

# New Hampshire Yankee

Ted C. Feigenbaum  
President and  
Chief Executive Officer

NYN-91157

September 27, 1991

United States Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Attention: Mr. Thomas T. Martin, Regional Administrator

- References:
- (a) Facility Operating License No. NPF-86, Docket No. 50-443
  - (b) NHY Letter NYN-91142 dated September 6, 1991, "Pullman-Higgins Weld Radiograph Reinterpretation Program," T. C. Feigenbaum to NRC Document Control Desk
  - (c) NHY Letter NYN-91151 dated September 17, 1991, "Additional Reply to Notice of Violation (NRC Inspection Report 50-443/91-12) and Radiograph Reinterpretation Program Completion Report," T. C. Feigenbaum to T. T. Martin
  - (d) NRC Letter dated September 24, 1991, "Review of Radiograph Reinterpretation Program Completion Report and of the Reply to an NRC Notice of Violation," T. T. Martin to T. C. Feigenbaum

Subject: Supplemental Submittal for the Radiograph Reinterpretation Program Completion Report

Dear Mr. Martin:

The NRC letter dated September 24, 1991 [Reference (d)] requested New Hampshire Yankee's (NHY) response to three questions. Enclosure 1 to this letter provides NHY's response to the three questions. Enclosures 2 and 3 to this letter transmit additional information and errata to the NHY letters dated September 17, 1991 (NYN-91151) [Reference (c)], which transmitted the results of implementing the Weld Radiograph Reinterpretation Program (WRRIP) and September 6, 1991 (NYN-91142) [Reference (b)], which transmitted the WRRIP description.

This letter transmits the justification for NHY's determination that the WRRIP results and corrective actions were conclusive in fully bounding, examining and resolving any generic implications regarding radiography at Seabrook Station. In the letter dated September 6, 1991 (NYN-91142) [Reference (b)], NHY provided the results of a detailed evaluation of such generic implications and submitted a Program Description for the Reinterpretation of Pullman-Higgins Field Weld Radiographs. In the letter dated, September 16, 1991 the NRC found this Program acceptable.

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NRC Inspection Report 50-443/91-12 identified six radiographs that the NRC found not to meet ASME film quality requirements. NRC Inspection 50-443/91-21 found one additional radiograph which also did not meet ASME film quality requirements. The subsequent NHY WRRIP identified forty-seven weld radiograph packages that did not conservatively demonstrate strict compliance with all film quality requirements prescribed by the Code. These combined reviews identified a total of fifty-four weld radiograph sets found to require re-radiography because of noncompliance with the ASME Code. NHY analysis of these radiographs led to the identification of the root causes for these Code non-compliances. The vast majority of these welds involved density concerns where small bore, piping was originally radiographed using a difficult double wall exposure, double wall viewing, source side penetrameter technique. This technique was unique in that no station markers were used at the outer boundaries of the area of interest. This introduced greater subjectivity and required more interpretive skills when evaluating the outer edges of the weld. This unique set of circumstances was particularly exacerbated in three inch, heavy wall piping. This configuration resulted in a gradual transition of film density at the extremes of the area of interest. In retrospect, the extent to which densitometer readings were taken over the area of interest was insufficient for this extremely difficult technique. The uniqueness of this set of conditions limited this difficult interpretation to an identifiable set of welds. For all other techniques used at Seabrook Station, station markers delineated the boundaries of the weld areas to be evaluated. NHY concludes that the extent to which densitometer readings were taken for this difficult technique is the root cause of the interpretive difficulties for the above forty-five welds.

The remaining welds were identified by others as not being in full compliance with ASME film quality requirements for radiographic sensitivity. NHY has evaluated the sensitivity concerns for these radiographs and concluded that the original Pullman-Higgins and YAEC reviews were correct in their determinations that the radiographs were acceptable per the Code. The WRRIP was specifically designed to be conservative to eliminate the potential for further questions and concerns regarding welds and their radiographs at Seabrook Station. Therefore, the radiographic packages with sensitivity concerns were rejected since, after close scrutiny, it was determined by multiple reviewers that these weld radiographic packages exhibited marginal, but acceptable required sensitivity.

NHY reviewed the entire population of potentially suspect welds radiograph packages (less those weld radiograph packages previously reviewed and accepted by the NRC). All radiographs found to contain inadequacies have been reradiographed and found to be in full compliance with the Code. NHY also reviewed radiographs taken with other techniques and, with no exceptions, found them to be in full compliance with the Code.

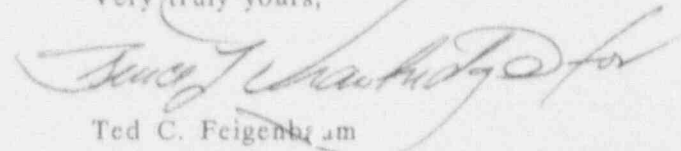
Based on the root cause analysis, confirmatory bounding analysis and completed corrective actions NHY concluded that there were no remaining unresolved film quality concerns for field welds requiring radiography by Code. NHY further concluded that any generic implications were fully bounded, examined and resolved.

United States Nuclear Regulatory Commission  
Attention: Mr. Thomas T. Martin

September 27, 1991  
Page three

Should you have any questions regarding this matter, please contact Mr. Neal A. Pillsbury, Director of Quality Programs, at (603) 474-9521, extension 3341.

Very truly yours,



Ted C. Feigenbaum

Enclosure

TCF:EWD/act/ss

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New Hampshire Yankee  
September 27, 1991

ENCLOSURE 1 TO NYN-91157  
SUPPLEMENTAL SUBMITTAL FOR THE RADIOGRAPH  
REINTERPRETATION PROGRAM COMPLETION REPORT

RESPONSE TO NRC LETTER DATED SEPTEMBER 24, 1991

A. Background

In the letter dated September 17, 1991 (NYN-91151), NHY provided the results of the Weld Radiograph Reinterpretation Program (WRRIP). The results of this reinterpretation program concluded that 100 percent of the physical welds reviewed had no rejectable indications, and, therefore, the subject welds were acceptable per the ASME Code. The reinterpretation effort also recognized that while the subject radiographs generally met the intent of the Code, 47 of the 90 Pullman-Higgins field weld radiograph packages did not conservatively demonstrate strict compliance with all film quality requirements prescribed by the Code. NHY subsequently reradiographed the 47 welds regardless of the nature or degree of the film quality concerns, and the results substantiate and confirm that the physical welds were in compliance with the Code.

In the letter dated September 24, 1991, the NRC requested that NHY provide answers to three questions. The following provides the specific questions and NHY's responses.

B. Question Number 1

"Fifty-four weld radiograph sets were found to require re-radiography because of noncompliance with the ASME code. Multiple layers of film review during construction, including the 100% Yankee Atomic Electric Company review, did not identify this problem. What root cause or causes has or have been identified? Have generic implications been evaluated? If so, with what results? Please explain, as soon as practicable, the justification for the conclusion that the radiograph reinterpretation program should be concluded despite the 54 radiograph packages inadequacies missed during construction."

Summary Response to Question Number 1

1. NHY identified the root cause of the radiograph non-compliance with Code as a shortcoming in the original radiographic interpretation process that is specifically limited to a single radiographic technique. The technique involved is the double wall exposure, double wall viewing, source side penetrameter technique, when it is applied to three (3) inch nominal pipe size welds where the initial Pullman-Higgins review occurred prior to October 1, 1982.
2. NHY reviewed the entire population of potentially suspect weld radiograph packages (less those weld radiograph packages previously reviewed and accepted by the NRC). All radiographs found to contain inadequacies have been reradiographed and found to be in full compliance with the Code.
3. NHY reviewed radiographs taken with other techniques and, with no exceptions, found them to be acceptable and in full compliance with the Code. Based on the root cause analysis, confirmatory bounding analysis and completed corrective actions, NHY concluded that there were no remaining unresolved film quality concerns for field welds requiring radiography by Code. NHY further concluded that any generic implications were fully bounded, examined and resolved.

The WRRIP identified a total of 47 weld radiograph packages that did not conservatively demonstrate strict compliance with all film quality requirements prescribed by the Code. As provided in the Hellier Report #919-12F, Revision 1, which was attached to the NHY letter dated September 17, 1991 (NYN-91151), forty-four (44) of the 47 weld radiograph packages were identified primarily due to density concerns. Three (3) others were identified due solely to sensitivity concerns<sup>1</sup>. NHY concluded that for 44 of the 47 weld radiograph packages, the original Pullman-Higgins and YAEC reviewers were in error in their determination that these radiographs were acceptable per the Code. This is a technique specific shortcoming regarding the extent to which density readings were taken at the outer fringes of the weld area of interest on the radiograph. NHY also concluded that for three (3) of the weld radiograph packages, the original Pullman-Higgins and YAEC reviews were correct in their determinations that the radiographs were acceptable per the Code. The bases for these conclusions are presented in Section B.1.

The Notice of Violation from Inspection Report 50-443/91-12 addressed a total of six (6) weld radiograph packages. A seventh radiograph package was subsequently added to the Notice of Violation as a result of NRC Inspection 91-21. As provided in NHY's response to the Notice of Violation, dated July 8, 1991 (NYN-91106), NHY disputed the violation regarding the six (6) weld radiograph package concerns that were identified at that time. Notwithstanding the fact that these welds have since been reradiographed, NHY still concludes that these six (6) weld radiographic packages are acceptable per the Code, and therefore, that the original Pullman-Higgins and YAEC determinations regarding Code acceptability were correct. A discussion of these six weld radiograph concerns and the bases for NHY's conclusions are presented in Section B.1. The seventh weld radiograph in question was identified by the NRC in Inspection 91-21. NHY has previously concluded that the radiographic package for this weld did not comply with all film quality requirements prescribed by the Code. This non-compliance, which concerns film density, was caused by the same interpretation error that caused the 44 density concerns identified during the conduct of the WRRIP, and as summarized above. A detailed discussion of this issue is also provided in Section B.1.

The completion of these evaluations bounded and resolved the above listed weld radiograph concerns. Therefore, NHY concludes that no further weld radiograph reinterpretation efforts are necessary. The bases for these conclusions are the results from the WRRIP, evaluation of other radiographic techniques, and the numerous technical and independent reviews that have been conducted for weld radiography at Seabrook Station. Section B.3 details the bases for these conclusions.

#### Detailed Response to Question Number 1

Root Cause Analysis Concluding that Concerns are Limited to the Double Wall Exposure, Double Wall Viewing, Source Side Penetrameter Technique

As described in the letters dated July 8, 1991 (NYN-91106), and September 17, 1991 (NYN-91151), the WRRIP was conducted to specifically eliminate any question of doubt regarding the quality of the subject population of welds and their radiographic packages.

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<sup>1</sup>Refer to response to question number 2.

As a result, the weld radiographic packages for 100 percent of the subject population (less those weld radiograph packages previously reviewed and accepted by the NRC), were re-examined to ensure strict compliance with every facet of film quality and weld quality criteria prescribed by the Code. All of the weld radiograph packages identified were rigorously examined, and it was found that in 47 cases they did not conservatively meet all of these requirements. This does not mean, however, that the physical welds themselves did not achieve Code compliance. As described in the letter dated September 17, 1991 (NYN-91151), NHY has reradiographed all 47 subject welds. These new radiographs were interpreted by independent, certified Level III reviewers, and were found to be in full compliance with the Code. These new radiographs substantiate and confirm that the physical welds themselves were in full compliance with the Code, and that the original Pullman-Higgins and YAEC determinations regarding physical weld quality were correct.

The original Pullman-Higgins and YAEC reviews of radiographic film were conducted in accordance with the Code requirements. These original reviews were intended to ensure both that the film quality was acceptable and that the radiograph satisfied the film quality requirements of the Code. As to the latter, the degree of precision employed varied with the apparent acceptability of the film. Where the density through the weld area of interest and penetrameter were acceptable, and the film appeared to meet comparative density requirements, only a few densitometer readings were taken to confirm density. On the other hand, applying the strict, ultra-conservative approach of the WRRIP, the same film may have been rejected after extensive densitometer readings were taken. Similarly, an otherwise perfect radiograph with acceptable, but marginal sensitivity, may, after close scrutiny, have been accepted by Pullman-Higgins and YAEC, but rejected by the WRRIP. The WRRIP was specifically designed to be ultra-conservative in its density review. The elimination of the potential for density concerns regarding weld radiographs at Seabrook and their implementation of the WRRIP in this manner was considered to be the most efficient method of resolving any outstanding weld quality concerns.

Notwithstanding the above, NHY has reviewed, for generic implications, the 44 weld radiograph packages that were rejected due to film density concerns as a result of the WRRIP, and the one (1) weld radiograph package also rejected for density concerns as a result of NRC Inspection 91-21. This investigation revealed the aforementioned shortcoming in the original Pullman-Higgins and YAEC review process. This shortcoming is specific to the interpretation of radiographs performed on three (3) inch nominal pipe size welds that utilized the double wall exposure, double wall viewing, source side penetrameter radiographic technique, that is discussed below.

The 45 weld radiographs in question were all performed using the double wall exposure, double wall viewing, source side penetrameter radiographic technique. This technique is accepted by the Code for welds on three and one-half (3 1/2) inch outside diameter and smaller piping. With this particular technique it is extremely difficult to accomplish all the Code film quality requirements. As described in the Hellier Report #919-12F, Revision 1, which was attached to the NHY letter dated September 17, 1991 (NYN-91151), this technique is particularly difficult. The effective composite through-wall thickness that the radiation passes through to reach the film, radically changes as a function of the distance away from the pipe center, as depicted on the film. The larger the effective composite through-wall thickness, the more the radiation will be attenuated. This will cause a gradual transition of film density. These difficulties are exacerbated with the three (3)

inch nominal pipe size since the composite thickness that the radiation must travel through varies more so than with smaller diameter pipe utilizing the same technique. Hence, it is the double wall exposure, double wall viewing, source side penetrometer technique, utilized on three (3) inch nominal pipe size welds, that presents the greatest demands on the reviewer's interpretive skills.

This radiographic technique also requires even more extensive interpretation when it is used on three (3) inch nominal pipe size, heavy wall schedule 160 pipe. Specifically, with this size pipe it is necessary for the reviewer to interpret the weld area on the radiographic film without the benefit of reference boundary markers being present on the film to depict the edges of the weld area of interest. The radiographs do have a 0° or 90° marker to indicate the center of the weld area of interest. For the 45 subject welds, the original Pullman-Higgins and YAEC reviews did examine the entire weld area of interest. However, the lack of boundary markers and gradual transition of film density at the outer fringes of the weld imposed by this technique created special challenges for the reviewers. It was within these small fringe areas where the WRRIP identified film densities that were not in strict compliance with the Code requirements. The specific portions of the weld area of interest that are in question with the 45 weld radiographs are depicted in Figure 1. Figure 1 shows the use of the double wall exposure, double wall viewing, source side penetrometer radiographic technique on three (3) inch nominal pipe size, heavy wall, schedule 160 pipe. This figure shows the projection of the incident radiation as it passes through the 0° station and onto the radiographic film. (The 90° station projection is not shown for clarity). This figure illustrates the composite through-wall thickness that the radiation passes through the pipe wall to the film. Note the extreme variation of the composite thickness as the distance from the pipe center increases as projected onto the film. For example, radiation passing along path "B" passes through 1.15 inches of pipe wall material. Similarly, radiation passing along path "A" passes through 2.26 inches of pipe wall material. As shown on the figure, the distance between the points on the radiographic film which intersect the projections of the latter two radiations paths, is only 0.393 inches. Thus, it is within this small outer fringe of the weld area of interest where the film density varies due to the large difference in material thickness (1.15" to 2.26"). It is these specific areas on the radiographic film that caused the error in the original interpretation process.

NHY concluded that the root cause for these 45 welds is attributable to the differences in density at the edges of the weld area of interest under examination caused by this particular technique. A contributing cause is, in retrospect, the extent to which density readings were taken.

NHY evaluated the sensitivity concerns for the three (3) weld radiograph packages identified by the WRRIP<sup>2</sup> and concluded that the original Pullman-Higgins and YAEC reviews were correct in their determinations that these radiographs were acceptable per the Code. As previously discussed, the WRRIP was specifically designed to be ultra-conservative in its determinations so as to eliminate all potential for future questions and concerns regarding welds and their radiographs at Seabrook Station. These three (3) sensitivity concerns were rejected by the WRRIP since, after close scrutiny, it was determined by multiple reviewers that these weld radiograph packages exhibited only marginally acceptable 4T sensitivity. By the guidelines of the WRRIP, if an issue was the least bit controversial, it was conservatively

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<sup>2</sup>Refer to response to question number 2.

identified for reradiography. Notwithstanding this, NHY concludes that the original Pullman-Higgins and YAEC determinations regarding the Code acceptability of these three weld radiograph packages were correct. Additionally, the reradiography performed as part of the WRRIP substantiates and confirms the original determinations as to the Code acceptability of the physical welds.

As provided in the NHY response to the Notice of Violation, dated July 8, 1991 (NYN-91106), NHY disputed the violation regarding six (6) weld radiograph package concerns that were identified at that time. Notwithstanding the fact that these welds were reradiographed, NHY still concludes that these six (6) weld radiograph packages are in compliance with the Code requirements, and therefore, that the original Pullman-Higgins and YAEC determinations regarding Code acceptability were correct.

Based on the root cause analyses discussed above, NHY has concluded that the concerns are limited to the double wall exposure, double wall viewing, source side penetrameter technique.

#### B.2 Results of NHY Review of Radiographs taken with the Double Wall Exposure, Double Wall Viewing, Source Side Penetrameter Technique

NHY is confident that the 44 weld radiograph packages that were previously identified during implementation of the WRRIP comprise the complete set of radiographs affected by the above described interpretation error. As described in the letter dated September 17, 1991 (NYN-91151), the scope of the WRRIP provided a 100 percent reinterpretation of all Pullman-Higgins field welds:

"that required radiography in order to meet the ASME Code, that is three (3) inch nominal pipe size and smaller, where the initial Pullman-Higgins Level II (or III, where the only Pullman-Higgins review was performed by a Level III) review signature occurred prior to October 1, 1982, and where the double wall exposure, double wall viewing radiographic technique was used with source side penetrameters, excluding any welds previously accepted by the NRC."

This 100 percent review of the potentially affected population identified the set of 44 actually affected weld radiograph packages.

The WRRIP review also performed additional bounding conditions analyses that confirmed the validity of the parameters utilized to determine the scope of the WRRIP. The first of these additional population samples included field weld radiographic packages meeting all of the program population parameters with the exception of the October 1, 1982 date of initial Pullman-Higgins review. NHY and Hellier Associates, Inc. reviewed a total of twenty (20) of the radiographic packages in the period immediately following October 1, 1982, and documented that each of them complied with the Code requirements. This sample confirmed the effectiveness of program enhancements and corrective actions taken after October 1, 1982, to improve the construction era radiographic examination process.

The second bounding conditions analysis, carried out in order to confirm that the proper selection of key program parameters had occurred, involved a research of the field weld radiographic packages that were three (3) inch nominal pipe size and smaller but

involved a different radiographic filming technique. This analysis included radiographs taken during the entire construction era. This analysis confirmed the selection of the double wall exposure, double wall viewing with source side penetrameter radiographic technique as a valid bounding parameter in that out of a collective total of 55 previous and current independent weld examinations, of radiography performed by a different technique (double wall exposure, single wall viewing), all were found to be acceptable.

NHY further concluded that there were no implications for smaller pipe diameters radiographed with this technique. To support this conclusion, NHY has investigated the use of the double wall exposure, double wall viewing, source side penetrameter technique on welds smaller than three (3) inch nominal pipe size. The results of the WRRIP indicate that it is only with the three (3) inch nominal pipe size where these interpretive concerns occurred.

NHY believes that these reviews have reexamined the entire set of Pullman-Higgins field weld radiograph packages which may have been subject to the aforementioned radiographic interpretation error.

### B.3 No Other Generic Implications as a Result of the Foregoing Weld Concerns

NHY has investigated the concern regarding generic implications raised in the first question and has concluded that the generic implications do not extend beyond the population of weld packages evaluated in, and responded to by implementation of the WRRIP. The following provides the bases for this conclusion.

As presented above, NHY has previously evaluated the weld radiograph sensitivity concerns identified for the six Notice of Violation welds, and the three WRRIP welds, and has concluded that the Pullman-Higgins and YAEC reviews were correct in their determinations that these radiographs were acceptable per the Code. There are no generic implications associated with these weld radiograph packages since they are in compliance with the Code.

NHY has also reviewed the potential for similar interpretation errors with other radiographic techniques. This review indicated that for all other techniques (e.g., panoramic and double wall exposure, single wall viewing), the radiographic films inherently contain less variations in film density. Unlike the double wall exposure, double wall viewing source side penetrameter technique, these other techniques utilize station or boundary markers which clearly delineate the full extent of the radiograph which must be reviewed for density. Additionally, with other techniques there is conservative overlap onto the adjacent station's film. Based on this and the foregoing, NHY concludes that the potential for this interpretation error is limited to situations where the double wall exposure, double wall viewing, source side penetrameter technique is utilized on three (3) inch nominal pipe size welds.

In addition to the above, throughout the life of Seabrook Station, numerous technical, documentation and independent reviews have been conducted for the weld radiography at Seabrook Station, and these reviews collectively comprise a significant sample of the weld radiograph population. During the conduct of these reviews, any weld radiograph quality concerns have been evaluated, and corrective actions implemented as appropriate. Due to

the comprehensive nature and varied scope of these reviews, NHY has concluded that weld radiograph quality concerns have been resolved.

In summary, based on the foregoing, NHY concludes that there are no generic implications other than those evaluated in, and responded to by implementation of the WRRIP. NHY further concludes that no further weld radiograph reinterpretation efforts are necessary.

C. Question Number 2

"The contractor report lists seven weld radiographs rejected for unacceptable film quality but the report summary only lists three rejects for sensitivity. What criteria, in addition to inadequate density, caused rejection of the other four radiographs?"

Response to Question Number 2

As described in the Hellier Report #919-12F, Revision 1, which was attached to the NHY letter dated September 17, 1991 (NYN-911.1), a total of seven (7) weld radiographs were rejected for unacceptable film quality. Three of these weld radiograph packages were rejected solely due to inadequate sensitivity. The remaining four film quality rejections were due primarily to density concerns, in addition to sensitivity concerns.

The NHY reinterpretation results associated with these same seven (7) weld radiograph sets were in essential agreement with the Hellier results. As described in the September 6, and September 17, 1991 NHY transmittals (NYN-91142 and NYN-91151, respectively), the NHY and Hellier reinterpretation processes were conducted by independent teams of highly qualified radiographic film interpreters utilizing ultra-conservative acceptance criteria in order to ensure Code compliance beyond all question or doubt. If either team found cause for concern in a particular radiograph set, such as a professional judgement call on marginal or inadequate sensitivity, and if there was less than full concurrence between the teams, then the weld was simply reradiographed in order to be most conservative in resolving any concerns. Notwithstanding this process, however, a more specific NHY analysis of the seven (7) Hellier radiograph sets identified as exhibiting unacceptable film quality has been conducted. NHY has concluded that while being in essential agreement with Mr. Hellier that the film sensitivity is marginal, the original Pullman-Higgins and YAEC determinations regarding sensitivity were correct in terms of Code compliance. The essential 4T image quality indicator hole was discernable on the original films in question, and the issue has been further rendered moot through reradiography.

D. Question Number 3

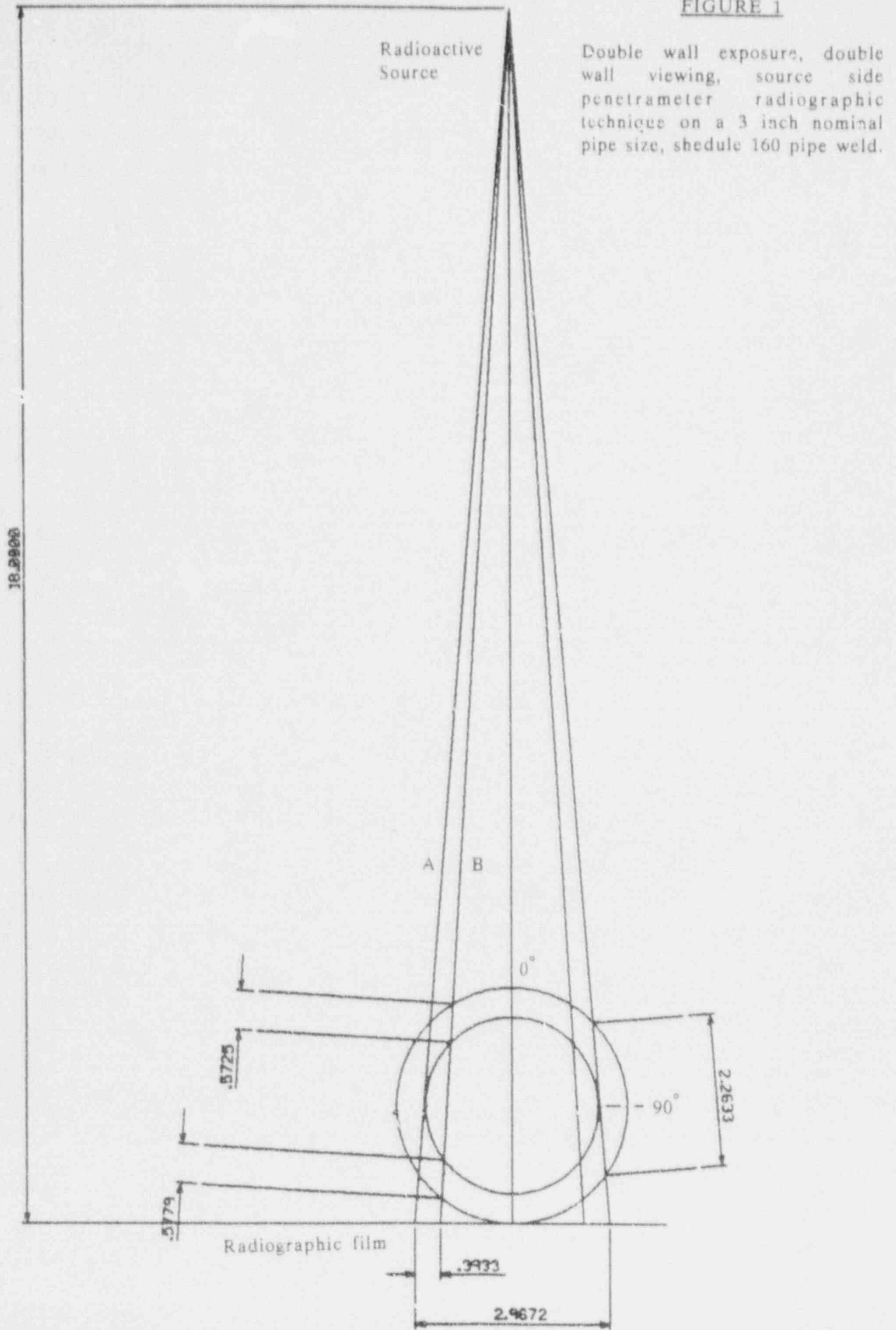
"Table 2 of Attachment A to the NHY report lists 55 welds. To what does the number 59 (identified as the population confirming the acceptability of the single wall viewing technique) used in your "second bounding condition analysis" refer and how were the 59 (or 55) selected for review?"

Response to Question Number 3

Pages four (4) and ten (10) of the WRRIP Report transmitted in the NHY letter dated September 17, 1991 (NYN-91151), state that the total number of previous and current independent examinations of radiography performed using the double wall exposure, single wall viewing techniques was 59. This is a typographical error. The correct number is 55. Table 2 of Attachment A to that report correctly indicates that the actual number of welds that are in this category is 55.

The 55 welds listed in Table 2 of Attachment A to the WRRIP report were selected as follows. Weld related NRC Inspection Reports and NUREG-1425 were reviewed to determine that population of welds reviewed by the NRC that met all of the common factors parameters, except for the radiographic technique. For this Table, the radiographic technique of double wall exposure, single wall viewing, replaced the original technique parameter of double wall exposure, double wall viewing, with a source side penetrometer. Inspection of Table 2 of Attachment A to the WRRIP Report indicates that the welds reviewed by the NRC comprise 51 of the 55 welds listed. The remaining four (4) welds were reviewed as part of the WRRIP before the final list of welds, which satisfied the WRRIP common factors parameters, was finalized. As a result, NHY added these four welds to Table 2 of Attachment A to the WRRIP Report. These four welds are the only welds that utilized the double wall exposure single wall viewing, technique, that were re-reviewed as part of the WRRIP.

FIGURE 1



New Hampshire Yankee  
September 27, 1991

ENCLOSURE 2 TO NYN-91157  
SUPPLEMENTAL HELLIER ASSOCIATES, INC. REPORTS

Supplemental Hellier Associates, Inc. Reports

Hellier Associates, Inc. Report # 919-12F, Revision 1, was included as Attachment B to NHY letter dated September 17, 1991 (NYN-91151) [Reference (c)]. Enclosure 1 to Hellier Report # 919-12F, Revision 1, has been revised. Attached as part of Enclosure 2 to this letter is Hellier Report # 919-12F Revision 2.

Page 7 of Hellier Report # 919-12F, Revision 1, listed five field welds reviewed by M. McLean of Hellier Associates.

Revision 2 to Hellier Report # 919-12F reflects the fact that Mr. C. J. Hellier also reviewed the field welds. The additional welds reviewed by Mr. Hellier are the following:

1-SL-X-6301-F0102  
1-SL-X-6401-F0102  
1-SL-X-6501-F0102  
1-SL-X-6601-F0102  
1-CS-360-06-F0601

Also included in this enclosure is Hellier Associates, Inc. Report # 919-20F. This second Hellier Report (919-20F) provides the results from reviewing the following two additional weld populations:

1. The first population included twenty field welds selected to verify the parameters used to establish the Weld Radiograph Reinterpretation Program. This population of welds included field weld radiographic packages meeting all of the program population parameters with the exception of the October 1, 1982 date of initial Pullman-Higgins review. Hellier Associates, Inc. reviewed these field weld radiographic packages and found them acceptable. Section B (page four) and Table 1 from Attachment A of the Completion Report [Reference (c)] provides the discussion and listing for this sample population of field welds.
2. The second Hellier Report (919-20D) also addresses the results of reviewing the reradiography of the 47 welds identified by the Weld Radiograph Reinterpretation Program. Hellier Associates, Inc. independently reviewed the new radiographs and concluded that the welds and their radiographs fully comply with the requirements of the Code. Section C.3 of the Completion Report [Reference (c)] provides additional details regarding WRRIP Corrective Action results.

# HELLIER

REPORT # 919 - 12F Rev 2

PREPARED FOR NEW HAMPSHIRE YANKEE

SEABROOK, NEW HAMPSHIRE

PREPARED BY

*Charles J. Hellier*  
Charles J. Hellier

DATE

*September 20, 1991*

### EXECUTIVE SUMMARY

HELLIER was contracted by New Hampshire Yankee to provide an independent and unbiased review of one hundred (100) weld radiographs taken by Pullman-Higgins prior to October 1, 1982 of three inch nominal pipe size and smaller. The radiographs were taken with the double wall exposure, double wall viewing technique which is in compliance with the ASME Code, Section V. The inherent difficulties with this technique requires precise set up and exposure in order to achieve required radiographic density coverage.

Of the 100, forty-four (44) were found not to be in compliance with the ASME Code requirements due to inadequate coverage based on code density requirements and three (3) due to unacceptable quality levels (essential penetrameter hole not visible).

### CONCLUSION

Based on the results of this review, it can be concluded that the technique used for some of the radiographs for under 3 1/2" diameter pipe welds prior to October 1, 1982 was not properly applied to achieve all film density criteria necessary to strictly comply with each of the applicable Code requirements. The film quality was sufficient to allow HELLIER to conclude that there were no apparent physical weld concerns in the welds reviewed.

### RECOMMENDATION

It is recommended that the welds which are not in compliance with the ASME Code requirements regarding density or film quality level be re-radiographed until compliance is achieved.

## Introduction

HELLIER has been engaged by New Hampshire Yankee for the purpose of providing an independent Code compliance review of a number of field weld radiographs evaluated and approved by Pullman-Higgins personnel prior to October 1, 1982. These welds are 3" nominal pipe size and smaller and were originally radiographed using the double wall exposure, double wall viewing technique.

## Personnel

HELLIER personnel involved with this review included Charles J. Hellier, President, Kenneth Coryell, Vice President, and Michael McLean, Senior Level III. All personnel carry HELLIER Level III Certifications and hold American Society for Nondestructive Testing Level III Certificates in Radiography. Documentation to support the certifications has been given to New Hampshire Yankee.

## Review

All radiographs were reviewed to ASME Section V and Section III, 1977 Edition and Pullman-Higgins Procedure LX-RT-1-W77; and New Hampshire Yankee Procedure 11230, Rev O dated 8/28/91 (Level III Review of Radiographic Film). While each radiograph was reviewed for total Code compliance, emphasis was placed on weld coverage and film quality level. Weld coverage is primarily a function of density achieved through the area of interest.

The base density is established by taking a density reading through the penetrometer. Density readings in the area of interest (AOI) cannot vary by greater than +30%, -15% from the base density established through the penetrometer. The Code further stipulates that the minimum density for each film (single film viewing) cannot be less than 2.0 or 1.3 (composite film viewing). The maximum density considered acceptable for evaluation by the Code is 4.0 (single or composite viewing).

When pipe welds with relatively small diameters are radiographed using the double wall exposure and double wall view technique, (either elliptical or superimposed image) the effective composite through wall path the radiation passes through, radically changes as the distance away from the pipe center increases. (See Figure # 1).

If a typical radiographic technique produces an image with good contrast (beneficial in radiography in order to observe density changes resulting from small cross sectional thickness changes), the density variations as a result of this effective composite through wall path will be significant.

If a low contrast radiograph is taken, the result will be a more uniform density throughout the area of interest thereby minimizing the possibility of falling outside the code-required density range.

To summarize, the lower contrast technique resulting in greater coverage does not provide the best quality image for interpretation.

This rationale is not intended to provide an excuse for not complying with the Code but merely to point out the reason for the density variation problems. Increasing the number of exposures to achieve greater coverage would have been one solution.

### Results

The results of this review are contained in Enclosure # 1. The categories are (1) Acceptable, (2) Inadequate coverage due to density variations either outside the -15% minimum or less than the 2.0 required, and (3) Unacceptable due to film quality level not being achieved. The review did not disclose any apparent concerns regarding weld quality. Subsequent reports will address the in-process re-radiographic results.

### Recommendations

Re-radiograph those welds considered unacceptable to achieve compliance with Code requirements regarding radiographic technique and coverage.

## ENCLOSURE # 1

<u>Accept</u>	<u>Inadequate Density</u>	<u>Unacceptable Film Quality</u>
1-CS-302-04-F0402		
1-CS-302-01-F0103		
1-CS-302-03-F0301		
1-CS-301-06-F0602		
1-CS-303-05-F0504		
1-CS-303-05-F0503		
1-CS-303-05-F0502		
1-CS-303-03-F0303		
1-CS-302-04-F0403		
1-CS-301-06-F0601		
1-CS-327-02-F0201		
	1-CS-327-02-F0210	
1-CS-328-01-F0103		
1-CS-303-05-F0505		
1-CS-318-01-F0101		
1-CS-318-04-F0404		
	1-CS-327-01-F0103	
1-CS-327-01-F0105		
	1-CS-318-04-F0402	
	1-CS-327-01-F0102	
1-CS-328-03-F0301		
1-CS-332-02-F0202		
1-CS-340-01-F0104		
1-CS-328-02-F0205		
	1-CS-303-04-F0405	
	1-CS-327-02-F0203	1-CS-327-02-F0203
	1-CS-324-02-F0203	
	1-CS-327-02-F0211	
	1-CS-328-01-F0101	
1-CS-340-01-F0105		
	1-CS-355-01-F0108	
	1-CS-355-01-F0111	
1-CS-355-02-F0203		
	1-CS-355-02-F0204	
	1-CS-355-03-F0303	
	1-CS-303-03-F0302	
	1-CS-355-01-F0101	
1-CS-355-01-F0103		
	1-CS-355-01-F0106	
	1-CS-355-01-F0105	
	1-CS-355-01-F0107	
	1-CS-355-04-F0404	
1-CS-355-04-F0403		
	1-CS-355-04-F0402	
	1-CS-355-04-F0401	
1-CS-355-05-F0502		
1-CS-355-05-F0503		
1-CS-356-01-F0104		
1-CS-355-09-F0906		
	1-CS-355-09-F0903	

<u>Accept</u>	<u>Inadequate Density</u>	<u>Unacceptable Film Quality</u>
1-CS-355-08-F0802	1-CS-355-06-F0603 1-CS-355-08-F0809 1-CS-355-09-F0902 1-CS-355-06-F0602	1-CS-355-01-F0105
1-CS-357-05-F0504	1-CS-360-01-F0101	1-CS-360-02-F0201
1-CS-360-03-F0302 1-CS-360-04-F0402	1-CS-360-04-F0403	
1-CS-360-07-F0702	1-CS-360-05-F0504	
1-CS-360-09-F0901 1-CS-364-03-F0303		1-CS-364-03-F0306
1-CS-364-03-F0304 1-RC-97-01-F0106 1-CS-365-02-F0201 1-CS-366-02-F0205 1-RC-97-03-F0304 1-RC-97-03-F0309 1-RC-97-02-F0204 1-CS-363-01-F0103	1-CS-360-11-F1102 1-CS-364-03-F0302 1-SB-1304-02-F0201	1-SB-1304-02-F0201
1-CS-360-11-F1101 1-CS-360-12-F1202 1-CS-360-12-F1201	1-CS-364-03-F0307	
1-CS-360-09-F0902	1-CS-318-01-F0103 1-CS-318-04-F0403	
1-CS-303-04-F0401 1-CS-303-05-F0501	1-CS-324-02-F0201 1-CS-327-01-F0104 1-CS-327-02-F0202 1-CS-327-02-F0204 1-CS-327-02-F0205 1-CS-328-01-F0102 1-CS-328-02-F0203 1-CS-328-02-F0201	1-CS-324-02-F0201  1-CS-328-01-F0102
1-SL-X-6301-F0102 1-SL-X-6401-F0102 1-SL-X-6501-F0102 1-SL-X-6601-F0102	1-CS-360-06-F0601	



EXAMPLE

Outside Diameter 3.0"

Wall Thickness 0.4"

S F D 20.0"

Total effective thickness through which the radiation passes:

@ C/L 0.800"

@ 1/2" of C/L 0.875"

@ 1" of C/L 1.187"

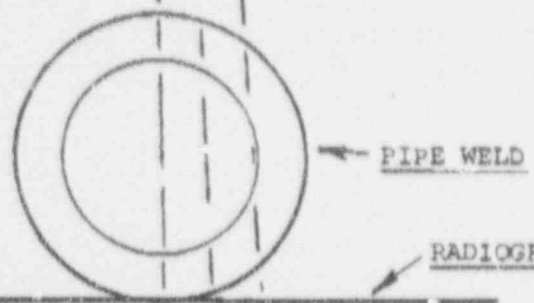


FIGURE #1

C/L 1/2" 1"

# HELLIER

REPORT # 919 - 20F

PREPARED FOR NEW HAMPSHIRE YANKEE

SEABROOK, NEW HAMPSHIRE

PREPARED BY

Charles J. Hellier  
Charles J. Hellier

DATE

September 25, 1991

## Introduction

This report contains the results of two additional radiographic review efforts conducted by HELLIER for New Hampshire Yankee at the Seabrook Nuclear Power Station.

## Post-October 1982 Sample

Radiographs for a sample of 20 welds were reviewed by HELLIER Level III personnel and found to be Acceptable. Of the twenty, six (6) were reviewed by Charles J. Hellier and signed accordingly. The Level III personnel signed the radiograph inspection reports to indicate review and acceptance. Mr. Hellier initialled the fourteen radiograph inspection reports to signify his concurrence that the radiographs were acceptable. See Table I for a listing of the twenty (20) welds.

## Pre-October 1982 Re-Inspection

The forty seven (47) sets of weld radiographs originally examined prior to October 1982 were re-radiographed in order to achieve code compliance. The welds were originally considered not to be in compliance by HELLIER due to inadequate coverage based on Code density requirements (44) or unacceptable quality level (3).

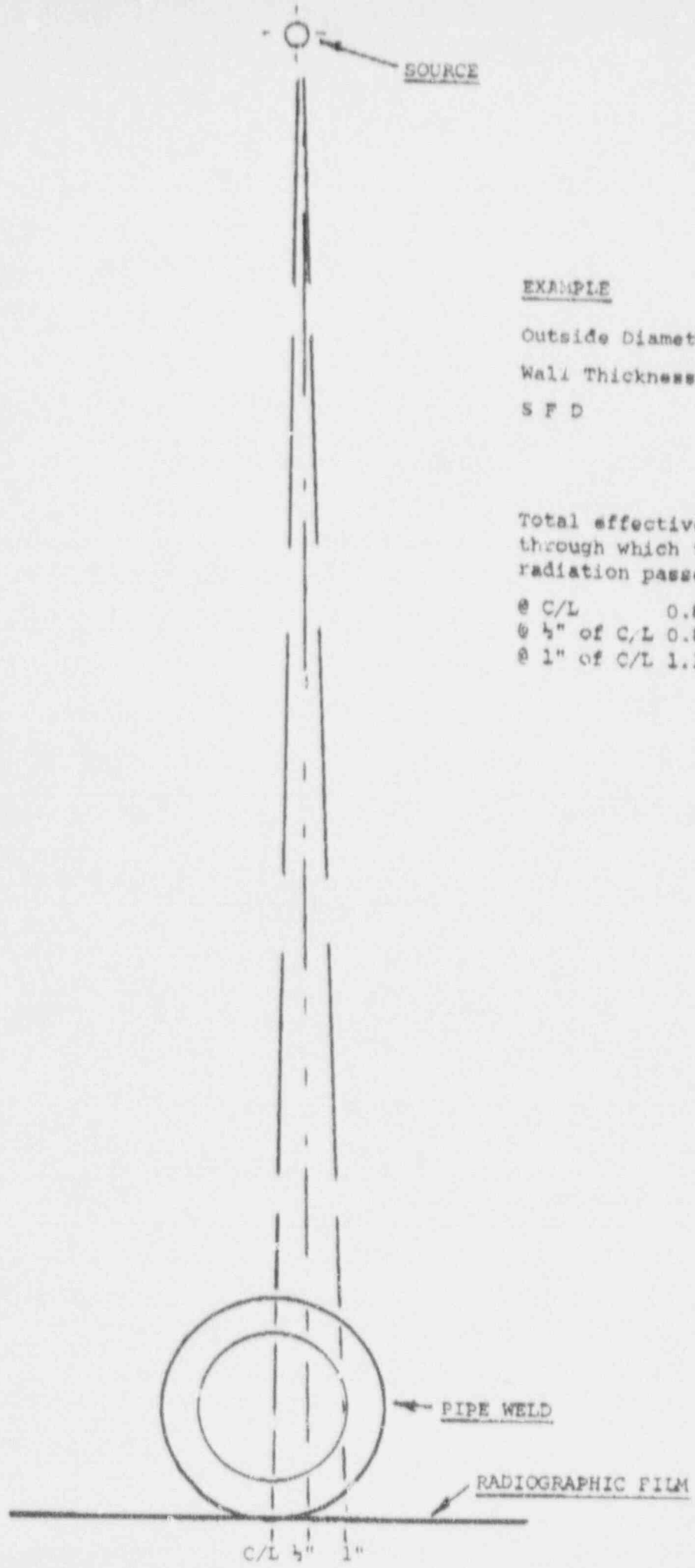
HELLIER Level III personnel reviewed the re-radiography for the forty-seven (47) welds HELLIER originally determined not to be in compliance. The HELLIER review of the forty-seven (47) re-radiographed field welds found them to be acceptable and in full compliance with the Code. The Level III personnel documented their reviews on NHY's Contractor Radiograph Review Procedure forms. Table II lists the forty-seven (47) field welds.

POST-OCTOBER 1982 SAMPLE

1-CS-318-04-F0405  
1-CS-351-03-F0301  
1-CS-351-03-F0302  
1-CS-360-10-F1001  
1-CS-360-10-F1003  
1-CS-365-01-F0104  
1-CS-365-01-F0108  
1-CS-365-04-F0402  
1-CS-365-04-F0407  
1-CS-365-04-F0408  
1-CS-365-04-F0409  
1-CS-366-02-F0205  
1-RC-15-01-F0103  
1-RC-15-01-F0104  
1-RC-15-01-F0105  
1-RC-15-01-F0106  
1-RC-44-01-F0104  
1-RC-59-02-F0201  
1-RC-59-02-F0202  
1-RC-59-02-F0203

PRE OCTOBER 1982 RE-INSPECTION

1-CS-303-03-F0302  
1-CS-303-04-F0405  
1-CS-318-01-F0103  
1-CS-318-04-F0402  
1-CS-318-04-F0403  
1-CS-324-02-F0201  
1-CS-324-02-F0203  
1-CS-327-01-F0102  
1-CS-327-01-F0103  
1-CS-327-01-F0104  
1-CS-327-02-F0202  
1-CS-327-02-F0203  
1-CS-327-02-F0204  
1-CS-327-02-F0205  
1-CS-327-02-F0210  
1-CS-327-02-F0211  
1-CS-328-01-F0101  
1-CS-318-01-F0102  
1-CS-328-02-F0201  
1-CS-328-02-F0203  
1-CS-355-01-F0101  
1-CS-355-01-F0105  
1-CS-355-01-F0106  
1-CS-355-01-F0107  
1-CS-355-01-F0108  
1-CS-355-01-F0111  
1-CS-355-02-F0204  
1-CS-355-03-F0303  
1-CS-355-04-F0401  
1-CS-355-04-F0402  
1-CS-355-04-F0404  
1-CS-355-06-F0602  
1-CS-355-06-F0603  
1-CS-355-08-F0809  
1-CS-355-09-F0902  
1-CS-355-09-F0903  
1-CS-356-01-F0105  
1-CS-360-01-F0101  
1-CS-360-02-F0201  
1-CS-360-04-F0403  
1-CS-360-05-F0504  
1-CS-360-06-F0601  
1-CS-360-11-F1102  
1-CS-364-03-F0302  
1-CS-364-03-F0306  
1-CS-364-03-F0307  
1-SB-1304-02-F0201



EXAMPLE

Outside Diameter 3.0"  
 Wall Thickness 0.4"  
 S F D 20.0"

Total effective thickness  
 through which the  
 radiation passes:

- @ C/L 0.800"
- @ 1/4" of C/L 0.875"
- @ 1" of C/L 1.187"

FIGURE #1

New Hampshire Yankee  
September 27, 1991

ENCLOSURE 3 TO NYN-91157  
ERRATA FOR NHY LETTERS

Errata For NHY Letters

Enclosure 3 transmits errata for the NHY letters dated September 17, 1991 (NYN-91151) [Reference (c)], which transmitted the results of implementing the Weld Radiograph Reinterpretation Program (WRRIP) and September 6, 1991 (NYN-91142) [Reference (b)], which transmitted the WRRIP description. NHY incorrectly identified the NRC Inspection, which occurred during the weeks of August 19 and 26, 1991, as NRC Inspection 91-27. The correct identification is NRC Inspection 91-21. The remaining errors apply to Tables 1, 2 and 4 of the Completion Report [Reference (c)]. Tables 1 and 3 incorrectly list the nominal pipe size for three welds. Table 4 incorrectly lists the references for two field welds. The following tables provide the original and corrected references.

Table 1

<u>Weld</u>	<u>Original Pipe Size</u>	<u>Correct Pipe Size</u>
1-RC-91-410005 F002	3	1"
1-RC-91-410005 F005	3"	1"

Table 3

<u>Weld</u>	<u>Original Pipe Size</u>	<u>Correct Pipe Size</u>
1-CS-318-04 F0204	3"	2"

Table 4

	<u>Original Reference</u>	<u>Correct Reference</u>
1-CBS-1208-01-F0104	NRC IR 80-60	NRC IR 80-06
1-CBS-1208-02-F0202	NRC IR 80-60	NRC IR 80-06