



INDIAN POINT GENERATING STATION
UNIT NO. 2 PIPING SYSTEMS
HYDRAULIC SHOCK SUPPRESSOR
REMOVAL STUDY

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Report No. 03-00101
Revision 0
April, 1978

INDIAN POINT UNIT 2
GENERATING STATION
BUCHANAN, NEW YORK
PIPING SYSTEMS
HYDRAULIC SHOCK SUPPRESSOR
REMOVAL STUDY

by

ASSOCIATED TECHNOLOGIES, INC.

for

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

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VERIFICATION OF DESIGN BY ANALYSIS

1. Project Identification : Indian Point Unit 2
Generating Station
2. Work Description : Report on removal of hydraulic
snubbers through review and
comparison with Unit 3
3. Revision and Date : 0 - April, 1978
4. ATI Reference : 03-001

This report covers items relating to nuclear safety. In accordance with rigorous procedures, the quality of the work has been assured through proper checking and this certifies that the work has been performed, checked, and approved as noted hereon.

Performed by Sal Sclafani/Lou Liang-Jy Date July 11, 1978
Sal Sclafani/Lou Liang-Jy

Checked by Sidney Austin Date July 14, 1978
Sidney Austin

Approved by Oscar P. Wong Date July 20, 1978
Oscar P. Wong

CERTIFICATION

The undersigned, a registered Professional Engineer, competent in the field of piping analysis, certifies that the report presented herein, for selected piping systems of Indian Point Generating Station Unit No. 2 which were found to be similar to corresponding systems of Unit No. 3 meets the requirements of the criteria presented herein.



Oscar P. Wong
O. P. Wong

State of New York

Registration Number 050726

August 14, 1978
Date

INTRODUCTION

This report, prepared by Associated Technologies, Inc. (ATI), provides the results of the first phase of a review of hydraulic snubbers on Indian Point Generating Station Unit No. 2. This report covers only those systems which were found to be of geometrically similar* configuration to that of Unit No. 3. A comparison of the lines and their support details provides the basis for removing or changing hydraulic snubbers on Unit No. 2, and where necessary, for modification of existing supports.

This task was requested by Consolidated Edison Co. of New York, Inc. (Con Ed) in order to reduce the number of snubbers being used on Unit No. 2. Indian Point Unit No. 3, although of similar design to Unit No. 2, has a significantly fewer number of hydraulic snubbers used in the plant. Physical examination and testing procedures required by the NRC for the hydraulic snubbers has led to exposures in high radiation areas of personnel and to excessive time requirements during periods of outage. This has prompted the review, and the results of this work are based on a study of the as-built drawings and available analytical data supplied by Con Ed. No new seismic dynamic computerized analyses have been carried out for the work presented in this report.

The results of this study indicate that a large number of hydraulic snubbers can be removed from their pipelines based on comparison with similar lines in Unit No. 3. It is further realized that more snubbers can be removed from Unit No. 2 if thermal and dynamic analyses are performed on the remaining lines.

*"similar" means "identical" for the purpose of analysis

However, this requires computerized thermal and/or dynamic analysis since the line configuration is dissimilar to that found in Unit No. 3, and this will be covered in a future report. This basic report is provided in a general format which covers all the similar lines systems and includes the overall description, problem definition, assumptions, conditions, recommendations.

The appendices address themselves to specific lines and the details of these findings are provided in these appendices. Each of these appendices are independent blocks of data and recommendations and may be extracted from the basic report for documentation or discussion purposes.

DESCRIPTION

The Indian Point Generating Stations, Units 2 and 3, are located at Buchanan, New York, and although designed and constructed at different times are of basically the same design. Overall layout of the major equipment and much of the piping are identical, but because of advances in technology in the intervening years, changes in routing were made on some Unit 3 safety related piping. Also on Unit 3, a more definitive method of analysis produced lower and more predictable loadings due to a postulated seismic event resulting in a significant reduction in the use of snubbers.

Both plants are on the same bed rock and structurally the buildings, foundations, and main structural elements are essentially the same. The seismic responses of both plants will therefore be essentially identical.

Unit No. 3 was designed based on dynamic analysis for lines equal to or greater than 6" IPS and for all high energy safety injection lines. Other lines less than 6" IPS were designed by span tables, based on appropriate floor response spectra. This latter set of tables was acceptable to the NRC for the design of Unit 3 and represents an advancement in the technology of seismic design that leads to larger spans and fewer snubbers. If Unit 2 pipe systems approximate Unit 3 systems, then the excess hydraulic snubbers in Unit 2 may be eliminated without affecting plant safety based on application of the previously accepted Unit 3 criteria.

Most of the major piping systems were routed similarly with a comparable support configuration. In some cases the only difference is the presence of additional snubbers in Unit No. 2. In other cases, the support locations and types differ even though the line configuration is similar. Around the pump areas where a relatively large number of snubbers are located on Unit 2, the piping configuration is significantly different.

The lines inside containment which are seismically restrained by snubbers and which are being considered in this report range in operating temperature levels from ambient up to a possible 605 degrees Fahrenheit.

PROBLEM DEFINITION

Because of the reasons outlined in the description, there are significantly more snubbers in Unit 2 than in Unit 3. The maintenance requirements on the existing large number of snubbers have been proven to be a great burden and result in significant personnel radiation exposures as well as expenditure of time and effort for assuring proper functioning. It has been proven through rigorous analysis and advanced technological procedures that these snubbers are not necessary in the quantities utilized on Unit 2, as demonstrated on Unit 3.

This report covers only that portion of the Unit 2 review based on comparison with Unit 3, and no dynamic seismic analyses were performed. The basic requirements are summarized as follows:

1. Compare configuration and geometry between Units 2 and 3 and note differences, if any.
2. Compare support and restraint types and locations between Units 2 and 3 and note differences, if any.
3. Review load distribution on supports if changes are recommended to assure that existing Unit 2 supports are adequate.
4. Provide recommendations to Con Ed for updating unit support configuration to match Unit 3 enabling removal of snubbers from Unit 2.

ASSUMPTIONS AND CONDITIONS

This report has been prepared in accordance with the assumptions and conditions outlined herein. The engineering study has been performed in accordance with good engineering practice and established quality assurance procedures. In accordance with the above, the following items provide a summary of the assumptions and conditions under which this work was performed, the units evaluated, and the basic recommendations made:

1. The existing Unit 2 line configuration and support condition is acceptable as is for all loading conditions.
2. All data supplied on drawings for Units 2 and 3 reflect the actual conditions.
3. The designs of Unit 3 are valid and resulting stresses and displacements are acceptable.
4. Justification for Unit 2 support changes lie in direct comparison, engineering judgement, and reasonable analytical bases without a rigorous computer analysis.
5. Where there are conflicts between drawings, the as built issue with the latest revision is used.

6. Unit 3 is designed to a later code revision with more stringent code requirements than Unit 2. Therefore, Unit 3 analyses for any line will be satisfactory for Unit 2 lines with similar configuration and similar hanger and restraint design.

CRITERIA

This section outlines the criteria and bases on which the study and the recommendations for removal and replacement of hydraulic snubbers were made for Indian Point Unit No. 2. The content of this criteria draws heavily upon the safety evaluation report by the NRC supporting Amendment No. 39 to Facility Operating License No. DPR-26. This evaluation report reflects ATI's engineering conclusions which strongly advocates the reduction of hydraulic snubbers on Indian Point Unit No. 2.

The purpose of any support system for piping or equipment is to provide for reliability during operation of that system. At the outset, it was thought that hydraulic snubbers were an excellent and complete answer to the problem of supports for seismic loading as opposed to the requirements for thermal movements during operation of a plant. Unfortunately, it has been shown that hydraulic snubbers have a potential for leakage. This potential makes them inherently less reliable than passive restraints and thus obviates the initial premise in which support systems should improve and assure the reliable operation of any given system.

In the original design of the subject Indian Point Unit No. 2 pipe lines, hydraulic snubbers were used more extensively than would be necessary with current piping analysis methods. The redesign of the support systems of the subject lines is based on a comparison of these lines with comparable lines in Indian Point Unit No. 3. The geometry and operating conditions of the lines are similar for both Units, but the selection and location of supports and restraints was improved in Unit No. 3 by means of more rigorous and detailed analyses. To utilize the improved Unit No. 3 design in Unit No. 2, the

support systems have been redesigned so that piping and supports are represented by the same analytical conditions found in the Unit No. 3 analyses.

The Unit No. 3 piping support systems were analyzed with respect to seismic loads for the Operating Basis Earthquake and the Safe Shutdown Earthquake of 0.10 g and 0.15 g, respectively. The modified earthquake time histories used for the design of support systems were adjusted in amplitude and frequency to envelope the response spectra for the site. Thus the support systems for Unit No. 3 are adequate to protect the piping against seismic events. Changes to the Indian Point Unit No. 2 piping support systems are acceptable because of the similarity of the two Units and their piping systems. On some of the piping involved the snubbers will be replaced with passive restraints. On other lines the snubbers will be deleted where analysis of similar lines at Indian Point 3 has shown that no piping restraints are necessary.

The reliability of the piping system will be increased by this modification of support systems because the number of hydraulic snubbers, which require frequent inspection to assure operability, will be reduced. This modification will, therefore, reduce the potential of a piping failure due to a malfunction of the support system.

RECOMMENDATIONS AND CONCLUSIONS

Based on the work performed for the lines identified, ATI recommends that the work outlined in the appendices for each line be completely carried out. It should be noted that there are two phases on three of the lines in which certain snubbers may be removed without any further work since they are redundant relative to the comparable lines on Unit 3. If, however, the recommendations are followed for removal of other snubbers on these three lines and the remaining systems, it should be clearly noted that all the recommendations for support changes and locations must be carried out in accordance with the statements in this report. The adherence to all work outlined in this report will result in a line configuration and stress condition similar to that of Unit 3. Based on item 3 of "Assumptions and Conditions" above, these changes will not adversely affect the safety and integrity of the lines and will, in fact, enhance the safe operation of the lines.

A tabular summary of the recommendations covered in this report follows. The detailed recommendations and required modifications will be found in the appendices.

SUMMARY OF HYDRAULIC SNUBBER REVIEW FOR REMOVAL

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
9	SR-801	X			Per Unit 3
	-802	X			"
	-803	X			"
	-803A	X			"
	-804	X			"
	-805		X		Replace with Anchor
	9-SR-1	X			Per Unit 3
10	SR-807			X	Per Unit 3
	-807A	X			Per Unit 3 but ACH 222 must be rigid rod
	-807B	X			"
	-807C	X			"
	-808	X			Per Unit 3 but ACH 223 must be rigid rod
	-809			X	Per Unit 3
	-809A			X	" - Must change ACH 224 to rigid rod
	-810	X			"
	-811	X			" - Must change ACH 226 to rigid rod
79	SR-901	X			Per Unit 3
	-902			X	"
	-903		X		Convert to rigid link
	-904	X			Alter PWR-49 per No. 3: CH-H&R-79-5-U
	-905	X			
	-906	X			Per Unit 3
	-907			X	"
	-908			X	"
	-909	X			Add U-bolt per No. 3: CH-H&R-79-10-U
	-910	X			(at location between SR909 & 910)
	-911	X			Per Unit 3
	-911A		X		Add U-bolt per No. 3: CH-79-11-G

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UNIT NO. 2
HYDRAULIC SNUBBER REVIEW

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SUMMARY OF HYDRAULIC SNUBBER REVIEW FOR REMOVAL

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
80	SR-920B	X			See comments on SR-920A
	-915B	X			Per Unit 3
	-916		X		Convert to rigid link
	-917 *	X			Per Unit 3
	-919 *	X			"
	-920 *	X			"
	-920A			X	Must be moved east of valve per Unit 3
96	SR-912 *	X			Per Unit 3
	-913		X		Convert to rigid link
	-914 *	X			Per Unit 3
	-915 *	X			"
	-915A *	X			"
356	356-SR-1	X			Convert SIH-176 to sliding base support
	SR-708	X			See SR-747
	-714	X			3 Hydraulics can be removed if SR-716 is retained per Unit 3, 7'-0" west of Column 16
	-715	X			
	-716		X		
	-717	X			
	-718	X			Relocate SR-718A per Unit 3: SI-R-356-4-H & revamp SIH-174 to act as a guide radially, & rigidize SIH-174A
	-718A		X		
	-719 *	X			Make sure SIH is anchor as required by design
	-720			X	Per Unit 3
	-747	X			SR's on Line #361 will control
27	SR-898		X		Add U-bolt Guide similar to CH-R-27-35-G of Unit 3.
352	352-SR-2		X		Add E-W guide at PWR-153 per Unit 3
	SR-713	X			Per Unit 3
	PWR-152			X	Per Unit 3

* May be removed with no further action.

SUMMARY OF HYDRAULIC SNUBBER REVIEW FOR REMOVAL

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
MS-3	SR-499			X	Per Unit 3
	-500		X		Replace with a guide similar to MS-R-1027-2-G of Unit 3
	-501			X	Per Unit 3
	-501A	X			Per Unit 3
	-501B	X			Per Unit 3
	-502	X			Per Unit 3
	-503			X	Per Unit 3
	-503A	X			Per Unit 3
	-503B	X			Per Unit 3
	-504	X			Per Unit 3
	-505		X		Replace with a guide similar to MS-R-1027-6-G of Unit 3
	-506		X		Replace with a guide similar to MS-R-1027-9-G of Unit 3 at Elevation 53'0"
	-507		X		Replace with RSSA
	-507A		X		Replace with RSSA
	-507B		X		Replace with RSSA
	-507C		X		Replace with RSSA
	-M20A		X		Replace with RSSA
	-M20B		X		Replace with RSSA
	-M21A		X		Replace with RSSA
	-M21B	X			Per Unit 3
	-M22A	X			Per Unit 3
	-M22B	X			Per Unit 3
	-M23B	X			Per Unit 3
	-M24	X			Per Unit 3

- NOTE: 1. An hydraulic snubber similar to MS-R-1027-7-H of Unit 3 should be added to Elevation 55'-10" between the 2 risers.
2. The supports MS-460 & MS-461 should be converted from sliding supports to anchors as in Unit 3.

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UNIT NO. 2
HYDRAULIC SNUBBER REVIEW

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SUMMARY OF HYDRAULIC SNUBBER REVIEW FOR REMOVAL

LINE NO.	SNUBBER IDENTIFI- CATION	REMOVE REPLACE LEAVE IN	COMMENTS
5	SR-B3	X	Per Unit 3
	-B4 *	X	Per Unit 3
	-B9 *	X	Per Unit 3
6	SR-B1	X	Per Unit 3
	-B2 *	X	Per Unit 3
7	SR-B7	X	Per Unit 3
	-B8 *	X	Per Unit 3
8	SR-B5	X	Per Unit 3
	-B6 *	X	Per Unit 3
	-B10 *	X	Per Unit 3
16 & 56	SR-83B *	X	Redundant
	-83C	X	If U-Bolt type support is provided on header as shown
	-83E *	X	Redundant

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APPENDIX I
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 9

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 9

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DESCRIPTION

Line No. 9 runs from the residual heat removal pumps 21 and 22 to the residual heat exchangers 21 and 22. This appendix addresses itself to only that portion of the line inside containment, from the penetration to the heat exchangers. See isometric drawing number 03-IP2-1009A. It is a moderately hot line, so thermal loading is not as significant a problem as encountered on Line No. 10, a portion of which may go up to 605 degrees F. It is a 12-inch line from the containment penetration, around the crane wall area, and then penetrates the crane wall, after which the configuration of Unit 2 is different from that of Unit 3. See isometric drawing number 03-IP2-1009B. If we add an anchor at column line 11, it will isolate the piping system from that point to the containment penetration. This portion of the line will then be the same as Unit 3. The snubbers between this location and the penetration area can then be changed to reflect the Unit 3 condition, and all the snubbers are recommended to be taken out. From this anchor toward the area within which the pipe penetrates the crane wall and goes inside, on Unit 2 there is an additional anchor at the platform elevation 66'-0". On Unit 2 this portion of the line is different from that on Unit 3. However, the anchor at 66'-0" on Unit 2 provides for a separate line system, and our review indicates that the snubber can also be taken out in this region. The reasons are given below.

RECOMMENDATIONS

From the configuration check it is apparent that Unit 3 and Unit 2 support configurations are quite similar outside the crane wall, except for the fact that Unit 2 has additional snubbers. These should be taken out as follows:

SR-801	Remove as redundant per Unit 3.
SR-802	Remove as redundant per Unit 3.
SR-803	Remove as redundant per Unit 3.
SR-803A	Remove as redundant per Unit 3.
SR-804	Remove as redundant per Unit 3.
SR-805	Should be replaced by an anchor to match that of Unit 3.
9-SR-1	Remove as redundant per Unit 3.

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 9

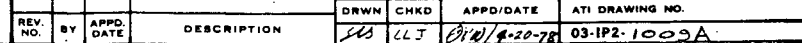
Sheet 2 of 2

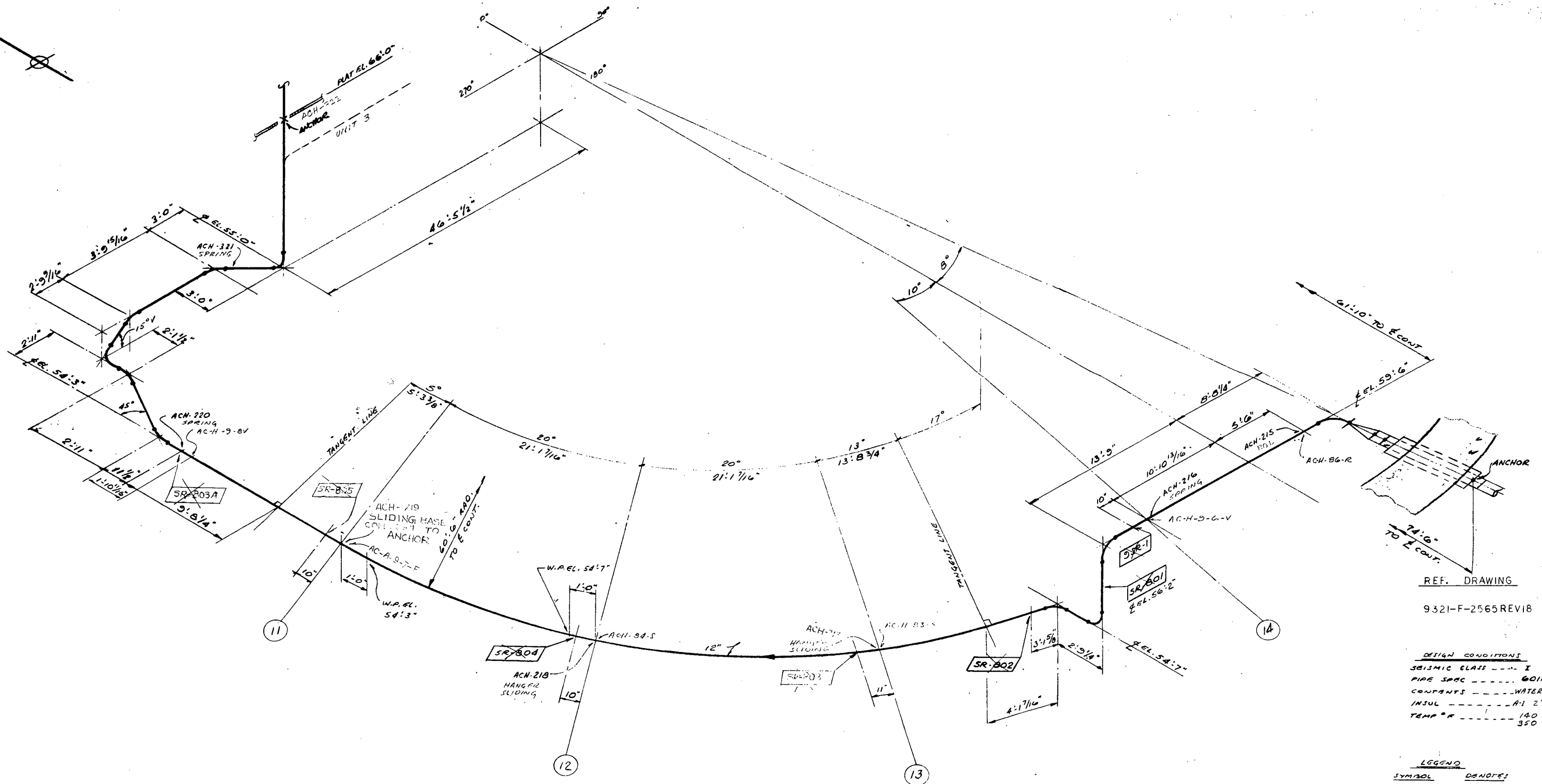
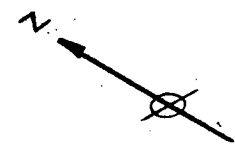
Report No. 03-00101

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April, 1978

Due to the fact that there is an anchor at column line 11 and at the platform at elevation 66'-0" inside the crane wall, this portion of the line can be treated separately. However, from the new anchor to the heat exchanger, the line for the two units differ. On Unit 2 this portion of the line is a much simpler run than on Unit 3, and is judged sufficiently flexible for thermal growth. Since Unit 3, which has more piping than Unit 2 in this area, does not require seismic snubbing, it is considered acceptable to remove SR-803A at this time with no further rework of this portion of the line. See isometric drawing 03-IP2-1009C. For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.





REF. DRAWING

9321-F-2565 REV18

DESIGN CONDITIONS

SEISMIC CLASS - I
PIPE SPEC - 601R
CONTENTS - WATER
INSUL - 1/2"
TEMP - 140
350

LEGEND

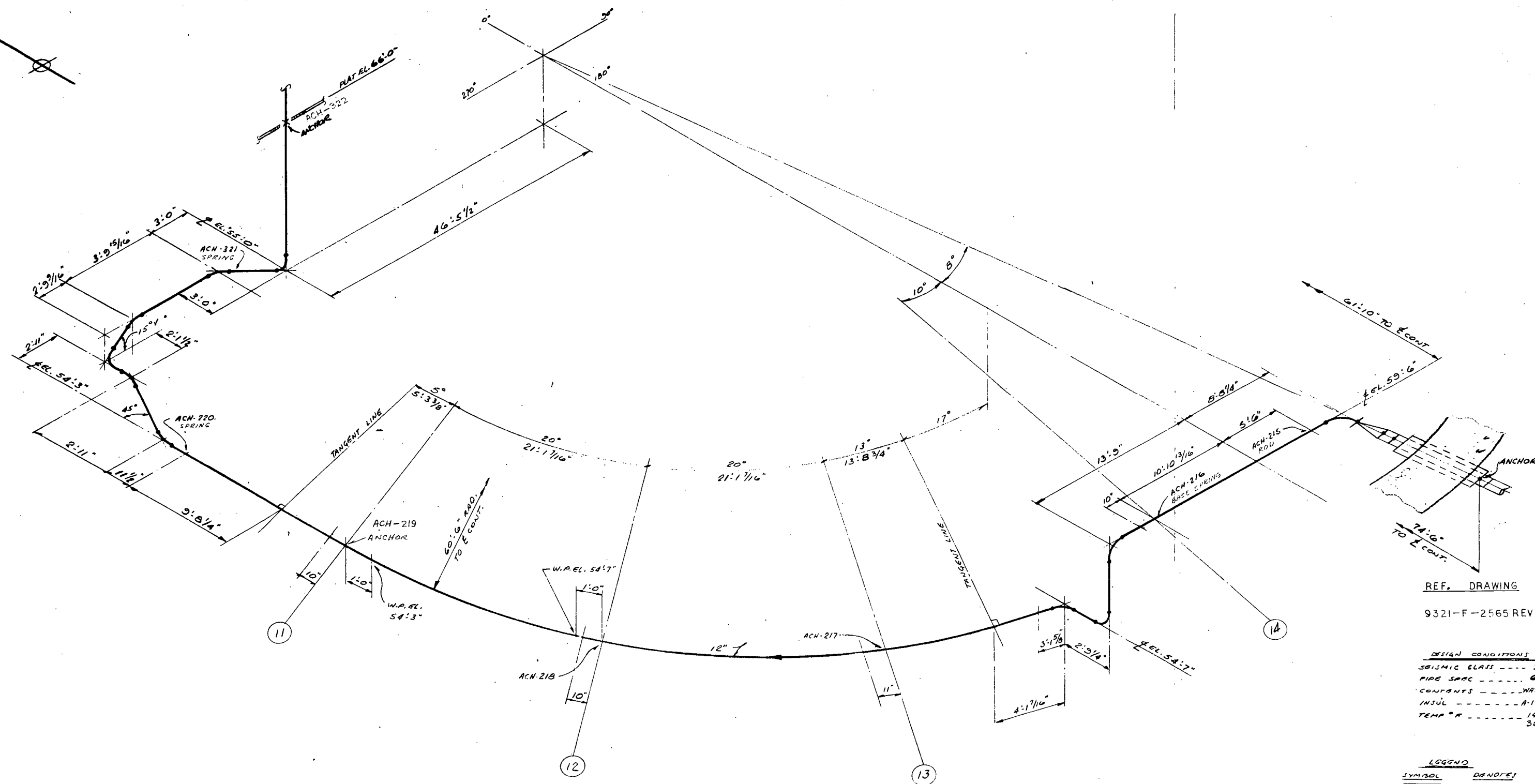
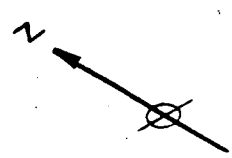
SYMBOL DENOTES
HYDRAULIC

SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.
FOR
CONSOLIDATED EDISON COMPANY

INDIAN POINT UNIT No. 2
HYDRAULIC SNUBBER REMOVAL STUDY
WITH UNIT 3 DETAILS
LINE NO. 9
INSIDE CONTAINMENT

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	JLS	4/20/78		JLS	LLJ	4/20/78	03-IP2-1009-B



REF. DRAWING
9321-F-2565 REV18

DESIGN CONDITIONS
SEISMIC CLASS - I
PIPE SPEC - 601R
CONTENTS - WATER
INSUL - A-1 2"
TEMP °F - 140
350

LEGEND
SYMBOL DRAFTER
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION			
LINE NO. 9			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
52	LL	07/14/80	03-IP2-1009C
DRWN	CHKD	APPD. DATE	ATL DRAWING NO.
52	LL	07/14/80	03-IP2-1009C

Report No. 03-00101

Revision 0

April, 1978

APPENDIX II

INDIAN POINT GENERATING STATION

UNIT NO. 2

HYDRAULIC SNUBBER REVIEW

LINE NO. 10

DESCRIPTION

Line No. 10 is a 14-inch line which runs from the hot leg of loop no. 22 to the containment penetration. There is a break in the pipe wall thickness at the second valve VA-730 about ten feet from the containment penetration. It changes in that area from a schedule 140 to a schedule 40. See isometric drawing number 03-IP2-1010A.

A thorough review of this line indicates that the configuration of Unit 2 line is identical to that of Unit 3. There are, however, some differences in the locations of the supports, all of which are considered minor since the largest difference encountered was only eight inches between Units 2 and 3. See isometric drawing number 03-IP2-1010B.

RECOMMENDATIONS

Based on the review performed, the line configuration and the support locations match those of Unit 3, and it is assumed that the analyses performed on the Unit 3 line are applicable to the Unit 2 line. On this basis, the following changes are recommended for Unit 2:

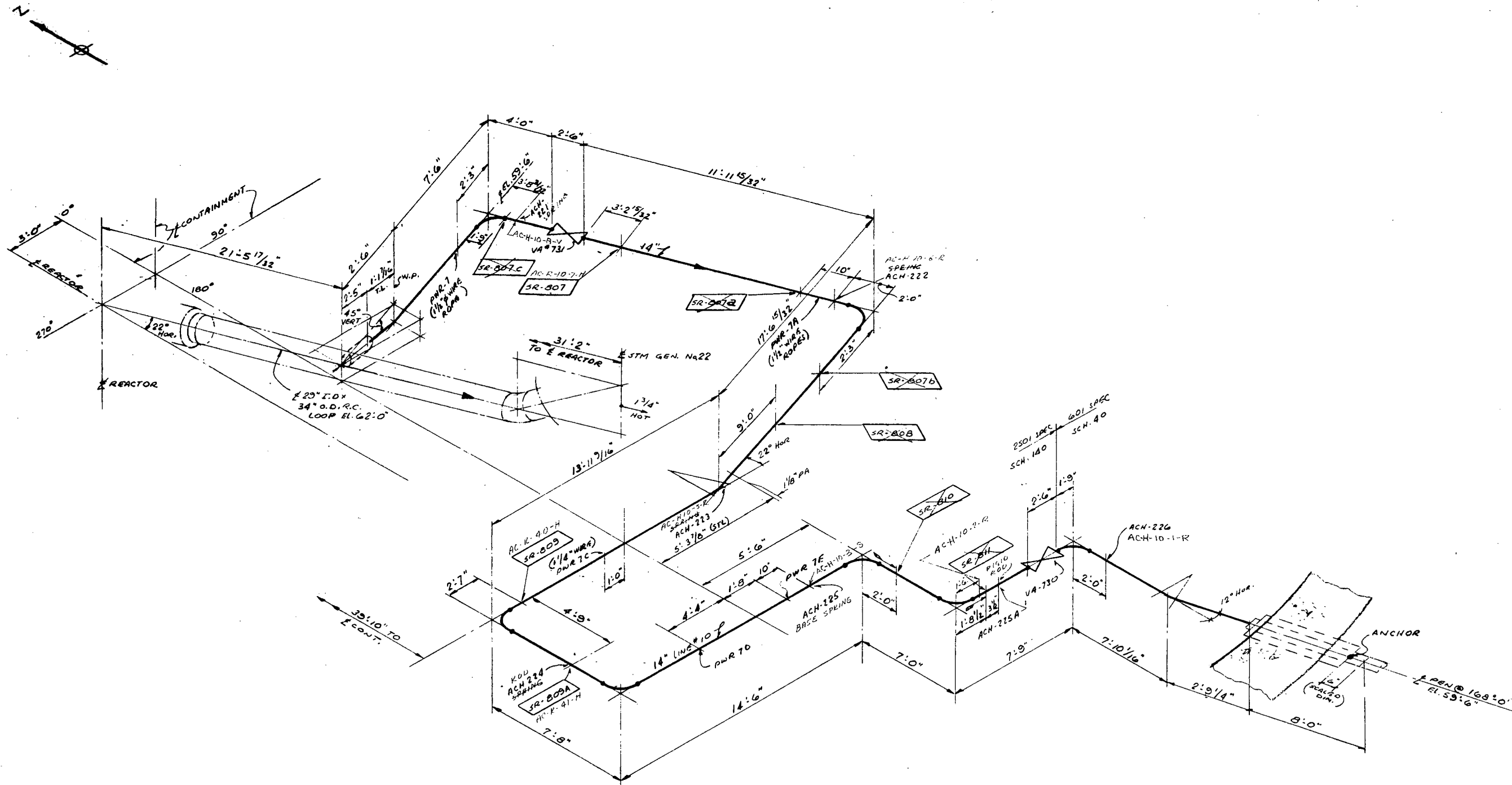
- | | |
|---------|--|
| SR-807 | This snubber should be left in place as it is required according to Unit 3. |
| SR-807A | Unit 3 has no snubbers in this area. However, the spring hanger ACH222 on Unit 2 should be changed to a rigid hanger. This may be accomplished by any means acceptable such as changing the system to a rod or fixing the pin in the spring can. |
| SR-807B | This may be removed according to Unit 3 and no other changes need be made. |
| SR-807C | This may also be removed with no further changes. |
| SR-808 | According to Unit 3, no snubber is required. However, spring hanger ACH223 on Unit 2 should be changed to a rigid hanger. |
| SR-809 | This snubber should be left in as required on Unit 3. |

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE 10

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- SR-809A This should also be left in as required by Unit 3 line. In addition, the spring hanger ACH224 on Unit 2 should be changed to a rigid hanger.
- SR-810 This is not required according to Unit 3 calculations and should be removed.
- SR-811 This snubber may be removed according to the analyses of Unit 3. ACH226 on Unit 2 is a spring and should be changed to a rod according to the requirements of Unit 3.

The above summarizes the recommendations on Line No. 10, which if carried out according to the items stated above, will match that of Unit 3 and those calculations will apply. See isometric drawing number 03-IP2-1010C. For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.



REF. DRAWING

9321 -F-2565 REV 18

DESIGN CONDITIONS

SEISMIC CLASS I
PIPE SPEC. 2501R
CONTENTS WATER
INSUL. A-1 2"
TEMP °F 120
605

LEGEND

SYMBOL Q&NOTES
HYDRAULIC

SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
WITH UNIT 3 DETAILS			
LINE NO. 10			
INSIDE CONTAINMENT			
DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
CLS	CLS	07/14/78	03-1P2-1910 B

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APPENDIX III
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 79

DESCRIPTION

Line No. 79 is a three-inch stainless steel line routed from the regenerative heat exchanger to the cross under leg of loop No. 21. This is a hot (550 degree F.) insulated line which is supported primarily by rod supports on Unit 3. This is due to the fact that the line is in a flexible configuration and is primarily in a given horizontal plane. See isometric drawing number 03-IP2-1079A. The routing of this line on Unit 2 is identical to that on Unit 3. Additionally, support locations are also quite similar. However, the types of supports are different. Changes are necessary to bring about a duplication of the Unit 3 configuration. A more detailed description of the type of work necessary to bring about this match is provided below.

RECOMMENDATIONS

The changes recommended for the Unit 2 line are all in accordance with the requirements for Unit 3. If these changes are carried out as recommended, the line configuration on Unit 2 will then completely match those of Unit 3. Since the basic assumption is that the stresses and analyses of Unit 3 are acceptable, it is considered that the Line No. 79 will be completely acceptable from a stress, displacement, and dynamic point of view if all the changes recommended are carried out. The specific changes are basically the removal of snubbers and in some cases the replacement by U-bolt supports and guides in place of certain rod supports in Unit 2. The following work is to be performed on Line No. 79 in order to have it reflect the configuration on Unit 3:

- | | |
|--------|--|
| SR-901 | Remove from the line in accordance with Unit 3. |
| SR-903 | Convert to rigid support. |
| SR-904 | Remove this support and alter pipe whip restraint PWR-49 as in Unit 3, which in effect is to make it act as a guide. |
| SR-905 | Remove in accordance with Unit 3. This hydraulic snubber in conjunction with SR-904 together are taken care of by the adjustment to PWR-49. |
| SR-906 | Remove in accordance with Unit 3. |
| SR-909 | Remove and add a U-bolt in accordance with Unit 3. This U-bolt is located as indicated on drawing number 03-IP2-1079C between SR-909 and SR-910. |

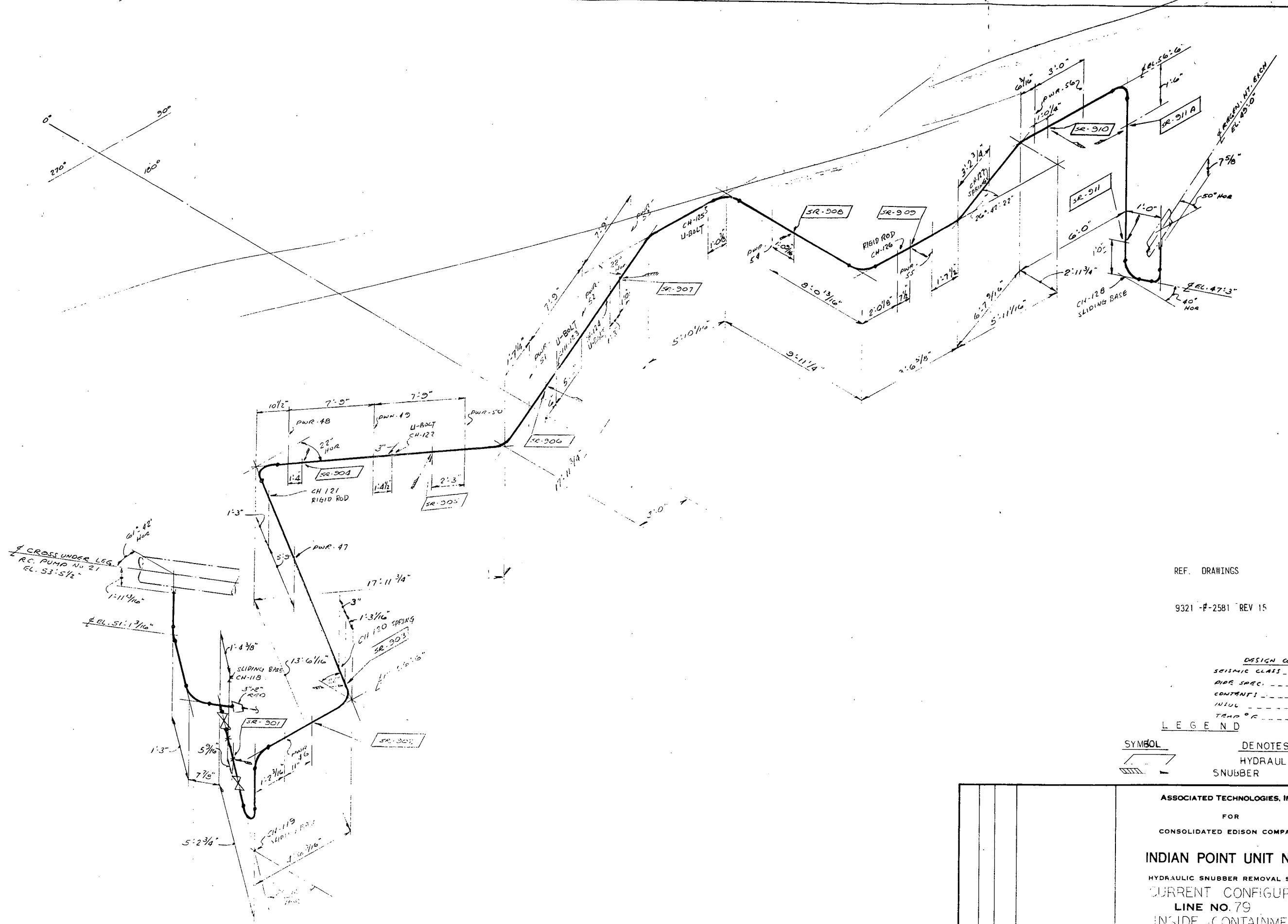
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 79

Sheet 2 of 2
Report No. 03-00101
Revision 0
April, 1978

SR-910	Remove in accordance with Unit 3.
SR-911	Remove in accordance with Unit 3.
SR-911A	Remove and add a U-bolt in accordance with Unit 3 at the location indicated on drawing number 03-IP2-1079C.

It should be noted from above that of the existing snubbers on this line, three are being left in place. This is as indicated on Unit 3. A review of the subsequent forces generated on the three snubbers as opposed to the original 12 snubbers indicates that the existing snubbers will be adequate for the dynamic forces generated in accordance with Unit 3.

ATI recommends that all of the work indicated above be carried out as described in order to have Unit 2 Line No. 79 match that of Unit 3. Since the line configuration and the support locations and types will then exactly match Unit 3, this line is considered completely acceptable as changed. For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.



REF. DRAWINGS

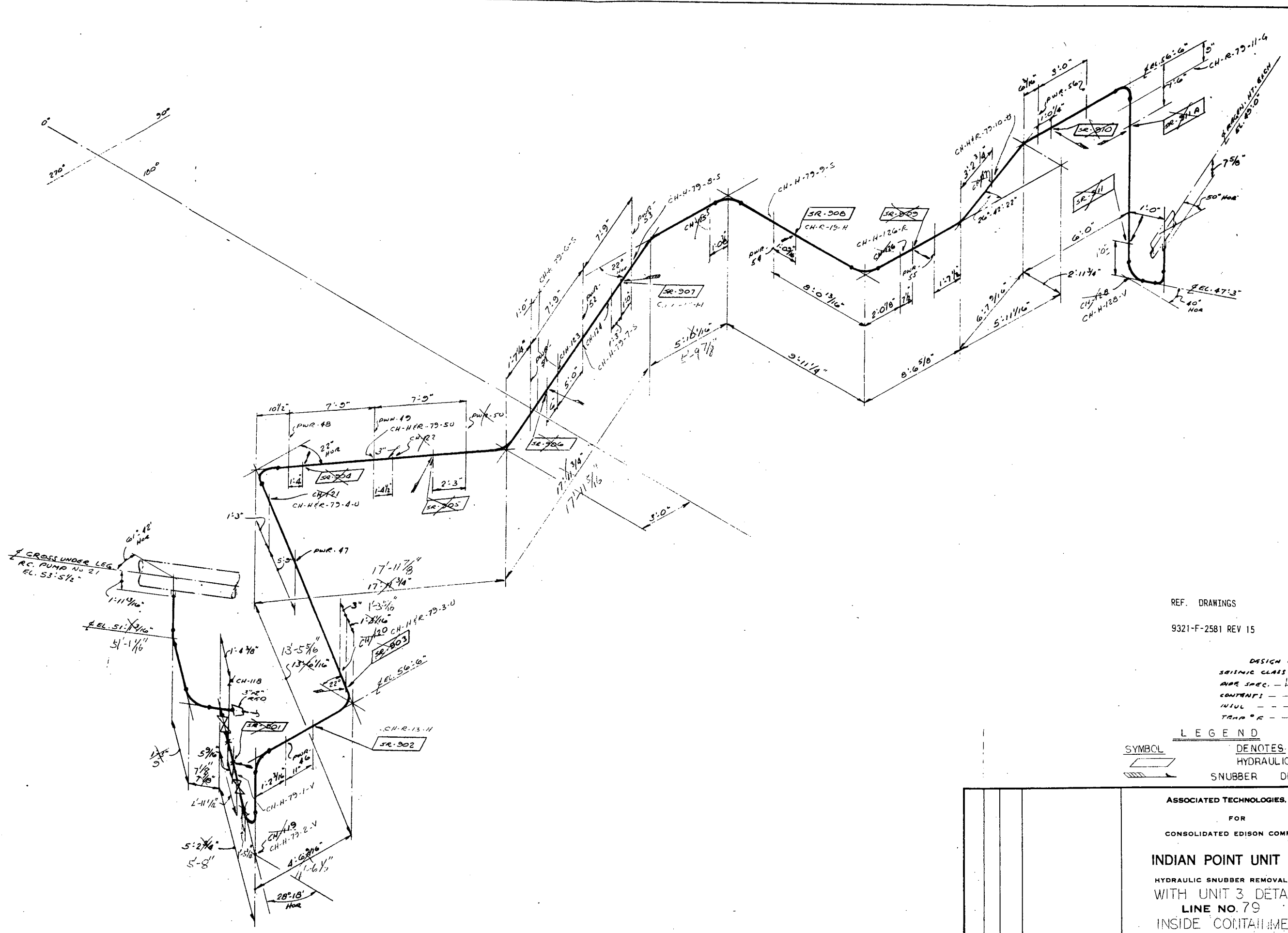
9321 -P-2581 REV 15

DESIGN CONDITIONS
 SEISMIC CLASS I
 PIPE SPEC. 2501R
 CONTENTS WATER
 INSUL 2" A3
 TEMP °C 550

LEGEND

SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER
	DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY CURRENT CONFIGURATION LINE NO. 79 INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	ATI	03/14/78	03-IP2-1073m



REF. DRAWINGS

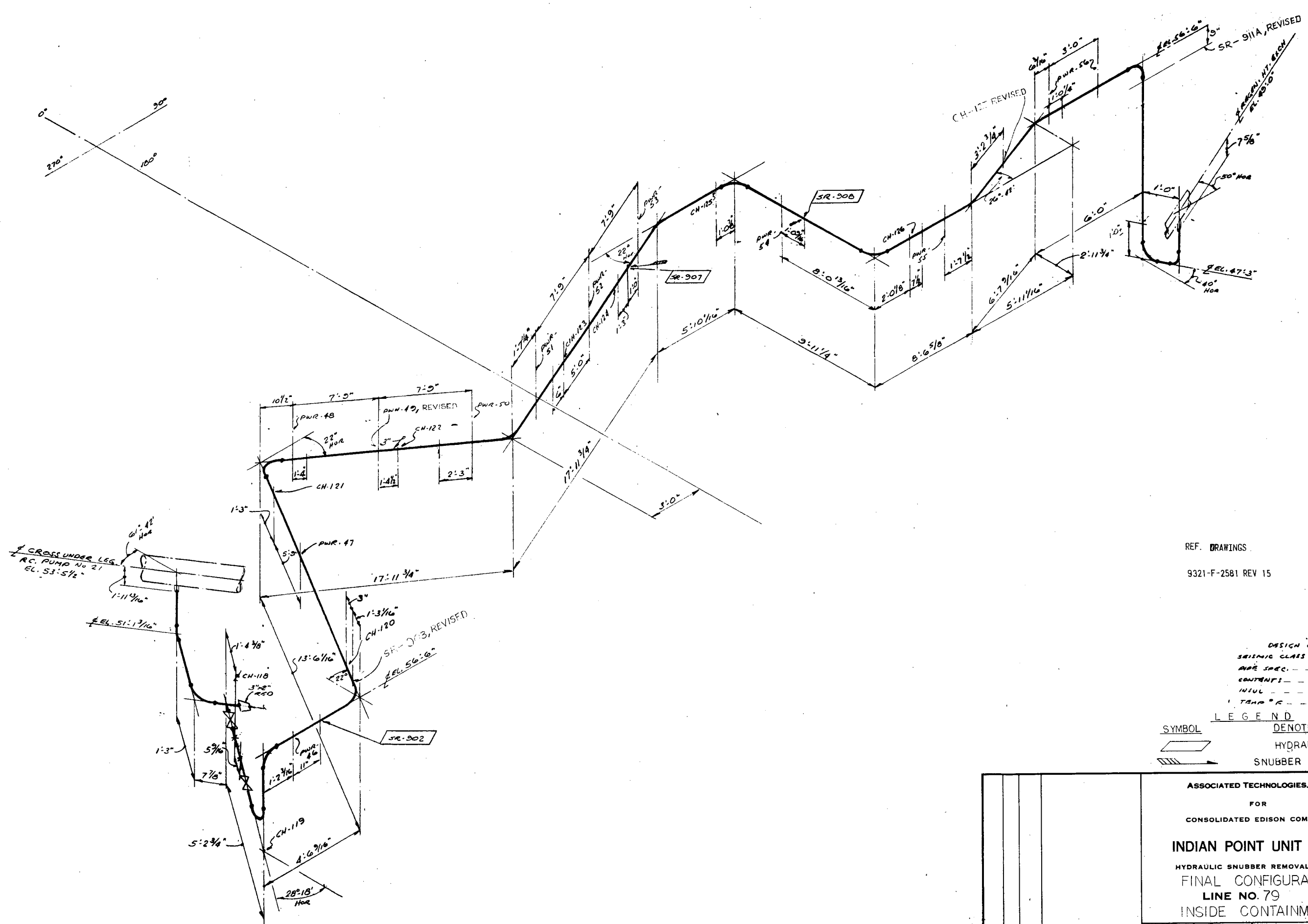
9321-F-2581 REV 15

DESIGN CONDITIONS
SEISMIC CLASS - I
PIPE SPEC. - 2501R
CONTENTS - WATER
INUL - 2" A3
TEMP °R - 550

LEGEND

SYMBOL DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
WITH UNIT 3 DETAILS			
LINE NO. 79			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	CLJ	07/04/20-78	03-IP2-1075 B



REF. DRAWINGS
9321-F-2581 REV 15

DESIGN CONDITIONS
SEISMIC CLASS - I
WAVE SPEC. - 2501R
CONTENTS - WATER
INUL - 2" A3
TEMP - 550

LEGEND
SYMBOL DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION			
LINE NO. 79			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	CLJ	07/04/2078	03-IP2-1079C

Report No. 03-00101
Revision 0
April, 1978

APPENDIX IV
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 80

DESCRIPTION

Line No. 80 is a three-inch diameter stainless steel line routed from the regenerative heat exchanger to steam generator #2 through the hot leg of loop #2. See attached isometric drawing number 03-IP2-1080A. The line is routed similarly to that of Unit 3 except for a slight difference in the top of the vertical leg from elevation 47'-3" to 58'-0". See the attached isometric drawing number 03-IP2-1080B in which a 45-degree slope is indicated for Unit 3.

The support configuration is similar; however, there are slight variations which are acceptable and which do not negate the validity of the comparison. Isometric drawing number 03-IP2-1080B provides a superimposed support configuration which reflects both the actual Unit 3 condition and the proposed recommendations. Finally, the proposed acceptable configuration with the maximum number of hydraulic snubbers removed and a minimum of rework is shown on isometric drawing number 03-IP2-1080C.

The engineering considerations suggested for line 80 are summarized below in which two phases are considered. The first addresses itself to the immediate removal of three snubbers with no additional work, while the second constitutes a more complete changeover to remove additional snubbers.

Phase I

Based on the assumption that the line is currently adequately supported for all load conditions as shown on the drawings, there are three snubbers which may be immediately removed and no further action taken. These are located very close to the regenerative heat exchanger. Unit 3 Line 80 has no seismic restraints between the regenerative heat exchanger and U-bolt support No. CH-H&R-80-2-U which corresponds to the same location as SR-916 on Unit 2. All snubbers on Unit 2 in this region serve no useful purpose seismically and may be removed immediately with no further action. These are SR-917, SR-919, and SR-920.

Phase II

This phase includes the reworking of supports which brings about the removal of additional snubbers on the system. A discussion of the effect on each load condition follows.

Gravity:

Although the gravity support locations differ slightly in the line at elevation 58'-0", the load distribution is considered to be equivalent for the following reasons:

1. Unit No. 3 spring hanger CH-H-80-1-V and CH-H-133-S duplicate the combined support distribution provided by Unit No. 2 supports
 - a) sliding base CH-133
 - b) vertical guide SR-918
 - c) rod hanger CH-132
2. Addition of a U-bolt support in place of SR-916 will additionally help in the distribution.
3. Unit No. 2 rod hanger CH-130 is less than two feet from Unit No. 3 rod hanger CH-H-80-3-R and are both right by the elbow.
4. Unit No. 3 has spring hangers on both sides of valve 204A. ATI recommends that this additional spring support be added.

Thermal:

The existing flexibility of this line will be slightly stiffened by the U-bolt replacing SR-916. To compensate for this, the U-bolt SR-918 should be loosened to allow 2" thermal movement south while still maintaining east-west restraint.

Earthquake:

After all changes recommended for line 80 are carried out, the seismic support system on Unit 2 will be at least equal to that of Unit 3. An additional existing support on Unit 2 will provide more seismic restraint.

RECOMMENDATIONS

The following work to be performed on Line No. 80 in order to have it reflect as close as possible the support configuration on Unit 3 includes the work which is recommended in Phase I.

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 80

Sheet 3 of 3
Report No. 03-00101
Revision 0
April, 1978

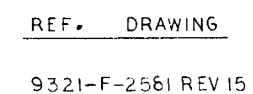
1. Remove SR-920.
2. Remove SR-919.
3. Loosen U-bolt SR-918 for thermal movement as requested.
4. Remove SR-917.
5. Convert SR-916 to a rigid link.
6. Remove SR-915B.
7. Remove SR-920B
8. Adjust SR-920A to the east side of the valve No. 204A.
9. Add a spring hanger on the east side of the valve.

This information is summarized on the attached sheet and also indicated graphically on isometric drawing number 03-IP2-1080C.

Phase I work can be effectively prosecuted immediately without affecting the integrity of the line.

Phase II work will require rework of existing supports and addition of new supports in order to remove the other three snubbers.


For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.

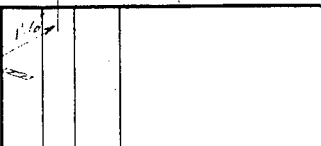


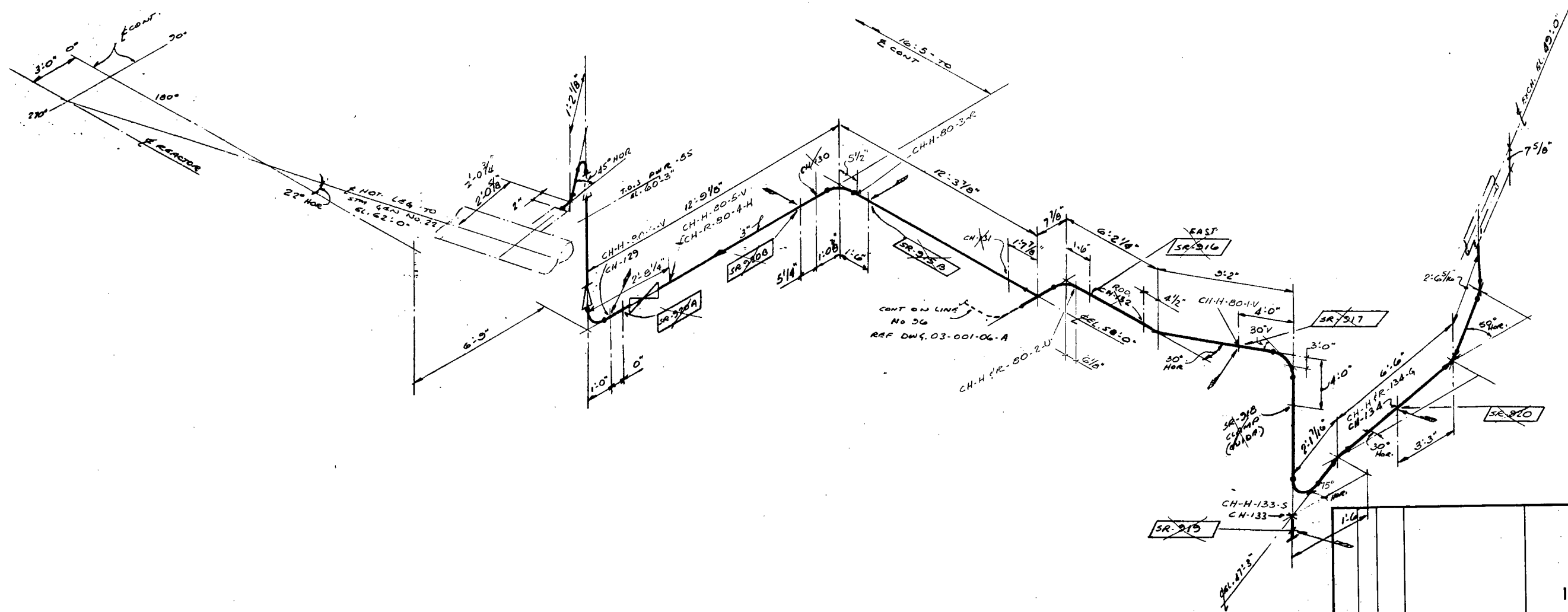
DESIGN CONDITIONS

SEISMIC CLASS I
PIPE SPEC. . . . 250IR
CONTENTS WATER
INSUL 2" A3
TEMP ° F 495
610

LEGEND

<u>SYMBOL</u>	<u>DENOTES</u>
	HYDRAULIC SNUBBER DIRECTION

				<p align="center">ASSOCIATED TECHNOLOGIES, INC.</p> <p align="center">FOR</p> <p align="center">CONSOLIDATED EDISON COMPANY</p>			
				<p align="center">INDIAN POINT UNIT No. 2</p>			
				<p align="center">HYDRAULIC SNUBBER REMOVAL STUDY</p>			
				<p align="center">CURRENT CONFIGURATION</p>			
				<p align="center">LINE NO. 30</p>			
				<p align="center">INSIDE CONTAINMENT</p>			
REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
				1st		APR 11-20-78	03-IP2-1050A



REF. DRAWING

9321-F-2581 REV 15

DESIGN CONDITIONS

SEISMIC CLASS --- I
PIPE SPEC. --- 2501R
CONTENTS --- WATER
INSUL --- 2\"/>

LEGEND

SYMBOL DENOTES
[Box with arrow] HYDRAULIC
[Box with arrow] SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.

FOR

CONSOLIDATED EDISON COMPANY

INDIAN POINT UNIT No. 2

HYDRAULIC SNUBBER REMOVAL STUDY

WITH UNIT 3 DETAILS

LINE NO. 80

INSIDE CONTAINMENT

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
1	CLJ	03/14/78		CLJ	CLJ	03/14/78	03-IP2-10208

Report No. 03-00101
Revision 0
April, 1978

APPENDIX V
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 96

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 96

Sheet 1 of 1
Report No. 03-00101
Revision 0
April, 1978

DESCRIPTION

Line No. 96 is a three-inch stainless steel line which routes charging water from the regenerative heat exchanger to the cold leg of loop No. 21. It is an insulated line and is tied into Line No. 80 which is also a part of this report. The line configuration of Unit 2 is the same as that for Unit 3 with the minor difference of an additional valve on Unit 3 at the junction with the cold leg. See isometric drawing number 03-IP2-1096B. The locations of supports are similar on both units with the only exception being an additional spring support on Unit 2. See isometric drawing number 03-IP2-1096A. The Unit 3 line is without any snubbers.

Phase I

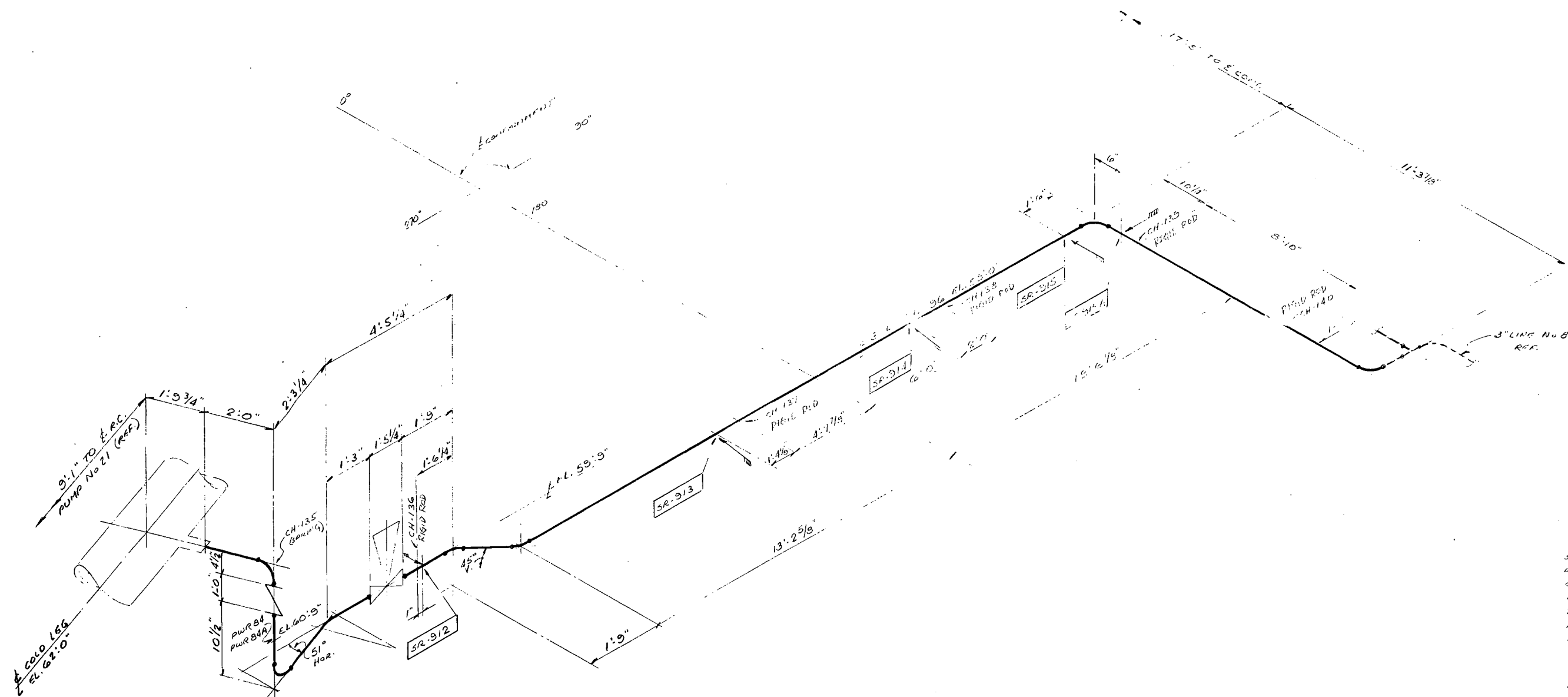
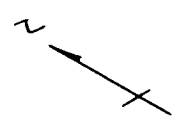
The Unit 3 Line No. 96 shows no snubbers required for seismic loading and four of the five shown on Unit 2 are redundant according to Unit 3 calculations. The fifth snubber must be left in place and its action in conjunction with the rigid rod CH-137 duplicates that of the U-bolt support CH-H&R-96-1-U on Unit 3. The four snubbers SR-912, SR-914, SR-915, and SR-915A may be removed immediately with no further action required.

Phase II

This phase entails a single change of support CH-137 on Unit 2 to a U-bolt support similar to that on Unit 3 support CH-H&R-96-1-U. The U-bolt provides the same restraint characteristics of the existing snubber and rod combination currently on Unit 2. Therefore, SR-913 can be removed. The thermal effect is considered acceptable based on the initial assumption that Unit 3 line configuration and supports are acceptable. Final configuration is shown on isometric drawing number 03-IP2-1096C. The additional spring support on Unit 2 is close to the cold leg junction and its effect on the thermal and dynamic analyses would be negligible.

RECOMMENDATIONS

Phase I work is self-evident in its simplicity since it requires only removal of four snubbers. The fifth snubber should also be removed since it entails only a change to a U-bolt on existing structural accessibility. The interim condition in which only one snubber is left in place is acceptable since the dynamic loads calculated on Unit 3 are nominal and the snubber is more than adequate for the postulated earthquake response load. For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.

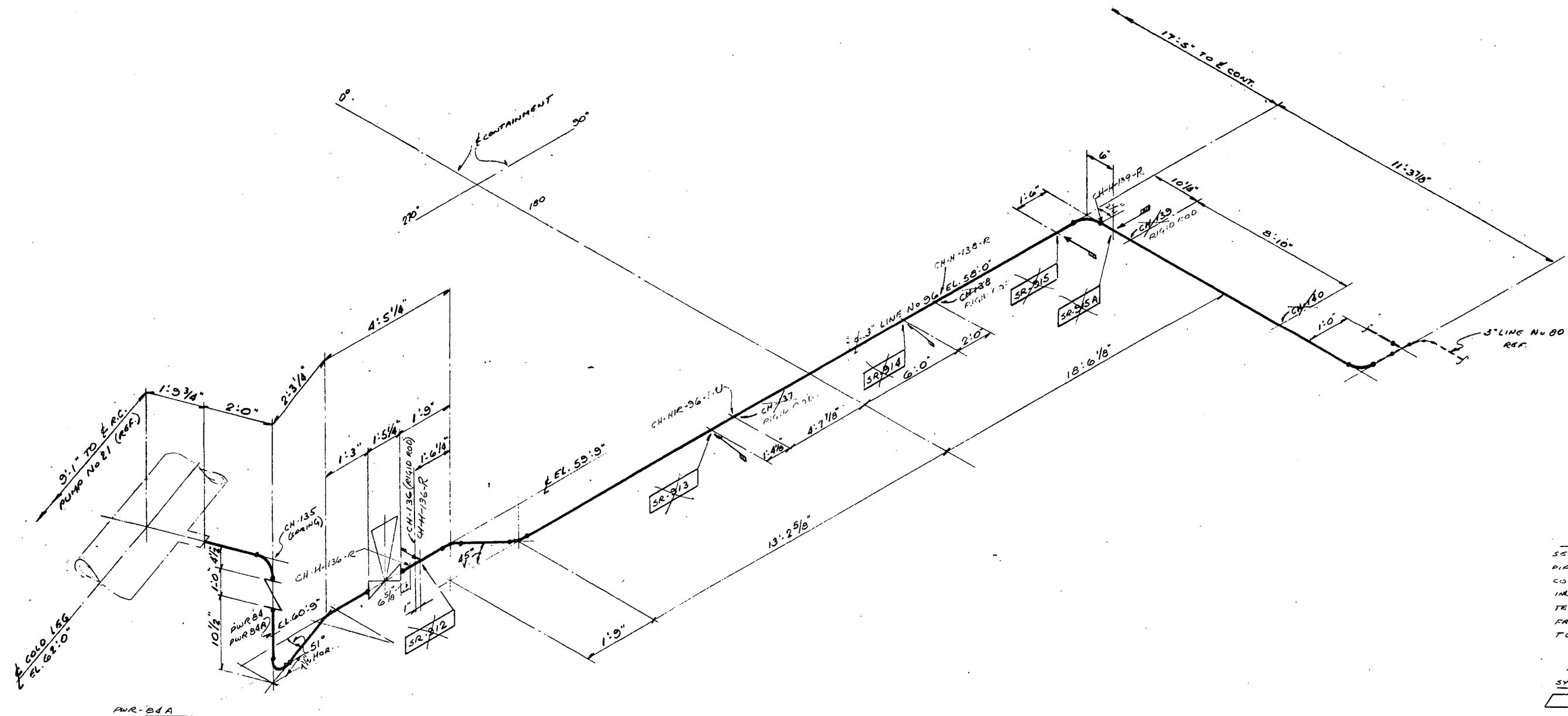


DESIGN CONDITIONS
SEISMIC CLASS ----- I
PIPE SPEC. ----- 25012
CONTENTS ----- WATER
INSUL ----- 2" A3
TEMP. "F" ----- 495 SSC
FROM ----- COLD LEG RC PUMP NO 21
TO ----- LINE NO 80

LEGEND
SYMBOL DENOTES
[Symbol] HYDRAULIC
[Symbol] SNUBBER DIRECTION

REF. DWG.
9321-F-2581 REV. 15

ASSOCIATED TECHNOLOGIES, INC.				FOR			
CONSOLIDATED EDISON COMPANY				INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY				CURRENT CONFIGURATION			
LINE NO. 96				INSIDE CONTAINMENT			
REV. NO.	BY	APPRO. DATE	DESCRIPTION	DRWN	CHKD	APPRO. DATE	ATI DRAWING NO.
1	LLJ	11/10/98		LLJ	LLJ	11/10/98	03-IP2-1096A



DESIGN CONDITIONS

SEISMIC CLASS ----- I

PIPE SPEC. ----- 2501R

CONTENTS ----- WATER

INSUL ----- 2" AB

TEMP. °F ----- 495 SSO

FROM COLD LEG RC PUMP NO 21

TO LINE NO 80

LEGEND

SYMBOL DENOTES

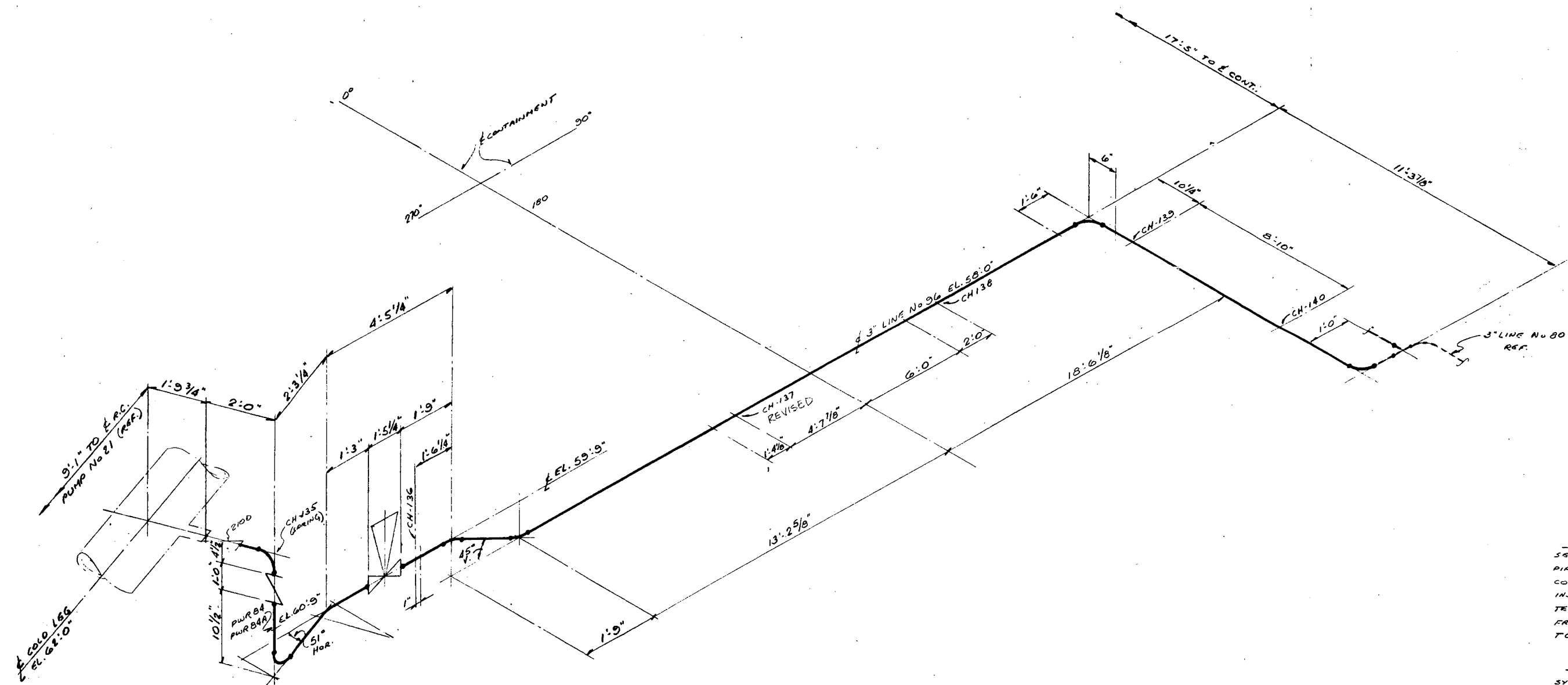
HYDRAULIC

NUMBER DIRECTION

REF. DWG.

9321-F-2581 REV.15

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
WITH UNIT 3 DETAILS			
LINE NO.96			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	LLS	01/10/2008	03-IP2-10360



DESIGN CONDITIONS
 SEISMIC CLASS ----- I
 PIPE SPEC. ----- 2501R
 CONTENTS ----- WATER
 INSUL ----- 2" AB
 TEMP. °F ----- 495 SSO
 FROM COLD LEG RC PUMP NO 21
 TO LINE NO 80

LEGEND
 SYMBOL DENOTES
 HYDRAULIC
 SNUBBER DIRECTION

REF. DWG.
 9321-F-2581 REV. 15

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION			
LINE NO. 96			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	CLJ	07/16/2028	03-IP2-2581-15

Report No. 03-00101

Revision 0

April, 1978

APPENDIX VI

INDIAN POINT GENERATING STATION

UNIT NO. 2

HYDRAULIC SNUBBER REVIEW

LINE NO. 356

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 356

Sheet 1 of 2
Report No. 03-00101
Revision 0
April, 1978

DESCRIPTION

Line No. 356 is a six-inch safety injection line interconnecting Line No. 352, from Accumulator Tank 22, and Line No. 361, which is the discharge from the residual heat exchangers. The operating temperature of the line is listed as 350F. The line swings around the south portion of the annulus. The portion adjacent to Line No. 352 and the entire run in the annulus is the same in Units 2 and 3. However, the portion of the line, after going through the crane wall into the residual heat exchanger room, differs for the two units. For Unit 2, the line connects almost immediately with Line No. 361, at elevation 53'-6", which is well controlled seismically by N-S and E-W snubbers. For Unit 3, the line has a longer run and interconnects with Line No. 355 at elevation 61'-2 5/8".

Phase I

SR-719 is adjacent to SIH-175 which should be an anchor. The anchor should be verified, and if it exists, SR-719 may immediately be removed with no other rework. This alteration should not affect the line. If SIH-175 is not an anchor, as called for on the drawing, it should be made into an anchor first, and then the hydraulic snubber SR-719 can be removed.

Phase II

Going west and north from SIH-175, the U-bolt support SIH-176 should be converted to a sliding base support at column line 12, and snubber 356-SR-1 can be removed. Since Line No. 361 is seismically controlled, SR-747 and SR-708 are removable. However, following Unit 3, SR-720 should be retained.

Going east from SIH-175, SIH-174A, which is a spring support, should be rigidized. The hydraulic snubber SR-718A should be converted from a N-S snubber at elevation 56'-5" to an E-W snubber at elevation 60'-4" following Unit 3. SIH-174, which is a sliding base support, should be converted to a guide along the run of pipe, and SR-718 should be removed. The snubber SR-716 is to be retained as in Unit 3, but SR-714, 715, and 717 should be removed.

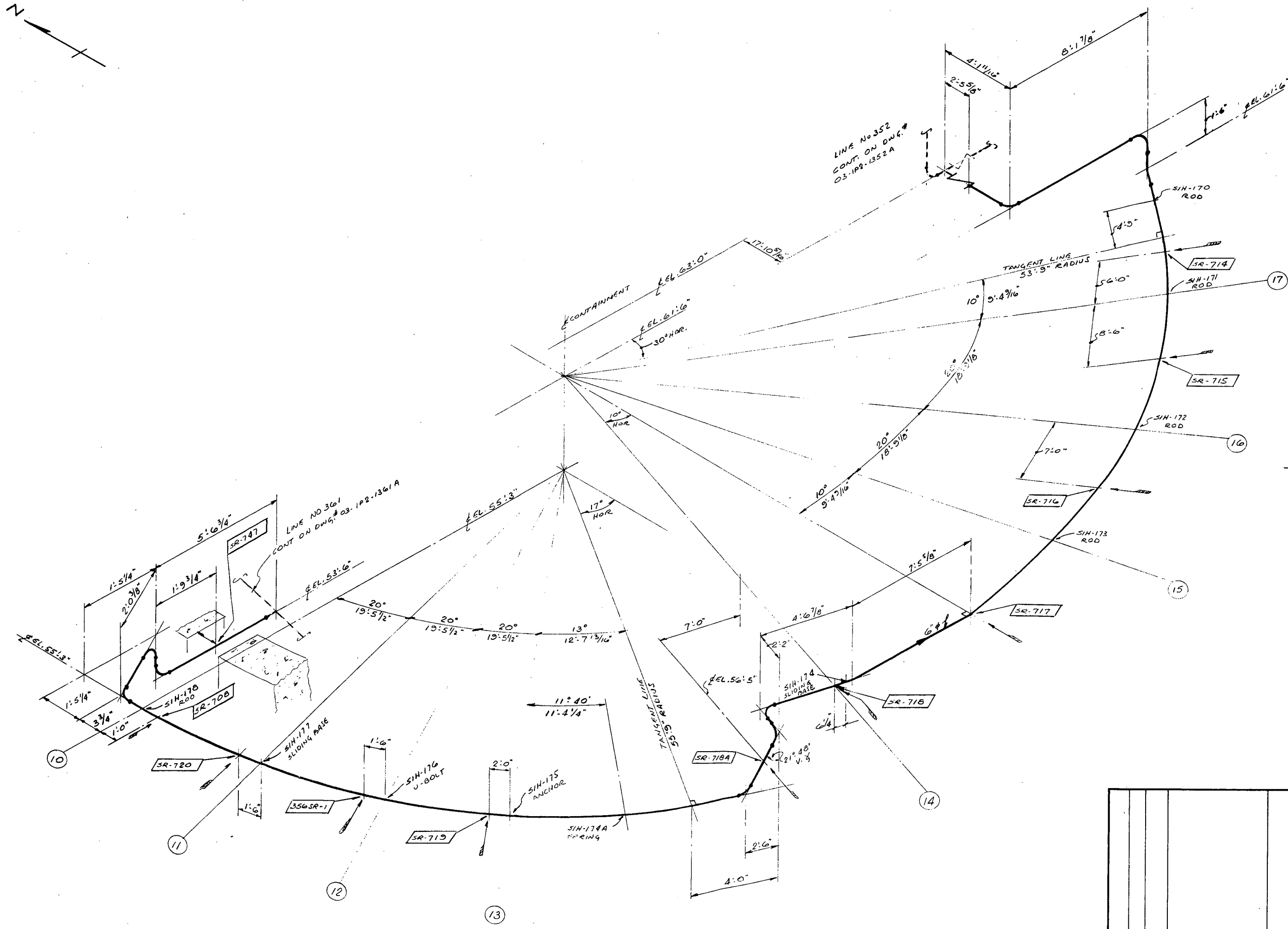
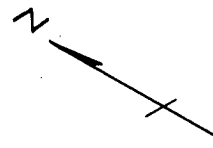
Additionally, the Unit 3 isometric drawing shows a restraining guide at 55'-10" elevation between column lines 13 and 14. Following Unit 3, this restraint, SI-R-356-6-G, should be added.

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 356

Sheet 2 of 2
Report No. 03-00101
Revision 0
April, 1978

The restraining guide on Unit 3, 6'-4" north of column line 11, SI-R-356-2A-G, is there to put cold spring into the line. The reduced flexibility of the portion of this line in the heat exchanger room will not allow this for Unit 2. The installation, without the cold spring, and with the anchor SIH-175, as it exists, must be assumed to have been thermally satisfactory. It is, therefore, our considered opinion that this guide is not necessary for the rework being suggested.

For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.



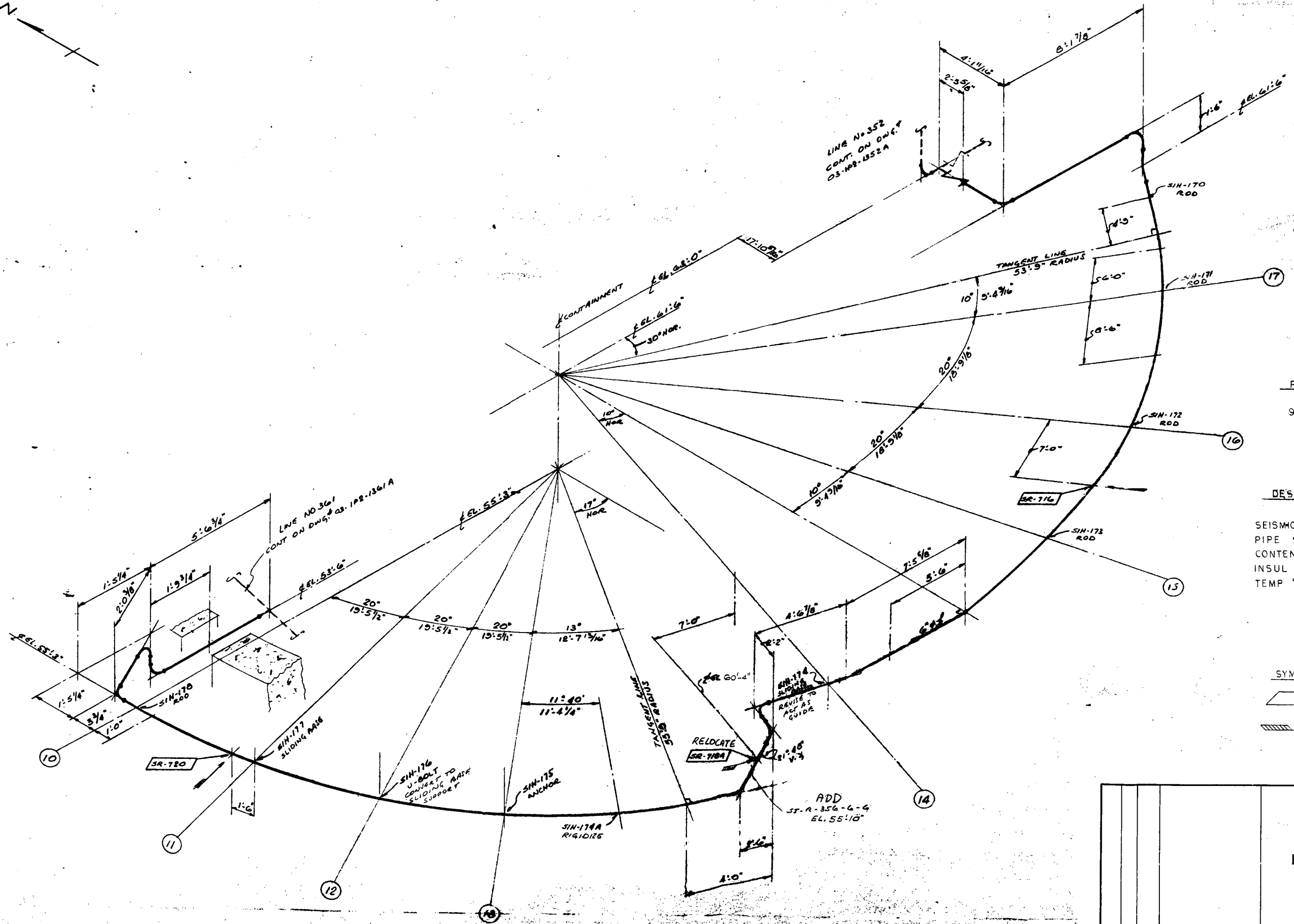
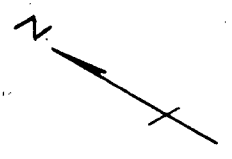
REF. DRAWING
9321-F-2614REV13
-2617 REV15

DESIGN CONDITIONS
SEISMIC CLASS I
PIPE SPEC. 2501R
CONTENTS WATER
INSUL. 2" PP ONLY
TEMP °F 350

LEGEND
SYMBOL DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.				FOR			
				CONSOLIDATED EDISON COMPANY			
				INDIAN POINT UNIT No. 2			
				HYDRAULIC SNUBBER REMOVAL STUDY			
				CURRENT CONFIGURATION			
				LINE NO. 356			
				INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	LLJ	10/4-20-78		LLJ	LLJ	10/4-20-78	03-IP2-1356A

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
				SLJ	LLJ	OPW/4-20-78	03-IP2-1356 B



REF. DRAWING
9321-F-2614 REV13
-2617 REV15

DESIGN CONDITIONS
SEISMIC CLASS-----I
PIPE SPEC-----250IR
CONTENTS-----WATER
INSUL-----2" AL PP ONLY
TEMP °F-----350

LEGEND
SYMBOL DENOTES
[Symbol] HYDRAULIC
[Symbol] SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.				FOR			
CONSOLIDATED EDISON COMPANY							
INDIAN POINT UNIT No. 2				HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION				LINE NO. 356			
INSIDE CONTAINMENT							
REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
							03-IP2

Report No. 03-00101
Revision 0
June, 1978

APPENDIX VII
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 27

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 27

Sheet 1 of 1
Report No. 03-00101
Revision 0
June, 1978

DESCRIPTION

Line #27 is a 3" IPS let-down line that connects the cooled down primary water from the regenerative heat exchanger discharge to the containment penetration, and the outside containment to the non-regenerative heat exchanger. The portion of the line inside containment has been reviewed. To within fractions of an inch, the systems of Unit 2 and Unit 3 are similar. (For Unit 3 refer to isometric drawing 9321-F-55503, and for Unit 2 refer to dwg. 9321-F-2581) Most hangers and restraints are reasonably similarly located and will function similarly although their design details vary.

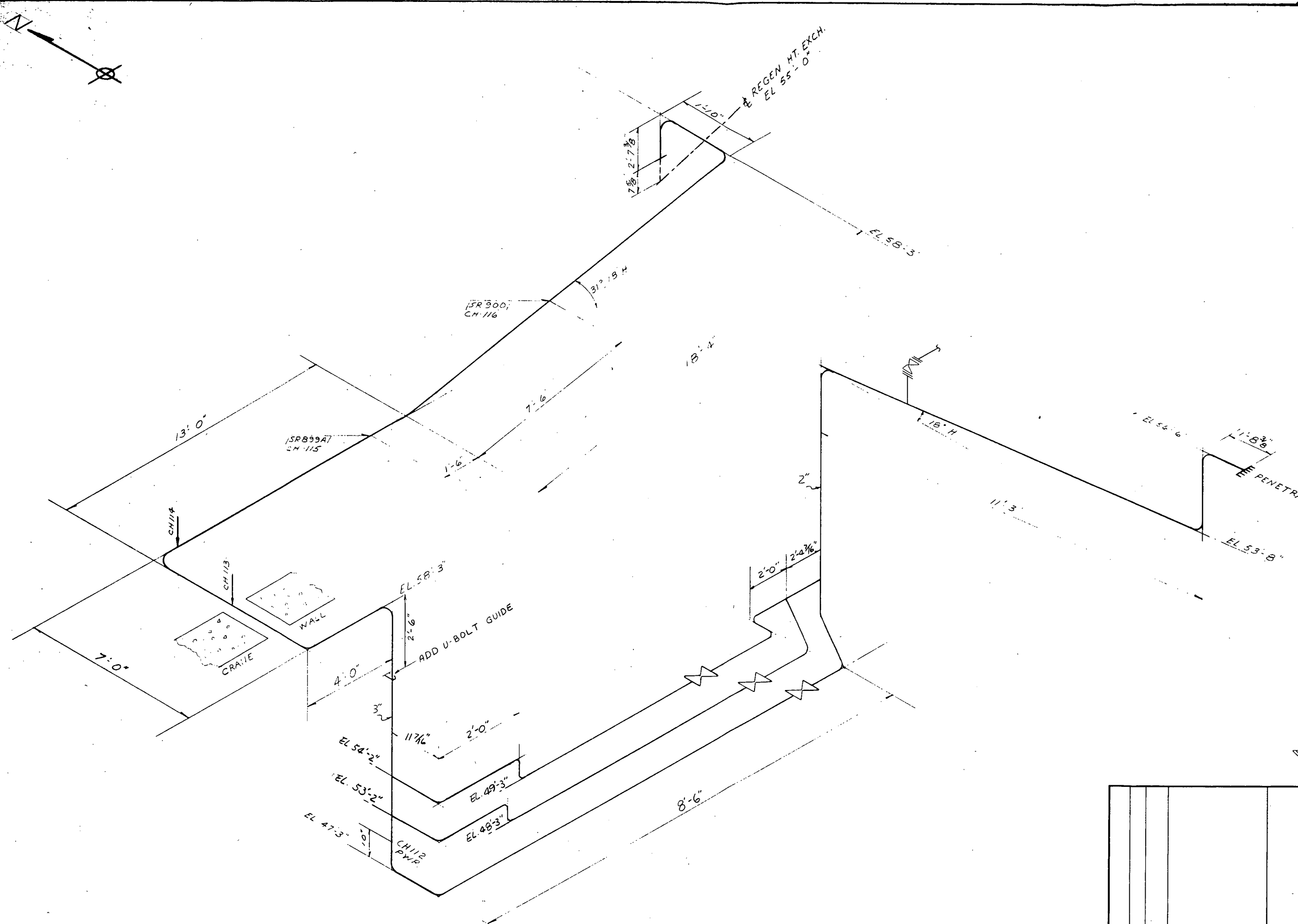
The major restraint differences are:

1. Unit 2 has an hydraulic snubber adjacent to the crane wall penetration SR-898. This does not exist on Unit 3.
2. Unit 2 has a support and PWR on the vertical leg ahead of the pressure break-down orifices, CH-112 & PWR89, at EL. 48'-1". Unit 3 has a U-bolt guide, CH-R-27-35-G, at El. 55'-0", and a spring base support, CH-H-27-36-V, at El. 58'-3".

RECOMMENDATIONS

If the hydraulic snubber, SR-898 is removed and the U-bolt guide, similar to CH-R-27-35-G, is added at approximately 55'-0" + 1"-0" (to avoid possible instrumentation interference), Unit 2 becomes very similar to Unit 3 so that the acceptable design of Unit 3 should apply for Unit 2. It is, therefore, recommended that the hydraulic snubber be removed and the U-bolt guide be added.

For ease of review, three isometric drawings are attached to these appendices which reflect the current condition, the superimposed Unit 3 condition, and the last isometric drawing presents ATI's recommended final configuration for Unit 2.



REF. DRAWING
 9321-F-2581 REV15
 -2582 REV14

DESIGN CONDITIONS
 SEISMIC CLASS---I
 PIPE SPEC-----2501R, 601R
 CONTENTS-----WATER
 INSUL -----1/2 A-I
 TEMP °F -----380

LEGEND
 SYMBOL DENOTES
 HYDRAULIC
 SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION			
LINE NO. 27			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
LLT	SA	09/05/25-78	03-IP2-10276

Report No. 03-00101
Revision 0
June, 1978

APPENDIX VIII
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 352

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 352

Sheet 1 of 1
Report No. 03-00101
Revision 0
June, 1978

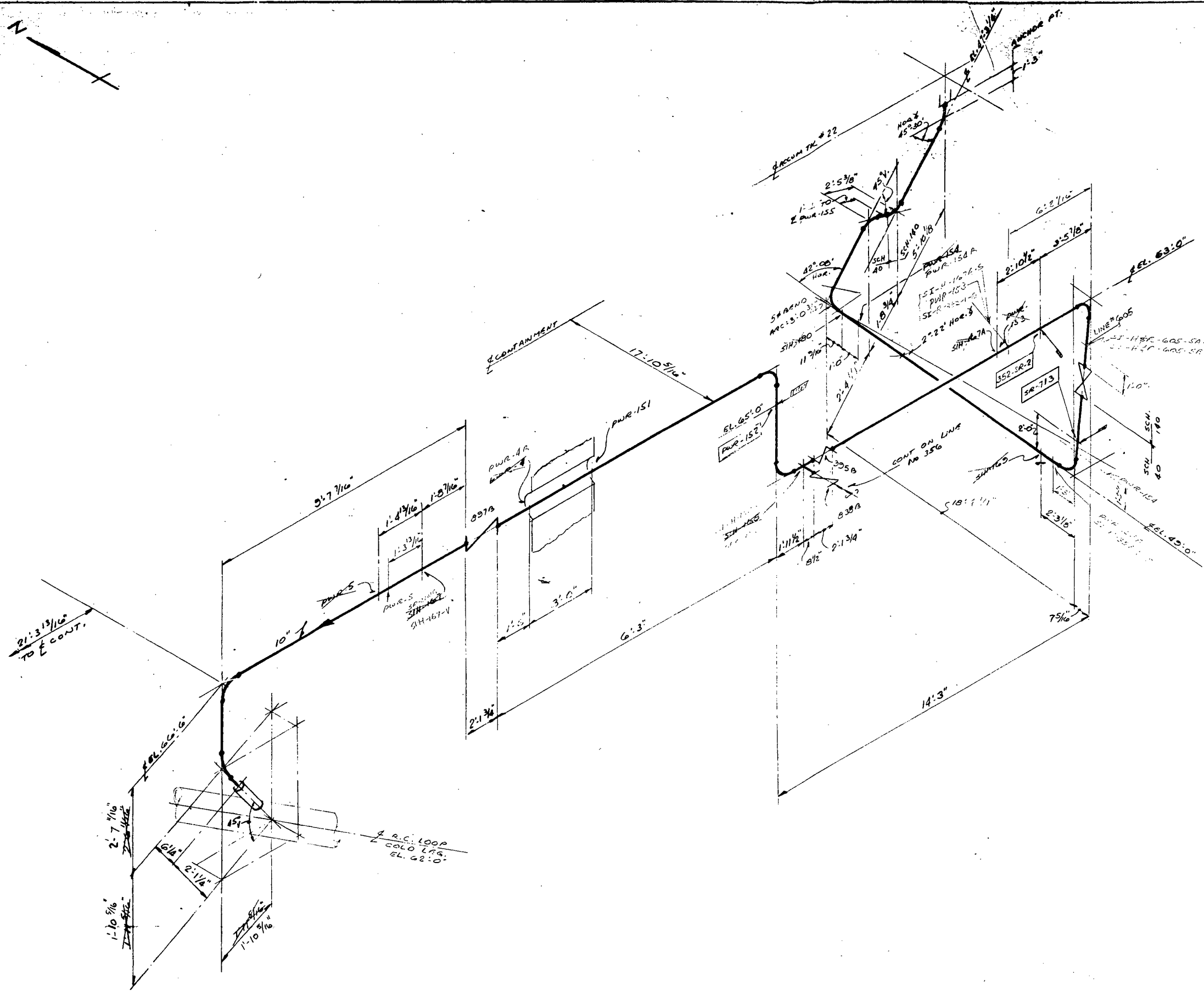
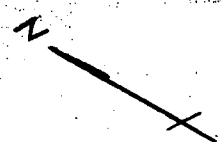
DESCRIPTION

Line No. 352 is a 10" IPS pipe that runs from Accumulator Tank No. 22 to the cold leg of Steam Generator No. 22. The line configuration for Unit 2 and Unit 3 is similar. Hanger locations are similar. Unit 2, however, contains three hydraulic snubbers while Unit 3 only has one.

RECOMMENDATIONS

Because of the similarity of the systems, following Unit 3 it is possible to remove two of the three snubbers. 352-SR-2 can be removed. However, it should be replaced with a guide at PWR-153 similar to conditions for Unit 3. SR-713 can be removed per Unit 3. However, PWR-152 should be maintained as a snubber following Unit 3.

For ease of review, three isometric drawings are attached to this appendix which reflect the current condition of this line, the condition for Unit 3, and the last isometric presents ATI's recommended final configuration for Unit 2.



REF. DRAWING

9321-F-2617 REV 15
-2614 REV 13

DESIGN CONDITIONS

SEISMIC CLASS 1
PIPE SPEC. 250IR, 60IR
CONTENTS WATER
INSUL 2" A-1
TEMP °F 120
550

LEGEND

SYMBOL DENOTES
HYDRAULIC

SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.

FOR

CONSOLIDATED EDISON COMPANY

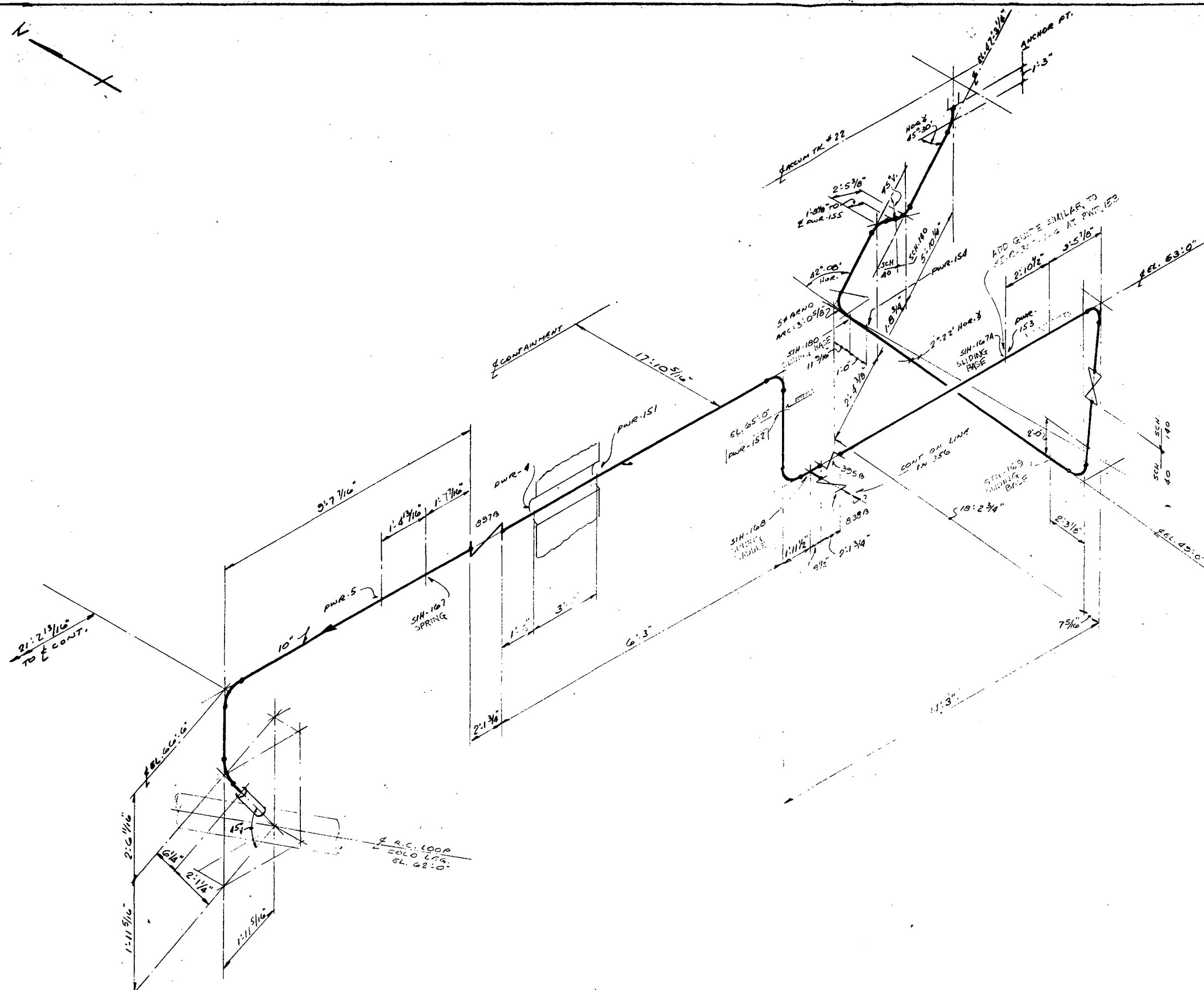
INDIAN POINT UNIT No. 2

HYDRAULIC SNUBBER REMOVAL STUDY
WITH UNIT 3 DETAILS

LINE NO. 352

INSIDE CONTAINMENT

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	SA	5/11/78		SA	SA	5/11/78	03-IP2-1352B



REF. DRAWINGS

9321-F-2617 REV 15

9321-F-2614 REV 13

DESIGN	CONDITIONS
GRADE	CLASS I
PIPE	2501 R, 60IR
CONTENTS	WATER
INSTR	2" A-1
TIME	120
	550

LEGEND	SYMBOL	DENOTES
		HYDRAULIC

SLIDING PAGE

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY 119/1 CONFIGURATION LINE NO. 252 HYDRAULIC CONTAINMENT			
REV. NO.	BY	APPRO. DATE	DESCRIPTION
DRWN	CHKD	APPRO. DATE	ATI DRAWING NO.
			03-IP2-1352-C

Report No. 03-00101 .
Revision 0
June, 1978

APPENDIX IX
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. MS-3

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. MS-3

Sheet 1 of 2
Report No. 03-00101
Revision 0
June, 1978

DESCRIPTION

Line No. MS-3 is a 4" carbon steel pipe. It carries Main Steam from two of the 28" Main Steam lines, outside of the containment but adjacent to the penetrations, to the turbine driven auxiliary boiler feed pump.

The configuration of the line in Unit 2 is identical to that in Unit 3 except for a slight variation at Elevation 68'-0" in the run to the 28" main steam lines from Steam Generator No. 23.

The run in Unit No. 2 has 25 hydraulic snubbers. That for Unit No. 3 has only 3. A review of the line for Unit 2, based on calculated results for Unit 3, indicates that we can remove or replace 21 of the hydraulic snubbers, leaving only 4 in the system. The additional snubber above those in Unit 3 is the result of the slight variation in run previously mentioned. This variation loosens the line in the area so that thermally it will reduce stress, but seismically the fourth snubber should be used.

RECOMMENDATIONS

SR-499, SR-501 and SR-503 should remain in place. A hydraulic snubber similar to MS-R-1027-7-H of Unit 3 should be added at Elevation 55'-10" between the 2 risers.

The following hydraulic snubbers may be removed without further alteration:

SR-M21B
SR-M22A & B
SR-M23B
SR-M24
SR-501A & B
SR-502
SR-503A & B
SR-504

The following hydraulics may be removed with the attendant alterations:

SR-M21A	Replace with RSSA
SR-M20A & B	Replace with RSSA
SR-507 & 507C	Replace with RSSA
SR-507A & B	Replace with RSSA
SR-505	Replace with a guide similar to MS-R-1027-6-G of Unit 3
SR-500	Replace with a guide similar to MS-R-1027-2-G of Unit 3
SR-506	Replace with a guide similar to MS-R-1027-9-G of Unit 3 at Elevation 53'-0"

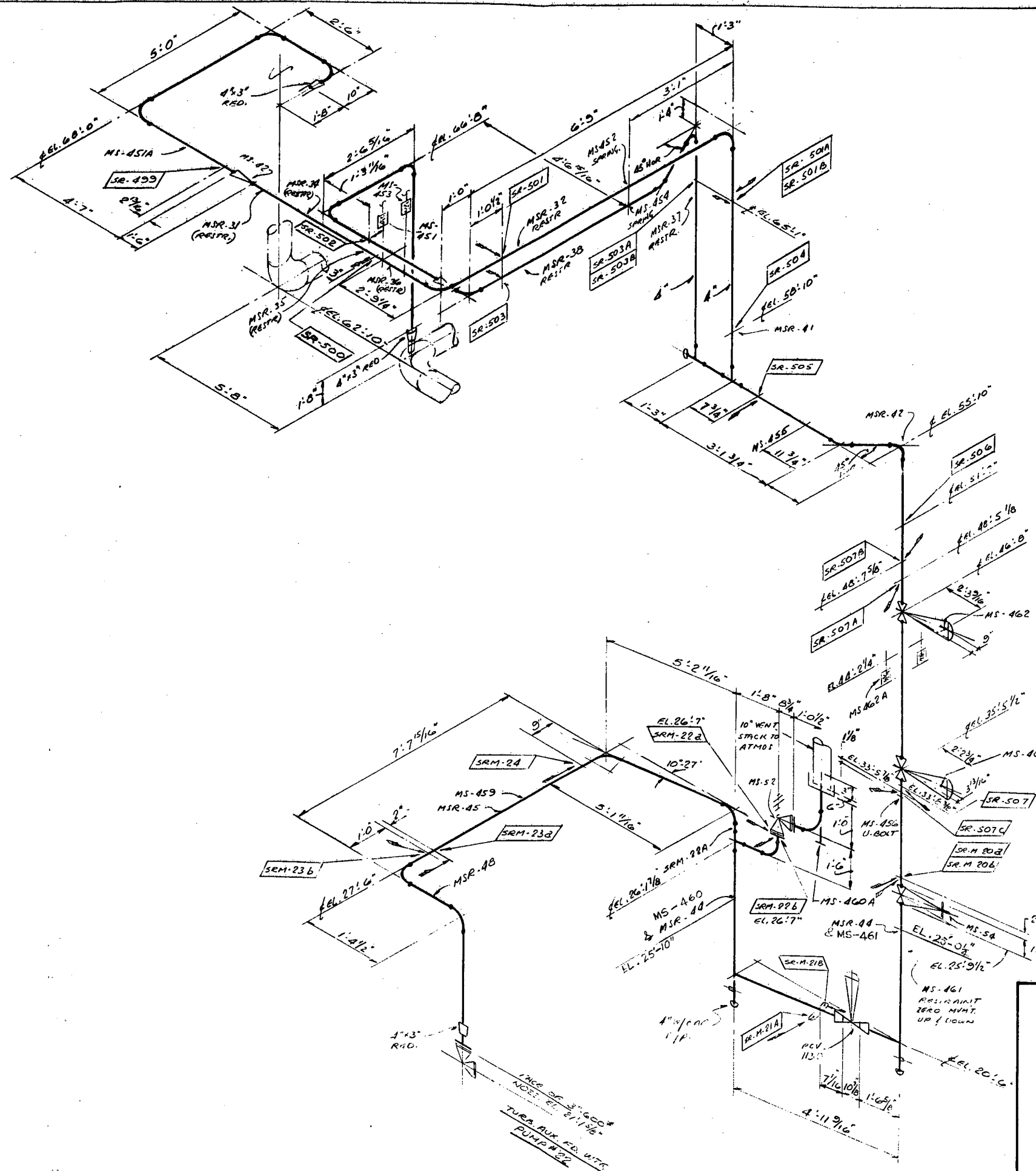
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. MS-3

Sheet 2 of 2
Report No. 03-00101
Revision 0
June, 1978

In addition the supports MS-460 & MS-461 should be converted from sliding supports to anchors as in Unit 3.

The records indicate SR-M23A to be a snubber. However, it is actually a rigid sway strut. Unit 3 has no support in this area and it is recommended that this sway strut be removed to preserve the consistency of support configuration with Unit 3.

For ease of review, three isometric drawings are attached to this appendix which reflect the current condition of this line, the condition for Unit 3, and the last isometric presents ATI's recommended final configuration for Unit 2.



REF. DRAWINGS

9321-F-2125 REV 12

DESIGN CONDITIONS

SEISMIC CLASS ---- I
PIPE SPEC. ---- A-1
CONTENTS ---- STEAM
INSUL ---- 2" A-1
TEMP °F ---- 600

LEGEND

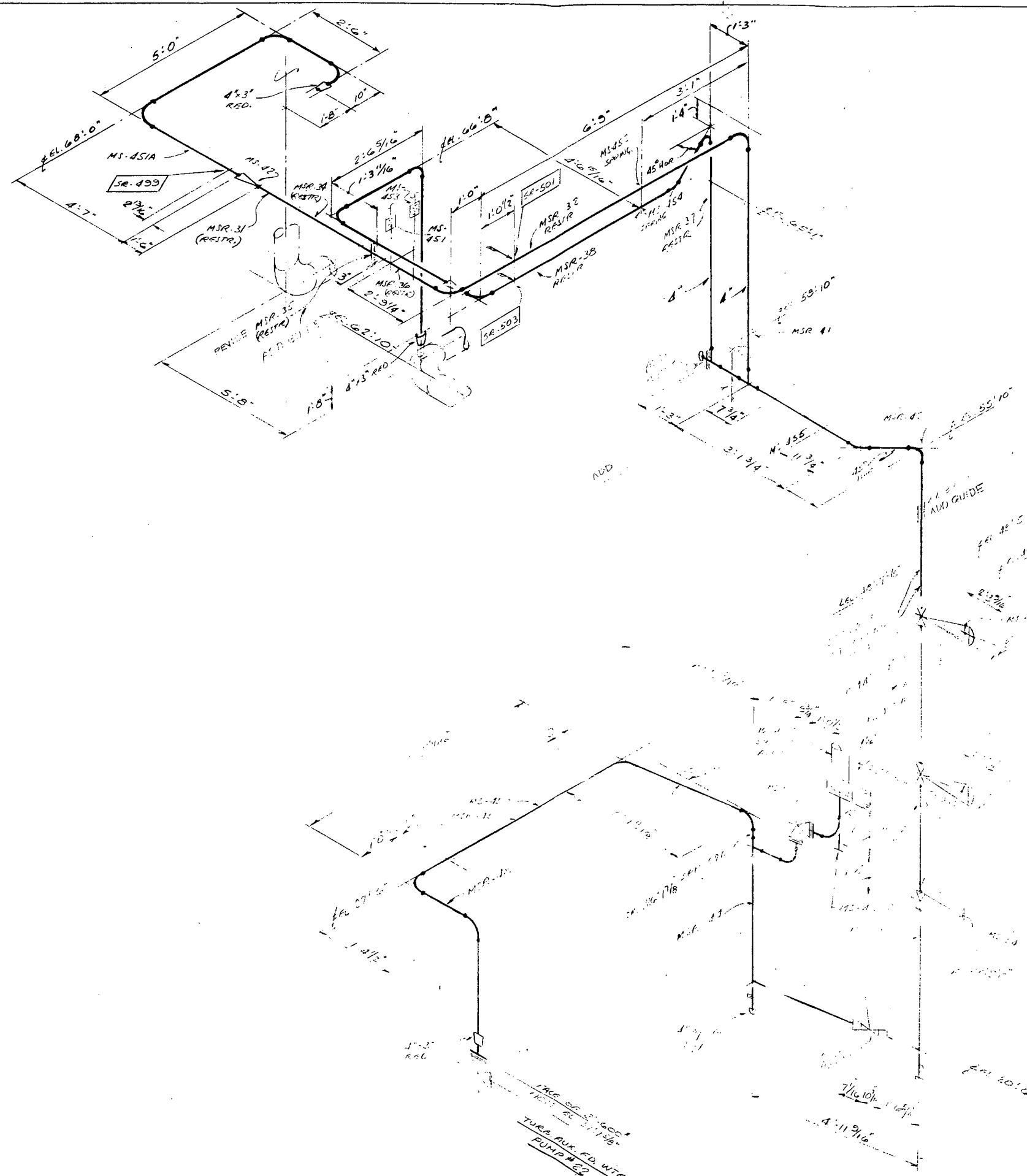
SYMBOL DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.

FOR
CONSOLIDATED EDISON COMPANY

INDIAN POINT UNIT No. 2
HYDRAULIC SNUBBER REMOVAL STUDY
CURRENT CONFIGURATION
LINE NO. MS-3
OUTSIDE CONTAINMENT

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	SA	07/29/78		SS	SA	07/29/78	03-IP2-2MS3A



REF. DRAWING

4321-1-1125 REV. 2

DESIGN: 11/15/78
 CHECKED: 11/15/78
 FILED: 11/15/78
 INST'L: 11/15/78
 TEMP: 600

LEGEND
 SYMBOL DENOTES
 HYDRAULIC
 SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.
 FOR
 CONSOLIDATED EDISON COMPANY

INDIAN POINT UNIT No. 2
 HYDRAULIC SNUBBER REMOVAL STUDY
 FINAL CONFIGURATION
 LINE NO. MS-3
 OUTSIDE CONTAINMENT

REV. NO.	BY	APPRO. DATE	DESCRIPTION	DRWN	CHKD	APPRO. DATE	ATI DRAWING NO.
1	J.E.	11/15/78	33-IP2-2MS30				

Report No. 03-00101
Revision 0
July, 1978

APPENDIX X
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NOS. 5, 6, 7 & 8

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NOS. 5, 6, 7 & 8

Sheet 1 of 1
Report No. 03-001G1
Revision 0
July, 1978

DESCRIPTION

Boiler Feed Discharge Lines 5, 6, 7 & 8 run from the 30" header to the containment penetrations, and continue inside containment to each of the four steam generators. Each of the lines is 18" O.D. and supplies feedwater at 427°F during normal operation. The portions under consideration for this review are outside containment, in the auxiliary feed pump building.

DISCUSSION

The configurations of these four lines are identical to their Unit 3 counterparts. See the attached isometric drawing No. 03-IP2-2005A for the portion of these lines under review as presently installed. These four lines at present have ten hydraulic snubbers installed. On Unit 3 which has been thermally and dynamically analyzed these lines use only four hydraulic snubbers.

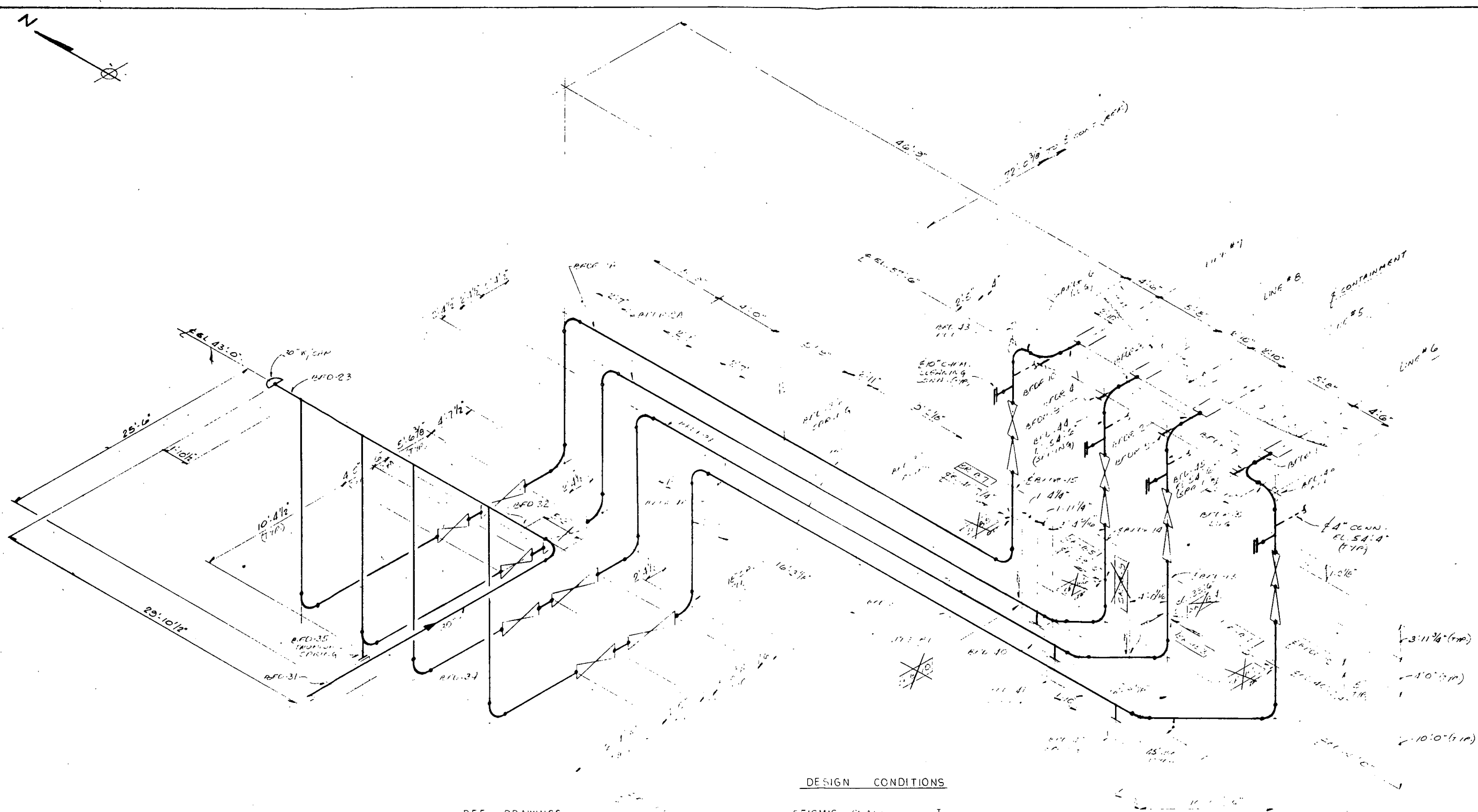
RECOMMENDATIONS

Since these four lines are identical runs in Unit 2 and Unit 3, and since Unit 3 analyses have found these lines to be acceptable with only four snubbers, it is recommended that the six excess snubbers that exist in Unit 2 be removed.

The following table is a summary of our recommendations:

Line No.	Snubber Identification	Comments
5	SR-B3	Keep as is
	SR-B4	Remove
	SR-B9	Remove
6	SR-B1	Keep as is
	SR-B2	Remove
7	SR-B7	Keep as is
	SR-B8	Remove
8	SR-B5	Keep as is
	SR-B6	Remove
	SR-B10	Remove

See attached isometric drawing No. 03-IP2-2005C for the portions of these lines under review with recommended installation.



REF. DRAWINGS
9321-F-2062 REV 10
-2061 REV 12

DESIGN CONDITIONS

SEISMIC CLASS --- I
PIPE SPEC. --- B-2
CONTENTS --- WATER
INSUL --- 2 1/2 A-2
TEMP °F --- 427

LEGEND

SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY WITH UNIT 3 DETAILS LINE NO. 5, 6, 7 & 8 OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	LLJ	APR 3/23/28	03-IP2-2005B
DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
LLJ	LLJ	APR 3/23/28	03-IP2-2005B

Report No. 03-00101
Revision 0
July, 1978

APPENDIX XI
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NOS. 16 & 56

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NOS. 16 & 56

Sheet 1 of 1
Report No. 03-00101
Revision 0
July, 1978

DESCRIPTION

Line Nos. 16 & 56 are comprised of 4-inch and 6-inch diameter stainless steel pipe which serve to carry boric water and run from the safety injection pumps 21, 22 and 23 to the reactor coolant loops. For this review, only the portions outside containment are considered.

The lines have three snubbers oriented horizontally on the vertical discharge legs from the three pumps. See isometric drawing 03-IP2-2016A. The horizontal legs of lines 16 & 56 which run parallel to the north-south orientation of the three pumps are attached by clamps and U-bolts to a concrete wall. The maximum line temperature is 140°F.

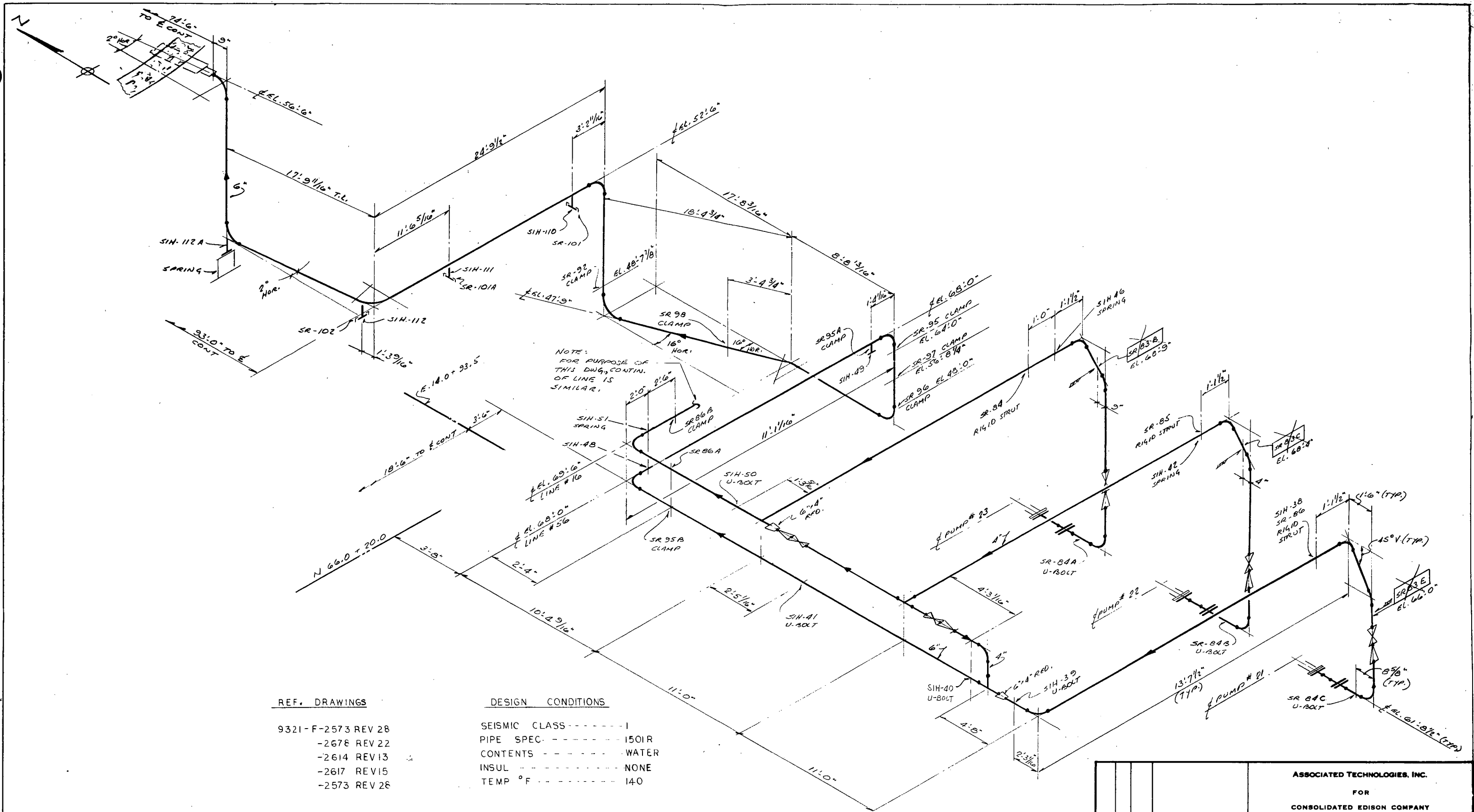
RECOMMENDATIONS

From the geometry of the line and the orientation of the snubbers it is seen that SR-83B and SR-83E are redundant. The fixity provided by the header lines would adequately support the east-west horizontal seismic motions through the lengths of pipe itself. Additionally, SR-83C could also be removed if an east-west stop can be provided on the north-south run of the header as shown on drawing 03-IP2-2016C. These changes would provide more positive system of seismic restraint on the lines.

The following summarizes the recommendations:

SR-83B	Remove as redundant
SR-83C	Remove if U-bolt type support is provided on header as shown.
SR-83E	Remove as redundant

Since no comparison with Unit 3 is necessary, the usual "B" drawing is not required.



ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT Unit No. 2 HYDRAULIC SNUBBER REMOVAL STUDY CURRENT CONFIGURATION LINE NO. 16 & 56 OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	LLT	03/28/78	03-IP2-2016A
DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
LLT	LLT	03/28/78	03-IP2-2016A

Report No. 03-00102
Revision 0
July, 1978

INDIAN POINT UNIT 2
GENERATING STATION
BUCHANAN, NEW YORK
PIPING SYSTEMS
HYDRAULIC SHOCK SUPPRESSOR
ANALYSIS FOR REMOVAL

by

ASSOCIATED TECHNOLOGIES, INC.

for

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

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XV	PCA-2, PCA-3

VERIFICATION OF DESIGN BY ANALYSIS

- | | |
|---------------------------|--|
| 1. Project Identification | Indian Point Unit 2
Generating Station |
| 2. Work Description | Report on removal of hydraulic snubbers through review and computerized analysis |
| 3. Revision and Date | 0 - July, 1978 |
| 4. ATI Reference | 03-001 |

This report covers items relating to nuclear safety. In accordance with rigorous procedures, the quality of the work has been assured through proper checking and this certifies that the work has been performed, checked and approved as noted hereon.

Performed by Sal Sciafani Liang-Jy Leu Date 8/24/78
Sal Sciafani/Leu Liang-Jy

Checked by Sidney Austin Date 8/25/78
Sidney Austin

Approved by Oscar P. Wong Date 8/29/78
Oscar P. Wong

CERTIFICATION

The undersigned, a registered Professional Engineer, competent in the field of piping analysis, certifies that the report presented herein contains the results of thermal analyses performed in strict accordance with standard strength of material methods and accepted engineering practice. These analyses were carried out on selected piping systems of Indian Point Generating Station Unit No. 2 and the results meet the requirements of the criteria presented herein.



Oscar P. Wong
O. P. Wong

State of New York

Registration Number 050726

July 26, 1978
Date

INTRODUCTION

This report provides the results of the second phase of a review of hydraulic snubbers on Indian Point Generating Station Unit No. 2 performed by Associated Technologies, Inc. (ATI). The first phase, presented in Report No. 03-00101, covered only those systems which were found to be of geometrically similar configuration to that of Unit No. 3. This report includes lines that are sufficiently different to warrant additional independent analysis beyond a comparison of piping systems. The lines considered in this report have been analyzed for thermal loading only, and in the proposed configuration. Seismic loading has been considered by comparison with Unit No. 3 seismic restraints, or by the fact that the piping configuration restraint spaces are equal or less than those required by Unit No. 3 criteria.

This task was requested by Consolidated Edison Company of New York, Inc. (Con Ed) in order to reduce the number of snubbers being used on Unit No. 2. Indian Point Unit No. 3, although of similar design to Unit No. 2, has significantly fewer hydraulic snubbers in the plant. Physical examination and testing procedures required by the NRC for the hydraulic snubbers has led to exposures in high radiation areas of personnel and to excessive time requirements during periods of outage. This has prompted the review, and the results of this work are based on a study of the drawings and available analytical data supplied by Con Ed. Formal analyses for thermal loadings were performed for the piping systems, except for a few ambient systems.

The results of this study indicate that a number of hydraulic snubbers can be changed to rigid restraints based on the results of the thermal analyses.

INTRODUCTION (Cont'd)

There are some cases where the line configuration of Unit 2 is similar to that of Unit 3 but the support locations are dissimilar. For those Unit 2 lines where modifications to exactly duplicate the Unit 3 support configuration would not be extensive, these changes have been proposed and the lines evaluated as such. Where the Unit 2 lines are quite different from their Unit 3 counterparts, a direct substitution of rigid struts or guides in place of snubbers for Unit 2 has been made to satisfy seismic criteria and the piping has been analyzed for acceptable thermal stresses. The acceptable configurations are presented herein.

The appendices address themselves to evaluation of specific lines and the details of the findings are provided in these appendices. Each of these appendices is an independent block of data and recommendations and may be extracted from the basic report for documentation or discussion purposes.

DESCRIPTION

The Indian Point Generating Stations, Units 2 and 3, are located at Buchanan, New York, and although designed and constructed at different times are of basically the same design. Overall layout of the major equipment and much of the piping are identical, but because of advances in technology in the intervening years, changes in routing were made on some critical piping. On Unit 3, a more definitive method of analysis produced lower and more predictable loadings due to a postulated seismic event resulting in a significant reduction in the use of snubbers.

Both plants are on the same bed rock and structurally the buildings, foundations, and main structural elements are essentially the same. The seismic spectra of both plants will therefore be essentially identical.

Unit No. 3 design was based on dynamic analysis for lines equal to or greater than 6" IPS and for all high energy safety injection lines. Other lines less than 6" IPS were designed by span tables, based on appropriate floor response spectra. This set of span tables was acceptable to the NRC for the design of Unit 3 and is an advance in the technology of seismic design beyond that used for Unit 2 that leads to larger spans and fewer snubbers. The dynamic effects of a postulated seismic event are therefore conservatively provided for on the original Unit 2 lines if the seismic restraint system is left intact. This would be true if the Unit 2 and 3 line configurations were different or even if the configurations were identical and the supports different. This report covers both cases.

DESCRIPTION (Cont'd)

Lines were selected for thermal analysis where expansion charts indicated a good possibility of success in changing snubbers to rigid restraints. It was found in some cases that the pipe routing was so restricted that significant changes in support locations or piping or both would be necessary to reduce the number of snubbers. These lines have not been considered in this report. More detailed descriptions of the problem, procedure and analysis are provided in the following chapters.

The lines inside and outside containment which are seismically restrained by snubbers and which are being considered in this report range in temperature levels from ambient up to a possible 605 degrees Fahrenheit.

PROBLEM DEFINITION

Because of the reasons outlined in the description, there are significantly more snubbers in Unit 2 than in Unit 3. The maintenance requirements for snubbers have been proven to be difficult and to result in a significant expenditure of time and effort for assuring proper functioning. It has been proven through rigorous analysis and advanced technological procedures that these snubbers are not necessary in the quantities utilized on Unit 2, as demonstrated on Unit 3.

This report covers those lines in which the configuration of Unit 2 was dissimilar to that of the Unit 3, or in some cases where the configurations were similar but the support locations were not.

In all cases, a comparison of the Unit 2 line with the Unit 3 counterpart was carried out for configuration and support locations. The removal of snubbers on Unit 2, as covered by this report, is based primarily on thermal analysis and in some cases include comparison with Unit 3. Relocation of existing supports was not considered except in a few instances where relatively minor changes in the field would produce significant results.

The removal of snubbers was carried out by the simple procedure of converting selected snubbers to rigid restraints, which would still satisfy seismic requirements, and performing a thermal analysis to ascertain the effect of this action on the piping. A review of the maximum stresses, displacements and loads due to this change for thermal loading was compared to the allowable values. As discussed in the Description section, a dynamic analysis is not necessary since no change in the seismic support system is brought about by changing snubbers to rigid restraints and assuring that seismic span lengths satisfy existing criteria.

ASSUMPTIONS AND CONDITIONS

This report has been prepared in accordance with the assumptions and conditions outlined herein. The engineering study has been performed in accordance with good engineering practice and established quality assurance procedures. In accordance with the above, the following items provide a summary of the assumptions and conditions under which this work was performed, the units evaluated, and the basic recommendations made:

1. The existing Unit 2 line configuration and support condition is acceptable for all loading conditions.
2. All data supplied on drawings for Units 2 and 3 reflect the actual conditions.
3. The designs of Unit 3 are valid and resulting stresses and displacements are acceptable.
4. The drawings used for this study are referenced on the appropriate isometrics.
5. Justification of support changes lie in direct comparison, engineering judgement, and particularly, thermal analysis.
6. Unit 2 was designed to an earlier seismic criteria with an accompanying design conservatism with respect to dynamic supporting design.

Thus, the existing seismic restraint support configuration is acceptable. Therefore, only thermal analyses need be performed to verify acceptability of the conversion of snubbers to rigid restraints for any Unit 2 line.

COMPUTER PROGRAM

The computer program utilized in this analysis is named ADLPIPE and is a commercially available program which has the capacity for performing stress computations according to ASME and ANSI code requirements. ADLPIPE is a digital computer program which may be used for the static and dynamic analysis of complex piping systems.

The program may be used for static loads due to thermal, dead weight, or externally applied forces. The thermal analysis approach utilizes sections which may be composed of straight and curved members. These weightless members are connected by network points which define the overall piping system. Each member may have common or different temperatures or physical properties. Intermediate springs to the ground or between members may be placed within any section to represent hangers, bellows or guided restraints or equipment stiffness. The network points may be free or partially or fully restrained and may, in those cases where they are restrained, have specified displacements that represent thermal anchor movements.

Additional details of the program and its internal development are proprietary but are on file with the organization which is responsible for its development.

CRITERIA

This section outlines the criteria and bases on which the study was performed and the recommendations for removal and replacement of hydraulic snubbers that were made for Indian Point Unit No. 2. The content of this criteria draws heavily upon the safety evaluation report by the NRC supporting Amendment No. 39 to Facility Operating License No. DPR-26. This evaluation report reflects ATI's engineering conclusions which strongly advocates the reduction of hydraulic snubbers on Indian Point Unit No. 2.

The purpose of any support system for piping or equipment is to provide for reliability during operation of that system. At the outset, it was thought that hydraulic snubbers were an excellent and complete answer to the problem of supports for seismic loading as opposed to the requirements for thermal movements during operation of a plant. Unfortunately, it has been shown that hydraulic snubbers have a potential for leakage or other malfunctions. This potential makes them inherently less reliable than rigid restraints and thus obviates the initial premise that support systems should improve and assure the reliable operation of any given system.

In the original design of the subject Indian Point Unit No. 2 pipe lines, hydraulic snubbers were used more extensively than would be necessary with current piping analysis methods. The redesign of the support systems of the subject lines is based on thermal analyses to ascertain the effect of converting snubbers into rigid restraints. Maximum acceptable stresses due to thermal effects are based on ANSI B31.1, 1977 code values.

CRITERIA (Cont'd)

Unit No. 2 piping systems were seismically supported in accordance with an overly conservative span criteria which has since been modified (e.g. for Unit 3 piping systems) to incorporate a more realistic conservative approach. More rigorous analysis and a greater understanding of seismic motion and transmission have brought about these changes. A change of snubbers to rigid restraints on Unit 2 will not adversely affect, and in fact will enhance the inherent adequacy of the existing support configuration.

The reliability of the piping system will be improved by this modification of the support systems because the number of hydraulic snubbers, which require frequent inspection to assure operability, will be reduced. This modification will, therefore, reduce the potential of a piping failure due to a malfunction of the support system.

RECOMMENDATIONS AND CONCLUSIONS

A number of lines have been reviewed, most of which have been selected for thermal analysis. The results for those that have been selected for thermal analysis indicate that snubbers may be reduced in number by conversion to rigid restraints. ATI recommends that the work outlined in the appendices for each line be completely carried out based on the results of these analyses.

In many cases the Unit 2 line matches to a great degree the configuration of its corresponding Unit 3 line. Under those conditions many snubbers are removed because of the similarity to Unit 3, whereas in the region in which the configuration is different, a thermal analysis was performed. These analyses were carried out to ascertain whether the stress levels of the piping system due to the changing over of snubbers to rigid restraints are within acceptable limits. In all cases in which such changes are acceptable the rigid restraints will perform more predictably and this will enhance the reliability and safe operation of the line.

A tabular summary of the recommendations covered in this report follows this section. Detailed recommendation and required modifications for each line are presented separately in the individual appendices to this report.

SUMMARY OF HYDRAULIC SNUBBER REPLACEMENT BY
THERMAL ANALYSIS REVIEW

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
351	PWR-127			X	Per Unit 3
	-128			X	Retain for transient flow condition
	-129			X	Retain for transient flow condition
	351-SR-1			X	Retain for seismic requirements
	SR-742*	X			Per Unit 3
BFD-21	SR-A24 *	X			Redundant due to presence of SR-463
	-471A	X			Make BFD-98 into anchor, weld support to base
	-484A	X			Make BFD-101 into anchor
	-496A		X		Convert to rigid link
BFD-22	SR-464A	X			Convert BFD-84 to an anchor
	-A10		X		Convert to rigid link
	-473A	X			Convert BFD-91 to an anchor
	-486A	X			Convert BFD-88 to an anchor
	-472A		X		Convert to rigid link
BFD-23	SR-466A	X			Convert BFD-62 to anchor
	-A8		X		Convert to rigid link
	-475A	X			Convert BFD-69 to anchor
	-492A	X			Convert BFD-67 to anchor
BFD-24	SR-465A	X			Convert BFD-72 to anchor
	-A9		X		Convert to rigid link
	-474A	X			Convert BFD-75 to anchor
	-490A	X			Convert BFD-79 to anchor
	-494A		X		Convert to rigid link
	-A11		X		Convert to rigid link
	-A13		X		Convert to rigid link

SUMMARY OF HYDRAULIC SNUBBER REPLACEMENT BY
THERMAL ANALYSIS REVIEW (Cont'd)

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
42	SR-1109		X		Convert to rigid link
	-1107		X		Convert to rigid link
	-1108 *	X			Redundant due to presence of SR-1107
	-1111		X		Convert to rigid link
13	SR-1099			X	
(RCP 22)	-1100			X	
	-1101		X		Convert to rigid link
	-1102		X		Convert to rigid link
	-1103			X	
	-1104			X	
	-1105			X	
	13-SR-1105A			X	
	-1106			X	
	-1124			X	
14	SR-925			X	
(RCP 21)	-927			X	
	-927A			X	
	-928			X	
	-928A			X	
	-929 *	X			Redundant due to presence of SR-931
	-931		X		Convert to rigid link
	-969			X	
	-970			X	
	-971			X	
14A	SR-954			X	
(RCP 21)	-955 *	X			Unnecessary by Unit 3 criteria
	-955A*	X			Unnecessary by Unit 3 criteria
	-956		X		Convert to rigid link
	-956A		X		Convert to rigid link

SUMMARY OF HYDRAULIC SNUBBER REPLACEMENT BY
THERMAL ANALYSIS REVIEW (Cont'd)

LINE NO. NO.	SNUBBER IDENTIFI- CATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
9	SR-55			X	
	-56		X		Convert to rigid link
	-57		X		Convert to rigid link
	-58		X		Convert to rigid link
	-59		X		Convert to rigid link
10 & 57	SR-64		X		Convert to rigid link
	-60		X		Convert to rigid link
	-61		X		Convert to rigid link
	-62		X		Convert to rigid link
	-63		X		Convert to rigid link
	-65			X	
15	SR-1B *	X			Redundant due to presence of SR-2
	-7		X		Convert to rigid link
	-8 *	X			Redundant due to presence of SR-8A
	-8A		X		Convert to rigid link
	-8B *	X			Redundant due to anchor SR-4
	-8C (2)		X		Convert to rigid link
	-11A		X		Convert to rigid link
	-13B		X		Convert to rigid link
41	SR-948A		X		Convert to rigid link
	-949		X		Convert to rigid link
	-952			X	
	-952A		X		Convert to rigid link
	-953			X	
	-953A			X	

SUMMARY OF HYDRAULIC SNUBBER REPLACEMENT BY
THERMAL ANALYSIS REVIEW (Cont'd)

LINE NO.	SNUBBER IDENTIFICATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
51	SR-20		X		Convert to rigid link
	-21 *	X			Redundant due to presence of SR-21A
	-21A		X		Convert to rigid link
	-21B *	X			Redundant due to anchor SR-17
	-21C (2)		X		Convert to rigid link
	-24A		X		Convert to rigid link
	-26B		X		Convert to rigid link
60	SR-73A			X	
	-76A *	X			Redundant due to presence of SR-75A and SR-78
	-77A		X		Convert to rigid link
	-83A *	X			Redundant due to presence of SR-75A and SR-75
	-83D *	X			Redundant due to presence of SR-74
413	SR-376A		X		Convert to rigid link
	-395A		X		Convert to rigid link
414	SR-377A		X		Convert to rigid link
	-396A		X		Convert to rigid link
V-3	SR-M29			X	
	-M30			X	
	-M31			X	
	-M32 *	X			Remove as redundant
	-M33			X	
V-4	SR-M25			X	
	-M26 *	X			Remove as redundant
	-M27			X	
	-M28 *	X			Remove as redundant
	-M52			X	

INDIANA POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW

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SUMMARY OF HYDRAULIC SNUBBER REPLACEMENT BY
THERMAL ANALYSIS REVIEW (Cont'd)

LINE NO.	SNUBBER IDENTIFI- CATION	REMOVE	REPLACE	LEAVE IN	COMMENTS
V-5	SR-M34			X	
	-M35			X	
	-M36			X	
	-M37			X	
	-M38			X	
V-6	SR-M39			X	
	-M40			X	
	-M41			X	
	-M42 *	X			Remove as redundant
	-M43 *	X			Remove as redundant
PCA-2	SR-418		X		Convert to rigid link
PCA-3	SR-432		X		Convert to rigid link

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APPENDIX I
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 351

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 351

Sheet 1 of 1
Report No. 03-00102
Revision 0
July, 1978

DESCRIPTION

Line No. 351 is a 10" IPS pipe that runs from Accumulator Tank No. 21 to the cold leg of RCS Loop No. 21. The line run for Unit 2 and Unit 3 are similar except for the portion in the heat exchanger room. In this area there is a basic similarity, but the run for Unit 3 is a tighter configuration than that for Unit 2, which can be seen from looking at drawings attached.

The basic support and restraint system for this line is similar for both units. However, the use of hydraulic snubbers was drastically reduced in the Unit 3 system.

DISCUSSION

Although Line 351 on Unit No. 2 very closely approximates the configuration of Unit No. 3, it was decided not to remove the hydraulic snubbers, PWR-128 and 129, which were originally installed for loads due to transient flow conditions. Therefore analyses with suggested restraint changes have been negated and no computer analysis sheets are included for this line. The portion of the line in the annulus is the same as that for Unit 3, and on this basis SR-742 can be removed, since it does not exist on Unit 3.

RECOMMENDATIONS

There are five hydraulic snubbers in Unit 2 and only one in Unit 3. However, of the four excess snubbers in Unit 2 only one can be eliminated as follows:

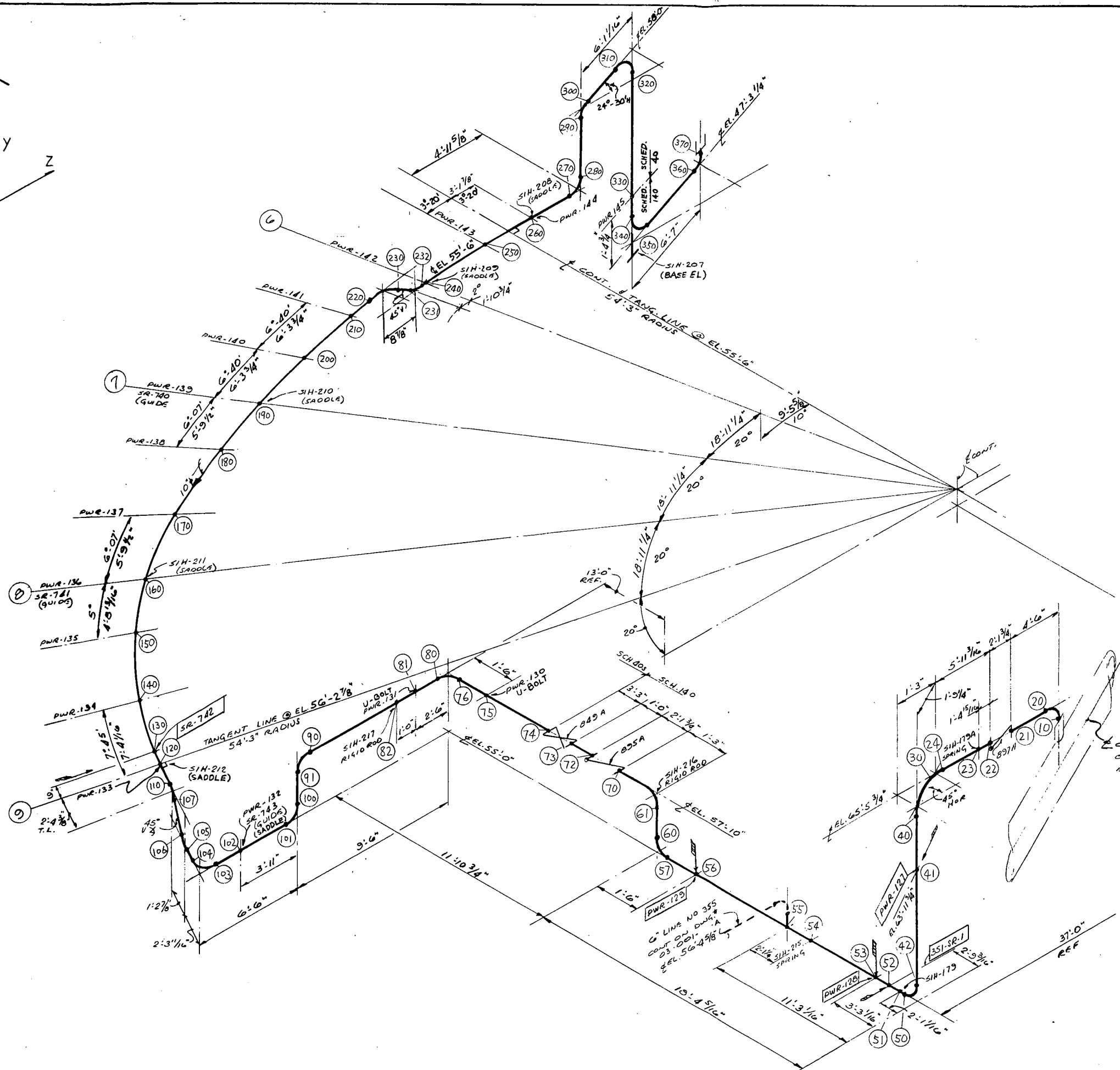
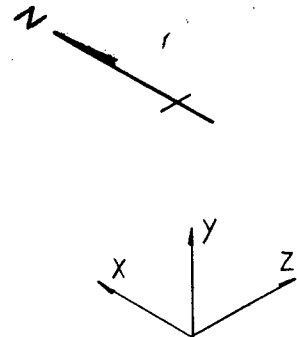
PWR-127 must be retained as it is in Unit 3.

PWR-128 & 129 are vertical snubbers required for transient flow conditions.

351-SR-1 must be retained.

SR-742 in the annulus can be removed following Unit 3.

For ease of review, an isometric drawing is attached to this appendix which reflects the current condition of the line and ATI's recommended final configuration.



TEMPERATURE

120° F
550° F

REF. DRAWING

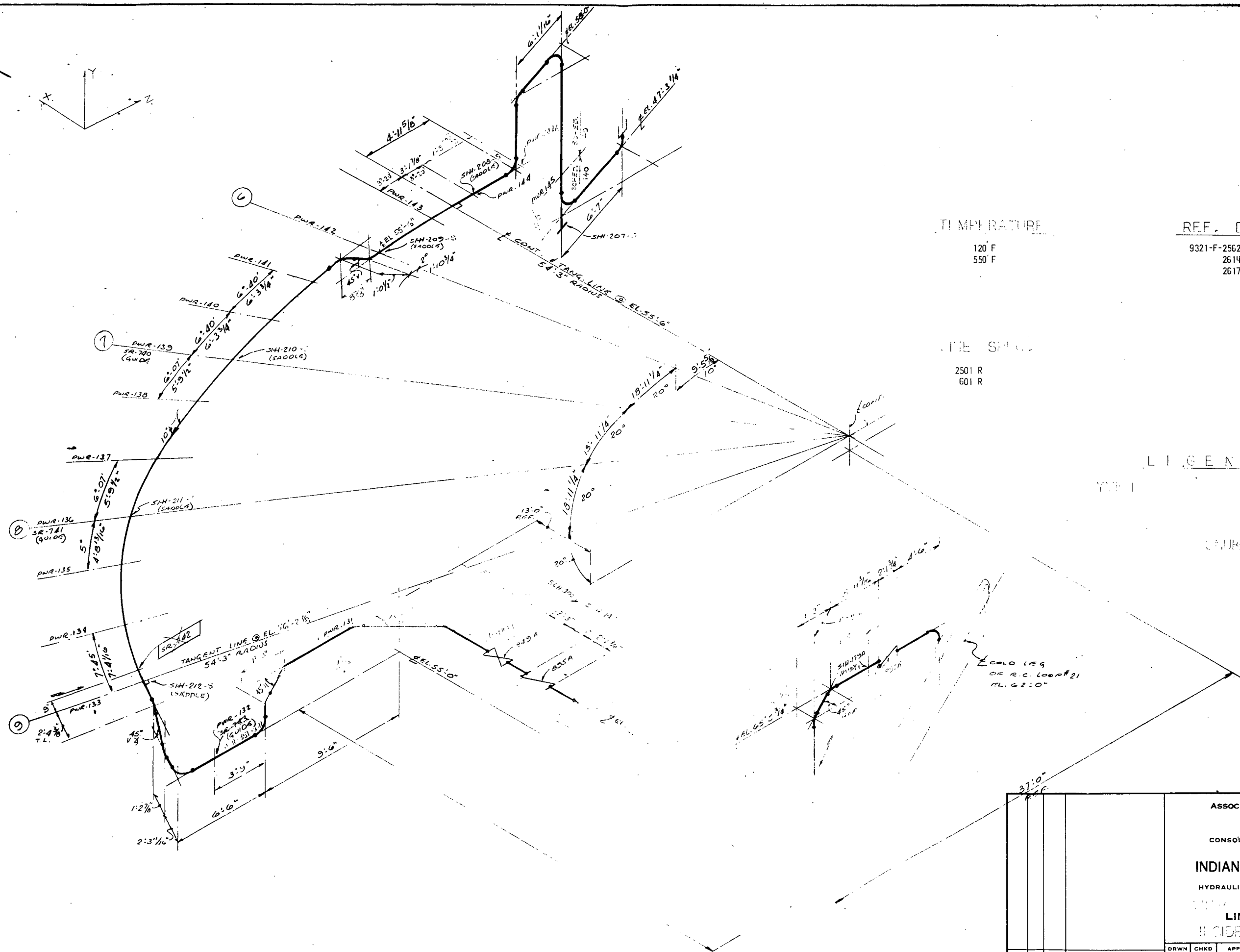
9321-F-2562 REV 19
2614 REV 13
2617 REV 15

LINE SPEC.

2501 R
601 R

LEGEND	
SYMBOL	NOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
CURRENT CONFIGURATION			
LINE NO. 351			
INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	SA	7-17-78	03-IP2-1351A



TEMPERATURE

120° F
550° F

REF. DRAWING

9321-F-2562 REV 19
2614 REV 13
2617 REV 15

PIPE SPEC.

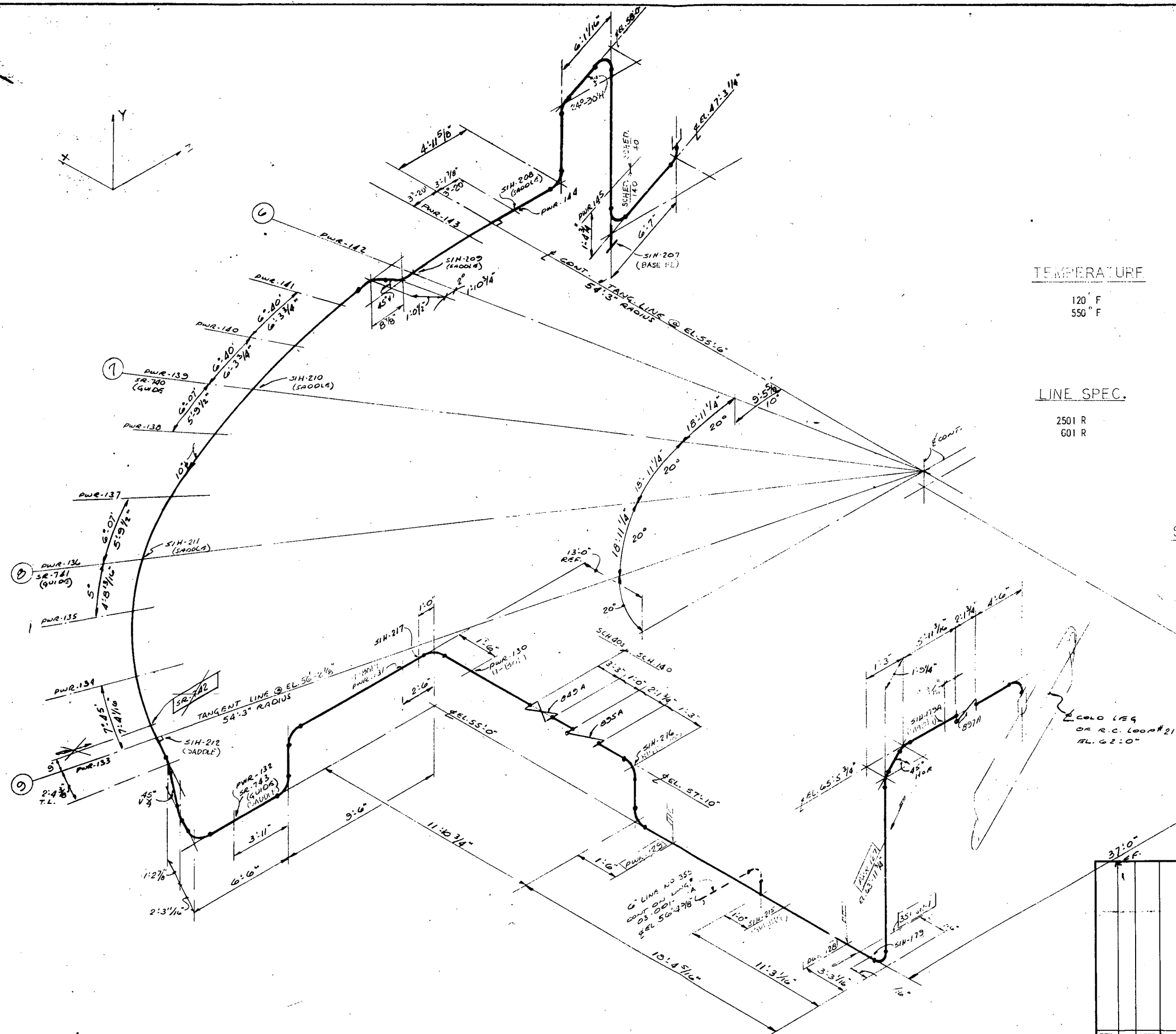
2501 R
601 R

LEGEND

YIP I

DEFINITIONS
HYDRAULIC
NUMBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY UNIT 2, LINE NO. 351 WIDE CONTAINMENT			
REV.	BY	APPD.	DESCRIPTION
NO.		DATE	
1	SA	10/1/82	03-IP2-1231 B



TEMPERATURE

120 ° F
550 ° F

REF. DRAWING

9321-F-2562 REV 19
2614 REV 13
2617 REV 15

LINE SPEC.

2501 R
601 R

LEGEND

SYMBOL

DEFINITIONS

HYDRAULIC

CN-FR DIRECTION

LINE #351

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
FINAL CONFIGURATION			
LINE NO. 351			
INSIDE - CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	S.A.	1/19/75	03-IP2-1351C

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APPENDIX II
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES BFD-21, -22, -23 & -24

DESCRIPTION

These lines are 3" & 4" schedule 80 carbon steel pipe. They connect the auxiliary boiler feed pumps to the four (4) 18" Boiler Feed Discharge Lines that feed each of the four Steam Generators. The feed for these lines comes from the condensate storage tank and will be at ambient temperature. The only thermal movements encountered from these lines are at the connections to the Main BFD lines when these are at normal hot operating temperatures. Isometric drawings of these lines are attached.

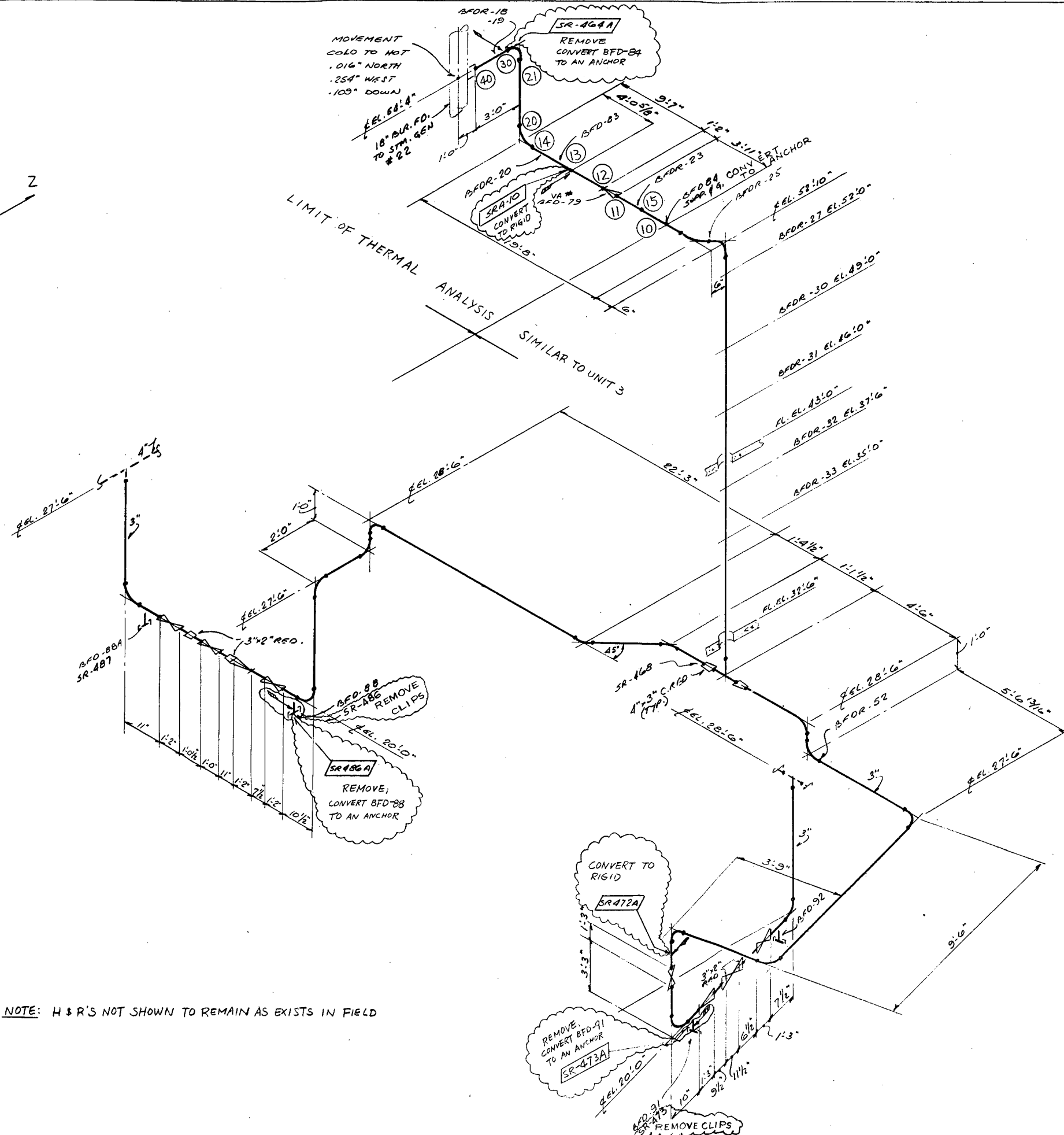
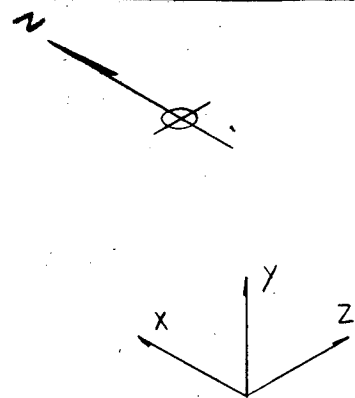
DISCUSSION

A review of these lines indicates that 20 hydraulic snubbers are being used. Since these lines are at ambient temperature, a large number of these snubbers may be removed without analysis. The hydraulic snubber at each valve station may be removed, and it is recommended that the base support that utilized the snubber be converted to an anchor. Other snubbers which are located a reasonable distance from the 18" connections can similarly be removed or converted to rigid links. The areas adjacent to the 18" pipe junctions, which absorb the main BF pipe movements that exist during normal operation, have been thermally analyzed. By adding an anchor and rigidizing the first East-West hydraulic snubber downstream from the connection, all remaining hydraulic snubbers can be removed, as proved by the analyses that were performed.

RECOMMENDATIONS

Based on the discussions above, a comparison with Unit 3 lines and the results of thermal analysis, the snubbers on these auxiliary boiler feed lines should be removed or modified as presented herein. The following is a summary of all the hydraulic snubbers in this system and their recommended disposition.

SR-A24	Remove. Not required since guide SR-463 will control.
SR-471A	Remove. Make BFD-98 into anchor, weld support to base.
SR-484A	Remove. Make BFD-101 into anchor.
SR-496A	Convert to rigid link.
SR-464A	Remove. Convert BFD-84 to an anchor.
SR-A10	Convert to rigid link.
SR-473A	Remove. Convert BFD-91 to anchor.
SR-486A	Remove. Convert BFD-88 to anchor.
SR-472A	Convert to rigid link.
SR-466A	Remove. Convert BFD-62 to anchor.
SR-A8	Convert to rigid link.
SR-475A	Remove. Convert BFD-69 to anchor.
SR-492A	Remove. Convert BFD-67 to anchor.
SR-465A	Remove. Convert BFD-72 to anchor.
SR-A9	Convert to rigid link.
SR-474A	Remove. Convert BFD-75 to anchor.
SR-490A	Remove. Convert BFD-79 to anchor.
SR-494A	Convert to rigid link.
SR-A11	Convert to rigid link.
SR-A13	Convert to rigid link.



NOTE: H & R'S NOT SHOWN TO REMAIN AS EXISTS IN FIELD

TEMPERATURE

70°F

RFF. DRAWING

9321-F- 2224 REV 2
2126 REV 13
2127 REV 13

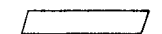
LINE SPEC.

A-106

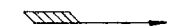
LEGEND

SYMBOL

DENOTES

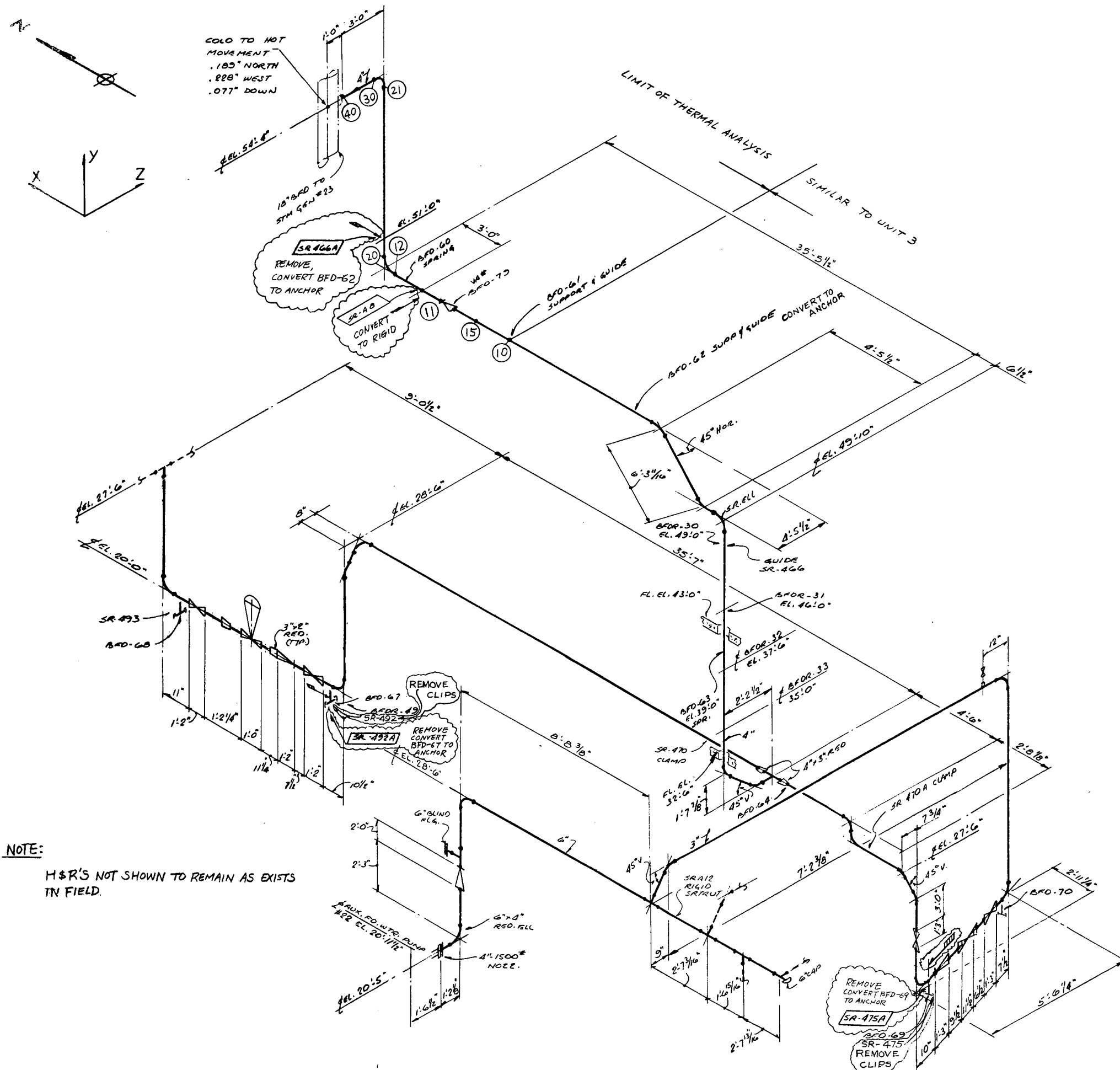


HYDRAULIC



SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.				FOR			
CONSOLIDATED EDISON COMPANY				INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY				LINE NO. BFD-22			
				OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	S.A.	7-19-78		LT	S.A.	7-19-78	03-IP2-2022



NOTE:
H&R'S NOT SHOWN TO REMAIN AS EXISTS
IN FIELD.

TEMPERATURE
70°F

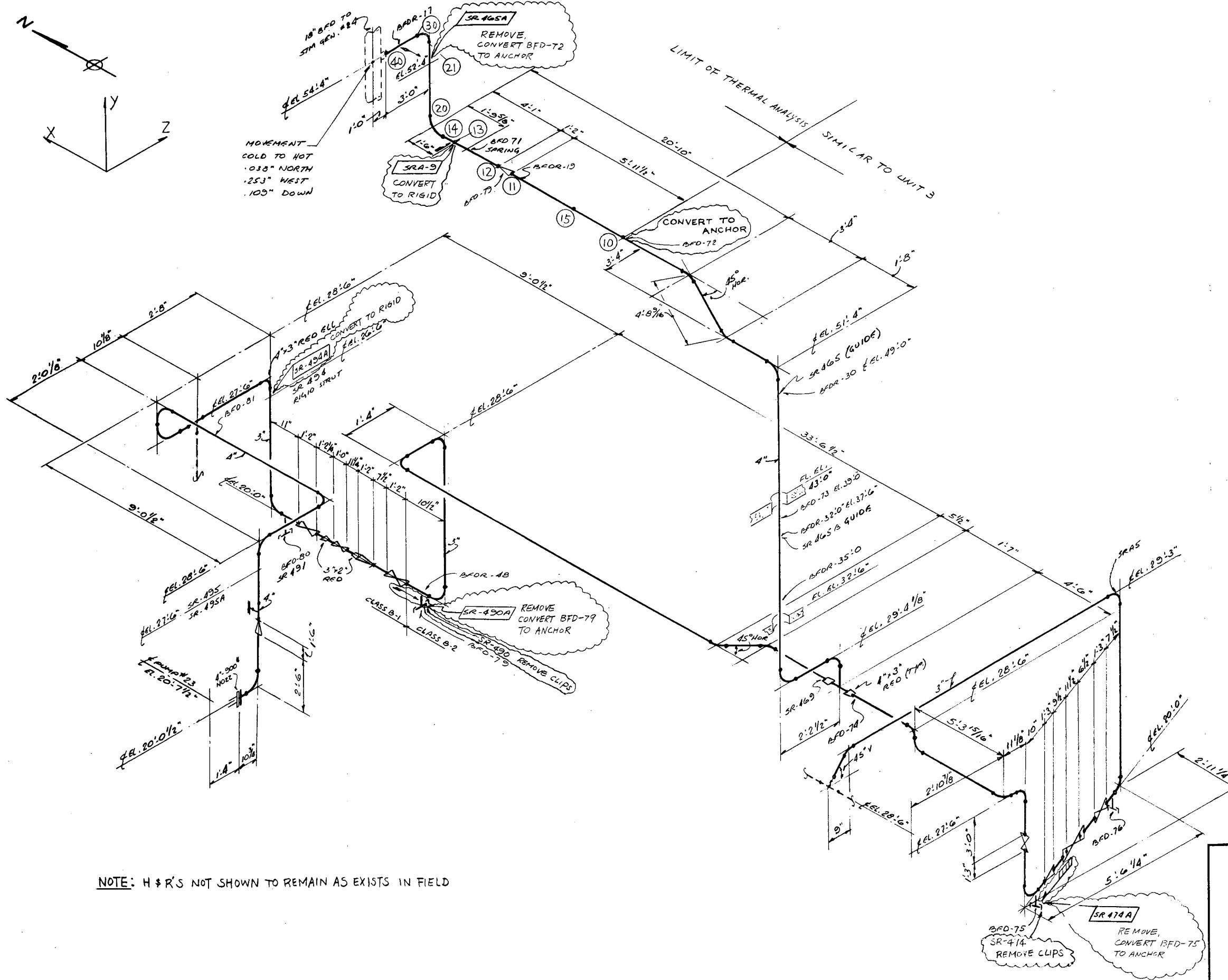
REF. DRAWING
9321-F-2224 REV 2
2126 REV 13
2127 REV 13

LINE SPEC.
A-106

LEGEND

SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. BFD-23 OUTSIDE CONTAINMENT			
REV. NO.	BY	APPRO. DATE	DESCRIPTION
1/1	S.A.	7-19-70	03-IP2-2023



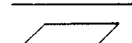
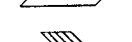
NOTE: H & R'S NOT SHOWN TO REMAIN AS EXISTS IN FIELD

TEMPERATURE
70°F

REF. DRAWINGS
9321-F-2224 REV 2
2126 REV 13
2127 REV 13

LINE SPEC.
A-106

LEGEND

SYMBOL DENOTES
 HYDRAULIC
 SNUBBER DIRECTION

REV. NO.		BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
					LLJ	S.A.	07-19-78	03-IP2-2024

ASSOCIATED TECHNOLOGIES, INC.
FOR
CONSOLIDATED EDISON COMPANY
INDIAN POINT UNIT No. 2
HYDRAULIC SNUBBER REMOVAL STUDY

LINE NO. BFD-24
OUTSIDE CONTAINMENT

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APPENDIX III
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 42

DESCRIPTION

Line No. 42 is a two inch stainless steel line which carries seal water from charging pump discharge, line 41 to the reactor coolant pump No. 22. The line temperature is 130°F, except for a short portion adjacent to the pump which may go up to 175°F. As may be seen from the drawing No. 03-IP2-1042, there are four snubbers which are all located in that portion of the line close to the coolant pump.

DISCUSSION

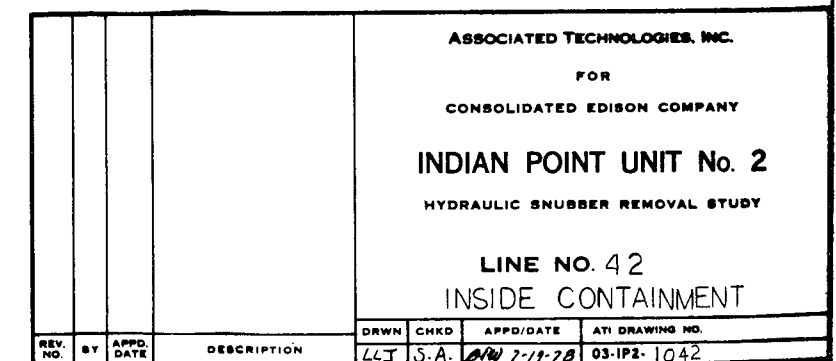
For the analysis that was performed, an anchor was assumed at a point sufficiently far away from the coolant pump so as not to have an overly significant effect on the pump and yet provide for a conservative thermal analysis. Only the portion from the anchor to the pump is considered for this thermal analysis.

Because of the line configuration, support locations and its relatively cold temperature, three snubbers are changed to rigid rods. Based on the thermal analysis, a maximum stress of 13,794 psi was computed at the pump connection nozzles. This compares with a code allowable thermal stress limit of 22,500 psi in the pipe. For the case of a small line connected to a thick walled pump casing, the moments introduced would have negligible effect on the pump casing. SR-1108 was removed due to the fact that SR-1107, which was rigidized, would accommodate the loads in the East and West direction, making SR-1108 redundant.

RECOMMENDATIONS

Based on the results of the thermal analysis and the discussion above, the following recommendations are made:

SR-1109	Convert to rigid link
SR-1107	Convert to rigid link
SR-1108	Remove
SR-1111	Convert to rigid link



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APPENDIX IV
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 13,
PUMP 22

DESCRIPTION

These are 1", 1½" and 3" carbon steel lines routed from the component cooling heat exchangers 21 and 22 via line 53 to R.C. pump seals and motor cooling. This appendix addresses itself to only that portion of the line going to R.C. pump 22. The lines carry cooling water and are at 120°F.

There are three connecting points to the Reactor Coolant pump at elevations 65'-10 5/8", 75'-9 1/8" and 84'-9 15/16". The main supply line is at elevations 69'-0" and penetrates the crane wall from a riser which is 21'-4" in overall height. The portion being considered is terminated at the bottom region of the riser as shown on isometric dwg. 03-IP2-1013-22.

DISCUSSION

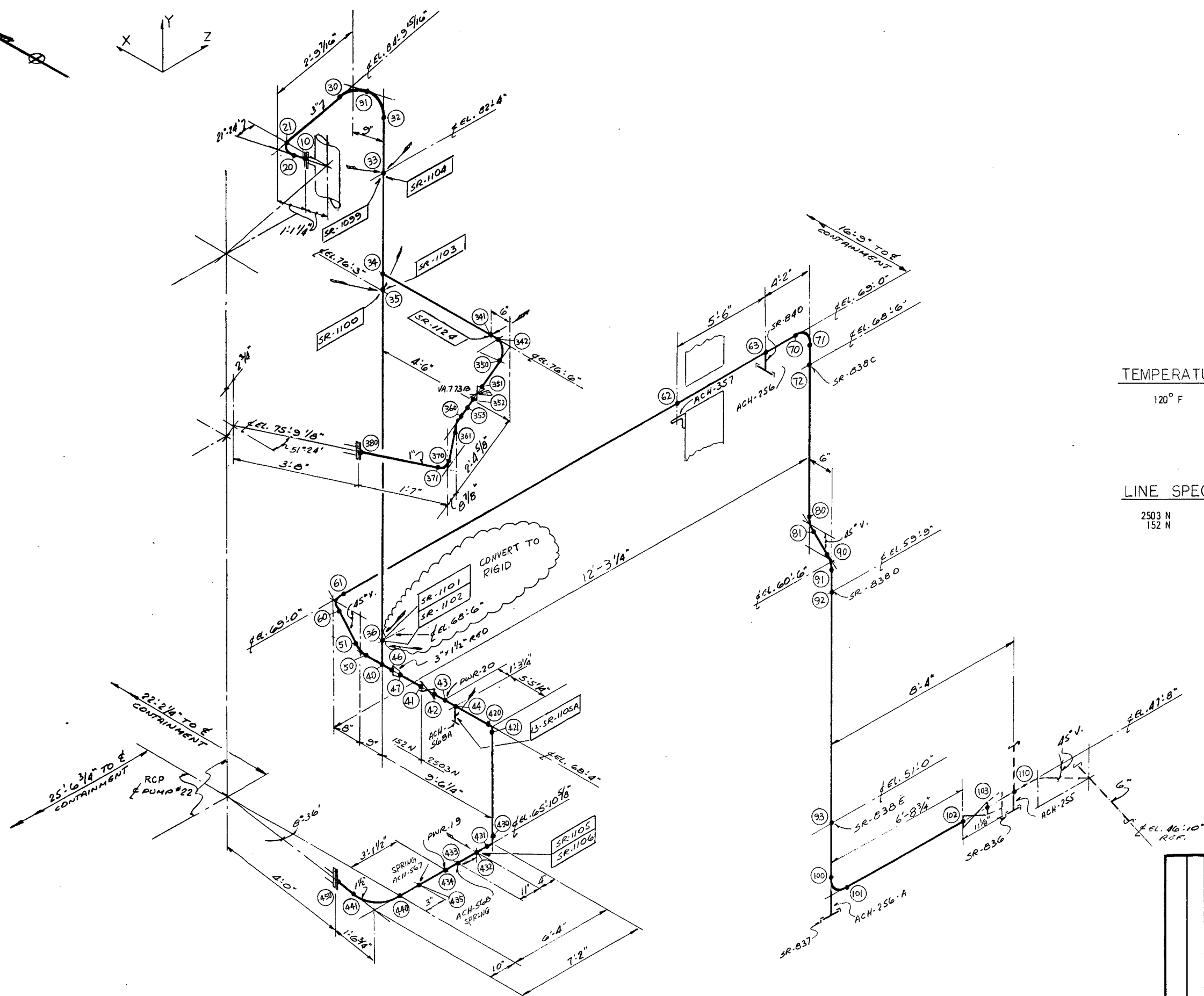
A review of the line configuration indicates that the routing is confined and has very little flexibility to allow for rigidizing many snubbers. Changes must accommodate the low temperature of the line as well as significant reactor coolant pump movement during heatup. Accordingly, only two out of the ten snubbers were found to be acceptable for conversion to rigid links.

Thermal analyses performed on the lines incorporating the changes when the two snubbers indicated a maximum stress of 20,533 psi. For the piping material specified the code allowable limit for thermal stress is 22,500 psi. The termination of the line at node 110, although not an anchor, is considered to be quite acceptable since the 21'-4" vertical riser supports essentially isolate the line portion near the pump.

RECOMMENDATIONS

Based on the results of the thermal analysis and the discussion above it is recommended that two snubbers be modified as follows:

SR-1101	Convert to rigid link
SR-1102	Convert to rigid link



TEMPERATURE

120° F

REF. DRAWING

9321-F-2566 REV 15
2565 REV 18
2527 REV 14

LINE SPEC.

2503 N
152 N

LEGEND

SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
LINE NO.13 (RCP 22)			
INSIDE CONTAINMENT			
REV. NO.	BY	APPRO. DATE	DESCRIPTION
LLT	S.A.	07/19/78	03-IP2-1013-22

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APPENDIX V
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 14,
PUMP 21

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 14, PUMP 21

Sheet 1 of 1
Report No. 03-00102
Revision 0
July, 1978

DESCRIPTION

Line 14 is a three-inch carbon steel line which runs from R.C. pump motor cooling to the component cooling pumps 21, 22 and 23 via line 52. This appendix addresses itself to only that portion of the line associated with R.C. pump 21. It carries cooling water at a maximum temperature of 120°F.

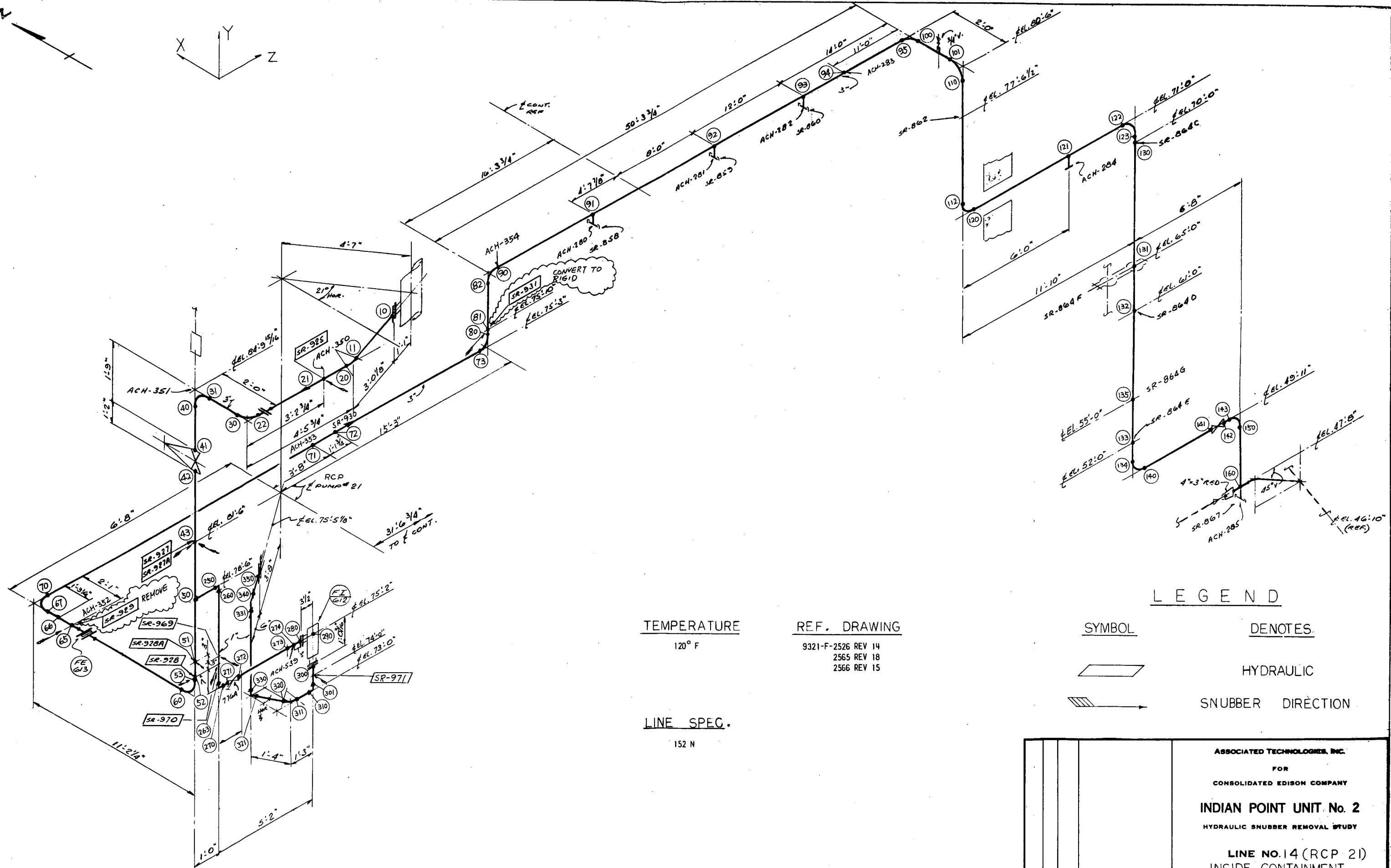
DISCUSSION

The ten snubbers placed on the whole system are concentrated in the R.C. pump area. See isometric drawing No. 03-IP2-1014-21. A review of the system shows that the configuration is not very flexible and snubbers may be made rigid only with difficulty. From the thermal analysis, only one snubber can be changed to a rigid rod. SR-929 was removed due to the fact that SR-931 was rigidized and supports the loads in the east-west direction. Under these conditions the thermal analysis performed indicates a maximum stress of 9,758 psi at point No. 250. For this piping material the code allowable thermal stress is 18,000 psi.

RECOMMENDATIONS

Based on the above, the following recommendations are made:

SR-931	Convert to rigid link
SR-929	Remove due to presence of SR-931



TEMPERATURE

120° F

LINE SPEC.

152 N

REF. DRAWING

9321-F-2526 REV 14
2565 REV 18
2566 REV 15

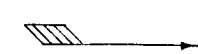
LEGEND

SYMBOL

DENOTES



HYDRAULIC



SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. 14 (RCP 21) INSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
LT	S.A.	7-19-78	03-IP2-1014-21

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Revision 0
July, 1978

APPENDIX VI
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 14A,
PUMP 21

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 14A, PUMP 21

Sheet 1 of 1
Report No. 03-00102
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July, 1978

DESCRIPTION

Line 14A is a 1 1/2" carbon steel line that brings cooling water from R.C. pump seals to component cooling pumps 21, 22 and 23 via lines 14 and 52. For this analytical review, only the portion of this line associated with R.C. pump 21 is considered. The line temperature is 120°F.

DISCUSSION

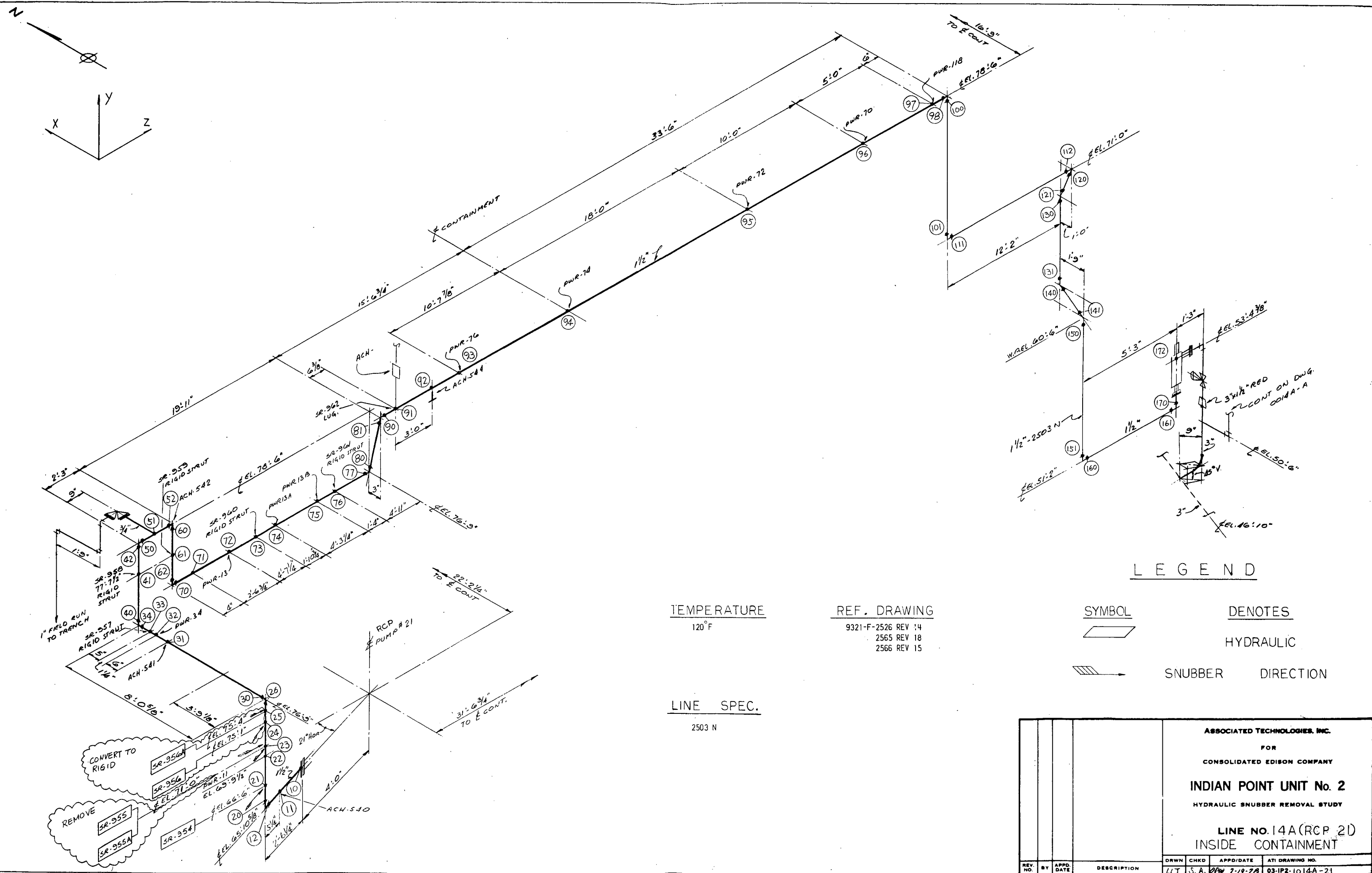
There are five snubbers and all are located on the first riser from R.C. pump 21. See drawing No. 03-IP2-1014A-21. Although the motions from the pump are significant: -1.125" X, 0.604"Y & -1.500"Z, there is adequate flexibility and thus the two snubbers which are located on the highest elevation were made rigid. From the thermal analysis results, the highest stress was 7825 psi at the nozzle. The code allowable thermal stress for this pipe is 22,500 psi. A review of the moments and forces causing this stress indicated that the load level was acceptable.

The span criteria for dynamic loads on Unit 3 provides for spans in excess of 10 feet for this location and elevation. Based on these criteria, it is also feasible to remove entirely snubbers SR-955 and SR-955A without compromising the safety and adequate support of the piping system.

RECOMMENDATIONS

It is recommended that two snubbers be made rigid and two others removed entirely. The breakdown is as follows:

SR-955	Remove
SR-955A	Remove
SR-956	Convert to rigid link
SR-956A	Convert to rigid link



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APPENDIX VII

INDIAN POINT GENERATING STATION

UNIT NO. 2

HYDRAULIC SNUBBER REVIEW

LINE NO. 9

DESCRIPTION

Line 9 is a 12 inch stainless steel line which runs from the residual heat removal pumps 21 and 22 to the residual heat exchangers 21 and 22. This Appendix addresses itself to only that portion of the line outside containment, from the pumps to the containment penetration. The line temperature is 350°F. Since there is an anchor within the run, one computer analysis was carried out for both portions. See attached drawing 03-IP2-2009 which provides the piping isometric with the current configuration and the recommended changes.

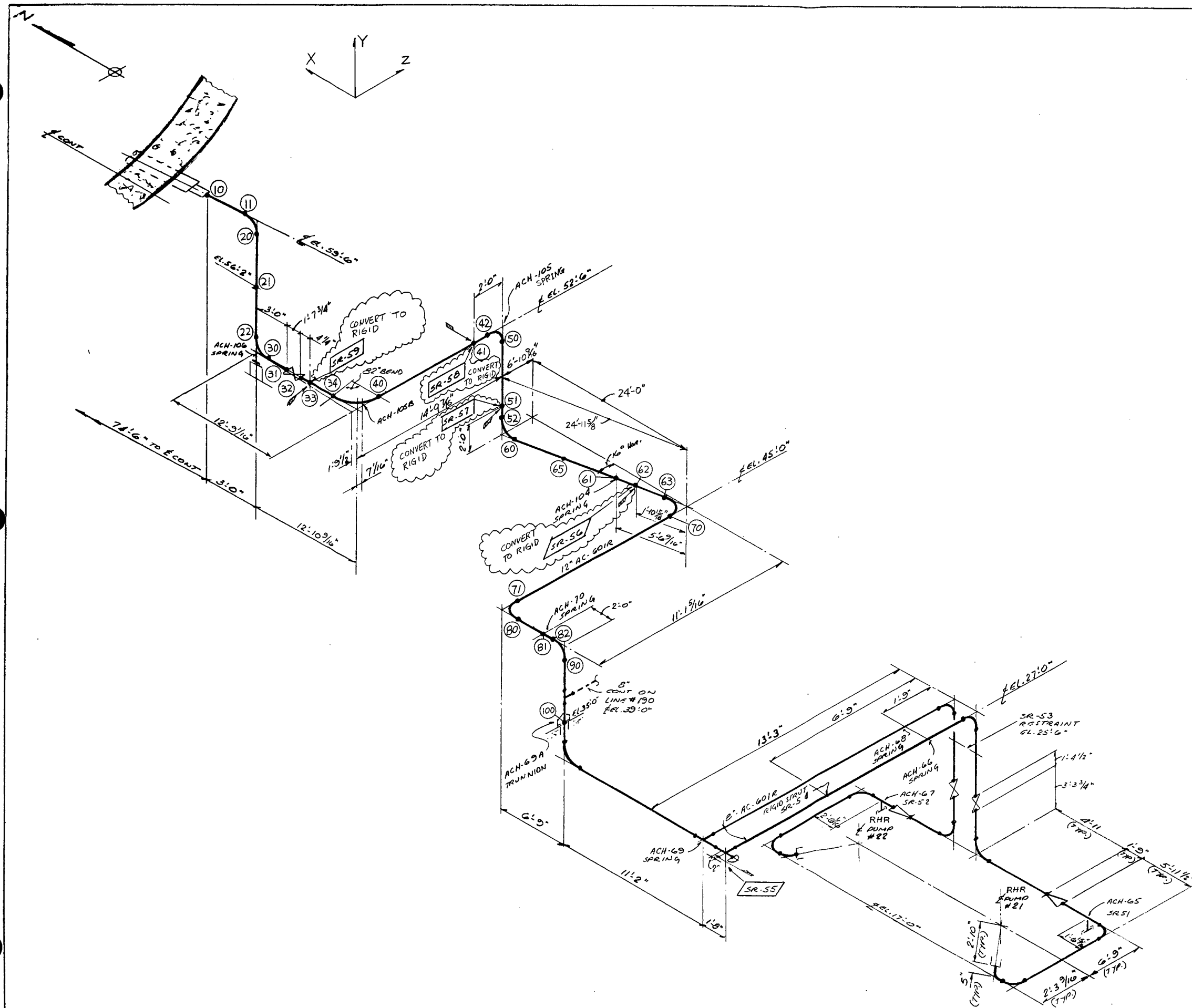
DISCUSSION

Based on the line configuration and support locations, all the snubbers were changed to rigid restraints and the system analyzed thermally to determine the maximum stresses, displacements and loads on the existing and modified supports. A maximum stress of 11,297 psi was obtained at point no. 71 under these conditions and this value is well within the code allowable limit of 26,740 psi. However, support loads in excess of 10 kips were obtained for rigidized SR-55. Because of this ATI recommends that SR-55 be left in place as an hydraulic snubber. The more conservative computer analysis results showing SR-55 as a rigid link are presented.

RECOMMENDATIONS

There are a total of five snubbers on the system and the following recommendations are made for their disposition:

SR-56	Convert to rigid link
SR-57	Convert to rigid link
SR-58	Convert to rigid link
SR-59	Convert to rigid link
SR-55	Leave as is



TEMPERATURE

350° F

REF. DRAWING

9321-F-2561 REV 10
2573 REV 28
2588 REV 27
2589 REV 20
2678 REV 22

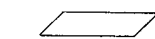
LINE SPEC.

601 R

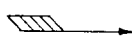
LEGEND

SYMBOL

DENOTES



HYDRAULIC



SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.				FOR			
				CONSOLIDATED EDISON COMPANY			
				INDIAN POINT UNIT No. 2			
				HYDRAULIC SNUBBER REMOVAL STUDY			
				LINE NO. 9			
				OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	LTJ	7-19-78		S.A.	7-19-78		03-IP2-2009

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APPENDIX VIII
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES 10 & 57

DESCRIPTION

Line 10 carries primary water from the reactor coolant loops to the residual heat removal (RHR) pumps while Line 57 runs from the containment building sump to the RHR pumps via Line 10. These lines are stainless steel 14 inch lines which terminate in 10 inch lines at the RHR pumps. The maximum line temperature is 350°F. The configuration is shown on the attached drawing 03-IP2-2010 which presents the piping isometric with the current configuration and the recommended changes. A portion of the line near the residual heat removal pump No. 21 was included in this computer model to a distance of over 40 feet and includes several lateral and vertical restraints to adequately filter out any possible thermal input from that end.

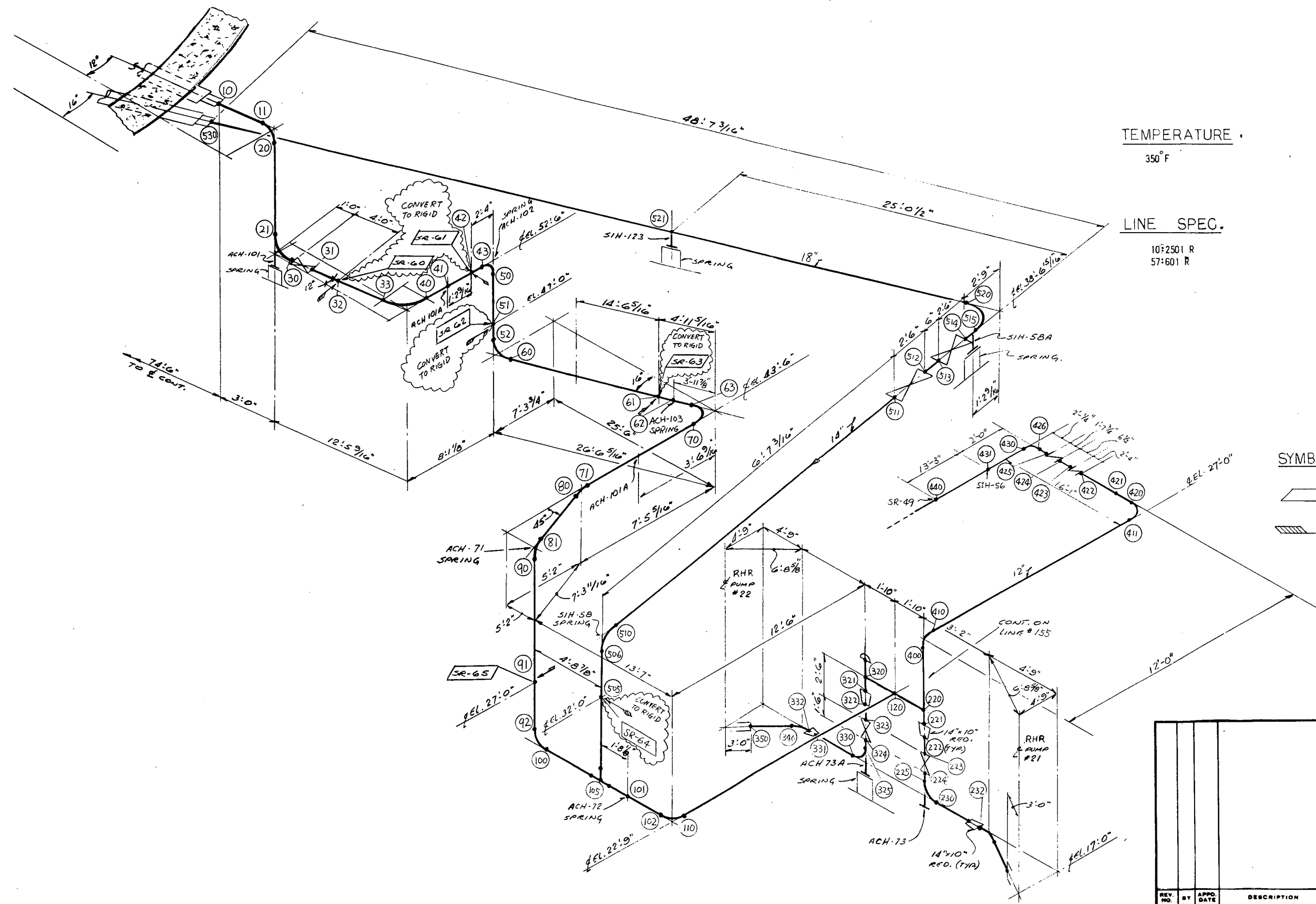
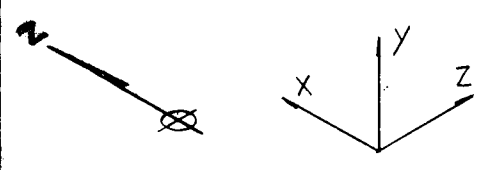
DISCUSSION

Based on the line configuration, the support configurations and the support locations, several snubbers were change to rigid and a thermal analysis performed. It should be noted that pump No. 22 is free to move in a direction along the axis of the pipe connected to it. The overall piping configuration is quite constricted and relatively high stresses were obtained. The maximum thermal stress was found to be 12,072 psi at node 520 which is in the elbow on line 10. The maximum stress encountered in line 57 is 11,085 psi at node 225 which is near the anchor prior to the run into the pump No. 21. Code allowable stress for this pipe is 26,740 psi. Several runs were made. In one study case, all snubbers were made rigid but exceptionally high stresses were obtained and thus SR-65 was left as a snubber in order to meet the stress requirements of the pipe.

RECOMMENDATIONS

There are a total of six snubbers on the system and it is recommended that they all be changed to rigid rods as indicated below except for SR-65 which should be left in place:

SR-60	Convert to rigid link
SR-61	Convert to rigid link
SR-62	Convert to rigid link
SR-63	Convert to rigid link
SR-64	Convert to rigid link
SR-65	Leave as is



TEMPERATURE
350° F

LINE SPEC.
10:2501 R
57:601 R

REF. DRAWING
9321-F-2566 REV 15
2573 REV 28
2588 REV 27
2589 REV 20
2613 REV 5
2678 REV 22

LEGEND	
SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.			
FOR			
CONSOLIDATED EDISON COMPANY			
INDIAN POINT UNIT No. 2			
HYDRAULIC SNUBBER REMOVAL STUDY			
LINE NO. 10 & 57			
OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	LLT	S.A. 07/19/78	03-IP2-2010

Report No. 03-00102
Revision 0
July, 1978

APPENDIX IX
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 15

DESCRIPTION

Line 15 is an 8 inch stainless steel line which carries borated water to the containment building spray system headers Nos. 1 and 3. The line temperature is 120°F. For this analytical review, the line portion being considered is outside containment from the penetration at elevation 64'-0" to the spray pump. Since there is an anchor within the run, and there are snubbers in each portion, two separate computer analyses were carried out. The designations are:

1. 15A for the main portion adjacent to the containment penetration.
2. 15B for the remaining section from the intermediate anchor to the spray pump.

See the attached drawing 03-IP2-2015 which provides the piping isometric with the current configuration and the recommended changes.

DISCUSSION

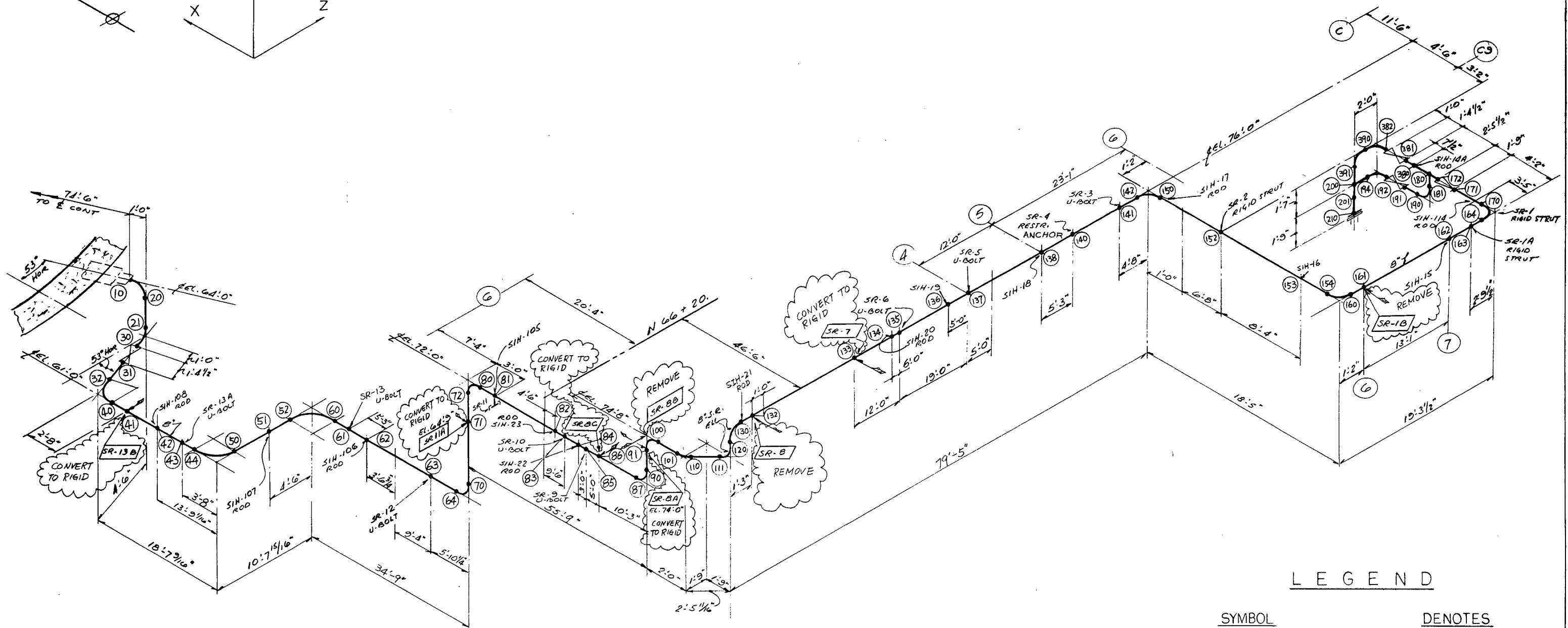
The line configuration and support locations lend themselves to significant improvement in the removal and replacement of snubbers while enhancing the safe operation of the pipe through greater utilization of passive restraints. Based on the configuration, several snubbers were changed to rigid passive restraints and the system analyzed thermally to determine the maximum stresses, displacements and loads on the existing and modified supports. The changes were found to be quite acceptable resulting in a maximum stress of 7,313 psi at point no. 70. Code allowable stress for this pipe is 27,900 psi. Support end nozzle loadings are considered to be within acceptable limits.

In addition to the five snubber locations which were changed to rigid restraints, three snubbers were completely removed due to redundancy for postulated seismic loads. Snubber SR-8 performs no required function due to the presence of support SR-8A which has been changed to a rigid passive restraint. Snubber SR-8B duplicates the function of the anchor SR-4 at node 140 which completely restrains east-west motion. SR-1B may also be removed, since it is redundant due to the SR-2.

RECOMMENDATIONS

Based on the above the following recommendations are made for the enhanced safe operation of the pipe:

SR-1B	Remove. Redundant to SR-2
SR-7	Convert to rigid link
SR-8	Remove due to rigid SR-8A
SR-8A	Convert to rigid link
SR-8B	Remove due to anchor SR-4
SR-8C (2)	Convert to rigid links
SR-11A	Convert to rigid link
SR-13B	Convert to rigid link



SNUBBER	DIRECTION
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
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89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

301 R

				ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. 15 OUTSIDE CONTAINMENT			
REV. NO.	BY	APPRO. DATE	DESCRIPTION	DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
				LLT	S.A.	09-19-78	03-IP2-2015

Report No. 03-00102
Revision 0
July, 1978

APPENDIX X
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 41

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 41

Sheet 1 of 1
Report No. 03-00102
Revision 0
July, 1978

DESCRIPTION

Line 41 is a two-inch stainless steel line from the charging pumps 21, 22 and 23 to the reactor coolant pump 21. The line temperature is 130°F. except for a short portion adjacent to the coolant pump which may go up to 175°F. As may be seen from the drawing 03-IP2-1041, there is a total of six snubbers placed on the whole system. The geometric configuration of this Unit 2 line is dissimilar to that of Unit 3 and no comparisons on support locations may be made.

DISCUSSION

An anchor has been assumed at a point sufficiently far away from the coolant pump to assure that there will be no significant effect on the section with the snubbers from the remainder of the system. This is judged to be very conservative. The configuration is such that the results would be conservative. Only the portion from the anchor to the coolant pump is considered in this analysis. See the attached drawing 03-IP2-1041. Three snubbers were changed to rigid passive restraints and the maximum stress of 10,360 psi was obtained at point no. 11. This stress level is well within the code allowable limit of 27,460 psi.

RECOMMENDATIONS

Based on thermal analysis performed, the following changes are recommended:

SR-948A	Convert to rigid link
SR-949	Convert to rigid link
SR-952A	Convert to rigid link

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APPENDIX XI
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE NO. 51

DESCRIPTION

Line No. 51 is an 8 inch diameter stainless steel line which runs from the Containment Spray Pump No. 21 into the containment building. The region considered in this analysis lies completely outside of the containment from the penetration back to Pump 21. It carries borated water and is at a maximum temperature of 120°F.

As may be seen from the drawing No. 03-IP2-051A, the system configuration is relatively simple and consists of two major legs with minor jogs in each leg to accommodate the thermal growth in the system. There are a total of seven snubbers in the system. A comparison of this piping configuration with Unit No. 3 shows that the routing is sufficiently different to warrant a thermal analysis for the removal of these snubbers.

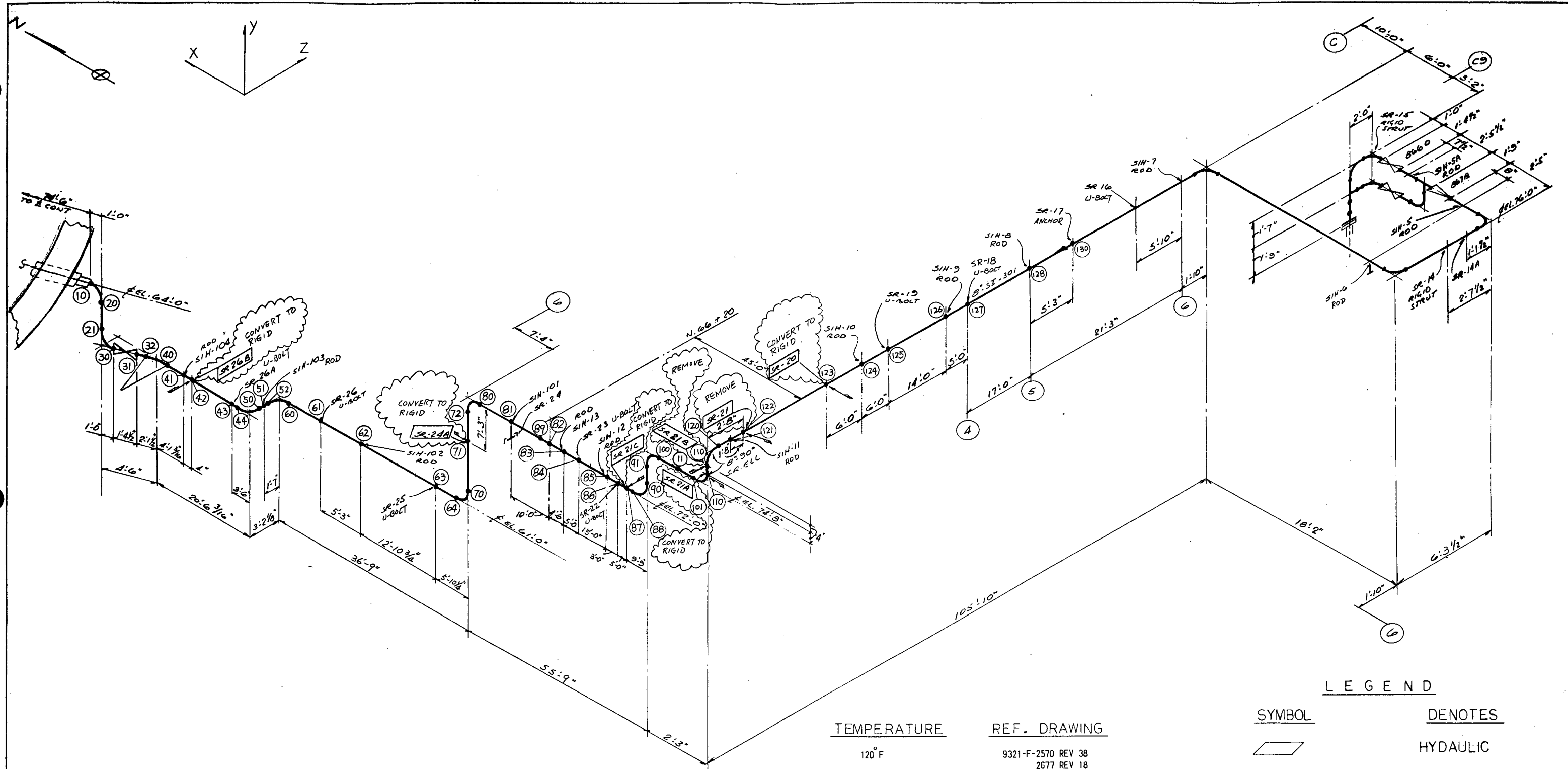
DISCUSSION

The line is relatively cold and because of this can be much more rigidly held in place than presented in the current configuration. On this basis several snubbers were changed to rigid restraints. At the same time other snubbers were completely removed because the configuration of the support system makes them redundant for earthquake induced loads. From drawing 03-IP2-051A it may be seen that the legs of the pipe run were adequate to accommodate the thermal movements, which was proven by analysis. The maximum calculated thermal stress is 7,791 psi, at point no. 64 which is well within the code allowable limit of 27,900 psi. In addition SR-21B and SR-21 were both completely removed because their function is redundant for the seismic loadings anticipated. SR-21B is not necessary because of the presence of the anchor at node 130. SR-21 is redundant due to the fact that SR-21A would accommodate the loads in the north-south direction. SR-20 has also been rigidized.

RECOMMENDATIONS

There are a total of seven hydraulic snubbers on the system, and the following recommendations are made for the disposition of the snubbers:

SR-21	Remove since it is redundant due to the presence of rigidized SR-21A.
SR-21B	Remove. Redundant due to anchor SR-17, at node 130
SR-21C (2)	Convert to rigid links
SR-24A	Convert to rigid links
SR-26B	Convert to rigid link
SR-20	Convert to rigid link
SR-21A	Convert to rigid link



TEMPERATURE
120° F

REF. DRAWING
9321-F-2570 REV 38
2677 REV 18

LINE SPEC.
301 R

LEGEND

SYMBOL	DENOTES
	HYDRAULIC
	SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. 51 OUTSIDE CONTAINMENT			
REV. NO.	BY	APPD. DATE	DESCRIPTION
DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
LCJ	S.A.	02/07/98	03-IP2-205

Report No. 03-00102
Revision 0
July, 1978

APPENDIX XII
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE 60 OUTSIDE CONTAINMENT

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINE 60 OUTSIDE CONTAINMENT

Sheet 1 of 1
Report No. 03-00102
Revision 0
July, 1978

DESCRIPTION

Line 60 supplies borated water from the residual heat exchanger #21 to the safety injection pumps #21, #22 and #23. The portion being considered here is located outside containment and runs from the penetration to the safety injection pumps. It consists of 8-inch stainless steel piping with a small 6-inch section and operates at 270°F with a design maximum of 350°F.

DISCUSSION

The line is seismically restrained by rigid stops and five hydraulic snubbers. A thermal analysis was performed to evaluate the stress levels due to rigidizing SR-77A. The maximum stress was found to be 9548 psi at node 154 which is acceptable, based on a code allowable limit of 26,740 psi. In addition to the thermal analysis, a seismic review indicates that three additional snubbers may be completely removed. Each of these are located on a riser which immediately turns west to a horizontal header which is oriented in the north-south direction. The header is rigidly restrained from any movement perpendicular to its north-south axis. This makes the three east-west snubbers SR-76A, SR-83A and SR-83D functionally redundant. See the attached drawing No. 03-IP2-2060 which presents the current configuration and the recommended changes.

RECOMMENDATIONS

Based on the results of the thermal analysis and the discussions above, it is recommended that the following modifications be made:

SR-73A	Leave in
SR-76A	Remove. Redundant due to presence of SR-75A and SR-78.
SR-77A	Convert to rigid link
SR-83A	Remove. Redundant due to presence of SR-75 and SR-75A.
SR-83D	Remove. Redundant due to presence of SR-74

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APPENDIX XIII
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES 413 & 414

DESCRIPTION

Lines 413 and 414 supply cooling water to the diesel generator lube oil system and operates at an ambient temperature of 85°F. They are 10" lines and run from the service water return header to diesels 21, 22 and 23. They are supported adequately for gravity load and are restrained against seismic loads. There are two snubbers on each line all of which are oriented in a north-south direction.

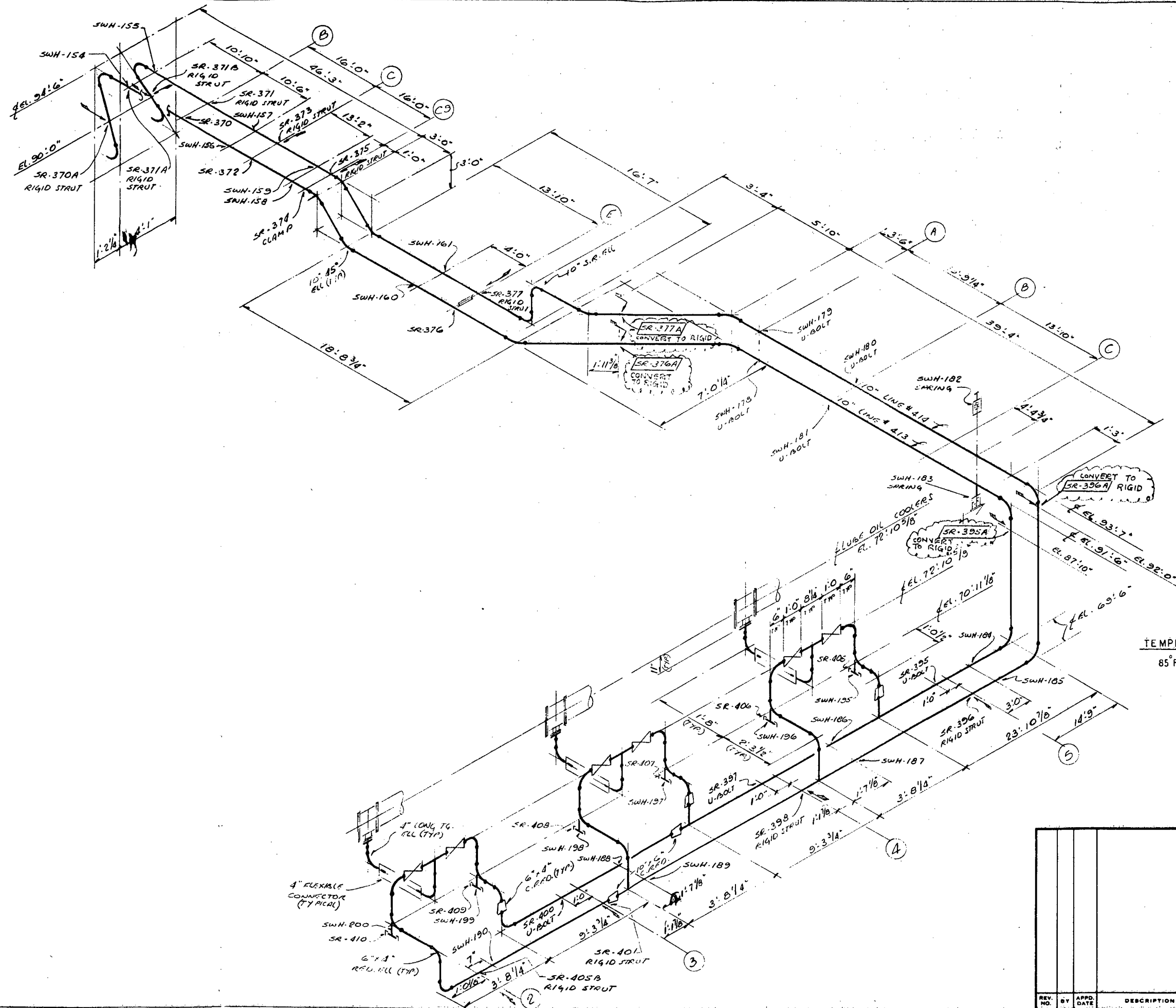
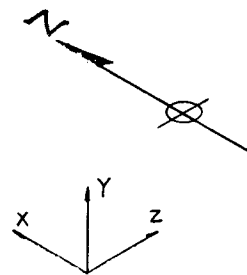
DISCUSSION

There appears to be adequate flexibility in the lines for thermal loading. There must however be adequate supports for seismic loadings at the same time and lateral restraints must be utilized. In both lines the snubbers are located in such a manner that rigidizing both of them would not adversely affect the thermal stress level of the line since sufficient flexibility is provided in the expansion legs. A formal computer analysis was not considered necessary because of the ambient temperature of these lines. The applicable region of consideration is of very simple configuration and is located on elevation 91'-6", and includes the riser from elevation 69'-6". See the attached drawing No. 03-IP2-2413 which presents the current configuration and the recommended changes.

RECOMMENDATIONS

Based on the above discussions, it is recommended that the following changes be made on each line.

Line 413	SR-376A	Convert to rigid link
	SR-395A	Convert to rigid link
Line 414	SR-377A	Convert to rigid link
	SR-396A	Convert to rigid link



REF. DRAWINGS

9321-F-2257 REV 12
2571 REV 32

TEMPERATURE
85°F

LINE SPEC.
4-6-10 SWN

LEGEND
SYMBOL
DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC.
FOR
CONSOLIDATED EDISON COMPANY
INDIAN POINT UNIT No. 2
HYDRAULIC SNUBBER REMOVAL STUDY
LINE NO. 413 & 414

REV. NO.	BY	APPD. DATE	DESCRIPTION	DRWN	CHKD	APPD. DATE	ATI DRAWING NO.
1	S.A.	09/27/78					03-IP2-2413

Report No. 03-00102
Revision 0
July, 1978

APPENDIX XIV
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES V-3, -4, -5 & -6

DESCRIPTION

These lines are located above the auxiliary building and vent the exhaust steam from the main steam power operated relief valves and from the emergency feed pump turbine feed pump. They consist of 12-inch carbon steel piping and may experience a maximum temperature of 240°F. In the current configuration the lines terminate into large silencers which are themselves firmly restrained against seismic loadings.

DISCUSSION

In all cases, additional snubbers over and above those recommended for removal in this appendix can be considered for conversion to rigid by modifying existing supports and performing thermal analyses.

Line V-3

SR-M32 can be removed due to the presence of the Z-stop indicated in the Con Ed calculation at node 25. Because of the 7/8" movement in the X direction, however, SR-M33 should be left in place.

Line V-4

SR-M26 should be removed as a redundant restraint due to the presence of the Z-stop at node 230 and the restraint provided by SR-M25. SR-M28 should be removed since its restraint function can be fulfilled by SR-M27 which is offset by only three feet.

Line V-5

There are no restraints in the Z-direction and thus the only possible snubbers which may be considered for removal, SR-M35 and -M36 must be left in, as must the remainder.

Line V-6

MS-375A is a guide and acts as a horizontal restraint on the riser two and a half feet above SR-M42 and -M43. This effectively negates any restraint capability which may be supplied by these snubbers and they should be removed as redundant.

RECOMMENDATION

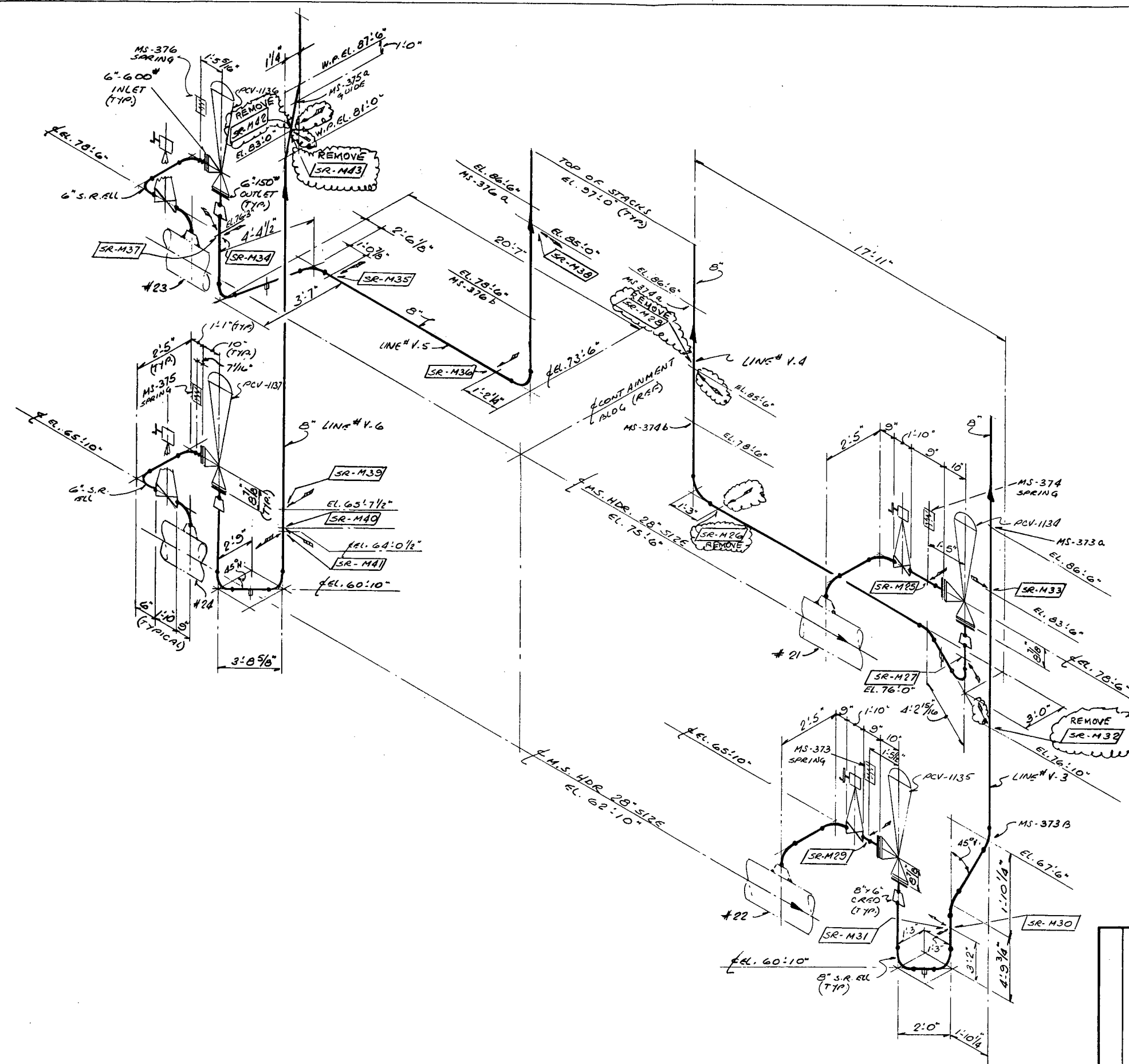
Based on the above discussions and without considering additional or extensive modifications it is recommended that the following changes be made:

V-3	SR-M29	Leave in
	SR-M30	Leave in
	SR-M31	Leave in
	SR-M32	Remove as redundant
	SR-M33	Leave in

INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES V-3, -4, -5 & -6

Sheet 2 of 2
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V-4	SR-M25	Leave in
	SR-M26	Remove as redundant
	SR-M27	Leave in
	SR-M28	Remove as redundant
	SR-M52	Leave in
V-5	SR-M34	Leave in
	SR-M35	Leave in
	SR-M36	Leave in
	SR-M37	Leave in
	SR-M38	Leave in
V-6	SR-M39	Leave in
	SR-M40	Leave in
	SR-M41	Leave in
	SR-M42	Remove as redundant
	SR-M43	Remove as redundant



REF. DRAWINGS

9321-F-2049 REV 20
2050 REV 14
2073 REV 11

TEMPERATURE
240° F

LINE SPEC.
A-53

LEGEND
SYMBOL DENOTES
HYDRAULIC
SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. V-3, 4, 5 & 6			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	S.A.	01-07-78	03-IP2-20V3
DRWN	CHKD	APPD/DATE	ATI DRAWING NO.
SA	SA	01-07-78	03-IP2-20V3

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APPENDIX XV
INDIAN POINT GENERATING STATION
UNIT NO. 2
HYDRAULIC SNUBBER REVIEW
LINES PCA-2 & PCA-3

DESCRIPTION

Lines PCA-2 and PCA-3 are 3" carbon steel lines which provide cooling air to the containment hot penetrations. PCA-2 is the inlet side and is at ambient temperature while PCA-3 is the outlet line with a maximum assumed temperature of 120°F. Each system has one hydraulic snubber.

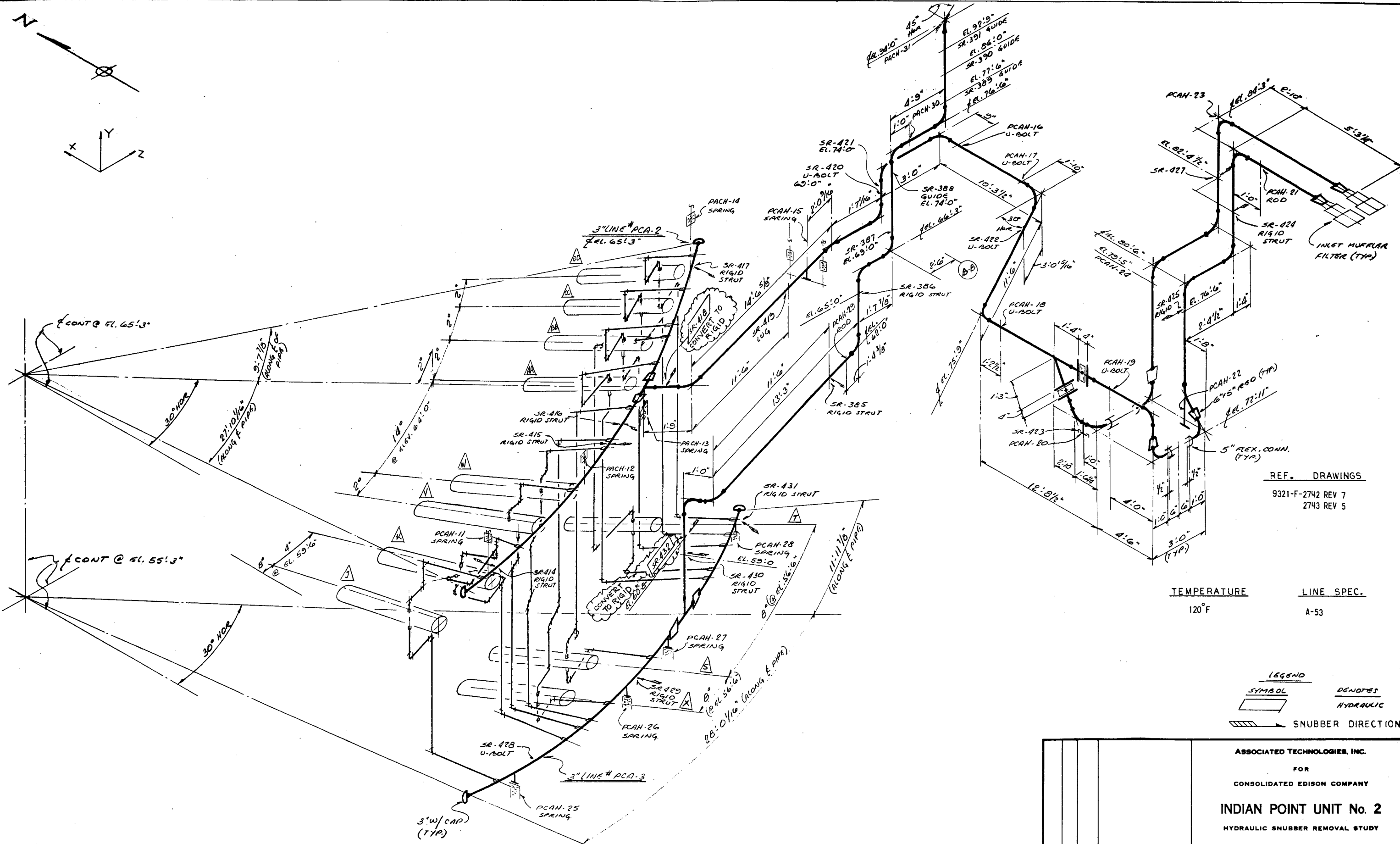
DISCUSSION

On PCA-2, SR-418 may be changed to a rigid restraint since the line is an ambient cold water line and no thermal problems are foreseen. Line PCA-3 which we assume to be at 120°F has one hydraulic snubber also, SR-432, which may be changed to a rigid restraint. Flexibility in the line to accommodate the expansion of the 13'-3" run is judged to be sufficient between SR-386 and SR-432. Note that between elevation 62'-0" and 55'-3" the line is in torsion which is quite acceptable. Formal analyses were not required for these lines due to their low nominal temperatures.

RECOMMENDATION

Based on the above discussion, it is recommended that both snubbers be rigidized to improve the safe operation of the line as follows:

SR-418	Convert to rigid link
SR-432	Convert to rigid link



REF. DRAWINGS
9321-F-2742 REV 7
2743 REV 5

TEMPERATURE
120°F

LINE SPEC.
A-53

LEGEND

SYMBOL DENOTES

SNUBBER DIRECTION

ASSOCIATED TECHNOLOGIES, INC. FOR CONSOLIDATED EDISON COMPANY INDIAN POINT UNIT No. 2 HYDRAULIC SNUBBER REMOVAL STUDY LINE NO. PCA-2&3			
REV. NO.	BY	APPD. DATE	DESCRIPTION
1	S.A.	APR 7-1978	03-IP2-2 PCA