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UNITED STATES NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

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INVESTIGATIVE INTERVIEW
OF
DON K. CRONEBERGER

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF INVESTIGATION

GPUN Headquarters
100 Interpace Parkway
Parsippany, New Jersey

The Investigative Interview convened at 1:35 p.m.,
Richard A. Matakas, presiding.

PRESENT:

DON K. CRONEBERGER, Interviewee

RICHARD A. MATAKAS, Investigator
Region I
Nuclear Regulatory Commission
King of Prussia, Pennsylvania

ROBERT G. LA GRANGE
Section Leader
EQ Branch
Office of Nuclear Reactor Regulation

1 P R O C E E D I N G S

2 MR. MATAKAS: The date is May 1, 1985 and the
3 time is 1:35. Present for this interview are myself,
4 Richard A. Matakas, investigator, USNRC; Bob LaGrange,
5 section leader in the NRC EQ branch, Office of Nuclear
6 Reactor Regulation; and Mr. Don Croneberger, director,
7 engineering and design, GPUN.

8 The purpose of this interview is to discuss
9 facts and circumstances leading to GPUN submittals to the
10 NRC involving the environmental qualification of
11 electrical equipment at TMI Unit 1.

12 Mr. Croneberger, do you have any objection to providing
13 this information under oath?

14 THE WITNESS: No.

15 Whereupon,

16 DON C. CRONEBERGER

17 was called as a witness and, having been first duly sworn,
18 was examined and testified as follows:

19 EXAMINATION

20 BY MR. MATAKAS:

21 Q For the record, will you state your full name
22 and business address, please?

23 A Don K. Croneberger; 100 Interpace Parkway,
24 Parsippany, New Jersey 07054.

25 Q And what extension can we reach you at?

1 A 2031.

2 Q Mr. Croneberger, we are going to be talking
3 first about some internal audits conducted by GPUN. I
4 would like to introduce some documents into the record.

5 The first one I would like to show you is what has been
6 identified as GPUN interoffice memorandum dated June 25,
7 1981, letter number QA/4161, and attached to it is
8 internal audit 81-02.

9 Would you take a look at that? I ask you if you
10 recognize it. Do you recognize that document, sir?

11 A Yes, I do.

12 Q I asked for the response from Tech Functions to
13 QA, and that couldn't be located. But what I do have is
14 QA's response back to Tech Functions regarding the Tech
15 Functions response, and that is identified by interoffice
16 memorandum dated June 25, 1981, letter number QA-4186, the
17 subject of which is 81-02 audit, and it's addressed to
18 yourself. Take a look at that.

19 Do you recognize receiving that particular document in
20 this particular time frame, June 1981, as a response from
21 QA back to Tech Functions?

22 A Yes, I do.

23 Q The third document is Tech Functions' revised
24 response dated August 21, 1981, letter number is EP&I,
25 81/0176, and it is from Mr. Maus to Mr. Stromberg.

1 Do you recognize that as Tech Functions' revised
2 response to 81-02?

3 A Yes, I do.

4 Q And the last document for right now that I would
5 like to show you is dated April 4, 1984. The subject is
6 "Open Audit Findings, 81-02 audit." It's from Mr. Guimond
7 to Mr. Stromberg.

8 Take a look at that.

9 Do you recognize that document, sir?

10 A I recognize the document, although I'm not sure
11 exactly when I saw the document.

12 Q Would it have been in the 1984 time period?

13 A Yes.

14 Q Did you have any input into the request for the
15 audit to QA?

16 A In 1981?

17 Q Yes.

18 A No.

19 Q Were you aware that the audit was going to be
20 conducted?

21 A Yes, I was.

22 Q I notice that there were 11 deficiencies noted
23 in the audit and that you signed for the proposed
24 corrective action for findings 1, 3 -- signed for, I don't
25 know if you want to call it "acceptance" or "acknowledgment"

1 of the audits -- for 1, 3, and 11. Why did you sign for
2 those three and Mr. Maus for the remaining? Was there any
3 particular reason?

4 A I believe -- and this was some long time ago --
5 at that time, included in my organization, was a group
6 which was responsible for procedures and standards. That
7 function, near this time frame, was reassigned to the
8 engineering services department.

9 I believe my signature was intended to convey the fact
10 that Maus, himself, could not take the responsibility for
11 getting the procedure in place; that I would have to get
12 this other group to develop the procedure.

13 Q Specifically audits 1 and 3, they appear to be
14 more of a programmatic type --

15 A Yes, my recollection was those were
16 programmatic, which required the development of
17 procedural guidelines.

18 Q What is Tech Functions' responsibility to
19 correct audit findings? In other words, is there a
20 procedure that tells you you have to do X, Y, and Z by a
21 certain amount of time during the 1981 time period?

22 A To my knowledge, no such guidance existed.

23 Q Is there one today?

24 A I believe there is; yes.

25 Q Was there any type of understanding? In other

1 words, what's the purpose of the audit? If it identifies
2 deficiencies and makes recommendations, was there any type
3 of understanding that these would be corrected or --

4 A Normally, the signature on the finding conveyed
5 a commitment within a month to either correct the finding
6 or propose a plan by which the finding would be closed out.

7 Q And what did you do in this particular area,
8 particularly for findings 1 and 3?

9 A Tried to get started the development of what
10 eventually became procedure EP-301.

11 Q When did that procedure finally come out? I
12 noticed the proposed date on it is September -- I think
13 September 1, 1981?

14 A I'm not certain. I could check. I know I
15 signed that out on behalf of Mr. Wilson and I'm really not
16 sure of the year; whether that was '81 or '82.

17 Q Was that engineering procedure, was that already
18 being generated at the time of this audit?

19 A I'm not certain. I'm not certain.

20 Q Then you wouldn't be certain if it was generated
21 because of the audit; is that correct?

22 A I'm not certain.

23 Q Were you aware that some of the audit
24 deficiencies remained open in 1982?

25 A I believe I was aware, in 1982, that some of the

1 deficiencies were still not closed out.

2 Q Were you aware that some of the deficiencies
3 were still not closed out in 1983?

4 A To my knowledge, no.

5 Q Okay. What gave you indication that these
6 deficiencies had been closed out in 1983?

7 A My recollection of the absence of any
8 interaction with QA.

9 Q I notice in the initial response from Tech
10 Functions to QA on the audit, that audit finding number 1
11 was not addressed. That finding is: "No evidence of
12 management direction to correlate the efforts of
13 intersectional effort in establishing the master list and
14 qualification documentation file."

15 Was there any reason for that?

16 A None that I am aware of, other than I believe
17 the background of that response was from Maus, and he may
18 have considered that not to have been his area of
19 responsibility.

20 Q You didn't have any contact with QA, or
21 discussions with QA that that not be addressed?

22 A Not to my knowledge.

23 Q Was there any concern that that particular
24 finding was too critical of management? Was there any
25 concern on your part that audit finding number 1 was too

1 critical of management?

2 A No.

3 Q Subsequent to the audit, did you attend any
4 meetings with QA concerning the audit findings?

5 A Subsequent to the audit? I'm certain I did,
6 although I suspect that was primarily in the April-May
7 time frame of 1984.

8 Q You don't recall attending any meetings back in
9 1982, 1983?

10 A I know I attended meetings relative to that
11 audit finding. I do not remember meetings subsequent to
12 that until the 1984 time frame.

13 Q Did you have any contact with QA individuals,
14 either Mr. Guimond, Mr. Stromberg, Mr. Bader, and Alatary,
15 anybody on that level, who advised you that they did not
16 feel that the audit findings were closed out -- being
17 satisfactorily closed out?

18 A Clearly that was an issue in 1984. I do know
19 prior to 1984 that some of the specific technical issues
20 were not considered closed out, and I suspect that was
21 maybe some discussion with Matt Stromberg. I didn't get
22 the impression from that that the open issues -- and I
23 really forget what the open issues were -- were things
24 that were easily corrected.

25 One that comes to mind that was involved was

1 documentation on the ASCO valve issue, where I couldn't
2 determine how we could get drawings corrected when the
3 drawings didn't exist during April. I recall that as
4 being an open issue.

5 Q In what time period?

6 A Probably prior to the April-May time frame of
7 1984. And I suspect, with that recollection, there were
8 probably some discussions with someone like Matt Stromberg.

9 Q During the '82-'83 time period, did QA tell you
10 that they were not satisfied with the documentation in the
11 files, the documentation to qualify individual components?

12 A Not explicitly.

13 Q Would you clarify that, please? "Explicitly"?
14 What does that mean?

15 A I mentioned the fact that there was a concern on
16 the auditor, that we not repeat by buying a part again
17 which was the same as the original construction versus the
18 replacement. That was the kind of issue that I recall
19 that existed. But I viewed it, at that time, as not being
20 related to what's there being unqualified; it was
21 something that had to be corrected to make sure that
22 subsequently we didn't do something to the plant which
23 would jeopardize the qualification.

24 Q Which QA auditor are we talking about, who you
25 had these discussions with?

1 A Probably Matt Stromberg.

2 Q Did you have any specific responsibilities
3 relating to the Environmental Qualification program?

4 A The recognition that we needed to set up a
5 function to address Environmental Qualification. As I
6 remember, it was raised in 1981.

7 In 1981 it was decided that that function would be in
8 the engineering and design department and within the
9 electrical power and instrumentation section, we call it.

10 So, in 1981 it was decided there would be a functional
11 responsibility assigned for EQ within that section and at
12 that time Maus was assigned as being supervisor of that
13 function.

14 Q Getting back to, specifically, audit findings 1
15 and 3, according to the April 4th memo, April 4, 1984 memo,
16 both audit findings 1 and 3 were still considered as open,
17 according to Mr. Guimond, who was the lead auditor on
18 audit 81-02.

19 Why did they stay open so long; do you know?

20 A Again, undoubtedly they stayed open longer than
21 required; but a version of EP-031 was issued prior to 1984,
22 and when that EP-031 was issued, I had assumed that that
23 was the basis for closing out finding number 1 and, I
24 believe, number 3.

25 Q I would like to show you a letter. It is to

1 yourself, "Proposed Corrective Action to Audit 81-02";
2 that's the subject of the letter. And it's a letter from
3 Mr. Guimond.

4 I would like to ask you if you have ever seen the
5 letter before.

6 (Discussion off the record.)

7 BY MR. MATAKAS:

8 Q Did you recognize that document?

9 A Yes, I do. That in itself may be misleading.
10 This document was brought to my attention, I believe, in
11 something like the May '84 time frame.

12 Q Okay. I want to show you another document also,
13 and we'll talk about both of them. The second document I
14 would like to show you, the subject is "Emergency
15 Procedure-031, equipment, environmental qualification."
16 It is to yourself. It was from, again, Mr. Guimond. It
17 starts out: "Per our agreement I am forwarding to you our
18 comments on EP-031 for your disposition and corrective
19 action." And under general comments, it states "The
20 procedure does not address nor reference all of the
21 implementing procedures needed to assure all," emphasis
22 added, "the requirements of the bulletin is being met."

23 Do you recognize that document?

24 A No, I do not.

25 Q Okay. Let's talk a little bit about the

1 document which is entitled -- or the subject of which is
2 "Engineering Procedure 031."

3 Do you remember any procedure with Mr. Guimond where
4 you discussed -- where you wanted him to look over
5 Engineering Procedure-031, and review it for acceptance?

6 A I had no direct discussion with Mr. Guimond, to
7 my knowledge.

8 Q Did you have it with any of his supervisors, to
9 have him look over that procedure?

10 A Procedure EP-031 was initially released under my
11 signature in Mr. Wilson's absence.

12 I do recall in that time frame that there was an
13 outstanding issue with the QA department, where they were
14 not satisfied with that procedure.

15 I do remember that pending resolution of those comments
16 I would not sign that procedure off.

17 Now, who within QA generated those comments to that
18 procedure when it was going through the sign-off process,
19 I'm not sure.

20 Q Did you ever sign off that procedure?

21 A I did.

22 Q Do you have any idea why these two documents
23 were never officially brought to your attention or sent to
24 you?

25 A No, I do not.

1 Q I should rephrase that: Why they were not
2 officially put into the GPUN system?

3 A I do not.

4 Q And you were never informed by QA that, in their
5 opinion, Engineering Procedure 031 did not satisfy the
6 audit findings in 81-02, specifically audit 1 -- audit
7 finding number 1 and audit finding number 3?

8 A No, to the contrary: my understanding before my
9 signature was applied was that the comments from the QA
10 department were resolved.

11 Q And who left you with that impression?

12 A Mr. Maus and/or Mr. Flynn. Flynn would have
13 been the one who was handling the procedures.

14 Q I notice at the close-out date on audit finding
15 3, it is closed out by Mr. Magitz on 6/29/1984. And
16 that's the same for audit finding number 1 and the same
17 for audit finding number 11.

18 Does this document ever come back to you to let you
19 know when it is closed out? And I'm talking about "this
20 document," the actual audit finding nonconformance sheet?

21 A To my knowledge, no.

22 Q Did you ever tell Mr. Maus that this procedure
23 was acceptable for the close-out of audit finding number 1?
24 And I'm talking about Engineering Procedure 031?

25 A I believe not, although I just don't recall. I

1 could have, I just don't recall.

2 Q Do you have any responsibility to incorporate or
3 follow audit recommendations?

4 A Would you repeat the question?

5 Q Do you have any responsibility -- and I say "you,"
6 I mean Technical Functions -- to address the
7 recommendations that are made in an audit? I notice on
8 page 10 of 10 there's three recommendations that were made?

9 A Today the procedure would require at least a
10 memorandum addressing a recommendation. That requirement
11 would not have existed today, so it would have been up to
12 the audited organization to determine whether to respond
13 or not or how to follow a recommendation.

14 Q Do you mean -- what didn't exist back in 1981?

15 A That approach did not exist. In 1981 it would
16 have been up to the recipient of the audit to determine
17 what action if any he was supposed to take relative to
18 recommendations.

19 Q Okay. Regarding the recommendations that are
20 noted on page 10 of 10, instead of reading that into the
21 record -- I have done that several times -- if you would
22 look at those audit recommendations as shown on page 10 of
23 10 in audit 81-02, did you consciously make a decision to
24 follow or not to follow those three recommendations?

25 A There was a conscious decision to try to push

1 getting the procedure in place. There was, on my part, no
2 conscious decision to address or not address items 2 and 3.

3 Q Once that procedure was in place, did you have a
4 responsibility to find out if that procedure has been
5 accepted by QA?

6 A The normal approach on procedures which involved
7 interfaces with other divisions would be to get for them
8 the opportunity to review the draft procedure and provide
9 comments; and our process of resolving comments is
10 incorporated in that process.

11 Up until we made use of the new corporate procedure
12 system, acceptance by QA would have been inferred from
13 their providing comments and a satisfactory resolution of
14 the outstanding comments.

15 Q Okay. That's what I'm getting at. The two
16 documents that I showed you were reviewed by the audit
17 team leader -- and, by the way, those were dated August
18 1982; which, in effect, finds Engineering Procedure 031
19 unacceptable to resolve audit findings 1 and 3. And at
20 the same time, there was a document generated which states
21 essentially the same as the April 4, 1984 document that
22 you have looked at here, that states: Audit findings 1, 3,
23 5-A and 6-A and portions of 11 are unacceptable.

24 What I'm trying to get at is where was the breakdown?
25 And the reason for this is: Would it be fair to say that

1 these audit findings were addressing the programmatic
2 problems of documentation and management direction in the
3 Environmental Qualification program? Would that be fair
4 to say? Those particular audit findings?

5 A My interpretation of those audit findings and
6 the focus on the procedure was primarily to assure that
7 the various responsibilities were assigned and the
8 interfaces between groups were assigned. The procedure,
9 as written, also attempted -- attempted to define
10 documentation requirements. But the main focus was to
11 understand who was responsible for doing what.

12 Q Okay. Then who was responsible for audit
13 findings 1 and 3? Who was responsible for assuring that
14 those audit findings were corrected?

15 A I took on the responsibility by signing that
16 finding of 1981, and was driving to get the procedure in
17 place. So I would say I was responsible for trying to
18 close out those findings.

19 Q Okay. Then what information did you have which
20 would lead you to believe that those audit findings were,
21 in fact, closed out?

22 A The only evidence that I can recall being aware
23 of was a QA concurrence on the resolution of comments for
24 EP-031, prior to my signing that document in 1982 or 1983.

25 Q Would you have those on file?

1 A I would have to check with Mr. Flynn. He could
2 have those on file.

3 MR. MATAKAS: Let's go off the record for a
4 second.

5 (Discussion off the record.)

6 BY MR. MATAKAS:

7 Q Before we went off the record we were talking
8 about Engineering Procedure 031, and a -- when this
9 procedure was adopted. You have indicated that there was
10 a sign-off sheet where it has to be accepted -- an
11 accepted procedure by various sections or departments
12 within the GPUN organization; is that correct?

13 A Yes. An opportunity to review and provide
14 comments. And by commenting, require resolution of
15 comments prior to a document being issued.

16 Q Okay. What was the purpose of engineering
17 procedure 031?

18 A The purpose of Engineering Procedure 031 was to
19 define responsibilities for performing work required by
20 the EQ issue, and to provide some guidance on
21 documentation requirements.

22 Q I know we talked about this before. Then it was
23 a procedure that was initiated specifically to resolve
24 those audit deficiencies? That's what I'm not clear on.
25 What I'm getting at now, because QA gets this procedure,

1 and they sign off on it for procedure, is that
2 necessarily -- does that necessarily mean that it resolves
3 audit findings 1 and 3 in internal audit 8202? Or are
4 they just accepting it as a procedure as it stands on its
5 own?

6 A To my knowledge, their sign-off would not
7 necessarily state that closes out an audit finding.

8 Q Then would it be your responsibility to see if
9 in fact it does close out the audit finding, and not that
10 it's an accepted procedure? It's one thing to close out
11 an audit finding; it's another thing that it's an accepted
12 procedure?

13 A As I remember, and I believe this is included in
14 the one memorandum that was sent back, we had a commitment
15 to issue EP-031 as a vehicle for closing out the one --
16 audit finding 1, I believe.

17 Q That's correct. In your revised response dated
18 August 21st -- the revised response dated August 21, 1981,
19 it states: "As proposed corrective action, Engineering
20 Procedure 031 is scheduled to be issued 9/1/81." And
21 that's the proposed corrective action. And it is found
22 accepted by Magitz.

23 But that's proposed corrective action. And the same
24 thing with audit finding number 3. However, it says --
25 there's a note at the bottom of the corrective action. It

1 says: "Original corrective action was accepted in error."
2 I don't know what that means. Could you shed any light on
3 that?

4 A No, I could not.

5 Q In any event, corporate procedure 1000-ADM-7317.01
6 was issued. I don't know if that means in place of
7 Engineering Procedure 031 --

8 A There was a major rewrite of EP-031 which I
9 personally was involved with, in the April-May time frame
10 of 1984.

11 Among other things, I believe that then got into the
12 corporate numbering system.

13 The attempt in that rewrite was to address many things
14 that were being identified as deficiencies in the program.

15 I suspect what was issued in that April-May time frame
16 is that number, which is a revision to the original EP-031.

17 Q The ADM number, 1000-ADM --

18 A Yes.

19 Q Obviously there was a breakdown somewhere. We
20 have documented in 1984, we have an attempt to document in
21 1982, that that procedure was not -- didn't satisfy the
22 requirements to close out those audit findings.

23 Can you tell me what happened? Why they were left open?
24 Do you have any idea now, in retrospect? You have talked
25 about it. You said you have seen the document that was

1 intended to go to you from Mr. Guimond?

2 A One of the documents I did see in the '84-'85
3 time frame. The other one I do not recall having seen.

4 This one I recall having seen. This one I do not.

5 Q And "this one" is -- the subject is audit 81-02,
6 and states "audit findings 1 and 3, 5-A, 6-A, 10, and
7 several of the subparts on finding 11, were considered
8 open by QA."

9 A And this was brought to my attention concurrent
10 with the attempt to revise EP-031, and we wanted to be
11 sure that, in fact, in the revision that any outstanding QA
12 concerns were taken care of.

13 Q This was the purpose for the rewrite of --

14 A No, the rewrite was primarily to address the
15 many concerns that had cropped up as a result of the NRC
16 audits.

17 Q And you don't recall this other document, the
18 subject of which is engineering procedure 031, requesting
19 that QA look at that document and provide comments?

20 A I do not recall seeing that memorandum.

21 Q Do you recall during this time frame, in 1982,
22 asking them to review the document and provide comments?

23 A I personally would not have. But that would
24 have been an automatic part of the review process for a
25 procedure.

1 BY MR. LA GRANGE:

2 Q But you did not see the letter you have stated
3 you have seen, before 1984 and 1985 period?

4 A No. That's right.

5 Q I mean, you were not aware of this back in 1982?

6 A No, I was not.

7 BY MR. MATAKAS:

8 Q And the same with the subject of document EP-031?

9 A That I do not recall having seen, until you have
10 shown it to me now.

11 Q Okay. If the natural scheme of things would
12 have been for QA to review that procedure, would you have
13 suspected that they'd provide you with a written review
14 documenting their review of the procedure?

15 A Yes, I would.

16 Q Did you ever get anything like that?

17 A I believe I physically saw written comments on
18 the procedure prior to my signing it off in 1982 or 1983;
19 whenever that sign-off occurred.

20 Q And that is the document that you will get us?

21 A That was the one that I indicated should be in
22 the file with the procedures.

23 Q I notice that the audit team leader was
24 Mr. Guimond. Mr. Guimond reviewed the initial Tech
25 Functions response. But I noticed in the revised response

1 where the proposed corrective actions were found
2 acceptable, that was done by Mr. Magitz.

3 Do you know why that was?

4 A No, and I forget what the time frame was. I
5 know Mr. Guimond was out ([REDACTED])--

6 Q 1984?

7 A -- 1984. I know nothing beyond that.

8 Q The proposed corrective action, the letterhead
9 is dated August 1981?

10 A I have no understanding of that.

11 MR. MATAKAS: Bob, do you have any questions
12 regarding the audits?

13 MR. LA GRANGE: No.

14 BY MR. MATAKAS:

15 Q Did you review the December 10, 1982 NRC SER,
16 transmitting the FRC/TER?

17 A Can I see the document?

18 Q It's two volumes --

19 A I did not review that in detail; no.

20 Q Are you aware of what the deficiencies were all
21 about, generally?

22 A In general terms I was aware of some
23 deficiencies. I did not have those summarized. I was
24 just informed of bits and pieces of that document.

25 Q Okay. What was your understanding of the

6, 7c
portions

1 deficiencies? Were they documentation, or were they
2 deficiencies that were directed at components or
3 documentation to qualify components? What was your
4 understanding of the deficiencies?

5 A My understanding was the deficiencies were in
6 documentation.

7 Q What action did you take to make sure -- or what
8 action did you take to address the deficiencies, as a
9 manager, in your position?

10 A Again, the actions taken were to set up a
11 functional group responsible for that area which did not
12 occur when the initial submittals were being made, and to
13 provide resources to that group to try to help address the
14 problems.

15 Q And that group being?

16 A The then EQ subsection under EP&I.

17 Q That would have been headed by Mr. Maus?

18 A That is correct.

19 Q Was it ever indicated to you that QA was having
20 problems getting the EQ section to follow recommendations?

21 A I knew there were problems between the EQ
22 section and QA. It was not clear to me specifically what
23 the nature of the problems were.

24 Q Who was making you aware of those problems?

25 A Primarily Mr. Stromberg.

1 Q What was the general gist that he was informing
2 you about? What was the heart of the problem, is what I'm
3 getting at?

4 A Quite candidly, our discussions were more in the
5 context of the personalities on both sides and their
6 inability to come to terms on issues, rather than the
7 issues themselves.

8 Q And those individuals being whom?

9 A Maus and Guimond.

10 Q Did Dr. Long ever have any conversation with you
11 regarding the Environmental Qualification program?

12 A In what time frame?

13 Q Any time frame. 1984, mainly.

14 A In the April-May time frame, Dr. Long was
15 involved in discussions; yes.

16 Q And why was it escalated to his level? Or why
17 did he get involved in it? How did he come about to be
18 involved in the area of EQ ?

19 A At that time frame, we were trying to upgrade
20 our files on EQ comments, and QA had retained an outside
21 consultant to help review the files which engineering was
22 upgrading. And to the extent there were programmatic
23 issues -- I shouldn't say that, not programmatic issues.
24 There were meetings relative to what the status of the
25 file development in primarily the second quarter of 1984

1 were, and the results of the QA review, Dr. Long did sit
2 in on some of the review meetings.

3 Q Did you ever receive any direction from Dr. Long
4 to follow or not to follow QA recommendations?

5 A To my knowledge, no.

6 BY MR. LA GRANGE:

7 Q Did you say that QA had retained an outside
8 consultant to assist in the review of the files?

9 A Yes.

10 Q In what time frame was that, again?

11 A I want to say May-June-July time frame.

12 Q Of 1984?

13 A 1984.

14 MR. MATAKAS: Let's take a break for a second.

15 (Discussion off the record.)

16 BY MR. MATAKAS:

17 Q The two documents that I showed you that I have
18 identified as being from Mr. Guimond, written to yourself
19 back in 1982, one essentially addressing the inadequacies
20 of Engineering Procedure 031 and the second addressing the
21 open audit items of audit 81-02, if you would have
22 received those documents would you have taken any action
23 on them? Would that have noted an official position from
24 QA on the audit findings?

25 A Yes. It would have required my action.

1 Q What would you have done?

2 A What I would have done in 1982 would have been
3 to inform the technical supervisor and the then procedures
4 manager to review those comments and resolve them.

5 Q So it would have been Mr. Flynn and Mr. Maus?

6 A And Maus; yes.

7 Q Did anyone ever indicate to you -- and I'm
8 talking about anyone, mainly Mr. Boucher, Mr. Maus, or
9 Mr. Chisholm -- that they were requesting assistance for
10 the EQ program in order to satisfy it?

11 A No. No.

12 BY MR. LA GRANGE:

13 Q Was there ever any discussion about hiring
14 consultants to help them at any time?

15 A No, there was not.

16 Now, please understand, there was a consultant hired
17 initially and their contract ran out, I would estimate,
18 sometime in 1981, which was then EDS.

19 It was after the termination of EDS that we set up the
20 functional group, or about the time EDS was supposed to be
21 finished; under Maus. And my answer really applies after
22 that time.

23 Q So, between Mr. Maus and -- let's talk strictly
24 TMI-1, not Oyster Creek -- and Mr. Boucher taking over
25 that responsibility up until, let's say, the NRC audit in

1 March 1984, you do not recall any discussion of going
2 outside for assistance in the EQ program?

3 A No, I do not.

4 Q What about inside? In other words, from within
5 the organization, adding more resources?

6 A There was no such discussion.

7 Q Okay. I would like to show you two other
8 documents. These are GPUN letters to NRR. The subject is
9 "Environmental Qualification of Electrical Equipment,
10 TMI-1."

11 The first document is dated May 20, 1983, letter number
12 5211-83-157; the second document is dated February 10,
13 1984, letter number 5211-84-2038.

14 I ask you to take a look at them and tell me if you
15 recognize those documents?

16 A Yes. I recognize both documents.

17 Q Did you have any input into either document?

18 A I had no input to either document, although I
19 believe on the first document I would have reviewed that
20 prior to its having been issued.

21 Q The May 20th document?

22 A The May 20 document.

23 Q I have attached -- attached to these documents,
24 I have the review sheets, I believe?

25 A Yes. In fact my signature is on one of the

1 review sheets for this document.

2 Q On the February 10 it's signed, for Tech
3 Functions, by Mr. Maus?

4 A I recall this. I do not recall if I saw this
5 before it was issued.

6 Q Okay. Do you know what these documents were a
7 response to?

8 A I know what the documents were in response to;
9 yes.

10 Q Okay. The May 20th was in response to 50.49;
11 and --

12 A This was to close out the TER, I think.

13 Q As a result of an NRR request on the October 5th
14 meeting?

15 A Yes.

16 Q You say you didn't review the February 10th
17 document before -- you don't recall reviewing it before it
18 was submitted?

19 A That's correct.

20 Q Okay. Specifically, the sentences that I have
21 outlined in green. Basically what it boils down to is the
22 statements in both these documents state that GPUN's
23 position that they are in compliance with 10 CFR 50.49,
24 the one document it refers to, DOR guidelines -- the point
25 being that both 10 CFR 50.49 and the DOR guidelines

1 require auditable and documented files to support
2 qualification?

3 A Yes.

4 Q With what you have learned in subsequent audits,
5 or audits subsequent to these two documents, do the audits
6 and inspections support those statements?

7 A Clearly the audits the NRC conducted in -- I
8 want to say March, June, July --

9 Q March, I think.

10 A -- indicated that the files were not auditable
11 as the rule -- they interpreted the rules to require.

12 Q And, in fact, the 1981 internal audit stated
13 essentially the same thing. Do you disagree with that?

14 A No.

15 Q At the time that you reviewed the May 20th
16 document, and your subsequent review of the February 10th
17 document after it was submitted, did you recognize those
18 statements as being false statements?

19 A I did not recognize this as being a false
20 statement. I got involved when this one -- probably in
21 the April-May time frame, when we were trying to upgrade
22 the files.

23 Q April 1984?

24 A 1984.

25 Q After the UCS petition had come out?

1 A Yes.

2 Q The documents that you stated that you did not
3 become involved with, you were referring to the February
4 10, 1984 document which you became involved with after the
5 UCS petition came out?

6 A Yes.

7 Q And on the May 20th document, you did have a
8 review function on that document?

9 A Yes.

10 Q On the May 20th submittal, you obviously signed
11 as final approver for Tech Functions. Did you talk with
12 anybody about this document before signing it?

13 A I'm certain I would have to talk with somebody
14 before signing it; yes.

15 Q Who would that have been?

16 A Probably it would have been either Chisholm or
17 Maus and the licensing engineer, which would have been
18 Harding.

19 Q Do you remember any specific conversation in
20 this case?

21 A No, I do not.

22 Q Have you talked to Mr. Maus about either of
23 these statements since this time?

24 A No, I have not.

25 Q Why was Mr. Maus relieved from his position?

1 A Mr. Maus was both from a management standpoint
2 responsible for this function, and it was clear he did not
3 do an adequate job - (

4 [REDACTED]
5 [REDACTED]
6 [REDACTED]
7 [REDACTED]
8 [REDACTED]) b, 1c

9 Q [REDACTED]
10 [REDACTED]
11 [REDACTED]) b, 7c

12 Q Was he disagreeing or agreeing with the findings?

13 A Disagreeing.

14 Q In your opinion, do you feel that he felt that
15 he had the files in order and thought that the
16 qualification was there?

17 A Yes, sir.

18 Q Why is Mr. Wilson now signing correspondence to
19 NRR regarding the environmental qualification program; do
20 you know?

21 A I really don't know.

22 MR. MATAKAS: Do you have any further questions?

23 MR. LA GRANGE: Yes.

24 BY MR. LA GRANGE:

25 Q Are you aware of any audit by QA and Tech

b, 7c, portions

1 Functions of the EQ files, possibly around the summer of '83?

2 A No, I'm not.

3 BY MR. MATAKAS:

4 Q Let me add a little bit to this. On March 8,
5 1984, Mr. Maus met with the NRC and had indicated -- this
6 was a transcribed meeting -- and indicated that QA had
7 recently looked at the EQ files, and in our conversation
8 with him he mentioned he thought it was in the summer of
9 1983. And there's -- I have asked for all the audits and
10 there's no audit for that time period.

11 I was wondering -- and he didn't call it an audit. He
12 called it a look-see, or a review, or something like that.
13 I was wondering if you were aware of what he was talking
14 about?

15 A That could have occurred. I just wasn't aware
16 of it.

17 BY MR. LA GRANGE:

18 Q Did you ever get any feedback, either verbal or
19 written, from Mr. Maus or anyone else, characterizing the
20 meetings in Bethesda on October 5, 1983, or March 8, 1984
21 where the TDR deficiencies were discussed?

22 A I did not recall any specific discussions with
23 Mr. Maus. One of the meetings -- and I believe it might
24 have been the -- I'm sorry, on both those cases: No.

25 There was a meeting that dealt with the UCS petition,

1 where one of the other participants did talk to me about
2 the EQ aspects of the discussion.

3 BY MR. MATAKAS:

4 Q I don't understand that.

5 A As I remember, there were some discussions --
6 I'm not too sure whether it was with NRR or the
7 commissioners -- relative to EFW, which included the EQ
8 issue, and I did get feedback from the one mechanical
9 engineer who was down there.

10 Q Feedback in regard to what?

11 A Negative perception as to the effectiveness of
12 the EQ discussion.

13 BY MR. LA GRANGE:

14 Q That engineer was not directly associated with
15 the EQ program?

16 A No, no. It was just an observation.

17 BY MR. MATAKAS:

18 Q I would just like to go over a few things. I'm
19 really concerned -- I don't know if you can see my concern
20 or not -- about the review function on both these
21 documents and the -- essentially the 1981 internal audit,
22 finding the same programmatic problems and making
23 recommendations to resolve them that were found in later
24 NRC audits and inspections, and FRC inspection review,
25 whatever you want to call it. And we have the two

1 documents in 1982 that were drafted, which would have went
2 to you. They were addressed to you. And you say you
3 don't -- have never reviewed those documents nor were the
4 contents brought to your attention; is that correct?

5 A With the exception --

6 MR. MATAKAS: Why don't we take he a one--minute
7 break here.

8 (Discussion off the record.)

9 MR. MATAKAS: We went off the record there
10 because one of the individuals that work for
11 Mr. Croneberger had brought some documents over that we
12 wanted to take a look at.

13 BY MR. MATAKAS:

14 Q What we were talking about is the concern we
15 have with the false statements and the documents that we
16 have in our possession that may have averted -- could have
17 possibly averted these statements and brought the problem
18 to light much earlier.

19 I would like to ask you again, just to make sure I have
20 these covered, those two documents, prior to 1984, or the
21 contents of those documents, were never brought to your
22 attention?

23 A To my knowledge that is correct.

24 Q And you don't recall asking anyone from QA
25 specifically to review Engineering Procedure 031, as it

1 would pertain to audit 81-02?

2 A That is correct.

3 Q Do you have any idea where this may have fallen
4 through the cracks? In other words, these audit items
5 staying open for three years, and in the interim
6 statements being made that the files are qualified?

7 A It's my impression, in retrospect, that the
8 issuance of EP-031 -- and the original issue was 10/2/81 --
9 did close out the finding. And I'm not aware until the
10 major effort in '83 that that was not interpreted to be
11 the case.

12 Q And then the individual audit findings --
13 specifically there were three areas in subsections of
14 audit number 11 -- were you aware that they had remained
15 open?

16 A Would you show me the ones you refer to?

17 MR. MATAKAS: Sure. Let's take a break and I'll
18 get them out.

19 (Discussion off the record.)

20 BY MR. MATAKAS:

21 Q The April 4th memo essentially states findings
22 11.4, 11.8, and 11.14 A and B are open as of this time.

23 A I do know that in the time frame of April 1984
24 it was brought to my attention that there was concern
25 about the acceptability of the B&W files which we were

1 relying upon. This deals with finding 11.8. And I was
2 involved with sending an engineer plus a QA auditor down
3 to Lynchburg to review those files, prior to one of the NRR
4 audits.

5 The other two items I am unaware of.

6 Q Back when you signed for audit finding number 11,
7 did you assign someone to correct those deficiencies?

8 A Maus and Chisholm.

9 Q Did he ever indicate to you that it had been
10 corrected?

11 A I'm unsure.

12 Q Was it around this time that the document that
13 we had previously talked about, the letter to you from
14 Mr. Guimond back in August of 1984, that this letter was
15 brought to your attention?

16 A Yes, that is correct.

17 Q It has the same findings that were open: 11.4,
18 11.8, 11.14.

19 Who brought this to your attention?

20 A Either Mr. Kazanas or Mr. Stromberg.

21 Q Why would they bring it to your attention?

22 A I believe they brought it to my attention
23 because of the activities I had under way to, in a major
24 way, revise EP-031. And I also issued, via memorandum,
25 more detailed guidance on how the file should be

1 structured.

2 And it was in support of that, in my recollection, that
3 they gave me that memorandum.

4 Q I have a memorandum dated June 29, 1984, from
5 yourself to Mr. Chisholm. Is this the memorandum that you
6 are talking about?

7 A Yes, it is.

8 Q Did you ever write any other memoranda regarding
9 documentation of the EQ files, back in '82-'83?

10 A No, I didn't.

11 MR. MATAKAS: I would like to take a break just
12 to look over these documents that have been brought in,
13 and then we'll go back on the record and discuss them.

14 (Discussion off the record.)

15 MR. MATAKAS: While we were off the record we
16 were reviewing documents that pertain to Engineering
17 Procedure 031, which is also known as procedure
18 1000-ADM-7317.01, and we have been looking at comments on
19 revisions back to late 1983. I have a memorandum from
20 Mr. Guimond, dated December 6, 1983, which lists several
21 comments where he feels procedure is not adequate and
22 considers it to be an open item.

23 BY MR. MATAKAS:

24 Q I would like to you go ahead, Mr. Croneberger,
25 and discuss that.

1 A These comments were identified to me as all
2 being resolved as it related strictly to the EQ issue, but
3 not resolved as it related to certain issues on
4 classification of hardware or software, which related to
5 the IE Bulletin dealing with the Salem ATWS event.

6 I subsequently had discussions with Mr. Kazanas
7 concerning that the Salem ATWS event should be decoupled
8 from EQ, and my discussions with Mr. Kazanas were detailed
9 in the subsequent memorandum from him to me, dated
10 December 30, 1983.

11 As a result of that communication I did sign off the
12 procedure, which was 1000 ADM-7317.01, revision 0, both in
13 concurring and because of Mr. Wilson's absence; I signed
14 off that procedure to issue it.

15 This is a date which is different than I reflected in
16 my earlier comments.

17 Q And the date is January 18, 1984?

18 A Yes.

19 Q When did you think you signed it before?

20 A I thought I said '83.

21 Q We have asked Mr. Flynn to bring over earlier
22 comments as they pertain to Engineering Procedure 031, so,
23 until he brings those documents over concerning the
24 1981-1982 time frame, let's go ahead and take another
25 break.

1 (Discussion off the record.)

2 MR. MATAKAS: We have reviewed the earliest file
3 on Engineering Procedure 031, and we have an interoffice
4 memorandum, GPUN service, dated January 23, 1981, which
5 indicates that -- a note on the bottom of this document --
6 I believe that's your handwriting, Mr. Croneberger --
7 where you refer to a procedure that is needed for
8 controlling review approval and record-keeping on
9 Environmental Qualification documentation.

10 BY MR. MATAKAS:

11 Q So this, evidently, kicked off the procedure; is
12 that correct?

13 A Yes. The original memorandum to me was
14 generated by an electrical engineer who was involved with
15 EQ activities, expressing concern, and as a result of his
16 concerns I so advised the procedures group.

17 Q But we have no -- nothing in any of the files
18 which indicate that the procedure was accepted by QA; is
19 that correct?

20 A The only relevant correspondence I see here is
21 that from the QA engineering manager in November 1981,
22 that he apparently was satisfied with the responses to his
23 comments on EP-031.

24 Q And he reserved the right for a final review
25 when it was issued?

1 A Yes.

2 Q But there's no indication that this, in fact,
3 resolved the audit comments in 81-02?

4 A No, sir.

5 Q Then we talked about this earlier in the
6 interview and you had mentioned that you had thought that
7 QA had signed off on the procedure, in effect giving their
8 blessing that it did resolve the audit comments; is that
9 correct? You had thought that that happened?

10 A I had thought that had been the case; yes.

11 Q I think you mentioned that Mr. Maus, maybe, had
12 informed you of that?

13 A He may have.

14 MR. MNTAKAS: Do you have anything else?

15 BY MR. LA GRANGE:

16 Q Prior to the NRC's first audit on March 20-21,
17 1984, did you ever personally look at EQ documentation or
18 discuss with Mr. Maus or Mr. Chisholm or Mr. Boucher the
19 appropriate documentation that should be in those files in
20 order to demonstrate qualification?

21 A I did not personally look at any of the files;
22 and my understanding of what should have been in the files
23 would have been that which was conveyed in the procedure
24 which was issued in January of '84.

25

1 BY MR. MATAKAS:

2 Q January of '84?

3 A That was that version, fairly official version
4 which I had signed out for Mr. Wilson.

5 Q But that was not accepted until June 1984 as
6 closing out those audit items. Why is that? Is that
7 because it didn't come out in final form until
8 approximately the June time period?

9 A No. It came out in January. It was apparent,
10 after I became aware of the NRR concerns on the files,
11 that that procedure was very inadequate, and that was in
12 the April-May time frame. So, as a result of that I
13 personally became very involved with preparing a revision
14 to that procedure, which was finally issued in, I believe,
15 July -- June I think it was.

16 Q June 1984?

17 A Yes.

18 Q And that's what closed out --

19 A As far as I was concerned, that addressed the NRR
20 concerns; and QA had indicated at that time that that
21 addressed the concerns of the QA audit, the old QA audit.

22 Q 81-02?

23 A Yes.

24 Q But you were not aware that this audit, 81-02,
25 had remained open during all this time period?

1 A No, I did not.

2 BY MR. LA GRANGE:

3 Q With regard to the May 20, '83 response to 50.49,
4 saying that the equipment is qualified in accordance with
5 the DOR guidelines, what would you have thought was in the
6 files at that time to support the qualification of the
7 equipment?

8 A I thought that appropriate test documentation or
9 analysis existed in the files for the items of equipment
10 which were identified.

11 Q Why did you think that at the time?

12 A I'm sure the impression was conveyed to me by
13 Mr. Maus and/or Mr. Chisholm that such documentation
14 existed.

15 BY MR. MATAKAS:

16 Q Oh, one question I had on the February 10
17 submittal, there are statements in the attachment 2 to the
18 February 10 submittal, such as the ASCO solenoids, stating
19 they would be replaced in June 1985.

20 MR. LA GRANGE: '84.

21 BY MR. MATAKAS:

22 Q -- '84. And in a couple of other areas they are
23 talking about work to be done in the future.

24 Is that consistent with your knowledge of the
25 requirements of 50.49? Is that consistent with your

1 knowledge of 50.49 allowing you to make a statement that
2 you are qualified, and at the same time make the statement
3 that you realize that some things are not qualified and
4 you can replace them in the future -- with qualified
5 solenoids, in this case?

6 A Again, I was unaware -- I was unaware of this
7 letter until the April-May time frame. Certainly I was
8 aware at that time, as we identified deficiencies, that
9 they had to be corrected or JIOs put in place --

10 Q JCOs?

11 A JCOs -- prior to being able to make this kind of
12 a statement. But I'm not in a position to really draw any
13 conclusions from the February 10 letter, which I hadn't
14 seen.

15 BY MR. LA GRANGE:

16 Q Prior to the NRC's first audit on May 20-21,
17 1984, did you spend very much time interfacing with
18 Mr. Chisholm or Mr. Maus? Or were you very involved in
19 the EQ effort?

20 A My primary involvement was to assure that we had
21 some awareness of what was going on out in industry, via
22 organizations such as AIF; and to assure that to the
23 extent there were meetings or seminars on the EQ subject,
24 people such as Maus had the opportunity to attend. And
25 then to get some report back on what the meeting content

1 was.

2 BY MR. MATAKAS:

3 Q Mr. Croneberger, is there anything you would
4 like to say, any statement you would like to make before
5 we conclude this interview?

6 A No.

7 Q Have you appeared here today voluntarily?

8 A Yes.

9 Q Have any threats been made or have any promises
10 been made to you?

11 A No.

12 MR. MATAKAS: Okay. The time is 15:38. This
13 will conclude the interview.

14 (Whereupon, at 3:40 p.m., the interview was
15 concluded.)

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CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the UNITED STATES NUCLEAR REGULATORY COMMISSION in the matter of:

NAME OF PROCEEDING: INVESTIGATIVE INTERVIEW OF:

DON K. CRONEBERGER

DOCKET NO.:

PLACE: PARSIPPANY, NEW JERSEY

DATE: WEDNESDAY, MAY 1, 1985

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(sigd) Joel Breitner

(TYPE)

Joel Breitner
Official Reporter

Ace-Federal Reporters, Inc.
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February 10, 1984
5211-84-2038

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Environmental Qualification of Electrical Equipment

On October 5, 1983 representatives of GPUN and NRC met to discuss outstanding items of the NRC SER/TER dated December 10, 1982 on the subject. By letter dated October 17, 1983 GPUN committed to provide a resolution of each item and a justification for continued operation (JCO) for those items not completed. Attachment I provides a tabular listing of the deficiencies by component from Table 4-1 of the TER (Technical Evaluation Report) for NRC categories 1.B, 11.A, and 11.B. Attachment II provides the resolution of each item of Attachment I and each item of NRC Categories 11.C and IV of Table 4-1. Based on these resolutions, no additional justification for continued operation is required. It is GPUN's position that TMI-1 is currently in compliance with the Environmental Qualification Rule 10CFR 50.49 as applicable to TMI-1.

Sincerely,

G. Toole for

R. G. Huxill
Vice President - TMI-1

cc: J. Van Vliet
R. Conte

EQUIPMENT QUALIFICATION DEFICIENCIES
(Categories I.B, II.A and II.B)[illegible]

QUALIFICATION DEFICIENCIES SUMMARY - CATEGORIES IB, IIA, IIB

<u>NRC requirement</u>	<u>Deficiencies</u>	<u>NRC Requirement</u>	<u>Deficiencies</u>	<u>Total # of Deficiencies=120</u>
1 Documentation	20	7E steam exposure	2	
2 Similarity	30	8 spray	1	
3 Aging evaluation	24	9 submergence	0	
4 Qualified life	21	10 radiation	1	
5 Aging program	0	11 test sequence	2	
6 Aging simulation	5	12 test failure	0	
7A Peak temperature	5	13 function test	0	
7B Peak pressure	2	14 instrument accuracy	0	
7C Duration	2	15 duration margin	2	
7D Profile envelope	3	16 margins	0	

Equipment Qualification Deficiencies/Resolution
(Categories I.B, II.A, and II.B)

I. Specific

A. Limatorque Motor Operators

- o When necessary GPUN has performed a plant walkdown of Limatorque motor for model and serial number (for those required for hot shutdown).
- o GPUN has qualified in containment Limatorque operators required to be qualified for hot shutdown for high temperature/radiation including limit switches, brakes, motors, and lubrication.
- o GPUN central file contains all correspondence and test reports required to document qualification.
- o SCEW sheets will be revised to reflect additional information in the update schedule for submittal in the fall of 1984.

1. TER Items 1, 3, 118-120 [WDG V-3; DHV-1&2; CAV-13; MUV-2; WDLV-303].

Limatorque models SMB/SMB-3, SMB-000/SMB-00 are shown to be similar to models tested/age analyzed/qualified life in Limatorque Generic Report B0058 Section 4.1.4.

2. TER Item 2 [AHV-1]

Limatorque model SMB-2 is shown to be similar to models tested/age analyzed/qualified life in Limatorque Generic Report B0058 Section 4.1.4 Ding motor brake model 6-71310-6 is qualified by similarity to model 6-63009-50 which was tested as described in test report 600198 (F-62232-01). Both models are constructed of similar materials and rate for approximately the same torques but differ only in size.

3. TER Items 6&7 [CFV-2&3; CAV-1, 2, 3 &4; ICV-2]

Limatorque model SMB-000 is shown to be similar to models tested/age analyzed/qualified life in Limatorque generic report B0058. CFV-2&3 which are required to function in a LOCA are located in the Intermediate Bldg. (mild environment for LOCA) and are qualified for a harsh environment. These CF valves will be therefore deleted from the Master List.

4. TER Items 10, 11, 14 & 15 [FWV-5; EFV-2; FWV-92; & EFV-1]

Limatorque models SB-3/SMB-0/SMB-00/SMB-000 are shown to be similar to models tested/age analyzed/qualified life in Limatorque generic report B0058. Limatorque has developed a thermal lag analysis which shows that the operator will operate through the Intermediate Bldg. MSLB temperature spike of 326°F.

B. ASCO Solenoid Valves

- 568
ASCO
- X
- o There are no ASCO solenoid valves required to be qualified inside containment.
 - o GPUN central file contains all correspondence and test reports required to document qualification.
 - o SCEW sheets will be revised to reflect additional information in the update scheduled for submittal in the fall of 1984.

1. TER Items 26 and 28 [EFV-30A; EFV-30B] (SV 1, 2, 3 & 4)]

As described in GPUN letter dated August 2, 1982 (82-183) GPUN has removed the EFW latch signal from the EFW control valves. Therefore this solenoid is no longer required to be qualified and was deleted from the Master List but the SCEWS were not removed. This will be accomplished in the fall 1984 update.

2. TER Items 26, 27, 29 & 32 [FWV-17B (SV 364); FWV-16B (SV 364); FWV-16B; (SV 162) MSV-13]

ASCO solenoids will be replaced with qualified ASCO solenoids by June 1984. Therefore, ASCO qualification test reports AQR67368 and AQS21678/TR apply.

C. Westinghouse Motors

1. TER Items 45, 46, 49, 50 & 51 [MUP-4; MUP-1; BSP-1; DHP-1, EFP-2]

- 100
Inspection
+ 11/11/81
11/11/81
- a. Motorettes (stators) testing included silicon rubber insulated lead wires. Aging analysis on the assembly showed a 40 years life expectancy.
 - b. Bearing Analysis showed that the bearings could withstand a LOCA/HELB (ref. GPUN calculation 1101X-5330-000 and GPUN memo R. Spragg to D. Slear dated 5/14/81).
 - c. Motor Lubrication (Exxon Terisstid 32) is controlled within the preventive maintenance program and is rated by Exxon at a radiation level of 10^6 rads with a flash point of 410°F. (This lubricant is not used on MUP-4 which has sealed bearings.)

d. Qualification of lead splices is controlled within the corrective maintenance program by GPUN procedure 1420-Y-15.

EFP-2 was analyzed in Westinghouse Report dated 1/81 for motor insulation life analysis which envelopes the thermal lag peak for the Intermediate Bldg. of 326°F.

Similarity for the above listed motors is established by Westinghouse report WCAP 8754 Rev. 1 Section 2.

D. Victoreen Radiation Monitors

1. TER Item 53 [RM-A2; A5, A6]

These radiation monitors (RM-A2, 5&6) are indicators of LOCA and are located outside containment (subject to a mild environment). They are not required for a main steam line or feedwater line break. These SCEW sheets will be deleted.

E. Static O Ring Pressure Switch

1. TER Item 57 [FW Iso. Press Switch (600-607)]

These switches will be replaced prior to June 1984 by a qualified pressure switch. No justification for continued operation is required since the plant will not go critical prior to restart and therefore no nuclear heat will be generated.

F. Bailey E/P Convertors

1. TER Item 60 [MSV-4]

The ADV's are not required for Licensed (hot) shutdown and are therefore not required to be qualified. Pressure control is maintained in hot shutdown via the MS safety valves.

G. NAMCO Limit Switches

1. TER Item 66 & 67 [MSV-6; MSV-13]

Under LOCA and MSLB sufficient flow is provided to the OTSG's by a single motor driven EFW pump. (See GPUN letter dated 3/22/83). The steam driven EFW pump is only required for station blackout which does not produce a harsh environment. Failure of the limit switch (MSV-6) with MSV-6 open may result in initially overfeeding the OTSG's which could be reduced immediately (manually) based on qualified EFW flow and OTSG level instrumentation. Therefore the EFW system will function and the operator will not be misled. Failure of the limit switch (MSV-13) results in the inability to monitor valve position and may result in lifting reliefs but

because of qualified EFW flow and OTSG level this will not mislead the operator. These switches will be deleted from the Master List.

H. Fisher Limit Switch

1. TER Item 71 [MSV-4]

The valve position indication for the atmospheric dump valves will be deleted from the Master List (see discussion of item F).

I. Foxboro Transmitters

1. TER Items 78, 79 & 81 [RC Press (WR), RB Press, SG Press]

GPUN possesses original purchase orders which are part of the QA file which refers back to a plant tag number or vendor letters which are part of the EQ file. GPUN calculations were based on a B&W evaluation of Class 1E In Containment Controls and Instrumentation (77-11207001-00) dated 7/81, which is part of GPUN central file.

The E11 series transmitters were purchased prior to 1974 and were qualified by DOR Guidelines which do not require sequence testing. The time duration listed in the SCEWS indicates qualification for 86 hours which exceeds the 29 hours (10^4 sec.) of the profile (Items 78 & 81). Item 79 is located in the Aux. Bldg. and is not subject to as severe an environment.

2. TER item 93 [RB EC Flow]

The utility report (Wyle 45592-4/Model E13 DMK) on Foxboro transmitters documents the qualification of this transmitter.

J. GEMS Limit Switch

1. TER Item 98 [WOL LS-116]

The Reactor Building Sump Level instrument has been upgraded in accordance with NUREG 0737 Item II.F.1 and qualification will be documented in a revision to the SCEW sheets in fall 1984. Consequently, the limit switch of item 98 will be deleted.

II. Generic

A. Kerite Cable

1. TER Item 106

GPUN has in central file the original Bill of Materials which documents the applicable test report for the Kerite cable.

B. Continental Cable

1. TER Item 107

GPUN has in central file a letter from the vendor which establishes similarity between the cable tested and that installed at TMI-1. The lots are traceable through purchase orders which are part of our QA files.

C. Ray Chem Cable Splice

1. TER Item 108

GPUN has reviewed the applicable Ray Chem Test Reports and determined that it is applicable to the splices at TMI-1 because the material composition is the same for all Raychem splices.

D. GE Penetration

1. TER Item 109

GPUN had reevaluated the penetrations installed at TMI-1 and have determined that they are all above flood level; and that the hyperlon paint is immune to caustic spray. GPUN has also performed an aging analysis on the penetrations.

E. GE Terminal Blocks (EB-25)

1. TER Item 111

GPUN has determined that these terminal blocks were tested to AMF 110-11004 page 3. The SCEW sheets will be revised to reflect this change.

F. Conax Connectors

1. TER Item 114 & 115

GPUN has reviewed the Conax Connectors and determined that they are pressure seal modules described in PL-14-BL and IPS 409 and 325.

G. GE Thyrectors

1. TER Item 116

The GE Thyrectors have been replaced by General Semi Conductor Bi Polar Transient Voltage Suppressors (Square D) (which are qualified). A new SCEW sheet will be sent in our fall 1984 submittal.

Equipment Qualification Deficiencies/Resolution
(Category II.C)

I. Qualified Life

A. Limiterque Motor Operators

TER Items 5, 17-22, 24 [BS-V-1, 2, 3; DH-V-3, 4, 5, 6, 7; MU-V-12, 14, 16, 36, 37; NS-V-35]

Qualified life is established in Limitorque Generic Report B0058.

B. ASCO Solenoid Valves

TER Item 33, 36, 39, 40 [SV/AHV-1A; SV/CAV-2, 5, 189; SV/ICV-6; SV/MUV-3,26; SV/WDL-V304, V534, V535]

The qualified life, based upon an Arrhenius Analysis, is shown on the SCEW sheets.

C. Static O Ring Switches

TER Item 56 [PS-672 through 675]

The qualified life is established by the calculations listed on the SCEW sheets. The basis for these calculations is an Arrhenius Analysis.

D. Square D Switches

TER Items 58 & 59 [PS-283, 284, 286, 287, 289, 290, 480 (745)]

The MUPS 480 (745) (Item 58) will be replaced by qualified pressure switches by June 1984. All other PS listed above are now qualified for 40 years due to material replacement which will be reflected in our fall 1984 submittal.

E. Namco Snap Locks Switches

TER Items 63, 64, 69 [(LSA, LSB) AHV-1A; (LSA, LSB) CAV-2; (LSB, 33) ICV-3; (LSA, LSB), MU-V-3, 18, 20, 26; (LSA, LSB) WDL-V304, V534, V535]

The material evaluation for a 40 year life of Buna N is correct based upon an Arrhenius Analysis. The conflicting temperature data in the TER does not include an Arrhenius Analysis and therefore cannot be evaluated.

F. Micro Switches

TER Item 72 [(LSA, LSB) CAV-19, 20, 189; (LSA, LSB) WDG-V4]

Same resolution as E above.

II. Replacement Schedule

The replacement schedule for all environmentally qualified equipment at TMI-1 is included in the computerized Preventive Maintenance Schedule or Licensing Action Item List (for transmitters). The replacement schedule is not included on the SCEW sheets. The SCEW sheets specify qualified life on sub components or materials only when that life is less than the plant design life of 40 years.

Equipment Qualification Deficiencies/Resolution
(Category IV)

I. Generic

This documentation was not requested by the Franklin Research Corporation from GPUN in any of their requests for documentation. GPUN has provided all of the documentation requested as documented in GPUN letters dated March 2, 1982 (E&L: 4062/82-052), March 24, 1982 (5211-82-067) and June 25, 1982 (5211-82-155). All documentation is contained in the GPUN central file.

II. Specific

A. Ross Solenoid Valves

TER Item 42 [SV/MUV-18, 20]

See I above.

B. GE Motors

TER Item 44 [(A, B, C) MU-P-2, 3]

The TER states that these motors are considered to be qualified.

C. GE Motors

TER Item 47 [(A, B, C) AH-E-1]

See I above.

D. Rosenbunt Pressure Transmitters

TER Item 76 [(PT1, 2) RC3A, B]

The SCEW sheets will be revised to list specific (instead of summary) qualification reports and change the qualified life from 40 to 10 years. Revised sheets are scheduled for a fall of '84 submittal.

E. Barton D/P Transmitters

TER Item 77 [EFW FI-S-77, 78, 79]

These flow switches are for the EFW pump recirculation line. Per our discussion in GPUN letter dated February 4, 1983, the valves are now locked open. Therefore, these switches will be deleted from the Master List in the fall of 1984 submittal.

F. Bailey Level Transmitters

TER Items 85, 88 [(LT1, 2, 3) RC1; (LT4) SP1A, B]

Report is on file at the NSSS vendor, B&W.

G. Bailey Level Transmitters

TER Item 87 [(BS1) DPT1, 2; BS3-LT; BS5-LT]

1. FRC disagrees with GPUN's analysis that this display instrumentation need not be environmentally qualified. FRC did not have the documentation necessary to make this conclusion.
2. See I above.

H. Rosemount Temperature Transmitter

TER Items 90, 91 [(TE2, 3) RC4A, B; (TE1, 2, 3, 4) RC5A, B]

1. Report is on file at the NSSS vendor, B&W.
2. The qualified life on the SCEW sheets will be changed from 40 to 10 years.

J. Stanwick Terminal Blocks

TER Item 113 [Common Item]

Qualification is based upon a report that is proprietary to the Duke Power Co. Only summary information is available to GPUN.



4-4-83
Jm R51

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944 7621
TELEX 84 2386
Writer's Direct Dial Number

February 10, 1984
5211-84-2038

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sir:

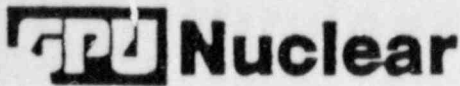
Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPF-50
Docket No. 50-289
Environmental Qualification of Electrical Equipment

On October 5, 1983 representatives of GPUN and NRC met to discuss outstanding items of the NRC SER/TER dated December 10, 1982 on the subject. By letter dated October 17, 1983 GPUN committed to provide a resolution of each item and a justification for continued operation (JCO) for those items not completed. Attachment I provides a tabular listing of the deficiencies by component from Table 4-1 of the TER (Technical Evaluation Report) for NRC categories 1.B, 11.A, and 11.B. Attachment II provides the resolution of each item of Attachment I and each item of NRC Categories 11.C and IV of Table 4-1. Based on these resolutions, no additional justification for continued operation is required. It is GPUN's position that TMI-1 is currently in compliance with the Environmental Qualification Rule 10CFR 50.49 as applicable to TMI-1.

Sincerely,

R. E. Hukill
Vice President - TMI-1

cc: J. Van Vliet
R. Conte



4-11-83
for

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number

May 20, 1983

5211-83-157

Office of Nuclear Reactor Regulation
Attn: Harold A. Denton, Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Environmental Qualification of Electrical Equipment
(10 CFR 50.49)

In accordance with 10 CFR 50.49(g) and NRC letter dated March 30, 1983, GPUN is supplying the following information to identify the electrical equipment important to safety within the scope of Section 50.49(g) that is already qualified, and to submit schedules for environmental qualification or replacement of the remaining equipment that is important to safety as defined in 10 CFR 50.49(b).

(1) Safety Related Electrical Equipment

GPUN letter dated August 28, 1981 (L1L 238) in response to IEB 79-01B lists all the safety related electrical equipment which is required to be and which is already qualified. The additional information we submitted in our letters dated May 3, 1982 (5211-82-101) and May 16, 1983 (5211-83-076) (NUREG 0737 items), support our conclusions that the components listed are qualified in accordance with DOR Guidelines dated November, 1979.

Your letter dated December 10, 1982, contained TMI-1 TER which indicated some apparent equipment qualification discrepancies. In our letter dated March 21, 1983 (5211-83-054) we requested a meeting to resolve these apparent discrepancies. We would like to reiterate that request at this time. In the event any valid discrepancies result from this meeting, we will resolve them on a schedule consistent with the requirements of 10 CFR 50.49(g).

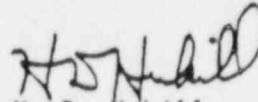
(2) Non Safety Related Electrical Equipment

GPUN letter dated July 21, 1982 (5211-83-170) in response to IE Notice 79-22, and PID dated December 14, 1981 Section P concerning interaction of safety and non-safety systems indicate that failure of non-safety systems during the design basis accidents will not result in an adverse effect on safety equipment.

(3) Certain Post Accident Monitoring Equipment (R.G. 1.97 Rev. 2)

Enclosed is a list of post accident monitoring instrumentation that is already environmentally qualified. GPUN letter dated April 15, 1982 concerning emergency response facilities discusses GPUN efforts through the B&W Owners to respond to Reg. Guide 1.97 guidelines. This effort is currently scheduled for completion mid Cycle 5. When this effort is complete, we will qualify or replace the remaining post accident monitoring equipment on a schedule consistent with requirements of 10 CFR 50.49(g).

Sincerely,



H. D. Hukill
Director, TMI-1

HDL:LWH:vjf

Enclosure

cc: J. Allen

J. Stolz

J. Van Vliet

TMI-1 Post Accident Instrumentation (Environmentally Qualified)

Regulatory Guide 1.97, Rev. 2

ITEM	CAT.	TYPE	ENVIRONMENTAL QUALIFICATION
RCS Hot Leg H ₂ O Temp	1	B	NUREG 0737 Item II.F.1
RCS Cold Leg H ₂ O Temp	1	B	NUREG 0737 Item II.F.1
RCS Pressure	1	C	NUREG 0737 Item II.F.2 sheets 12 and 13*
Core Exit Temp (Incore T/C)	1	B	NUREG 0737 II.F.2 sheet 1 thru 11*
Saturation Monitor	1	B	NUREG 0737 II.F.2 sheets 12 and 13*
R.B. Sump Level	2	B	NUREG 0737 Item II.F. sheets 15 thru 18*
R.B. Pressure	1	B	NUREG 0737 II.F.1
RB H ₂ Concentration*	1	C	NUREG 0737 Item II.F.1 sheets 1 thru 12*
DU Exchanger Outlet Temp	2	D	NUREG 0737 Item II.F.2
DH Removal Flow/LPI Flow	2	D	NUREG 0737 Item II.F.2
PORV/Safety Valve Position	2	D	NUREG 0737 Item II.D.3 sheets 1 thru 9*
Pressurizer Level	1	D	NUREG 0737 Item II.D.3
S/G Level	1	D	NUREG 0737 Item II.F.2
S/G Pressure	2	D	NUREG 0737 Item II.F.1
EFW Flow	1	D	NUREG 0737 Item II.E.1.2 sheets 1 thru 6*
MUT Level	2	D	NUREG 0737 Item II.F.1
R.B. High Range Radiation	1	E	NUREG 0737 Item II.F.1 sheets 13 and 14*

*See GPUN Letter dated May 20, 1983, (83-128)



GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania
717-944-7621
TELEX 84-2366
Writer's Direct Dial No.

MAY 27 1983

May 20, 1983

5211-83-157

TMI-1
Distribution
830115
10 CFR 50.49
signed to: H
Date: 5-30-83

Office of Nuclear Reactor Regulation
Attn: Harold A. Denton, Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Environmental Qualification of Electrical Equipment
(10 CFR 50.49)

In accordance with 10 CFR 50.49(g) and NRC letter dated March 30, 1983, GPU is supplying the following information to identify the electrical equipment important to safety within the scope of Section 50.49(g) that is already qualified, and to submit schedules for environmental qualification or replacement of the remaining equipment that is important to safety as defined in 10 CFR 50.49(b).

(1) Safety Related Electrical Equipment

GPU letter dated August 28, 1981 (LIL 238) in response to IEB 79-018 lists all the safety related electrical equipment which is required to be and which is already qualified. The additional information we submitted in our letter dated May 3, 1982 (5211-82-101) and May 16, 1983 (5211-83-076) (NUREG 076 items), support our conclusions that the components listed are qualified in accordance with DOR Guidelines dated November, 1979.

Your letter dated December 10, 1982, contained TMI-1 IEB which indicated some apparent equipment qualification discrepancies. In our letter dated March 21, 1983 (5211-83-054) we requested a meeting to resolve these apparent discrepancies. We would like to reiterate that request at this time. In the event any valid discrepancies result from this meeting, we will resolve them on a schedule consistent with the requirements of 10 CFR 50.49(g).

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FOIA-87-696

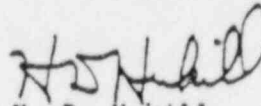
B/S

GPU Nuclear Corporation is a subsidiary of the General Electric Company. This document is a release of information to the public. It is not to be used for any purpose other than that for which it was released. EXH 2B

(3) Certain Post Accident Monitoring Equipment (R.G. 1.97 Rev. 2)

Enclosed is a list of post accident monitoring instrumentation that is already environmentally qualified. GPUN letter dated April 15, 1982 concerning emergency response facilities discusses GPUN efforts through the B&W Owners to respond to Reg. Guide 1.97 guidelines. This effort is currently scheduled for completion mid Cycle 5. When this effort is complete, we will qualify or replace the remaining post accident monitoring equipment on a schedule consistent with requirements of 10 CFR 50.49(g).

Sincerely,



H. D. Hukill
Director, TMI-1

HDE:LWE:vjf

Enclosure

cc: J. Allen
J. Stolz
J. Van Vliet

IMI-1 Post Accident Instrumentation (Environmentally Qualified)

Regulatory Guide 1.97, Rev. 2

ITEM	CAT.	TYPE	ENVIRONMENTAL QUALIFICATION
RCS Hot Leg H ₂ O Temp	1	B	NUREG 0737 Item II.F.1
RCS Cold Leg H ₂ O Temp	1	B	NUREG 0737 Item II.F.1
RCS Pressure	1	C	NUREG 0737 Item II.F.2 sheets 12 and 13*
Core Exit Temp (Incore I/C)	1	B	NUREG 0737 II.F.2 sheet 1 thru 11*
Saturation Monitor	1	B	NUREG 0737 II.F.2 sheets 12 and 13*
R.B. Sump Level	2	B	NUREG 0737 Item II.F. sheets 15 thru 18*
R.B. Pressure	1	B	NUREG 0737 II.F.1
RB H ₂ Concentration*	1	C	NUREG 0737 Item II.F.1 sheets 1 thru 12*
DH Exchanger Outlet Temp	2	D	NUREG 0737 Item II.F.2
DH Removal Flow/LPI Flow	2	D	NUREG 0737 Item II.F.2
PORV/Safety Valve Position	2	D	NUREG 0737 Item II.D.3 sheets 1 thru 9*
Pressurizer Level	1	D	NUREG 0737 Item II.D.3
S/G Level	1	D	NUREG 0737 Item II.F.2
S/G Pressure	2	D	NUREG 0737 Item II.F.1
ETW Flow	1	D	NUREG 0737 Item II.E.1.2 sheets 1 thru 6*
HBI Level	2	D	NUREG 0737 Item II.F.1
R.B. High Range Radiation	1	E	NUREG 0737 Item II.F.1 sheets 13 and 14*

*See GPOH Letter dated May 20, 1983, (83-128)



GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number

October 17, 1983
5211-83-303

TMI-1
Distribution
830472
Subject: EQ Item
Resolution
check
Signed to: F&M
Date: 1/15/84

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-285
Environmental Qualification

On October 5, representatives of my staff met with representatives of your staff to discuss the apparent qualification deficiencies indicated in Table 4-1 of the December 10, 1982 Technical Evaluation Report. Based on the resolutions discussed, GPUN intends to provide their commitments to resolve each apparent deficiency in January, 1984.

Sincerely,

H. D. Hladik
Director, TMI-1

HDH:LWH:vjf

cc: J. Van Vliet
R. LaGrange
R. Conte

to:	C	A
ig-Parsip.		
ill-Trl.122	X	X
Wilson-Parsip.		
ston-Admin.		
liard-Trl.175	X	X
itz-Trl.144		
afrock-Parsip.		
Trl.67		
arsip.		
Bldg.		
g-Parsip.	X	X
ton-Training		
ev-Parsip.		
Trl.197		
sch-Trl.145		
rd-Trl.88		
er-Airport		
se-Srv.Bldg.		
neberse-Parsip.		
er-Parsip.	X	X
erpe-Parsip.		
le-Srv.Bldg.	X	X
more-Parsip.	X	X
lah-Parsip.		
kins-Trl.127		
ell-Admin.		
FIKS	X	X
TC-Cherry Hill	X	X
eright Com.		
nolo-Trl.118		
rnhoff-Parsip.		
erry-Parsip.		
rk-Parsip.		
erkamp-Parsip.		
nes-Parsip.		
renchi-ICPM		
	X	X
	X	X

cc: C.W. Smyth
F.G. Maus
R.J. Torle
10-26-83

CORRESPONDENCE PROJECT ACCOUNTABILITY CHECKSHEET

RESPONDENCE NUMBER	CARD 7	ACT 8
23-151	A	A

REG 9	REGULATORY AGENCY
N - NRC	S - SRBC
E - EPA	F - FPC
O - DER	P - PUC
C - COE	L - POLI
B - DRBC	M - MISC/OTHER

11	13
TMI	

TMG - TMI
TM1 - TMI-1
TM2 - TMI-2
TTS - TITUS
PRT - PORTLAND
CT - COMBUSTION TURBINE

STATION
YH - YORK HAVEN
YSH - YORK STEAM HEAT
EVL - EYLER
CRF - CRAWFORD
OTH - OTHER/MISCELL ANEOUS
ALL - ALL STATIONS

DEPART LETTER
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GEL
GML
GOL
GAL

FOR CARD PRINTER USE ONLY

CORRESPONDENCE DATED
MO. DAY YR
17 22

DESCRIPTION
22
SEC - RESPONSE TO 10.C.F.R. 50.49
55

BY Regulation

FINAL DUE DATE
5/20/83

DATE ON CORRESPONDENCE SHOULD BE

1	INPUTS OBTAINED FROM	Date
AI NO	A LW Harding	5/16
WI NO	B RJ Chisholm	
TA NO	C TG Broughton	
2	DRAFT CORRESPONDENCE PREPARED AND SUBMITTED TO TYPING	
3	CORRESPONDENCE APPROVED BY	
A	JS Wetmore	5/16
B	C. Hartman for J. J. C. per letter 5-19	
C		
4	CORRESPONDENCE SIGNED	
BY	JS Wetmore	5-20-83
5	ORIGINAL AND CCS DISTRIBUTED	5-20-83
BY	WJF	5-23-83
6	VERIFY ATTACHMENTS ENCLOSED WITH LETTER OR MEMO	
BY	WJF	5-23-83
7	CCS DISTRIBUTED CHECKSHEET RETURNED TO CENTRAL FILE OCC	
BY	WJF	5-26-83

FINAL LETTER APPROVALS
Licensing <u>WJF</u>
Tech. Functions <u>JW LANGBACH per</u>
Operations <u>E. J. T. per</u>