

FINAL

TECHNICAL EVALUATION REPORT ON  
RESPONSE FROM THE  
NIAGARA MOHAWK POWER CORPORATION  
TO GENERIC LETTER 88-01  
PERTAINING TO THE  
NINE MILE POINT, UNIT 1

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## ABSTRACT

This report contains an evaluation of the licensee (Niagara Mohawk Power Corporation) submittal for Nine Mile Point, Unit 1 which was submitted in response to the NRC Generic Letter 88-01 in which Niagara Mohawk was requested to: (1) Furnish their current plans relating to piping replacement and other measures to mitigate IGSCC, inspection, repair, and leakage detection. (2) Indicate whether they plan to follow the NRC Staff positions, or propose alternative measures. Niagara Mohawk's plans are evaluated in Section 2 of this report in terms of compliance to NRC Staff positions. Niagara Mohawk presented an alternative position to the NRC Staff position on materials, and they applied provisions to the NRC Staff positions on inspection schedules and inspection methods for inaccessible welds.

## SUMMARY

The Licensee, Niagara Mohawk Power Corporation, submitted a response to the NRC Generic Letter 88-01. Niagara Mohawk's response pertaining to the austenitic stainless steel piping in Nine Mile Point, Unit 1 (a BWR nuclear power plant) was evaluated in terms of: (1) Their previous and planned actions to mitigate IGSCC to provide assurance of continued long-term service. (2) Their Inservice Inspection (ISI) Program. (3) Their Technical Specifications pertaining to ISI and their plans to ensure that leakage detection will be in conformance with the NRC Staff position. (4) Their plans to notify the NRC of significant flaws identified (or changes in the condition of the welds previously known to be cracked) during inspection and evaluation of such flaws.

Niagara Mohawk endorses 12 (two with provisions) of the 13 NRC Staff positions which are outlined in Generic Letter 88-01, and presented an alternative position to one. One of the provisions pertains to inspection schedules: they declined to include welds in the ISI program that are contained in portions of the RWCU that are outboard of the isolation valves. This provision is not acceptable.

About one-third of the welds are classified as IGSCC Category A as a result of an extensive piping replacement program, but some are incorrectly classified. The remaining welds are IGSCC Category D and G. Several (either 13 or 15, depending on which submittal is correct) welds are inaccessible. Plans for future actions include implementation of HWC and additional repair/replacement as needed.

Niagara Mohawk's position on inspections conforms with the NRC Staff positions on schedule (except for a few IGSCC Category D welds and the previously mentioned RWCU welds), methods and personnel, and sample expansion. A change to the Technical Specification on ISI to conform with the NRC Staff position is promised. The Technical Specification already conforms with NRC Staff requirements on leakage detection.

## CONTENTS

<b>ABSTRACT</b>	i
<b>SUMMARY</b>	ii
<b>1. INTRODUCTION</b>	1
<b>2. EVALUATION OF RESPONSE TO GENERIC LETTER 88-01</b>	2
<b>2.1 Documents Evaluated</b>	2
<b>2.2 Review of Niagara Mohawk's Responses to Staff Positions         and Implementation of Those Positions</b>	3
<b>2.3 Review of Classification of Welds, Previous Mitigating             Action, and Previous Inspections</b>	5
<b>2.3.1 Summary of Mitigating Actions</b>	5
<b>2.3.2 Niagara Mohawk's Position on Materials</b>	5
<b>2.3.3 Stress Improvement Treatments</b>	7
<b>2.3.4 Summary of IGSCC Classifications of Welds</b>	7
<b>2.3.5 Previous Inspection Programs</b>	13
<b>2.3.6 Evaluation and Recommendations</b>	17
<b>2.4 Current Plans for Mitigating Actions</b>	19
<b>2.4.1 Niagara Mohawk's Position</b>	19
<b>2.4.2 Evaluation of Conformance to Staff Positions             and Recommendation</b>	19
<b>2.5 Plans for Future Inspections</b>	19
<b>2.5.1 Niagara Mohawk's Position</b>	19
<b>2.5.2 Provision (Exception) Concerning Welds in the RWCU</b>	20
<b>2.5.3 Detailed Inspection Schedules</b>	21
<b>2.5.4 Inaccessible Welds</b>	22
<b>2.5.5 Methods and Personnel</b>	22

2.5.6	Sample Expansion	23
2.5.7	Evaluation and Recommendations	23
2.6	Changes in the Technical Specification Concerning ISI	24
2.6.1	Niagara Mohawk's Position	24
2.6.2	Evaluation and Recommendation	24
2.7	Confirmation of Leak Detection in the Technical Specification	24
2.7.1	Niagara Mohawk's Position	24
2.7.2	Evaluation and Recommendation	25
2.8	Plans for Notification of the NRC of Flaws	25
2.8.1	Niagara Mohawk's Position	25
2.8.2	Evaluation and Recommendation	25
3.	ALTERNATIVE POSITIONS AND EXCEPTIONS	26
4.	CONCLUSIONS AND RECOMMENDATIONS	26
5.	REFERENCES	30

## 1. INTRODUCTION

Intergranular stress corrosion cracking (IGSCC) near weldments in Boiling Water Reactor (BWR) piping has been occurring for almost 20 years. Substantial efforts in research and development have been sponsored by the BWR Owners Group for IGSCC Research, and the results of this program, along with other related work by vendors, consulting firms and confirmatory research sponsored by the NRC, have permitted the development of NRC Staff positions regarding the IGSCC problems. The technical basis for NRC Staff positions is detailed in Reference 1, and further background is provided in Reference 2.

The results of these research and development programs prompted the NRC to issue Generic Letter 88-01 (see Reference 3) requesting all licensees of BWR's and holders of construction permits to:

- (1) Furnish their current plans relating to piping replacement, inspection, repair, and leakage detection.
- (2) Indicate whether they:
  - (a) Plan to follow the staff positions, or
  - (b) Propose alternative measures.

Specifically, Generic Letter 88-01 stated that an acceptable licensee response would include the following items:

- (1) Current plans regarding pipe replacement and/or other measures taken or to be taken to mitigate IGSCC and provide assurance of continued long-term piping integrity and reliability.
- (2) An inservice inspection (ISI) program to be implemented at the next refueling outage for austenitic stainless steel piping.
- (3) A change to the Technical Specifications to include a statement

in the section on ISI that the inservice inspection program for piping will be in conformance with the staff positions on schedule, methods and personnel.

- (4) Confirmation of plans to ensure that the Technical Specification related to leakage detection will be in conformance with the Staff position on leak detection.
- (5) Plans to notify the NRC, in accordance with 10CFR50.55a(o), of any flaws identified that do not meet IWB-3500 criteria of Section XI of the ASME Code for continued operation without evaluation, or a change found in the condition of the welds previously known to be cracked, and an evaluation of the flaws for continued used operation and/or repair plans.

This report contains a technical evaluation of the response which Niagara Mohawk Power Corporation (called either Niagara Mohawk or NM in this report) submitted in response to the NRC Generic Letter 88-01 pertaining to the Nine Mile Point, Unit 1 (hereafter called Nine Mile 1).

## 2. EVALUATION OF RESPONSE TO GENERIC LETTER 88-01

This evaluation consisted of a review of the response to NRC Generic Letter 88-01 of January 25, 1988 by Niagara Mohawk to determine if their performance and plans are in conformance with the NRC Staff positions or if proposed alternatives are acceptable. Proposed inspection schedules and amendments to the Technical Specification were included in the review.

### 2.1 Documents Evaluated

Review was conducted on the information pertaining to Nine Mile

1 provided by the Licensee in the following documents.

- (1) "Nine Mile Point, Unit 1, Docket No. 50-220, DPR-63 (Response to Generic Letter 88-01, NRC Position on IGSOC in BWR Austenitic Stainless Steel Piping)," Niagara Mohawk Power Corporation, 301 Plainfield Road, Syracuse , NY 13212, July 28, 1988.
- (2) "Nine Mile Point, Unit 1, Docket No. 50-220, DPR-63, TAC No. 69147 (Response to Request for Additional Information Concerning Generic Letter 88-01)," Niagara Mohawk Power Corporation, 301 Plainfield Road, Syracuse , NY 13212, September 6, 1989.

Hereafter, in this report, these documents will be referred to as the Niagara Mohawk Submittals No. 1 and No. 2, respectively, and collectively as the Niagara Mohawk Submittals.

## 2.2 Review of Niagara Mohawk's Responses to Staff Positions and Implementation of Those Positions.

Generic Letter 88-01 outlines 13 NRC Staff positions pertaining to (1) materials, (2) processes, (3) water chemistry, (4) weld overlay, (5) partial replacement, (6) stress improvement of cracked weldments, (7) clamping devices, (8) crack evaluation and repair criteria, (9) inspection methods and personnel, (10) inspection schedules, (11) sample expansion, (12) leak detection, and (13) reporting requirements. Generic Letter 88-01 states that the licensee should indicate in their submittal whether they endorse these NRC Staff positions or propose alternative positions. Table 1 of this report, which is patterned after a similar table in Niagara Mohawk Submittal 2, contains a summary of the Niagara Mohawk positions on these items.

Table 1

Summary of Niagara Mohawk's Responses to Staff Positions  
Pertaining to Nine Mile 1

<u>Staff Position</u>	<u>NM accepts NRC Staff Position</u>	<u>Applied In Past</u>	<u>NM Has/Will Consider for Future Use</u>
1. Materials	no (a)	no (a)	yes
2. Processes	yes	no	yes
3. Water Chemistry	yes	no	yes
4. Weld Overlay	yes	no	yes
5. Partial Replacement	yes	yes	yes
6. Stress Improvement of Cracked Weldments	yes	no	yes
7. Clamping Devices	yes	no	yes
8. Crack Evaluation and Repair Criterias	yes	yes	yes
9. Inspection Method and Personnel	yes (b)	no	yes
10. Inspection Schedule	yes (c)	no	yes
11. Sample Expansion	yes	no	yes
12. Leak Detection	yes	yes	yes
13. Reporting Requirements	yes	no	yes

(a) Extensive piping replacement has been applied in the past which utilized low-carbon austenitic stainless steel, but an alternative position is presented concerning ferrite content of weld metal. See text for discussion.

(b) Provision applied concerning inaccessible welds. See text for discussion.

(c) Provision applied concerning RWCU outside the outer containment isolation valve. See text for discussion.

Note that Niagara Mohawk indicated that they endorse 12 of the 13 items, although they applied provisions to two of these items. One of the provisions is applied to inspection methods and personnel of inaccessible welds, and the second provision is applied to inspection schedules of certain RWCU welds. These provisions are discussed in Section 2.5 of this report. Niagara Mohawk proposed an alternative position to the NRC Staff position concerning materials. This item is discussed in Section 2.3 of this report.

Also note, that even though Niagara Mohawk indicated an alternative position concerning materials and applied provisions to the NRC Staff position on inspection methods and inspection schedules, they indicated that they will consider application of all of the 13 NRC Staff positions in the future.

### 2.3 Review of Classification of Welds, Previous Mitigating Actions, and Previous Inspections

#### 2.3.1 Summary of Mitigating Actions

Niagara Mohawk replaced susceptible materials in the Reactor Recirculation system and in portions of the Emergency Cooling System so that about one-third of the welds that are within the scope of Generic Letter 88-01 were classified as IGSCC Category A welds. The materials in the austenitic piping system and the IGSCC classifications of the welds are discussed in greater detail below.

#### 2.3.2 Niagara Mohawk's Position on Materials

Niagara Mohawk Submittal No. 1 contains the following statement concerning their position on materials:

"Niagara Mohawk has had a program of material replacement to improve resistance to Intergranular Stress Corrosion Cracking (IGSCC). Under this program, materials used in past replacements have been low carbon wrought austenitic stainless steel. These materials were not tested for resistance to sensitization in accordance with ASTM 1262-A in all cases since this requirement was not in effect at the time of the replacement. Material selection was based on the best information available at the time replacement was made. Filler metal used in the replacement of austenitic piping also complied with the best available information. The filler metal had a minimum ferrite content of 5% (5 FN). In some cases, the ferrite content may be below the new requirement of 7.5 % (7.5 FN). In addition, cast austenitic materials are generally original plant equipment and were not purchased as low carbon material. In addition, the documentation for ferrite content of these castings is not available. Under the criteria of Generic Letter 88-01, the welds between replacement piping and non-conforming cast austenitic pumps, valves and fittings are a special case. Since we are planning to install a permanent hydrogen injection system, we have classified these weldments as Category A. If the installation of the permanent hydrogen injection system is delayed, beyond the next refueling outage, these weldments will be as Category D. Thus, all replacement materials and their weldments are classified as Category A."

Niagara Mohawk Submittal No. 2 contains the following additional statement concerning the provision attached to their endorsement of the NRC Staff position on materials:

"In the past Niagara Mohawk's replacement program used low carbon austenitic stainless steel, but the material was not tested for resistance to sensitization in accordance with ASTM A262-A. Filler metal was specified to have a minimum ferrite content of 5%, and consequently may have a ferrite content of less than 7.5% (7.5 FN). These past replacements were made based on information available at the time of replacement. ASTM A262-A was not in effect at the time of the replacement. Future replacements will be in conformance with the staff position including minimum ferrite content."

#### 2.3.3 Stress Improvement Treatments

Although not discussed in Niagara Mohawk Submittal No. 1, stress improvement treatments are listed in a table of welds contained in Niagara Mohawk Submittal No. 2. Such treatments are listed for a total of 36 of the IGS SCC Category A welds at Nine Mile 1 (24 welds in the Recirculation system and 2 welds in the Emergency Cooling System). The stress improvement process used for these treatments was not disclosed, and no credit for these treatments is taken since the welds involved were classified as IGS SCC Category A on the basis of the materials contained in these welds.

#### 2.3.4 Summary of IGS SCC Classifications of Welds

Niagara Mohawk, in response to Generic Letter 88-01, initiated a review of all plant systems to identify those falling within the criteria of NUREG 0313, Revision 2. The classifications of IGS SCC Category A welds was based, in part, on their considerations which are discussed in Section 2.3.2 of this report and, in part, their previous inspection programs which are discussed in Section 2.3.5 of this report.

Niagara Mohawk Submittal No. 1 does not contain a list of welds that are within the scope of Generic Letter 88-01, but it does contain a table that lists the number of welds classified in each of the IGSCC categories in each of the piping systems at Nine Mile 1. That table is reproduced in this report as Table 2a.

Niagara Mohawk Submittal No. 2 contains a weld-by-weld listing (designated as Table 2 in that submittal) of the weld classifications (into the various IGSCC categories), weld compositions, and mitigating treatments. The summary presented in Table 2b of this report of IGSCC classifications of the welds at Nine Mile 1 was developed from that table.

Tables 2a and 2b differ in several respects:

The total number of welds is listed in Table 2a as 294; whereas Table 2b lists the total number of welds as 348.

The number of IGSCC Category A welds is listed in Table 2a as 133; whereas Table 2b lists that number as 130.

The number of IGSCC Category D welds is listed in Table 2a as 107; whereas Table 2b lists that number as 188.

The number of IGSCC Category G welds is listed in Table 2a as 54; whereas Table 2b lists that number as 30.

The numbers of inaccessible welds in the various systems differ in the two tables.

No satisfactory explanations exist for the differences in the number of IGSCC Category A welds in the recirculation system or in the differences of inaccessible welds, but

Table 2a

Summary of IGSCC Classifications of Welds Expected at Nine Mile 1  
Following the Inspections During the 1988 Refueling Outage  
(per Niagara Mohawk Submittal No. 1)

System	Number of Welds of Indicated IGSCC Category							Totals
	A	B	C	D	E	F	G	
Emergency Cooling	27	0	0	31	0	0	32 <sup>a</sup>	90
Shutdown Cooling	4	0	0	8	0	0	8 <sup>b</sup>	20
Core Spray	0	0	0	68	0	0	6 <sup>c</sup>	74
Reactor Recirculation	94 <sup>d</sup>	0	0	0	0	0	0	94
Reactor Water Cleanup	8	0	0	0	0	0	8	16
Totals	133	0	0	107	0	0	54	294

Notes:

- a. Includes 3 inaccessible welds.
- b. Includes 4 inaccessible welds.
- c. Includes 6 inaccessible welds.
- d. Thirty welds may be reclassified as IGSCC Category D if HWC program is delayed.

Table 2b

Summary of IGSCC Classifications of Welds Expected at Nine Mile 1  
Following the Inspections During the 1988 Refueling Outage  
(per Niagara Mohawk Submittal No. 2)

System	Number of Welds of Indicated IGSCC Category							Totals
	A	B	C	D	E	F	G	
Emergency Cooling	23	0	0	97 <sup>a</sup>	0	0	0	120
Shutdown Cooling	4	0	0	14 <sup>b</sup>	0	0	2 <sup>b</sup>	20
Core Spray	0	0	0	74 <sup>c</sup>	0	0	0	74
Reactor Recirculation	94	0	0	0	0	0	0	94
Reactor Water Cleanup	9 <sup>d</sup>	0	0	3	0	0	28 <sup>d</sup>	16
Totals	130	0	0	188	0	0	30	348

Notes:

- a. Includes 2 inaccessible welds.
- b. Includes 3 inaccessible welds (one IGSCC Category D weld and two IGSCC Category G welds).
- c. Includes 6 inaccessible welds.
- d. Includes 4 inaccessible welds (two IGSCC Category A welds and two IGSCC Category G welds).

hereafter, in this report, Table 2b will be taken as correct.

Explanations for the differences in the total numbers of welds are contained in Niagara Mohawk Submittal No. 2:

"... some welds in the Emergency Cooling System excluded from the July 1, 1988 response (Niagara Mohawk Submittal No. 1) because the piping is normally less than 200°F, are now included since leaking valves could cause pipe temperatures in excess of 200°F."

"The Commission also requested that welds in the Reactor Water Cleanup System previously excluded from Niagara Mohawk's response be included in the standardized tables. These welds are contained in Table 2. For reasons given in the notes to Table 1, these welds are not included in the Inservice Inspection Program Plan and are not part of the Inservice Inspection Program."

Concerning thirty of the IGSCC Category A welds, Niagara Mohawk Submittal No. 1 states:

"Under the criteria of Generic Letter 88-01, the welds between replacement piping and nonconforming cast austenitic pumps, valves and fittings are a special case. Since we are planning to install a permanent hydrogen injection system, we have classified these weldments as Category A. If the installation of the permanent hydrogen injection system is delayed beyond the next refueling outage, these weldments will be reclassified as Category D."

In a Request for Additional Information (RAI), Niagara Mohawk was asked to note that the existence of Hydrogen Water

Treatment (HWC) may justify reductions in frequency of inspections of certain IGSCC category welds, but it does not constitute a basis for classification of welds as IGSCC Category A. Pertaining to that request, Niagara Mohawk Submittal No. 2 contains the following statement:

"We have reviewed the welds in the Reactor Recirculation System categorized as IGSCC Category A, as requested by the staff. Upon the results of the review, we have determined that these welds should remain in Category A. In accordance with Section 2 of the staff position on inspection schedules in the Generic Letter, non-conforming material welded to a casting (pump or valve body) may be included as IGSCC Category A."

For purposes of comparison of the Niagara Mohawk position with the NRC Staff position, Paragraph 2, Staff Position on Inspection Schedules, Generic Letter 88-01 is quoted below:

"Although castings with higher carbon content than 0.035% are not considered to be resistant to sensitization, welds joining such castings (in the form of pump and valve bodies) to piping have been relatively free of IGSCC. This may be attributed to a favorable residual stress distribution, as calculations have indicated. For this reason, welds joining resistant material to pumps and valves will be considered to be resistant welds, and included in IGSCC Category A. If extensive weld repairs were performed the residual stress may be unfavorable, in which case such welds should be included in Category D."

Note that the NRC Staff position allows IGSCC Category A classifications to be assigned to welds between resistant

materials and high carbon castings. It does not allow such a classifications for welds between non-conforming materials and high carbon castings as stated in the Niagara Mohawk position.

### 2.3.5 Previous Inspection Programs

Niagara Mohawk Submittal No. 1 did not disclose their previous inspection program except for the following statement:

"Niagara Mohawk has been performing augmented inspections at Nine Mile Point Unit 1 since 1978. We have evaluated our inspection program using the criteria of NUREC 0313 Revision 2 and have reviewed the mitigation measures applied to the weldments of the affected systems. Based upon this review, we have assigned IGSCC categories as directed by the generic letter."

Niagara Mohawk Submittal No. 2, in response to a specific request contained in an RAI for a list of welds that have been inspected, contains a weld-by-weld list of inspections performed during 1986 and 1988 Refueling Outages and the inspections planned for the next two refueling outages (the latter are discussed in Section 2.5 of this report). Table 3 of this report provides a summary of those inspections and compares the number of welds of each IGSCC category inspected/scheduled with the inspection requirements (per Generic Letter 88-01) for welds in those categories.

Note that during the last two refueling outages that 31 of the 130 IGSCC Category A welds were inspected, 117 of the IGSCC Category D welds were inspected at least once (84 of these were inspected twice), and no IGSCC Category G welds were inspected.

Table 3

## Summary of Inspection Schedules for Nine Mile 1

IGSCC Categ	No. in Categ	No. Inspected/Scheduled During Indicated Refuel. Outage						Required by Generic Letter 88-01
		Past		Future				
		1986 RO	1988 RO	1991 RO	1993 RO			
A	130	0	31	0	31			25% every 10 years (at least 12% in 6 years)
B	0	-	-	-	-			50% every 10 years (at least 25% in 6 years)
C	0	-	-	-	-			All within the next 2 refueling cycles, then all every 10 years (at least 50 % in 6 years)
D	188	91	110 <sup>(a)</sup>	73	109 <sup>(b)</sup>			All every 2 refueling cycles
E	0	-	-	-	-			50% next refueling cycle, then all every 2 refueling cycles
F	0	-	-	-	-			All every refueling outage
G	30	0	0	0	0			All next refueling cycle

(a) Eighty-four of these inspections were performed on welds that were inspected during the 1986 Refueling Outage, so a total of 117 IGSCC Category D welds were inspected during either the 1986 Refueling Outage or the 1988 Refueling Outage or both.

(b) One of these inspections will be a repeat of an inspection scheduled for the 1991 Refueling Outage. A total of seven IGSCC Category D welds are not scheduled for inspection during either the 1991 Refueling Outage or the 1993 Refueling Outage.

As indicated earlier (Table 2b) fifteen welds at Nine Mile 1 are described as inaccessible (or partially inaccessible for ultrasonic (UT) inspection). These welds are listed in Table 4 of this report. It may be noted that conflicting (or at least confusing) information exists inasmuch as nine of these welds are : (1) classified as IGSCC Category D welds even though they are listed as inaccessible (or at least partially inaccessible), and (2) listed as either having been inspected, scheduled for inspection, or both.

The following additional items are contained in Niagara Mohawk Submittal No. 2:

"(Weld No.) 39-FW-42. A potential flaw was found during the 1988 outage. The flaw was sized as circumferential on the I.D., 5.5" length, 0.21" width and .39" depth. During this outage a section of pipe was removed and ID penetrant examined. No indications were found. The flaw was redispositioned as geometric. The replacement piping material and welding materials meet the requirements of Generic Letter 88-01, the new welds are considered non-conforming per NUREG-03413, Rev. 2, since the existing base material was not buttered prior to welding."

"(Weld No.) 39-FW-43. A flaw was found during the 1986 outage. The flaw is circumferential on the I.D., 0.8" length, 0.2" width. During the 1988 outage a re-examination was done, and the flaw was circumferential on the I.D., 4" length, 0.10" depth. During the outage a repair was made by removing an estimate four foot section of pipe. Although the replacement piping material and welding materials meet the requirements of Generic Letter 88-01, the new welds are considered non-conforming

Table 4

## Inaccessible Welds at Nine Mile 1

Weld No.	IGSCC Categ	Inspected/Scheduled During Indicated Outage						Extent Examined	Relief <sup>(a)</sup> Request
		Past			Future				
		86 RO	88 RO	91 RO	93 RO				
33.3-FW-RCU-10-2A	A							0%	IIIRR6
33.3-FW-RCU-8-3B	A							0%	IIIRR11
33.3-FW-RCU-10-2B	G							0%	IIIRR11
33.3-FW-RCU-9-2A	G							0%	IIIRR11
38-FW-4	D	X	X			X	WRV 50%	IIIRR11	
38-SW-27A	G						0%		
38-SW-3A	G						0%		
39-SW-23A	D		X		X	X	0%	IIIRR11	
39-SW-34A	D			X			0%	IIIRR11	
40-FW-16	D			X	X	X	0%	IIIRR11	
40-FW-30	D				X		0%	IIIRR11	
40-FW-34A	D	X	X			X	WRA 85%	IIIRR11	
40-FW-55	D	X	X			X	WRV 82%	IIIRR11	
40-SW-37A	D	X	X			X	WRV 31% WRA 25%	IIIRR11	
40-SW-46A	D		X			X	WRV 83%	IIIRR11	

Note:

(a) Relief requests were also made for two other IGSCC Category D welds (Weld No. 39-09R-SW1 and Weld No. 39-10R-SW1) even though these welds are not listed as inaccessible.

per NUREG-03413, Rev. 2, since the existing base material was not buttered prior to welding."

"(Weld No.) 40-SW-39D. Two flaws were found during the 1986 outage. The flaws are circumferential on the I.D., 1st) 1.6" length and 0.25" width. 2nd) 0.55" length and 0.10" width. The evaluation and acceptance was per section XI of ASME Code. This weld was re-examined during the 1988 outage and the indications were determined to be geometry."

"(Weld No.) 40-SW-39F. Three flaws were found during the 1986 outage. The flaws are circumferential on the I.D., 1st) 0.5" length and 0.35" width. 2nd) 0.25" length and 0.20" width. 3rd) 0.6" length and 0.20" width. The evaluation and acceptance was per section XI of ASME Code. This weld was re-examined during the 1988 outage and the indications were determined to be geometry."

"(Weld No.) 40-SW-40D. Two flaws were found during the 1986 outage. The flaws are circumferential on the I.D., 1st) 0.60" length and 0.05" width. 2nd) 1.55" length and 0.15" width. The evaluation and acceptance was per section XI of ASME Code. This weld was re-examined during the 1988 outage and the indications were determined to be geometry."

### 2.3.6 Evaluation and Recommendations

Niagara Mohawk is to be commended for the extensive replacement program, but clearly judgments must be made concerning the classifications of some of the welds as IGSCC Category A.

(1) Welds in piping material that do not have documented history of testing for resistance to sensitization and welds in which the filler metal has a specified minimum ferrite content of 5% (rather than 7.5%). In these cases, it is acceptable engineering judgment to assign these welds as IGSCC Category A welds since the IGSCC resistance is governed primarily by the carbon content and the carbon contents of the welds are below the maximum allowed by Generic Letter 88-01 and NUREG 0313, Revision 2.

(2) Concerning welds between replacement piping and castings (which were not purchased as low carbon material, have undocumented ferrite contents, and must be considered as non-conforming materials). These cases may also be evaluated on an individual case basis, according to Section 2.1.1 of NUREG 0313, Revision 2. Such welds may be classified as IGSCC Category A if the replacement piping is conforming material, but they should be classified as IGSCC Category D or G (depending on inspection history) if the replacement piping is non-conforming. The piping for thirty such welds at Nine Mile 1 (currently classified as IGSCC Category A) is non-conforming (according to Niagara Mohawk Submittal No. 1). Furthermore, contrary to the implication in Niagara Mohawk Submittal No. 1, the intended application of Hydrogen Water Chemistry does not justify the IGSCC A classification of these welds.

As indicated in Section 2.3.5 of this report, conflicting (or confusing) statements were made concerning the accessibility of nine IGSCC Category D welds. If in fact these welds are inaccessible, their classifications should be changed to IGSCC Category G. If they are not inaccessible

the listing of inaccessibility should be corrected.

## 2.4 Current Plans for Mitigating Actions

### 2.4.1 Niagara Mohawk's Position

Niagara Mohawk plans to implement a Hydrogen Water Chemistry (HWC) program for additional protection from IGSCC. At the present time they do not plan any additional piping replacement, although they stated that if piping repair or replacement becomes necessary, they will follow the appropriate staff positions as described in Generic Letter 88-01.

### 2.4.2 Evaluation of Conformance to Staff Positions and Recommendation

Since: (1) extensive mitigating actions have already been applied (2) Hydrogen Water Chemistry should further reduce the possibility of IGSCC at Nine Mile 1, (3) any needed repairs will be made in accordance with NRC Staff guidelines, Niagara Mohawk's current plan concerning mitigating treatments are satisfactory, provided that recommendations concerning the ISI program (as discussed in the following section) are followed, acceptance of Niagara Mohawk's plan is recommended.

## 2.5 Plans for Future Inspections

### 2.5.1 Niagara Mohawk's Position

Niagara Mohawk Submittal No. 1 contains the following

statements:

"The inservice Inspection Program will be revised prior to the next refueling outage to incorporate the examination categories and frequencies specified in the generic letter."

"All replacement materials and their weldments are classified as Category A. They will be examined using augmented techniques for austenitic materials in accordance with the selection criteria and frequency required by the ASME Boiler and Pressure Vessel Code, Section XI 1983 Edition, Summer 1983 addenda and ASME code Case N-408."

"There are no IGSOC Category B, C, E, and F weldments at Nine Mile Point Unit 1. There are, however, 107 weldments ... that are classified as Category D. A portion of these weldments will be examined during the 1990 refueling outage. The balance will be examined during the 1992 refueling outage."

"There are 54 weldments classified as Category G. Thirteen of these weldments are inaccessible for ultrasonic examination. They will be visually examined each refueling outage for evidence of leakage. The remaining 41 will be examined during the 1990 refueling outage. They will then be reclassified as Category D and scheduled for re-examination in 1994."

#### 2.5.2 Provision (Exception) Concerning Welds in the RWCU

Although the statements above appear to endorse the NRC Staff position on inspection schedules, Niagara Mohawk applied

a provision to their endorsement of the NRC Staff position concerning inspection schedules. That provision is quoted below from Niagara Mohawk Submittal No. 2:

"Reactor Water Cleanup System (RWCU) welds outside the outer containment isolation valve are not included in the ISI/IST Program. The RCU System is not a safety related system. Automatic RWCU System isolation occurs on low-low reactor water level, Cleanup System line break (High system flow), Liquid Poison System initiation, high heat exchanger effluent, high temperature, high pressure at RWCU filters or RWCU pump suction low flow. The weldments in the portion of the system outside the containment isolation valves were not designed for ultrasonic examination. They are located in an area of high radiation and the work required to prepare and inspect these welds would result in a substantial radiation exposure to plant personnel."

#### 2.5.3 Detailed Inspection Schedules

As previously mentioned Niagara Mohawk Submittal No. 2 contains a list of inspections planned for the 1991 and 1993 Refueling Outages which are summarized in Table 3. It may be noted that the dates of future refueling outages as stated in Niagara Mohawk Submittal No. 1 are different from those stated in Niagara Mohawk Submittal No. 2. These dates should be clarified to eliminate the confusion, but hereafter in this report it will be assumed that correct dates are those given in Niagara Mohawk Submittal No. 2.

Note that 31 (24%) of the IGSCC Category A welds are scheduled for inspection during the 1993 Refueling Outage. This schedule meets or exceeds the requirements for IGSCC Category

A welds as delineated in Generic Letter 88-01.

However, only 181 of the 188 IGSCC Category D welds are scheduled for inspection during either (or both) of the 1991 Refueling Outage or the 1993 Refueling Outage. This falls short of requirements outlined in Generic Letter 88-01, and seven accessible, IGSCC Category D welds are not scheduled for inspection. Relief was previously requested for two of these welds, but nothing was stated concerning the other five IGSCC Category D welds.

No IGSCC Category G welds are scheduled for inspection. Four of these welds are listed as inaccessible, and the remainder are RWCU welds outside of the isolation valves.

#### 2.5.4 Inaccessible Welds

The provision to the NRC Staff position on inspection methods and personnel pertains to inaccessible welds. Niagara Mohawk Submittal No. 2 states:

"Welds inaccessible for UT examination are visually inspected for leaks each scheduled refueling Outage."

Although Niagara Mohawk stated the above as a provision to endorsement of the NRC position, this position is actually in accordance with guidelines provided in Table 1 of Generic Letter 88-01.

#### 2.5.5 Methods and Personnel

Niagara Mohawk Submittal No. 1 states the following:

"The examination techniques and personnel qualification

methods used for the volumetric examinations will be qualified in accordance with the NDE Coordination Plan through the EPRI NDE Center in Charlotte, North Carolina. Niagara Mohawk does not intend to use any alternate plans, such as ASME Code Case N-409, at this time."

#### 2.5.6 Sample Expansion

Niagara Mohawk Submittal No. 1 states the following:

"If one or more cracked welds in IGSCC categories are detected, we will expand the sample examined in accordance with the staff position stated in the generic letter."

#### 2.5.7 Evaluation and Recommendations

Concerning the RWCU welds that are outside of the containment isolation valves: Rejection of Niagara Mohawk's position is recommended. This recommendation is made because the NRC Staff, in formulating their position on the scope of Generic Letter 88-01, recognized that difficulties and high radiation exposure would result from inspection of such welds. Nevertheless, the scope of Generic Letter 88-01 was specifically formulated to include all welds (inboard or outboard of isolation valves) that are four inches or greater in diameter and operate at temperatures above 200°F.

Niagara Mohawk should expand their inspection schedule of IGSCC Category D welds to include those welds that have not been scheduled (with the exception of those for which exceptions have been previously granted by the NRC Staff). Otherwise, acceptance of Niagara Mohawk's positions on inspection schedules, visual inspection of inaccessible welds, inspection methods and personnel, and sample expansion is

recommended since these positions comply with the NRC Staff positions on these items.

## 2.6 Changes in the Technical Specification Concerning ISI

### 2.6.1 Niagara Mohawk's Position

Niagara Mohawk Submittal No. 1 contains the following statement:

"Under separate cover, we are submitting an application to amend the technical specifications to incorporate the requirements of the generic letter."

### 2.6.2 Evaluation and Recommendation

Since Niagara Mohawk committed to submitting a change to the Technical Specification on ISI in accordance with the NRC Staff position, tentative acceptance of their position is recommended, pending actual receipt of that submittal.

## 2.7 Confirmation of Leak Detection in the Technical Specification

### 2.7.1 Niagara Mohawk's Position

Niagara Mohawk Submittal No. 1 contains the following statement:

"Plant Technical Specification section 3.2.5 already conforms to the Generic Letter 88-01 staff position on leak detection."

Niagara Mohawk did not elaborate on that statement in either of the Niagara Mohawk Submittals.

#### 2.7.2 Evaluation and Recommendation

Acceptance of Niagara Mohawk's position on leakage detection is recommended since they stated that the Technical Specification already conforms with the NRC Staff position.

### 2.8 Plans for Notification of the NRC of Flaws

#### 2.8.1 Niagara Mohawk's Position

Niagara Mohawk Submittal No. 1 contains the following statement:

"Niagara Mohawk will notify the Commission of any flaws identified that exceed the acceptance criteria of ASME Section XI, subsection IWB-3500. This notification will include our justification for continued operation and/or our repair plans."

#### 2.8.2 Evaluation and Recommendation

The Niagara Mohawk plans to comply with the NRC Staff position concerning reporting of flaws, so it is recommended that the plans for reporting of flaws should be accepted.

### 3. ALTERNATIVE POSITIONS AND EXCEPTIONS

Niagara Mohawk did not propose any alternative positions or exceptions to the NRC Staff positions as delineated in Generic Letter 88-01 except for their position on inspection of RWCU welds outside of the isolation valves. That position was discussed in Section 2.5.2 of this report.

### 4. CONCLUSIONS AND RECOMMENDATIONS

Niagara Mohawk Submittal endorses 12 (two with provisions) of the 13 NRC Staff positions and presented an alternative position concerning one (i.e., that pertaining to materials). One provision applies to inspection schedules: they excluded the welds in the portion of the RWCU that are outboard of the containment isolation valves from inspection. This is not an acceptable provision. The second provision is applied to inspection methods and personnel: they propose to use visual inspection of inaccessible welds. This position, although presented by Niagara Mohawk as a provision to their endorsement of inspection methods and personnel, is actually in conformance with NRC Staff guidelines.

The alternative position pertaining to materials concerns the minimum ferrite content of welds in replacement piping and the ferrite content of castings. In both cases, the specified minimum ferrite content was satisfactory per acceptable practices at the time of piping replacement, but it may be lower than current requirements of 7.5%. This alternative position is acceptable because: (1) the carbon content of welds in replacement piping is in compliance with current NRC Staff guidelines, and (2) welds between castings and resistant piping, as indicated in Generic Letter 88-01 and NUREG 0313, Revision 2, can be considered as IGSCC Category A welds.

A list of welds that are within the scope of Generic Letter 88-01 is

contained in Niagara Mohawk Submittal No. 2, but the total number of welds, the number of welds in each of the IGSCC categories, and the number of welds listed as inaccessible according to that list does not agree with a summary of that information provided in Niagara Mohawk Submittal No. 1. Explanations were provided concerning the differences in the total number of welds, but satisfactory explanations were not provided concerning the other differences. In this report, the list provided in Niagara Mohawk Submittal No. 2 is taken to be correct.

Extensive piping replacement has been performed in the past with the result that about a third of the welds in the austenitic piping system are classified as IGSCC Category 1 welds. However, Niagara Mohawk mistakenly interpreted a provision in Generic Letter 88-01 that permits welds between high carbon castings and resistant materials to be classified as IGSCC Category A welds to similarly apply to welds between high carbon casting and non-conforming piping. Such casting to nonresistant material welds should actually be classified as IGSCC Category D or IGSCC Category G, depending on the inspection history. The IGSCC classifications of about 30 welds are affected, and the IGSCC Category A classifications of these welds should be changed.

Plans for future actions at Nine Mile 1 include implementation of Hydrogen Water Treatment and repair/replacement as necessary. No repair is currently needed, and no additional piping replacement is currently planned.

An ISI program has been developed that conforms with the NRC Staff requirements for methods and personnel, inaccessible welds, sample expansion, and plans for reporting of flaws. The planned program also conforms with guidelines for inspection schedules for IGSCC Category A welds, but it falls short on inspection schedules for IGSCC Category D welds (no inspections are planned for seven such welds during the next two refueling outages), and no inspections are planned for IGSCC Category G welds in the portion of the RWCU that is outboard of the

containment isolation valves. These deficiencies in the planned schedules should be corrected.

Niagara Mohawk promised to change the Technical Specification on ISI as requested in Generic Letter 88-01. This change will be included in a separate submittal.

Niagara Mohawk claims that the Technical Specification for Nine Mile 1 is already in compliance with the NRC Staff position on leakage detection as delineated in Generic Letter 88-01; however, they did not elaborate on that comment in either the original submittal nor their reply to a Request for Additional Information.

As a result of this technical evaluation, the following recommendations are made.

- (1) Rejection of Niagara Mohawk's position concerning welds between non-conforming materials and high carbon castings is recommended. Such welds should not be classified as IGSOC Category A, and the IGSOC classification of such welds at Nine Mile 1 should be changed in accordance with guidelines provided in Generic Letter 88-01.
- (2) Acceptance of other portions of Niagara Mohawk's position pertaining to materials is recommended.
- (3) Clarification of differences between Niagara Mohawk's original submittal and their reply to the Request for Additional Information concerning the number of welds in each of the IGSOC categories and the number of inaccessible welds is needed. In addition, clarification of confusion resulting from listing several welds as inaccessible for inspection even though they are also listed as having been inspected (or are scheduled for inspection) and classified as IGSOC Category D (see Table

4 of this report).

- (4) Acceptance of Niagara Mohawk's position on inspections schedules of IGSCC Category A welds is recommended. However, rejection of Niagara Mohawk's planned inspection schedules of IGSCC Category D and IGSCC Category G welds is recommended. Specifically, Niagara Mohawk should revise their ISI plan to include inspections of accessible IGSCC Category D welds currently omitted from planned inspections (unless NRC Staff exemptions have been granted), and Niagara Mohawk should revise their ISI plan to include inspections of welds in the RVCU that is outboard of the isolation valves.
- (5) Acceptance of Niagara Mohawk's position on inspection methods and personnel, sample expansion, and reporting of flaws.
- (6) Tentative acceptance of Niagara Mohawk's position on changing the Technical Specification concerning ISI, pending receipt and evaluation of the promised supplemental submittal.
- (7) Acceptance of Niagara Mohawk's position on leakage detection.
- (8) Acceptance of the remaining portions of the Niagara Mohawk Submittal.

## 5. REFERENCES

1. "Technical report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," NUREG 0313, Revision 2, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, January, 1988.
2. "Investigation and Evaluation of Stress-Corrosion Cracking in Piping of Light Water Reactor Plants," NUREG 0531, U. S. Nuclear Regulatory Commission, February, 1979.
3. "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," Generic Letter 88-01, U.S. Nuclear Regulatory Commission, January 25, 1988.