Enclosure

82 - 313

AUG 5 1983

MEMORANDUM FOR: William J. Dircks, Executive Director for Operations

FROM: John T. Collins, Regional Administrator, RIV

SUBJECT: RESPONSE TO CONGRESSMAN G. W. LONG - RE: WATERFORD-3 (50-382)

Attached is a draft response to Congressman Long concerning the base mat problem at Waterford. This is in response to Action Control Item No. 13324. The Office of Inspection and Enforcement has reviewed this draft response and have given their concurrence.

Original Signed By
Paul C. Shemanski

John T. Collins
Regional Administrator

Attachment:
Draft ltr to G. W. Long

cc:
R. C. DeYoung
G. Cunningham

Jim Wilson -

This same ltr was sent for 3 inquiries - all from same "Concerned citizen" - from Senator Long Congressman Livingston Senator Johnston ...

DRRP&E
JGagliardo
8/4/83

8308180629 XA 1 PP.

FILE COPY

AT 83-313

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76011

The Honorable Gillis W. Long
United States House of Representatives
Washington, DC 20515

Dear Congressman Long:

Your letter of July 6, 1983, regarding the cracks in the common foundation mat at the Waterford Steam Electric Station, Unit 3, has been forwarded to me for action. I am pleased to provide you the following information.

There have been two incidents of water seepage through the common foundation mat at the Waterford 3 nuclear facility. The first occurrence was identified and the Nuclear Regulatory Commission was notified in July 1977. The location of the water seepage was in the area where the concrete which supports the containment vessel was to be placed. The sealing and repair of the cracks was considered necessary by the licensee's architect-engineer before placing the containment support concrete, because the water could have been detrimental to the newly placed concrete. A method of repair was determined and the cracks were satisfactorily sealed and repaired. NRC Region IV inspected the corrective actions and concluded that the cracks were satisfactorily repaired.

A second occurrence was reported in May 1983 when a series of leaks were discovered in a different location. This event was documented in a noncompliance report and the NRC was notified. The cracks were identified by the observation of a small amounts of water percolating through the top of the mat at several locations.

Engineering studies were conducted by Ebasco, the architect-engineer, to determine if any detrimental or deleterious effects could result from wa' - seeping through the 12-foot steel reinforced concrete mat. These studies examined the stability of the containment vessel against flotation and overturning under bouyant conditions caused by postulated groundwater intrusion, by groundwater induced corrosion of the reinforcing steel and the containment vessel, and by any effect on the base mat structural integrity due to groundwater percolating through the mat.

Our NRC inspectors are currently monitoring the recent leakage and reviewing the studies. The cracks are not visible to the naked eye and are evidenced only by the moist spots on the unpainted floor, and by imperfections on painted surfaces.

As a result of recent anonymous concerns, NRC has initiated an independent inquiry to determine if the indications have been properly evaluated. We have also learned that Lousiana Power & Light has hired an independent consultant to review the significance of the leakage. A report on this independent review is scheduled to be available September 1, 1983.

I trust that this information is responsive to your request. We will provide you the results of the ongoing studies and our conclusions when they become available. If you have any additional questions or require additional information, we would be pleased to discuss them with you.

Sincerely,

William J. Dircks
Executive Director for Operations

FROM:	ACTION CONTROL	DATES	CONTROL NO.
Rep. Gillis Long	COMPL DEADLINE	7/28/83	13324
TO:	INTERIM REPLY		DATE OF DOCUMENT 7/6/83
CA	FINAL REPLY		PREPARE FOR SIGNATURE OF: ☐ CHAIRMAN ☒ EXECUTIVE DIRECTOR OTHER:
	FILE LOCATION		

DESCRIPTION ☒ LETTER ☐ MEMO ☐ REPORT ☐ OTHER

Encloses ltr fm Ronald H. & Carol B. Burch concerning Waterford 3

SPECIAL INSTRUCTIONS OR REMARKS

Knighton d 6 7/15

Norah

SECY-83-2035

JW Lyle

ASSIGNED TO	DATE	INFORMATION ROUTING
[redacted]		
Collins, RIV	7/14/83	Denton GCunningham LUnderwood

NRC FORM 232
(5-80)

EXECUTIVE DIRECTOR FOR OPERATIONS
PRINCIPAL CORRESPONDENCE CONTROL

No. 83 Logging Date 7/13/83

NRC SECRETARIAT

TO: ☐ Commissioner ______ Date ______
☒ Exec. Dir./Oper. ☐ Gen. Counsel
☐ Cong. Liaison ☐ Solicitor
☐ Public Affairs ☐ Secretary
☐ ______ ☐ Inspector & Auditor
☐ Policy Evaluation

Incoming: Rep Gillis W. Long, Const Ref
From: Ronald Burch

To: NRC/OCA Date 7/6/83
Subject: cracked slab--Waterford 3

☐ Prepare reply for signature of:
☐ Chairman
☐ Commissioner ______
☐ EDO, GC, CL, SOL, PA, SECY, IA, PE
☐ Signature block omitted
☐ ______
☐ Return original of inc

☒ For direct reply* Susper
☐ For appropriate action
☐ For information

Yvonne
~~Please set completion deadline~~
Date changed to 8/10/83
(assuming it has not been changed before)

JW

Remarks: OCA to

For the Commissi

*Send three (3) copies of reply to Secy Correspondence and Records Branch

ACTION SLIP

NRC FORM 82A
(3-82)

GILLIS W. LONG
8TH DISTRICT, LOUISIANA

COMMITTEE ON RULES
CHAIRMAN
SUBCOMMITTEE ON THE LEGISLATIVE PROCESS
JOINT ECONOMIC COMMITTEE

Congress of the United States
House of Representatives
Washington, D.C. 20515

WASHINGTON OFFICE
2185 RAYBURN HOUSE OFFICE BUILDING
PHONE (202) 225-4926

ALEXANDRIA OFFICE
POST OFFICE BOX 410
ALEXANDRIA, LOUISIANA 71301-0410
PHONE (318) 473-7430

CARSON K. KELLEY
ADMINISTRATIVE ASSISTANT

JUL 6 82

MEMORANDUM TO THE OFFICE OF CONGRESSIONAL RELATIONS

Enclosed is a copy of a letter I recently received from one of my constituents which concerns a matter under the jurisdiction of your agency.

I would be most grateful for your advice and assistance concerning the attached communication. Should you require any additional information, please call William Meaux of my staff at (202) 225-4926.

Thank you very much.

GILLIS LONG
MEMBER OF CONGRESS
Eighth Congressional District
Louisiana

Dear Concerned Public Officer:

Would you want a nuclear power plant with a cracked slab in your neighborhood? We don't and we don't think you would either. Waterford 3 has a cracked slab! Will the slab crack and result in a Louisiana disaster? Even a low probability is too high a possibility.

Once Waterford 3 is fueled, the consumer will be assigned the responsibility for paying for Waterford 3, cracked slab and all. They could be paying for their own destruction. If the crack in the slab propagates, the plant will have to be shut down. Then the customers of LP&L will have to pay not only for the construction, but also for the dismantling of Waterford 3. Why should the customer have to pay for the mistakes of LP&L management?

STOP WATERFORD 3 NOW, before it is fueled. Avert the physical or financial disaster that is sure to follow. Let LP&L pay for its management mistakes.

Sincerely,

Ronald H Burch
Carol B Burch

Gillis Long
2311 Rayburn Off. Bldg.
Washington, D.C. 20515

FROM:	ACTION CONTROL	DATES	CONTROL NO.
Sen. J. Bennett Johnston	COMPL DEADLINE	8/11/83	13360
			DATE OF DOCUMENT: 7/19/83
	INTERIM REPLY		PREPARE FOR SIGNATURE OF:
TO: CA	FINAL REPLY		☐ CHAIRMAN
	FILE LOCATION		☒ EXECUTIVE DIRECTOR
			OTHER

DESCRIPTION ☒ LETTER ☐ MEMO ☐ REPORT ☐ OTHER

Encloses ltr fm Ronald & Carol Burch concerning cracked slab at Waterford 3

ASSIGNED TO	DATE	INFORMATION ROUTING
~~Denton, NRR~~ Collins, Reg IV	7/27/83	~~Collins, RIV~~
		GCunningham
		LUnderwood
		Denton

SPECIAL INSTRUCTIONS OR REMARKS

~~T. Novak~~ George Knighton

Return incoming with reply.

SECY-83-2092

See comment

I'd certainly be interested in seeing our reply — DE 8/2

NRC FORM 232 (6-80)

EXECUTIVE DIRECTOR FOR OPERATIONS
PRINCIPAL CORRESPONDENCE CONTROL

No. 23 2002 Logging Date 7/27/83

NRC SECRETARIAT

TO:
- ☐ Commissioner _____ Date _____
- XX ☐ Exec. Dir./Oper.
- ☐ Cong. Liaison
- ☐ Public Affairs
- ☐ _____
- ☐ Gen. Counsel
- ☐ Solicitor
- ☐ Secretary
- ☐ Inspector & Auditor
- ☐ Policy Evaluation

Incoming: Sen J. Bennett Johnston, Const Ref
From: Ronald H. Burch

To: OCA Date 7/19/83
Subject: cracked slab at the Waterford 3 plant

☐ Prepare reply for signature of:
- ☐ Chairman
- ☐ Commissioner _____
- ☐ EDO, GC, CL, SOL, PA, SECY, IA, PE
- ☐ Signature block omitted
- ☐ _____
- ☐ Return original of incoming with response

Suspense: Aug 5

XXXXX ☐ For direct reply*
- ☐ For appropriate action
- ☐ For information

Rec'd Off. EDO
Date 7-27-83
Time 3:00 P

Remarks: OCA to Ack

For the Commission: billie

*Send three (3) copies of reply to Secy Correspondence and Records Branch

NRC FORM 62A
(3-82)

ACTION SLIP

United States Senate

July 19, 1983

Respectfully referred to:

Nuclear Regulatory Commission
Office of Congressional Affairs
Washington, D.C. 20555

Because of the desire of this office to be responsive to all inquiries and communications, your consideration of the attached is requested. Your findings and views, in duplicate form, along with return of the enclosure, will be appreciated by

J. Bennett Johnston
U.S.S.

Form #2

(8308180641 XA 7pp-

J. BENNETT JOHNSTON
LOUISIANA

United States Senate

WASHINGTON, D.C. 20510

July 19, 1983

Mr. and Mrs. Ronald H. Burch
7308 Windsor Drive
Harahan, Louisiana 70123

Dear Mr. and Mrs. Burch:

Thank you very much for letting me hear from you concerning the cracked slab at the Waterford 3 nuclear plant.

I will certainly be pleased to look into this matter for you, and have taken the liberty of contacting the appropriate officials here in Washington to request a report. I will be back in touch with you just as soon as I have any additional information.

I appreciate your bringing this to my attention, and send every good wish.

Sincerely,

J. Bennett Johnston
United States Senator

JBJ:csb

Dear Concerned Public Officer:

Would you want a nuclear power plant with a cracked slab in your neighborhood? We don't and we don't think you would either. Waterford 3 has a cracked slab! Will the slab crack and result in a Louisiana disaster? Even a low probability is too high a possibility.

Once Waterford 3 is fueled, the consumer will be assigned the responsibility for paying for Waterford 3, cracked slab and all. They could be paying for their own destruction. If the crack in the slab propagates, the plant will have to be shut down. Then the customers of LP&L will have to pay not only for the construction, but also for the dismantling of Waterford 3. Why should the customer have to pay for the mistakes of LP&L management?

STOP WATERFORD 3 NOW, before it is fueled. Avert the physical or financial disaster that is sure to follow. Let LP&L pay for its management mistakes.

Sincerely,

Ronald H Burch
Carol B. Burch

REFERENCE 2

FOIA-84-455
E/B.11

twin city testing
and engineering laboratory, inc.
[illegible] CAMPBELL AVENUE
ST PAUL MN 55114
PHONE 612-645 [illegible]

REPORT OF: IDENTIFICATION OF LEACHATE

CT: LOUISIANA POWER & LIGHT
PROJECT NUMBER 8304

DATE: September 9, 1983

ITED TO: Harstead Engineering Assoc Inc
Attn: Gunner Harstead
169 Kinderkamack Rd
Park Ridge, NJ 07656

FURNISHED BY:

COPIES TO:

RATORY No. 1-34799

INTRODUCTION

s report presents the results of our recent testing of samples you submitted for analy-
. We received four samples; three liquid and one solid, for testing. The samples
e identified as follows:

1. Liquid Conduit
2. Liquid, Pit
3. Liquid, Crack
4. Leachate

understand the samples were taken from a reinforced concrete mat foundation. The
ndation is under hydrostatic pressure from an elevated water table. The purpose of
testing is to evaluate the likelihood of corrosion in the reinforced concrete.

CONCLUSIONS

ed on the results of our testing, it is our opinion the following conclusions are
ropriate:

1. The leachate consists primarily of calcium carbonate and iron. Much of the iron is magnetic, suggesting a form such as magnetite. The iron appears as fine wire-like pieces under magnification.

2. The water removed from the conduit is substantially different than the water obtained from the crack and the pit. The high pH and alkalinity of the conduit sample suggests the water has been in contact with the concrete for an extended period of time.

3. The chloride level in the water is sufficiently low to classify the fluid as not being aggressive.

TESTING METHODS AND RESULTS

August 18, 1983, we received four samples for analysis. The samples consisted of
ee plastic containers of liquid and one solid leachate sample. Each of the fluid
ples was tested for pH using colorphast indicator sticks. Also, each fluid sample
analyzed for chloride using the Standard Methods for Water Analysis, 407A. In addi-
n, alkalinity, iron, calcium and sodium was determined for each of the fluid samples
ng EPA Method 600/4-79-020. The following results were obtained:

twin city testing
and engineering laboratory, inc.
[illegible] AVENUE
ST PAUL MN 55114
PHONE 612 645 2601

REPORT OF: IDENTIFICATION OF LEACHATE

DATE: September 9, 1983

BORATORY No. 1-34799

TESTING METHODS AND RESULTS
(cont.)

Constituent	Sample 1	Sample 2	Sample 3
pH	12.5	7.5	7.5
Iron (ppm)	ND*	ND	1.7
Calcium (ppm)	375	71	31
Sodium (ppm)	2400	1400	5100
Chloride (ppm)	78	20	22
Alkalinity ($CaCO_3$) (ppm)	1300	-	-

*ND = Not Detected

e leachate sample was analyzed using a Jarrell Ash Emission Spectrograph. The sample s placed in carbon electrodes, and a film of the spectra was obtained with a D.C. arc. e following constituents were identified:

Concentration	Constituent(s)
Major Constituent (10% or greater)	Iron, Calcium
Minor Constituent (10% to 1%)	Sodium, Aluminum
Trace Constituent (1% or less)	Aluminum, Magnesium, Manganese, Titanium, Barium, Copper

leachate sample was also analyzed using X-ray diffraction techniques. The diffraction lysis identifies crystalline material which is present in the sample. The sample tains a major amount of calcium carbonate.

REMARKS

le found on the surface of Portland cement concrete is typically comprised of calcium bonate. During the hydration of Portland cement, calcium hydroxide is liberated. the presence of carbon dioxide, the calcium hydroxide will form calcium carbonate. carbonation layer is generally limited to the top 1/8" of a quality concrete.

twin city testing
and engineering laboratory, inc.
[illegible] Avenue
St Paul MN 55114
Phone 612 645 2601

REPORT OF: IDENTIFICATION OF LEACHATE

DATE: September 9, 1983

BORATORY No. 1-34799

REMARKS
(cont.)

e corrosion of reinforcing steel may form a magnetic residue such as magnetite. This rmation requires an aqueous environment where oxygen levels are low. The very low on content of the water samples suggests the water was not in contact with steel active- corroding. The formation of magnetite is observed frequently when steel corrodes a chloride contaminated cementitious material and is then exposed to air. The low loride levels found in the water suggest the presence of the iron in the leachate is t from such a condition. The test results are consistent with the iron originating om the surface of the slab.

TWIN CITY TESTING AND
ENGINEERING LABORATORY INC

Richard D. Stehly

Richard D Stehly, P.E.
Chief Engineer

S/st

REFERENCE 3

32. Conservatively assuming the existence of extensive through-cracks of the mat, assess the impact of the presence of water on the long-term structural integrity of rebars and mat capacity. Also assess the same impacts due to other potential corrosive elements.

Response: (EBASCO)

The assessment has been provided in the "Applicant's Answer to Joint Intervenor's Motion to Reopen Contention," dated September 30, 1983. Affidavit of William F. Gundaker, and in a memorandum dated August 5, 1977 by A. W. Peabody/M. D. Oliveira, titled "Corrosion of Reinforcing Steel and Steel Containment Vessel Plates in Contact with Water," which reads in part, "...we have analysed a possible situation in the common mat where supposedly groundwater seeping from concrete cracks found on the surface of the mat could corrode the reinforcing steel and the outside bottom plates of the Steel Containment Vessel.

> It is a proven fact that concrete by its alkaline nature passivates carbon steel embedded in it.
>
> It is also known that water in contact with concrete becomes alkaline and consequently its corrosivity to steel decreases considerably.
>
> In addition to these factors, assuming that groundwater is left inside the crack network to a certain extent, this water will be near stagnant and without replenishment of oxygen. Consequently, the rate of corrosion under the above circumstances, if any, will be negligible."

Response: (HEA)

The "existence of extensive through cracks" as hypothesized, considering the hydrostatic pressure acting at the base of the mat, would be manifested by substantial bleeding of groundwater through such cracks. HEA reiterates the summary of a site inspection performed on 08/30-09/02/83. During this time all accessible areas of the basemat were inspected and any cracks found were mapped (See HEA Report No. 8304-1, dated 09/19/83). Subsection 4.6 of the referenced report notes that:

> "The amount of moisture noted during this inspection period was minimal. In some instances dampness/moisture were present. There was, however, no evidence of seepage or migration that might have been deduced by the presence of standing water or draining along the local slope of the basemat."

REFERENCE #4

ATTACHMENT 2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Appeal Board

In the Matter of	)	
	)	
LOUISIANA POWER & LIGHT COMPANY	)	Docket No. 50-382
	)	
(Waterford Steam Electric Station, Unit 3)	)	
	)	

AFFIDAVIT OF WILLIAM F. GUNDAKER

WILLIAM F. GUNDAKER, being first duly sworn, deposes and says:

1. I am employed by Ebasco Services Incorporated ("ESI") as Director of Corrosion Engineering, and I have been involved in corrosion work for twenty-three years. A statement of my educational and professional qualifications is attached as Exhibit A. I analyzed from the corrosion viewpoint, the matters stated herein, and I make this Affidavit in support of Louisiana Power & Light Company's answer to Joint Intervenors' Motion to Reopen Contention.

2. Hairline cracking on the surface of the Waterford 3 common foundation mat has been indicated by the presence of moisture discovered on the surface of the mat in 1977 and in 1983. This affidavit presents my professional opinion of the potential for corrosion of the reinforcing steel within the foundation mat, and the steel containment liner, as a result of the hairline cracking.

3. When steel such as the reinforcing bars ("rebars") of the Waterford concrete mat is embedded in concrete, the concrete will

8310040245 6pp.

develop a film on the surface of the steel called "passivating film." This passivating film, consisting of gamma ferric oxide, is formed by cement hydration and is maintained in the alkaline environment of the concrete. This film acts like a protective coating applied to the rebar which precludes corrosion from taking place on the steel rebars.

4. For corrosion of any significance to take place on rebars embedded in concrete, the protective passivation film must first be destroyed. The primary cause for a breakdown of the passivation film is the presence of a high concentration of chlorides, as would be the case in marine environments or in roadways where salts are used for snow melting purposes. Laboratory studies conducted by D. A. Hausmann of the American Pipe and Construction Company in South Gate, California, show that the corrosion threshold for rebars is reached when the passivating film starts breaking down. This threshold is observed when the chloride concentration reaches 710 ppm in the presence of free oxygen.

5. The possible sources of chlorides contained in the water seeping through the cracks are the concrete mix water, the concrete itself and the groundwater. Analyses of the concrete mix water taken on 2/3/76 and 4/15/77 showed chloride contents of 28 ppm and 24 ppm respectively. The main sources of chlorides in the concrete are the mix water and the addition of calcium chlorides. The concrete specifications for the Waterford 3 Project states that the total soluble chloride ion content in the water extracted from the concrete mix should not exceed 250 ppm and that calcium chloride shall not be

added unless specifically authorized. According to information obtained from ESI personnel, no calcium chlorides were added to the concrete in the Waterford 3 Project. An analysis of a groundwater sample recently taken at the Waterford 3 site showed that the chloride content was 34.9 ppm. Thus, it is not possible in my opinion for the chloride level to even approximate the 710 ppm corrosion threshold level necessary to initiate corrosion.

6. Attempts were also recently made by ESI personnel to remove water samples from the concrete mat cracks on the floor of the auxiliary building for analysis. In the first attempt only about three drops of water could be extracted with a hypodermic needle. No analysis was possible with this amount of water. During a second attempt which lasted several hours, approximately 10 ml of water was gathered. This amount of water allowed the U.S. Testing Laboratory to make only a partial analysis of the sample. A comparison of some of the parameters measured in the two water samples is as follows:

	Ground Water	Crack Water
pH	6.75	7.95
Iron	0.07 ppm	0.08 ppm
Calcium Hardness ($CaCO_3$)	169 ppm	212 ppm
Chlorides	34.9 ppm	*
Calcium	67.5 ppm	85 ppm

7. The 710 ppm chloride corrosion threshold requires the presence of free oxygen. Hausmann's studies showed that no cor-

---

* Sample too small for measurement.

rosion took place in concentrations of up to 3550 ppm of chloride when free oxygen was not present. While water contains dissolved oxygen, the minute amount of groundwater penetrating the cracks would in my opinion be basically classified as stagnant water, and oxygen replenishment would be a very slow process. Thus, it is likely that the chloride corrosion threshold for the rebars in the foundation mat would be significantly higher than the 710 ppm value reported by Hausmann for corrosion in a free oxygen environment.

8. Another possible cause of the breakdown of the passivating film is direct chemical attack on the rebars. Dissolved hydrogen sulfide and dissolved carbon dioxide have been known to attack rebars in concrete. Analysis of a groundwater sample recently taken at the Waterford 3 site indicated a content of less than 0.01 ppm of hydrogen sulfide and a content of 1.32 ppm of carbon dioxide. Both these amounts are negligible and would have no deleterious effect on the concrete mat rebars. Since the concrete is not a source for the H_2S or the CO_2, no direct chemical attack of the rebars is to be expected.

9. A common and direct indication of rust developing in concrete rebars is the presence of a brownish stain on the surface of the concrete. With the water penetrating through the concrete from the bottom of the mat, such a rust colored stain would tend to deposit on the top surface of the concrete mat if any measurable corrosion is taking place on the rebars. ESI personnel who have

inspected the cracks have reported that no such stains are evident at the Waterford 3 concrete mat surface in the areas of the cracks. In addition, the minimal difference between the ferrous and ferric oxide contents on the two water samples analyzed (0.07 ppm for the groundwater and 0.08 ppm for the crack water) indicates that if any corrosion of the rebar is taking place, it is negligible.

10. In my opinion, the amount and nature of the water in the cracks precludes the possibility of any significant corrosion of the concrete mat rebars.

11. The steel liner of the containment, which is 2-1/2 feet above the surface of the mat at its lowest point, is installed over fill concrete. The same protective type of passivating film would develop on the surface of the liner in contact with the concrete, and the same statements outlined above for the rebars can be made for the liner.

12. When the cracking was discovered in 1977, my predecessor, A. W. Peabody (now retired), and M. D. Oliveira (who has since left ESI to return to his native land) were asked to analyze the potential for corrosion of the rebars and the outside bottom plates of the containment vessel. Their opinions were stated in memorandum COR-LW3-77-55M dated August 5, 1977, a copy of which is attached as Exhibit B. On the basis of my own evaluation, I agree with the conclusions stated in their memorandum.

13. Based on my own knowledge and experience of corrosion matters, on my review of the literature on the subject, and on the

data that I have obtained related to the Waterford 3 project, I can state that there is no reason for me to believe that corrosion of the reinforcing steel in the concrete mat at the Waterford 3 Nuclear Plant would occur to a degree that would have any significance. Nor do I have any reason to believe that the integrity of the containment liner in those areas attached to the concrete would be affected.

William F. Gundaker
WILLIAM F. GUNDAKER

Subscribed and sworn to before me this 27 day of September, 1983.

Katherine H. Haarke
NOTARY PUBLIC

My Commission Expires:_____

KATHERINE H. HAARKE
NOTARY PUBLIC, State of New York
No. 30-6712810
Qualified in Nassau County
Commission Expires March 30, 1984