ENCLOSURE 2

Supporting Documentation for Simulator Certification Indian Point 2 Simulator

Dated: 2/15/92

Submitted by:

Consolidated Edison of New York Indian Point - Unit 2

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Supporting Documentation for Simulator Certification Indian Point Unit 2

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SUPPORTING DOCUMENTATION FOR SIMULATOR CERTIFICATION INDIAN POINT 2 SIMULATOR

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Supporting Documentation for Simulator Certification Indian Point Unit 2 Plant Reference Simulator

I. INTRODUCTION

This introductory section is provided in order to create an understanding of the Con Edison Simulator program and its relationship with the Licensed Operator Training Program of the Indian Point 2 Nuclear Plant.

a. History of the IP2 Simulation Facility.

With the completion of on-site acceptance testing of the Indian Point 2 simulator in October 1972, Con Edison became the first Nuclear Plant Licensee to upgrade its training program with the procurement and application of a utility owned and operated full scope plant specific simulator. This simulator represented a significant advance in the quality of training delivered to the Indian Point 2 Operations staff. Over the years of operation of this plant specific simulator, Con Edison maintained its commitment to quality training through an extensive simulator modification and upgrading program. The basis of simulator upgrades ranged from changes to the reference plant design and changes in Training Department goals, to voluntary changes to meet the standards established by industry groups such as ANSI/ANS. Numerous panels and instrument groups have been added, the simulation computer system has been augmented with numerous upgrades of both hardware and software. The simulator was not simply updated due to software failure or changing regulatory requirements, it was more often updated to address the issues of plant design and performance changes, training needs assessments, availability of modern modeling techniques and good common sense. As it stands today the Indian Point 2 simulator is and should be a benchmark of commitment and training excellence in the Nuclear Industry.

In the evaluation of the continued viability of the current Indian Point Unit 2 Simulator it was determined that the simulator was not certifiable due to the number and magnitude of the "permanent" unacceptable exceptions that would have to be taken to the National Standard, the Regulatory Guide and the Federal Regulation. Through the procurement of the replacement simulator, the continued good stewardship of the current simulator and discussions with the Nuclear Regulatory Commission Staff, it became apparent that certification of the current simulator, with only temporary "exceptions" being taken and with those exceptions being removed by the certification of the new simulator, was an acceptable approach. It is this path that has been chosen for the certification of the Indian Point Unit 2 Simulator.

b. Recent Updates and Modifications.

In recent years there have been several significant modifications to the simulator with the objectives of extending the useful life of the simulator and addressing particular training needs. As an example, the entire electrical distribution system was replaced with an upgraded modeling approach. The NSSS models were replaced with a set of "state-of-the-art" models. All of the 1989 DCRDR mods to the CCR have been incorporated into the panels and software. All of these items were in addition to plant changes which were being tracked and moved into the simulator on a continuing basis.

As the simulator aged, a plan for its replacement was formulated. This plan had 4 Phases, since the impact of ANS 3.5, 1985, could not be determined prior to its issue. Accordingly, the first phase of the plan developed a data link from the existing PDP computers to a Gould computer. Having established the link, the second phase, replacement of the NSSS models to allow EOP training was executed, and new electrical models were added in response to plant changes. Near the completion of the second phase, ANS 3.4,1985 was released, and Con Edison management re-assessed the ability of the simulator to conform to the new standard and to continue to achieve a high level of performance in the rapidly changing environment of regulation and training need. The NSSS model replacements, as well as other on-site upgrades, had been found to create severe scheduling problems for both the simulation support groups and Operations Training. Many of the difficulties in this particular upgrade were directly attributable to the vintage of the simulator. Old style I/O, lack of modern software diagnostic programs, lack of a configuration management system, assembly level coding in many system level models, lack of documentation on the older (yet to be replaced) system models, lack of derivation and documentation of constants, etc. all contributed to an expensive upgrade of the simulator. From a quality perspective, Con Edison management had become rightfully concerned that the simulator was near the point of diminishing returns, at a time where the demands on the device were increasing. Studies were conducted that concluded that: much more (hardware) panel simulation was necessary to fully address the instrumentation observed by the licensed operators, the size of the simulator room and simulator computer room were inadequate for expansion [and the expansion of the existing training facility was not feasible], the fidelity of simulation math models must be further enhanced to expand the scope of the training in the area of the EOPs, the simulator needed an integrated Configuration Management System, the simulator needed to be taken through a re- documentation of its software, an extensive and well documented performance test needed to be conducted, the obsolete Simulator I/O system needed replacing, and most of all the simulator needed to be placed in a situation so as to be highly reliable and highly available for training and examination of the Licensed Operators. It was determined that the simulator could no longer undergo major on-site modifications without being out of service for extended periods. This determination resulted in the Con Edison Corporate commitment to replace the existing simulator with a new simulator.

Note: While this Certification Submittal is concerned with the certification of the exist-

ing simulator, the replacement simulator (now under contract) addresses the correction of all of the exceptions taken herein. In order to avoid confusion the term "simulator" will refer to the existing simulator and the terms "new simulator" or "replacement simulator" will refer to the simulator that is being procured from Westinghouse Electric Corporation. The new simulator's technical specification Table of Contents is provided as Attachment E2-A to this document. Specific portions of this document are available on request.

In 1987, the Con Edison Engineering Department began the process of establishing a scope for a new simulator which would meet all known or anticipated requirements, would extend Con Edison's commitment to quality training and would further incorporate all of the lessons learned over eighteen years of simulator training management. An engineering consulting firm, Exitech Corporation, was hired to prepare a detailed procurement specification. An RFP was issued, then bid evaluation and vendor selection was completed and a contract was awarded in September of 1988 to the Westinghouse Electric Corporation. The basis for the RFP and subsequently the Contract for the replacement simulator was to: achieve delivery of a well documented and thoroughly tested "state-of-the-art" Plant Reference Simulator, upgrade both the hardware and software capabilities of the Con Edison Simulator Support Staff, meet every applicable Code, Regulation and Standard, and achieve a Ready for Training delivery of the "certifiable" replacement simulator to the Indian Point 2 Site on or before March 1991. Westinghouse has failed to achieve the performance required to meet the March 1991 date and continues to work toward the delivery of a quality device.

c. Performance of the Simulator During Recent Exams.

A review of the performance of the simulator during recent Operator Exams indicates no major flaws in the operation of the simulator. The simulator has been able to achieve success through a clear understanding of its limitations and by using alternate functions to achieve those examination situations required by INPO and the Nuclear Regulatory Commission. It is recognized that the simulator has some limitations in the length of time and degree to which some of the Emergency Procedures can be taken. It is recognized that a temporary "exception" is taken to the ANSI/ANS 3.5 requirement to run all of the plant procedures without modification. The major reason for this temporary "exception" is the lack of hardware simulation in the back panel area. The replacement simulator will remove this temporary "exception".

d. Simulator Organization.

The simulator and the replacement simulator are both managed within the same organization. The majority of the personnel assigned to the simulator project have had in excess of 10 years of direct experience in manufacturing, maintenance and modification of nuclear plant simulators. The simulator organization chart appears on the page following this sub- section. From the chart, it should be noted that the simulator organization has direct input from the Operations Training Manager and is directed through an Oversight Committee which represents every major organization concerned with plant operation and safety.

e. Future Plans [Current and Future Simulator].

The simulator is expected to be replaced by the new simulator during an appropriate change over period in 1993. It is anticipated that both simulators will be simultaneously operated in order to avoid changing simulators in the middle of a training class. After delivery of the new simulator an assessment will be made relative to its phase-in based on its Ready for Training date as it fits with the Training Department Schedule of Classes.



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II. SIMULATOR FIDELITY.

While the term "fidelity" is not used in the ANSI/ANS 3.5 - 1985 Simulator Standard, it is used six times in the ANSI/ANS "draft" of the replacement for the 1985 Standard. In any case, the intent of the 1985 Standard is for the simulator to provide guidance for the explicit correlation between the control room and simulated control room, the instrumentation on those plant panels and the simulated panels, and the performance of the simulated systems to the plant actual and predicted performance data. This section is provided to discuss this correlation.

a. Physical Fidelity.

The simulator has, for those panels in its current scope, retained (within the update schedule allowed by the ANSI/ANS 3.5 Standard) a one to one relationship with the plant except as noted by Physical Fidelity studies conducted and documented by the Con Edison Engineering Staff. A copy of the Simulator Physical Fidelity Procedure along with a sample of several completed fidelity Data Sheets is found as Attachment E2-B. It is recognized that the physical scope of the simulator is inadequate to support the operator functions in the back panel area of the control room. A temporary "exception" is taken in the area of back panel simulation in support of Operator Training and Testing relative to the use of all plant procedures (un-modified) and as well the trainees ability to monitor all of the controls within the area of Operator responsibility. The replacement simulator has been given a hardware (physical) scope design to meet or exceed the physical fidelity requirements of the present and "draft" ANSI/ANS 3.5 Standard. Figures 1-1 and 1-2, provided as Attachment E2-C have been included to indicate the hardware scope of the existing simulator and the scope of the new simulator.

b. Simulated Systems.

The simulator now provides a simulated system scope which is consistent with the scope of the hardware. Certain systems which should, by plant procedures, be within the observation and control of the Plant Operator are not simulated or are simulated in a simplified fashion due to the limitations of the simulated control room hardware. Thus, a temporary "exception" is taken the scope of systems simulation. Figure 1-2 in Attachment E2-C is provided to indicate the scope of simulation to be provided in the new simulator. Attachment E2-D is a copy of the Data Sheets from the study which was conducted in order to determine, by review of each procedure assigned to the stewardship of the Licensed Operator. It is from this study that the scope of system simulator will remove any exceptions taken in the Systems Simulated area.

c. Use of Plant Procedures.

- -Surveillance Procedures. The surveillance procedures are currently limited to those procedures supported by panel hardware. The new simulator will have a greatly expanded scope of panels simulated, and as well there is a greatly increased scope of simulation inside of many of the panels. The new simulator's increased hardware scope, and the complementary software, will eliminate possible exceptions of not allowing the Operator Trainee to perform all assigned steps of the Surveillance Procedures.
- Normal Operating Procedures. As stated previously, Con Edison takes temporary "exception" to running all of the [unmodified] plant procedures assigned to the stewardship of the Licensed Operators. The new simulator will have a hardware and software scope which will remove this temporary "exception".
- Off-Normal Operating Procedures. As stated previously, Con Edison takes temporary "exception" to running all of the [unmodified] plant procedures assigned to the stewardship of the Licensed Operators. The new simulator will have a hardware and software scope which will remove this temporary "exception".
- Emergency Plan. While there have been no specific limitations identified in the simulator relative to its support of Emergency Plan Training, it is recognized that the simulator will require greater scope, model fidelity, and rigor of modeling those events leading to off-site emergency in order to allow for continued support of this training area. The specification of the new simulator has increased the scope of the simulated systems, the monitoring and control of plant functions external to the control room and the rigor of models such as the Radiation Monitoring System.

d. Data Base Status.

The simulator has been maintained, from the time of its construction and delivery to the training site, on a basis of evaluating plant change packages, making a determination of that change relative to the applicability to the simulator, moving applicable plant changes into the scope of hardware and software simulation, then testing and maintaining this change in scope. There is was a separate data base package maintained for the simulator which showed outstanding service requests. However, these service requests could not be executed on the simulator because of its limitations, and they became part of the motivation for procuring a new simulator. A Modification Tracking Database is in use for the new simulator and it also shows the status of the existing simulator for plant mods. While original method of tracking the design data is not in conflict with the ANSI/ANS 3.5 - 1985, it is in conflict with requirement A2. of Appendix A to that Standard. In as much as Regulatory Guide 1.149 has embraced the Appendices to the Standard a temporary "exception" must be taken. The new simulator will remove every temporary "exception" implied by the current design basis tracking methodology. There will be a specific design data base delivered with the new simulator. Simulator administrative procedures are in place which will require the tracking



and updating of the design simulator design data base.

e. Simulator's Ability to Emulated IP2 Events [LERs].

Through the continued use of the simulator, instructor feedback, and operator feedback there is a high degree of confidence in the ability of the simulator to meet the training goals within the current physical scope of the physical simulation and the known limits of simulation imposed by the modeling techniques.

III. COMPLIANCE WITH CODES & STANDARDS.

a. ANSI/ANS 3.5 -1985, Nuclear Power Plant simulators for Use in Operator Training.

There are no specific exceptions taken to the Standard other than as indicated elsewhere in this document. See temporary "exception" taken in item III.b. below.

b. Reg Guide 1.149, Nuclear Power Plant Simulation Facilities for use in Operator License Examinations.

Due to the fact that the Appendices of the ANSI/ANS 3.5 - 1985 Standard were embraced as a requirement by this Regulatory Guide, there are temporary "exceptions" taken to the maintenance of a specific simulator design data base, the maintenance of a record of the complete certification testing of the features of the simulator as required by the National Standard, and the re-testing required of a certified simulator. The new simulator will under go an extensive factory and site acceptance test program. Attachment E2-E is provided to illustrate the nature and extent of this testing program. There are in place Simulator Administrative Procedures that will cover the testing of changes to the simulator as well as the annual scheduling of re-testing as required by the National Standard and its Appendices. The completion of the acceptance test program for the new simulator along with activation of the Simulator Administrative Procedures will remove the temporary "exceptions" noted in this area.

c. 10CFR55.45, Code of Federal Regulations, Operator Licenses.

There are no exceptions taken to the direct requirements of this regulation.

IV. TEST PROGRAM.

General.

Due to the fact that the Indian Point Unit 2 Simulator has been in use for 20 years, through three revisions of the National Standard (ANSI/ANS 3.5), the initial issue of Regulatory Guide 1.149, the development of the Regulation (10CFR55.45), and numerous changes to follow changes made to the plant, it is relevant to discuss the generic approach taken in testing over the past several years. It would not be appropriate to discuss the original factory acceptance testing of the simulator due to the fact that almost every line of the original real time modeling code, as tested in the factory, has been replaced or modified.

Over the years there have been software modeling contracts issued to vendors that contained specific delineated testing requirements, however the bulk of the modifications to the simulator were accomplished on-site and were verified under the following testing methodology. When a plant modification or a simulator discrepancy [DR] was identified it was tracked via a simulator unique reference number. The training and simulation group would review this plant modification or DR, then make a determination as to the applicability of the item to the simulator (and training program). The item, once determined to be simulator applicable, continued to be tracked by the mod package or the DR number; if not applicable it was closed. When the item was completed in the software development load and/or any supporting hardware modifications were ready for integration into the training load, the modification was turned over to simulator operations testing. A test was conducted and the results were compared against actual or expected performance data, in some cases best estimate data. Many items were tested and accepted by simple observation [such as a correction to an engraving or a simple set point change] and other simulator updates required extensive formal testing. In all cases the operations testing resulted in one of three actions: acceptance of the simulator modification and close out of the item being tracked, complete rejection of the modification for cause thus resulting in a rework, or acceptance of the modification with comments [comments normally being recorded as DRs or open ACTION Items].

At any given point in time it is possible to determine items that are outstanding against the simulator. The simulator group maintains a list of un-installed "applicable" or yet to be determined plant modifications as well as a list of open DRs. It has been the track record of this simulator organization to maintain the simulator in an updated and tested condition in accordance with the current requirements of the ANSI/ANS 3.5 Standard. That is to say, hardware and performance data permitting, the simulator has been maintained within the 12 month update window allowed by the National Standard. The simulator performance testing has been used as the main Quality Assurance tool over the life-cycle of the simulator. In addition, testing of simulator modifications on work contracted outside of the Con Edison organization has been utilized as a contractual perfor-

mance acceptance method and has therefore, in most cases, exceeded the testing requirements expressed in Appendix A of ANSI/ANS 3.5.- 1985.

In addition to the testing conducted at the time of a modification being added to the simulator, the Con Edison Training Department considers itself to be constantly in the simulator test mode due to its liberal use of the DR system in identifying and tracking any discrepancy or anomaly discovered during training sessions or trainingware development. The scope of the simulator training program at IP2 continually exercises the simulator through its full range of capabilities as identified in the Training Modules List [Enclosure 2E-F]. Through the application of these modules the performance of the simulator is carefully observed and related to the expectations of both the instructors and the operators being trained. Any negative observation is treated as a DR which is then tracked to closure. Although, there is not a record of completed Appendix A type acceptance test, there are hundreds of individual tests which have in total exceeded the requirements of Appendix A. There does not exist a single test document record supporting the record retention as required by Reg Guide 1.149, yet each plant modification inserted in the simulator was subjected to an acceptance test equivalent to its impact on simulation. In lieu of the testing requirements as outlined in ANS 3.5 and Regulatory Guide 1,149, 100% of the training modules are run biennially. Therefore, the testing that is performed is accomplished more frequently than required by 10CFR55.45.

As noted both above and below, the simulator test program has been different than some of the test documentation retention or re-test scheduling requirements of Regulatory Guide 1.149. Con Edison remains confident that the testing and retesting of the Simulator over the past 20 years has resulted in a simulator that meets the intent of the National Standard and the Regulatory requirement, that is, to obtain and maintain a quality training tool. The new simulator will undergo one of the most extensive and well documented acceptance tests ever conducted on a simulator. There are already administrative procedures in place which will (after delivery) require the planning and scheduling of the yearly 25% re-testing of the simulator malfunction scenarios.

The delivery and commissioning of the new simulator will remove all temporary exceptions taken in this area of the certification.

a. Certification Tests [Performance Testing].

Earlier in this submittal there were temporary "exceptions" taken to the conduct and maintenance of a record of the complete certification testing of the features of the simulator as required by the National Standard, and the re- testing required of a certified simulator. Again, as previously stated, the new simulator will under go an extensive factory and site acceptance test program. See Attachment E2-E for the list of tests to be conducted. As well, Section 4.0 of the contract for the new simulator further defines the testing, conduct of testing, the documentation of test results and the requirements for recording test results for record. The completion of the acceptance test program for the new simulator along with activation of the Simulator Administrative Procedures will

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remove the temporary "exceptions" noted in this area.

b. Retesting Plan.

As described earlier, the use of the training modules, in Enclosure 2E-F verifies the existing simulator's continued operability. This list is utilized in the construction of training scenarios, and through normal useage is exercised biannually. The use of this list and documentation of DR's will comprise the Con Edison retest plan, and easily falls within the 25% per your testing requirement.

c. Real Time Verification.

The simulator is constantly monitored for real time operation through both timing tests as well as the monitoring of spare computer duty cycle (a direct indication of real time operation in the deterministic environment of the Encore computer system). The simulator presently maintains acceptable real time operation during the conduct of its assigned training scenarios.

V. SIMULATION FACILITY APPLICATION TO THE INDIAN POINT 2 TRAINING PROGRAM.

a. General Statement.

The combination of the current simulator, the replacement simulator, the in place test program and the administrative procedures have the following objectives:

- Ensure that the simulator possesses the capability to support the training program.
- Provide for certification of the replacement simulator in a timely fashion, addressing the specific requirements of Regulatory Guide 1.149, 10 CFR 55.45 and NUREG 1258.
- Ensure that training requirements are the driving factors in the scope, design and management of the simulator.
- Ensure that the available information, e.g., drawings, plant procedures, plant change documents, industry standards, etc., is effectively utilized.
- Ensure that the administration of the simulation facility is maintained in an up to date certifiable condition.

b. Open Issues, DRs and Work Arounds.

The current DR log is maintained at the simulator site as a living document. This log is available for review and inspection upon request. The major work around area facing the simulator training program is the set of 1991 plant modifications which have yet to be inserted into the simulator. Work is underway to insert those 1991 plant modifications which have been determined to have a training impact.

VI. SIMULATOR CONTROL CAPABILITIES.

a. Instructor Station.

The current instructor station has all of the capabilities required by regulation and the National Standard. This statement covers all of the requirements stated in section 3.4 of the National Standard. The new simulator will have an instructor system with a much more user friendly interface and greater remote monitoring capabilities.

b. Simulator Training Scenario [Malfunction] Capabilities.

There are no exceptions taken to the requirements associated with malfunction capabilities. The training program at Indian Point 2 does not directly apply the use of malfunctions. Malfunctions, along with other instructor directed actions and IC sets are used in the building of Training Scenarios. A Training Scenario is tested prior to its release to the instructors for application in the training environment. It is this administrative approach that results in the use of the term "Training Scenario" rather than "malfunction". Provided, as Attachment E2-F to this document, is a list of Simulator Training Scenarios now implemented on the simulator. The new simulator will have a more extensive suite of malfunctions, training scenarios and Computer Aided Exercises available to the instructor.

c. Other Control Features.

All of the requirements of ANSI/ANS 3.5 - 1985, Section 3.4.3 are exceeded by the simulator.

VII. SCHEDULE.

a. Upgrades and Modification Plans.

As identified by the Indian Point 2 Operations Training Manager, there will be an additional upgrade of the current simulator to add failure modes to valves, and to correct several DRs in existing software. Should other training needs be identified to the Simulator Project Manager, the simulator will be modified as required by regulation. As stated previously, this is a temporary "exception" to the requirements stated in the Appendices of ANSI/ANS 3.5 - 1985.

b. Exceptions Taken in this Submittal.

It should be noted that all "exceptions" taken in this submittal are temporary in nature and will be removed through the delivery, integration and certification of the new simulator as part of the Indian Point Unit 2 Operator Training Program. The following sections of this submittal have exception clearly noted: I.c., II.a., II.b., II.c., II.d., III.b., IV.a., and IV.b..

c. Correction of Exceptions Taken in this Submittal.

All "exceptions" taken herein have been reviewed against the scope of the replacement simulator and will be removed upon delivery and full integration of this simulator into the Indian Point Unit 2 training program. No exceptions are expected to remain after the phase-in of the new simulator.

d. Schedule for the Removal of Exceptions.

Based on the construction schedule issued in January 1991, by the simulator contractor (Westinghouse Electric Corporation) the Ready for Training date for the new simulator is currently 3/93. Should Westinghouse fail to meet their schedular commitments, the Ready for Training date will be adjusted to the schedule slip, the training schedule and the status of plant modifications beyond the data freeze date of the new simulator. The Ready for Training date as used herein is synonymous with the submittal of the certification package for the new simulator. Therefore, the removal of all temporary "exceptions" listed herein will take place at the Ready for Training date of the new simulator.

REFERENCES USE IN PREPARATION OF THIS SUBMITTAL:

ANSI/ANS 3.5-1985 Nuclear Power Plant Simulators for Use in Operator Training.

Code of Federal Regulations, Title 10 Part 55.45, Operator's Licenses.

EPRI - Simulator Qualification Plan NP-4977.

EPRI, NP-4243, Simulator Qualification Methodology.

EPRI, NP-5504 (4977), Simulator Qualification Plan.

EPRI, NP-6179, Procedures for Determining and Monitoring Simulator Operating Limits.

INPO TQ-504, Simulator Configuration Management Plan.

INPO-86-026 Guideline for Simulator Training.

USNRC, RG 1.149, Nuclear Power Plant Simulation Facilities for use in Operator License Examinations.

USNRC, NUREG 1258, Evaluation Procedure for Simulation Facilities Certified Under 10 CFR 55.

SUPPORTING DOCUMENTATION FOR SIMULATOR CERTIFICATION INDIAN POINT 2 SIMULATOR

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ATTACHMENT E2-A

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CONSOLIDATED EDISON OF NEW YORK, INC.

INDIAN POINT UNIT 2 SIMULATOR PHASES III & IV - UPGRADE

> REV 0 3-11-88

prepared for CONSOLIDATED EDISON by EXITECH CORPORATION Columbia, Maryland