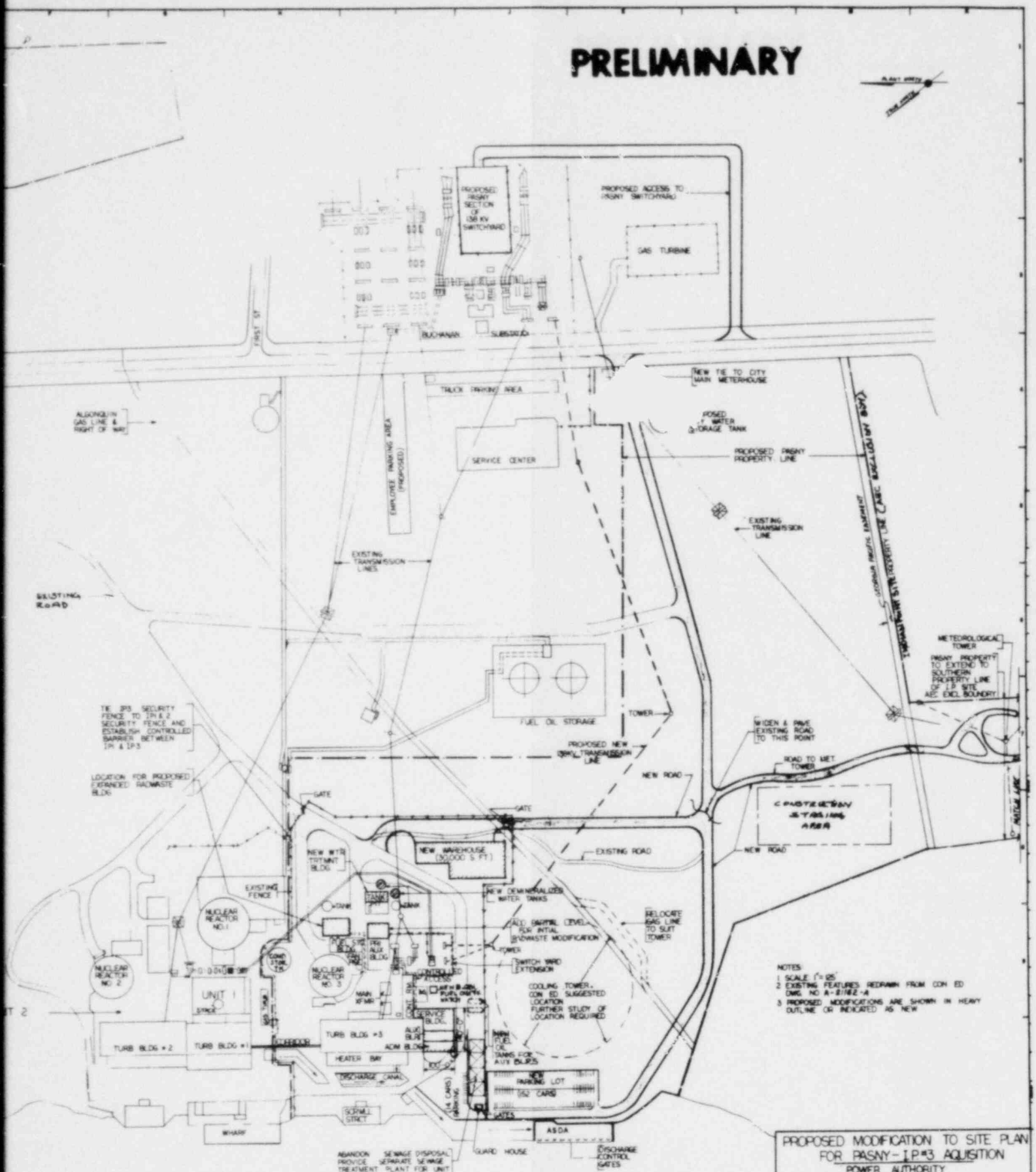

PROPOSED MODIFICATION TO SITE PLAN FOR PASNY - I.P.#3 AQUISITION

POWER AUTHORITY
STATE OF NEW YORK
INDIAN POINT 3 STUDY - JO 12516

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASS.

DRAWING NUMBER SK-12516-1

NOT FOR CONSTRUCTION