UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 7, 1986

Docket No. 50-219

Mr. P. B. Fiedler
Vice President and Director
Oyster Creek Nuclear Generating Station
Post Office Box 388
Forked River, New Jersey 08731

Dear Mr. Fiedler:

SUBJECT: ROD WORTH MINIMIZER (TSCR 145, TAC 61062)

Re: Oyster Creek Nuclear Generating Station

The Commission has issued the enclosed Amendment No. 113 to Provisional Operating License No. DPR-16 for the Oyster Creek Nuclear Generating Station. This amendment is in response to your application dated March 11, 1986, as supplemented by your letter dated September 5, 1986.

This amendment authorizes a change to the Appendix A Technical Specifications (TS) pertaining to the operability of the Rod Worth Minimizer (RWM) during reactor startup. The change is to add a note to TS 3.2.B.2.b in Section 3.2, Reactivity Control, which allows, during operating Cycle 11 only, an unlimited number of reactor startups without the RWM. The change requires that the Control Rod Pattern Templates (CRPT) must be used during Cycle 11 when the RWM is bypassed or inoperable until 50% control rod density (black and white pattern) is achieved or 10% power is reached whichever occurs first. All other provisions of TS 3.2.B.2.b remain in effect.

The staff requested, and you proposed in your letter of September 5, 1986, a statement to be added to the Bases of TS Section 3.2. Upon review of this statement, the staff concludes that this should not be added to the Bases. This is addressed in Section 3.2 of the enclosed Safety Evaluation.

The staff also consulted with the State of New Jersey, Department of Radiation Protection, in accordance with 10 CFR 50.91(b)(4). The State's comments regarding the issuance of this amendment have been addressed in Section 4.0 of the enclosed Safety Evaluation.

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notices.

Sincerely,

Jack N. Donohew, Jr., Project Manager
BWR Project Directorate #1
Division of BWR Licensing

Enclosures:
1. Amendment No. 113 to License No. DPR-16
2. Safety Evaluation

cc w/enclosures:
See next page

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Mr. P. B. Fiedler
Oyster Creek Nuclear Generating Station

Oyster Creek Nuclear
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GPU NUCLEAR CORPORATION

AND

JERSEY CENTRAL POWER & LIGHT COMPANY

DOCKET NO. 50-219

OYSTER CREEK NUCLEAR GENERATING STATION

AMENDMENT TO PROVISIONAL OPERATING LICENSE

Amendment No. 113
License No. DPR-16

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by GPU Nuclear Corporation and Jersey Central Power and Light Company (the licensees) dated March 11, 1986, as supplemented by letter dated September 5, 1986, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and Paragraph 2.C.(2) of Provisional Operating License No. DPR-16 is hereby amended to read as follows:

   (2) <u>Technical Specifications</u>

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 113, are hereby incorporated in the license. GPU Nuclear Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jack N. Donohew, Jr.

Jack N. Donohew, Jr., Project Manager
BWR Project Directorate #1
Division of BWR Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 7, 1986

ATTACHMENT TO LICENSE AMENDMENT NO. 113

PROVISIONAL OPERATING LICENSE NO. DPR-16

DOCKET NO. 50-219

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain vertical lines indicating the area of change.

REMOVE	INSERT
3.2-1	3.2-1
3.2-2	3.2-2*

* Pagination change only

3.2 REACTIVITY CONTROL

Applicability: Applies to core reactivity and the operating status of the reactivity control systems for the reactor.

Objective: To assure reactivity control capability of the reactor.

Specification:

A. Core Reactivity

The core reactivity shall be limited such that the core could be made subcritical at any time during the operating cycle, with the strongest operable control rod fully withdrawn and all other operable rods fully inserted.

B. Control Rod System

1. The control rod drive housing support shall be in place during power operation and when the reactor coolant system is pressurized above atmospheric pressure with fuel in the reactor vessel, unless all control rods are fully inserted and Specification 3.2.A is met.

2. The Rod Worth Minimizer (RWM) shall be operable during each reactor startup until reactor power reaches 10% of rated power except as follows:

   (a) Should the RWM become inoperable after the first twelve rods have been withdrawn, the startup may continue provided that a second licensed operator verifies that the licensed operator at the reactor console is following the rod program.

   (b) Should the RWM be inoperable before a startup (see NOTE below) is commenced or before the first twelve rods are withdrawn, one startup during each calendar year may be performed without the RWM provided that the second licensed operator verifies that the licensed operator at the reactor console is following the rod program and provided that a reactor engineer from the Core Engineering Group also verifies that the rod program is being followed. A startup without the RWM as described in this subsection shall be reported in a special report to the Nuclear Regulatory Commission (NRC) within 30 days of the startup stating the reason for the failure of the RWM, the action taken to repair it and the schedule for completion of the repairs.

NOTE: During Cycle 11 only, unlimited reactor startups are permitted without the RWM. The Control Rod Pattern Templates must be used during Cycle 11 when the RWM is bypassed or inoperable until 50% control rod density (black and white pattern) is achieved or 10% power is reached whichever occurs first. All other provisions of Specification 3.2.B.2.b remain in effect.

Control rod withdrawal sequences shall be established with a banked position withdrawal sequence so that the rod drop accident design limit of 280 cal/gm is not exceeded. For control rod withdrawal sequences not in strict compliance to BPWS, the maximum in sequence rod worth shall be $\leq 1.0\% \Delta K$.

3. The average of the scram insertion times of all operable control rods shall be no greater than:

Rod Length Inserted (Percent)	Insertion Time (Seconds)
5	0.375
20	0.900
50	2.00
90	5.00

The average of the scram insertion times for the three fastest control rods of all groups of four control rods in a two by two array shall be no greater than:

Rod Length Inserted (Percent)	Insertion Time (Seconds)
5	0.398
20	0.954
50	2.120
90	5.300

Any four rod group may contain a control rod which is valved out of service provided the above requirements and Specification 3.2.A are met. Time zero shall be taken as the de-energization of the pilot scram valve solenoids.

4. Control rods which cannot be moved with control rod drive pressure shall be considered inoperable. If a partially or fully withdrawn control rod drive cannot be moved with drive or scram pressure the reactor shall be brought to a shutdown condition within 48 hours unless investigation demonstrates that the cause of the failure is not due to a failed control rod drive mechanism collet housing. Inoperable control rods shall be valved out of service, in such positions that Specification 3.2.A is met. In no case shall the number of rods valved out of service be greater than six during the power operation. If this specification is not met, the reactor shall be placed in the shutdown condition.

5. Control Rods shall not be withdrawn for approach to criticality unless at least two source range channels have an observed count rate equal to or greater than 3 counts per second.

C. Standby Liquid Control System

1. The standby liquid control system shall be operable at all times when the reactor is not shut down by the control rods such that Specification 3.2.A is met and except as provided in Specification 3.2.C.3.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 113 TO PROVISIONAL OPERATING LICENSE NO. DPR-16

GPU NUCLEAR CORPORATION AND

JERSEY CENTRAL POWER & LIGHT COMPANY

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

1.0 INTRODUCTION

By letter dated March 11, 1986, as supplemented by letter dated September 5, 1986, GPU Nuclear (the licensee) requested an amendment to Provisional Operating License No. DPR-16 for the Oyster Creek Nuclear Generating Station (Oyster Creek). This amendment would authorize a change to the Appendix A Technical Specifications (TS) pertaining to the operability of the Rod Worth Minimizer (RWM) during reactor startup. The change is to add a note to TS 3.2.B.2.b in Section 3.2, Reactivity Control, which would allow, during Cycle 11 only, an unlimited number of reactor startups without the RWM. The change requires that the Control Rod Pattern Templates (CRPT) must be used during Cycle 11 when the RWM is bypassed or inoperable until 50% control rod density (black and white pattern) is achieved or 10% power is reached whichever occurs first. All other provisions of TS 3.2.B.2.b would remain in effect.

2.0 DISCUSSION

The licensee, by letter dated March 11, 1986, (Ref. 1), requested a change in the Oyster Creek TS affecting requirements for the operation of the RWM during operating Cycle 11. This change would increase the current number of startups permitted without the RWM operational during this cycle only. This request was supplemented (Ref. 2) in response to questions from the staff.

The RWM provides a backup system to reactor operator actions in selecting, withdrawing and inserting control rods to help assure that correct control rod patterns are maintained in the low power range of operation (less than 10 percent of full power for Oyster Creek). This in turn helps assure that only low rod reactivity worths could be involved should a control rod withdrawal or rod drop event occur.

All BWR 2 and 3 reactors have RWM systems. The TS requirement for operability of the RWM for these reactors varies, but, in general, the plant TS permit periods of low power reactor operation without the RWM being operable.

The Oyster Creek TS are typical of most BWR 2 and 3 plant TS. It permits operation with the RWM inoperable after the first 12 rods have been withdrawn, provided a second operator verifies that the operator is following the specified rod patterns. Also, a complete startup with the RWM inoperable is permitted once a year, if both the second operator and an additional reactor engineer verify that the correct pattern is pulled.

The RWM consists largely of a computer system and associated hardware which receives information on rod positions, keeps track of desired and existing rod patterns, and provides rod blocks when the existing pattern departs significantly from the desired pattern. The current Oyster Creek RWM is original equipment and is subject to significant down time and the licensee is in the process of replacing it with a new RWM. The new RWM was scheduled to be operational in the Cycle 11 refueling outage but this has been delayed and the installation will not be complete before startup from this outage. There may be a period of time during the cycle, therefore, when startup is required and neither system is operable. The licensee stated that every effort will be made to keep the inoperable time to a minimum, but has requested an unlimited number of startups only during operating Cycle 11 with the RWM inoperable. This request is to accommodate the uncertainties of this changeover. The TS only allow one startup in an operating cycle without the RWM.

During the RWM inoperable period the licensee will use the second operator and reactor engineer as replacements for the RWM, and, in addition, will use a CPRT to provide further assurance. The CRPT is a series of plastic sheets with cutouts which stack on top of the control rod select switches. These permit selection of only rods within appropriate groups, and would thus act similar to a RWM. The templates have mechanical features to assure proper stack order and orientation.

The licensee proposes to change TS 3.2.B.2.b with the addition of a note to indicate that only during operating Cycle 11 are startups permitted without the RWM but the second operator, reactor engineer and CRPT system must be used. Also the licensee has stated in response to staff questions (Ref. 2), that every effort will be made during the cycle to maintain an operable RWM and, thus, keep startups without a RWM to a minimum.

3.0 EVALUATION

3.1 Description

The RWM is discussed in Section 7.7.1.3 of the Oyster Creek Updated Final Safety Analysis Report. The RWM continuously monitors control rod positions, compares the reactor operator selected rod movements and positions against a predetermined rod pattern, and prevents rod movements that are not in accordance with this pattern. The RWM consists of the following components: Digital Computer, Input/Output Control, Input Buffer, Output Buffer, Display and Control Panel, Teletypewriter, and Keylock Switch.

The desired control rod movements are stored in the computer memory together with the actual rod positions. The pre-established control rod pattern is entered into the computer by means of a punched tape; the actual rod-position data is received from the control rod position indicating system. Rod selection and rod drive motion are evaluated by the computer with reference to permissible and existing control rod patterns. If rod operation is in accordance with the selected withdrawal sequence, the RWM output is permissive. If the operator attempts a rod selection or movement that deviates significantly from the selected program, the RWM either alarms or blocks such action.

The present RWM hardware at Oyster Creek is original plant equipment. The licensee stated that, during the past several years, it has been increasingly difficult to maintain the RWM in an operable condition. This is due to the age of the equipment and lack of spare parts. In order to improve the reliability and availability of this system, a new RWM has been scheduled for installation during the current Cycle 11 Refueling (Cycle 11R) outage. However, due to a delay in the project delivery date for the new hardware, installation and startup testing will not be completed prior to the current plant restart date from the Cycle 11R outage.

In anticipation of future problems with the old RWM during operating Cycle 11 and the possibility of an unplanned shutdown and subsequent restart during operating Cycle 11 while the changeover to the new RWM is in progress with neither the old or new RWM operable, the licensee is proposing a temporary change to the TS for Cycle 11 only, which will allow unlimited startups with an inoperable RWM. The licensee has stated that every effort will be made to maintain the old RWM in an operable status.

The design basis of the RWM is that it should serve as a backup for procedural control in limiting control rod worths so that, in the event of a control rod drop from the reactor core at a more rapid rate than can be achieved by the use of the control rod drive mechanism, the reactivity addition rate would not lead to damage of the Reactor Coolant System nor to significant fuel damage. The RWM is not intended by the licensee to replace operator selection of control patterns, but is intended simply to monitor and reinforce good procedures.

TS 3.2.B.2 addresses the RWM operability requirements during reactor startups. The basis in the TS addresses this as follows:

> The Rod Worth Minimizer provides automatic supervision of conformance to the specified control rod patterns. It serves as a back-up to procedural control of control rod worth. In the event that the RWM is out of service when required, a licensed operator can manually fulfill the control rod pattern conformance functions of the RWM in which case the normal procedural controls are backed up by independent procedural controls to assure conformance during control rod withdrawal.

The licensee stated that the first barrier or line of defense in preventing the establishment of high worth control rods is the reactor operator and the control rod withdrawal sequence. By procedures, the reactor operator follows the rod-by-rod withdrawal sequence provided by the core engineer. This sequence, in addition to providing for an efficient startup, minimizes the reactivity worth of the control rods to be withdrawn. The RWM has been designed as a backup to the operator so that if procedures are violated, the RWM will block rod motion.

Given, however, that the RWM is out of service during operation at less than approximately 10% power, less favorable control rod patterns which contain high worth rods in the withdrawal sequence could be set up, but only if the reactor operator violates an operating procedure. If the reactor operator operates within the bounds established by procedures, whether the RWM is operational or not, the maximum control rod worths of in-sequence control rods are the same. There is nothing inherent in the RWM which, because it is operational, gives lower rod worths than when the operator is running the plant by the same rules without it.

If the RWM is out of service, normal startup procedure would still be followed but would not be automatically monitored. Additional personnel monitoring would be used instead, as discussed in paragraph 3.2.B.2.b of the TS. If no operational errors were committed, rod worths and accident potential would be exactly the same as if the RWM were in operation. Rod grouping in startup sequences utilized in the RWM are exactly those that are the basis for the detailed sequence employed in a normal startup whether monitored by the RWM or not.

The RWM ensures operator compliance with a predetermined rod withdrawal sequence. However, the functional intent of the RWM can be fulfilled using other methods. The method the licensee proposes is the requirement that the CRPT be employed with a second licensed operator and core engineer being present to verify that the operator at the reactor control console is following the rod program. The CRPT are fabricated from plastic sheets. A set of CRPT is comprised of four sheets which stack together atop the control rod selection switches. The topmost sheet contains cutouts which permit selection of group 1 and 2 rods, etc., until the bottom sheet which enables the selection of any rod in the checkerboard or black-white pattern. Since the order of withdrawal of control rods within a group is unimportant, the CRPT performs one of the RWM functions by allowing withdrawal of only those rods which are members of the group being withdrawn.

Visual and mechanical features assure the proper stacking order of the various CRPT and correct orientation over the rod selection switches. First, each panel is clearly and conspicuously marked by group number order. In addition, adjacent sheets are keyed by uniquely positioned cutouts and raised areas, which by matching together, ensure the correct stacking order. Finally, the proper orientation over the rod selection panel is guaranteed by asymmetrical pegs on the console over which the CRPT fit.

There are two basic withdrawal sequences (A and B) which lead to a 50% control rod density or checkerboard pattern. Consequently, there is a set of CRPT for Sequence A and another set for Sequence B. Although there are several variations in the basic A and B sequences used to shape the core power distribution, these sequences remain the same in their approach to the 50% rod density. Thus, by the use of the CRPT, the probability of achieving a maximum out-of-sequence rod withdrawal error is effectively reduced to zero. This is because the maximum out-of-sequence control rod worth for a given withdrawal sequence (A or B) is always obtained by inadvertently withdrawing a control rod which is a member of the alternate sequence (B or A, respectively). For this reason only the proper set of templates is provided to the control room; the alternate set is stored in an area not readily accessible to the control room operators.

During those startups where 50% rod density is reached prior to 10% power, rod movement after 50% rod density must proceed without protection from the CRPT. However, the additional operator and core engineer who are verifying that the reactor operator is following the rod program is protection against withdrawal of an out-of-sequence rod and in conjunction with relatively low rod worths after 50% rod density and the increase in required rod worths needed to exceed the 280 calories/gram design limit for the rod drop accident compensates for rod withdrawal in this region without the CRPT. Analysis shows that at a reactor power level as low as 2% with a single worst operator withdrawal error, the local energy deposition in the fuel is less than the 280 cal/gram design limit.

3.2 Evaluation

In the time period 1972-1975, the staff extensively reexamined the BWR Rod Drop Accident (RDA) because of flaws found in previous analysis methods. During that period, stricter TS on RWM operability and use were introduced for reactors reexamination, not equipped with a Rod Sequence Control System (RSCS). This was in part because of the staff perception that the previous effectiveness of the RWM was minimal since little effort was expended in maintaining or improving RWM operability and capability, and the second operator substitution was becoming a frequent and routine occurrence. Since that time the RWM operability requirements appear to have resulted in greatly improving the availability of the RWM.

Following tightening of the RWM requirements, a probabilistic analysis of the RDA was performed by the staff (Ref. 3) to examine the question of backfit of the RSCS on older plants. It was concluded that the probability of a RDA exceeding peak fuel energy density limit criteria was well below reasonable probability limits used by the staff for such events, and that this was true even without credit for the RSCS or RWM. The conclusion of that study indicated that the RWM was apparently not an absolute requirement, but it recommended that TS continue to require a reasonable degree of operability in order to provide an easily available added degree of assurance. The staff thus concluded that there is a basis and precedent for allowing limited periods of time without direct RWM operation for low power control rod operations. The rod withdrawal transient at low power does not exceed fuel design limits even with a maximum error rod.

The RWM does not perform any function that proper action by the second operator function does not supply. In response to staff questions concerning the effectiveness of the second operator, the licensee stated that appropriate review and changes to relevant procedures and quality control of these actions have been made in preparation for the changeover. This review is satisfactory. The second operator procedures are augmented by the requirement for verification by the reactor engineer as an additional backup. This provides additional assurance of acceptable operation.

The CRPT will also be used during this changeover. It provides a function similar to the RWM over the range in which it is used. It is not used beyond 50 percent rod withdrawal, however, and below 50 percent withdrawal it enforces group withdrawal but not Banked Position Withdrawal Sequence banked patterns. Although not a complete replacement for the RWM, it provides further assurance for the correct control rod movement.

The staff concludes from past reviews and this review for Oyster Creek that limited periods of time, including an operating cycle, without the RWM operational during low power rod movement are acceptable if sufficient attention is given to backup operational control. The staff concludes that the licensee has performed an acceptable review and modification of relevant operations and procedures for providing in Cycle 11 that backup operational control.

In its reouest for additional information (RAI) dated July 11, 1986, the staff requested that the licensee add to this Bases of TS Section 3.2 a brief statement concerning the time frame in operating Cycle 11 that the licensee may restart the plant without a RWM. Upon review of the statement that the licensee proposed in its response dated September 5, 1986, to this RAI, the staff concludes that the Bases for the TS is not the place for such a statement. This statement is not a basis for the proposed TS change. This statement is actually a commitment by the licensee on its own actions that:

> "In anticipation of problems with the old RWM during operating Cycle 11 and the possibility of an unplanned shutdown and subsequent restart during operating Cycle 11 while the changeover to the new RWM is in progress with neither the old or new RWM operable, a temperatory change to the Technical Specifications has been provided, for Cycle 11 only, which will allow unlimited startups with an inoperable TWM. Every effort will continue to be made, however, to maintain the old RWM in an operable status until the new RWM is put into service."

Therefore, the staff concludes that this statement will not be added to the Bases of TS Section 3.2.

3.3 Conclusions

The staff has reviewed the report and supplemental information submitted by the licensee for the proposed TS changes relating to the operation in operating Cycle 11 without an operable RWM. Based on this review and the evaluation above, the staff concludes that (1) appropriate material was submitted and that the proposed changes satisfy staff positions and requirements in these areas, (2) that operation in the proposed manner is acceptable and (3) the proposed TS changes are acceptable.

4.0 CONSULTATION WITH THE STATE

On September 10, 1986, the staff's Project Manager consulted with Ms. R. Green of the State of New Jersey, Department of Radiation Protection. This consultation per 10 CFR 50.91(b)(4) was concerned with the staff's intent to issue this TS change to allow restarting the plant in operating Cycle 11 without an operable RWM. The State expressed its concern that the staff was not being sufficiently conservative in accepting this proposed TS change. The State agreed with the licensee replacing the old RWM but believed that the plant should not restart until the new RWM was operational. The State did not request a hearing on this TS change.

As discussed in Section 3.0 above, the RWM serves as a back-up to procedural controls to have the correct control rod movements during the low power part of startup. The licensee is providing sufficient additional assurance in the use of a second reactor operator, the reactor engineer and the CRPT to compensate for the RWM if it is inoperable. In addition, the staff concluded that the rod withdrawal transient at low reactor power where the RWM is used should not exceed the fuel energy deposition design limit and the TS change is only for one operating Cycle until the new RMW is operational.

5.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change to a requirement with respect to the installation or use of a facility component located within the restricted areas as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement nor environmental assessment need be prepared in connection with the issuance of this amendment.

6.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security nor to the health and safety of the public.

7.0 REFERENCES

1. Letter (and attachment) from Peter Fiedler, GPU, to Director, NRR, dated March 11, 1986, "Technical Specification Change Request No. 145."

2. Letter (and attachments) from Peter Fiedler, GPU, to J. Zwolinski, NRC, dated September 5, 1986, "Rod Worth Minimizer - Request for Information."

3. Attachment to memorandum from Bernard Rusche, NRR to R. Fraley, ACRS, dated June 1, 1976, "Generic Item IIA-2 Control Rod Drop Accident (BWRs)."

Principal Contributors: H. Richings and J. Donohew

Dated: November 7, 1986