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April 25, 1991

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Subject: McGuire Nuclear Station
Docket Numbers 50-369 and -370
Catawba Nuclear Station
Docket Numbers 50-413 and -414
Response to Conditions Relative to the
Use of Topical Report BAW-10173;
Supplement
(TAC Nos. 73771/73772)

By letter dated February 20, 1991, Mr. Robert Martin transmitted the NRC staff's Safety Evaluation Report (SER) for topical report BAW-10173. The SER found the Topical Report to be acceptable for referencing in support of future reloads, provided 5 conditions which the Staff requested be addressed were met. By letter dated March 14, 1991 responses to these conditions were provided. In a subsequent telephone conversation between members of the NRC staff, B & W Fuel Company, and Duke, it was determined that additional analysis was necessary to completely address the Staff's concern relative to Condition 1. Accordingly, a revised response to Condition 1 is provided in the Attachment.

If there are any questions, please call Scott Gewehr at (704) 373-7581.

Very truly yours,

M. S. Tuckman

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topcond/sag

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Attachment I
Additional Response to Condition 1 for use of BAW-10173

Condition 1:

A benchmark analysis should be performed to verify appropriateness of the LYNXT modifications and modeling for the analysis of steam line break with loss of offsite power (SLB-LOOP). The benchmark analysis should be provided for staff review to confirm the acceptability of the SLB-LOOP analysis results.

Response:

An analysis of the steamline break transient with offsite power available was provided in reference 1. In response to a staff question, an analysis without offsite power (loss of offsite power, or LOOP case) was provided in references 2 and 3. For the case where offsite power is available, full reactor coolant flow is maintained during the entire transient, and the analysis was performed with the single-pass 5-channel 1/8-core LYNXT model, which had been reviewed previously as an acceptable LYNXT core model. For the LOOP case, the core thermal-hydraulic conditions are characterized by natural circulation coolant flow with strong gradients in inlet temperature and power peaking conditions. Therefore, for this case a modification was made to the LYNXT code by incorporating the implicit pressure-velocity (PV) algorithm to ensure a convergent solution. In addition, a nine-channel, half-core model was used with the core modeled as three distinct regions, i.e. , a cold region to represent the faulted quadrant, a hot region to represent the combined intact quadrants, and a mix region to provide an interface between the hot and cold core areas.

As discussed above, analysis of the SLB-LOOP case required a larger, more detailed model than the full-flow case and an alternate solution scheme, the PV algorithm. Reference 4 provided a benchmark in which the two modifications were tested separately by analyzing the SLB transient with offsite power available (the full-flow case), the most limiting SLB transient. The results showed that the difference in results between the two solution schemes is less than 3% in predicted DNBR while there is no practical difference between the two models for this case (actual calculated difference 0.2%).

The benchmark analysis provided in reference 4 demonstrated that, for the limiting SLB case, the alternative models and solution schemes used in LYNXT produce equivalent results. As an additional demonstration of equivalence, the SLB-LOOP case has now been analyzed with the nine-channel model and the SCHEME algorithm. That is, the PV and SCHEME algorithms (SCHEME is the original LYNXT solution algorithm) were compared for the same low flow SLB transient statepoint, with the only difference being in the

thermal-hydraulic algorithm used for the solution. Figures 1 through 5 compare the results of the two cases. Figures 1 and 2 compare the flow rates of each channel. Figures 3 and 4 compare the channel enthalpies. Figure 5 shows that the minimum DNBR of the most limiting channel and rod differs by approximately 1 DNB point or 0.5% between the two cases. Analysis with the PV algorithm resulted in a minimum DNBR of 1.88 versus a value of 1.89 found using the SCHEME algorithm. The benefit of using the PV algorithm for this analysis is in the speed of problem execution and its ability to handle the arbitrary flow direction which can occur in some low flow problems. However, for this particular case both algorithms produced virtually equivalent results.

References

1. Letter transmitting Topical Report BAW-10173, Revision 0, H. B. Tucker to U. S. Nuclear Regulatory commission, March 30, 1989.

2. Letter transmitting Topical Report BAW-10173, Revision 1, H. B. Tucker to U. S. Nuclear Regulatory Commission, October 22, 1990.

3. Letter transmitting Topical Report BAW-10173, Revision 2, M. S. Tuckman to U. S. Nuclear Regulatory Commission, November 28, 1990.

4. Letter transmitting Response to Conditions Relative to the Use of Topical Report BAW-10173, M. S. Tuckman to U. S. Nuclear Regulatory Commission, March 14, 1991.

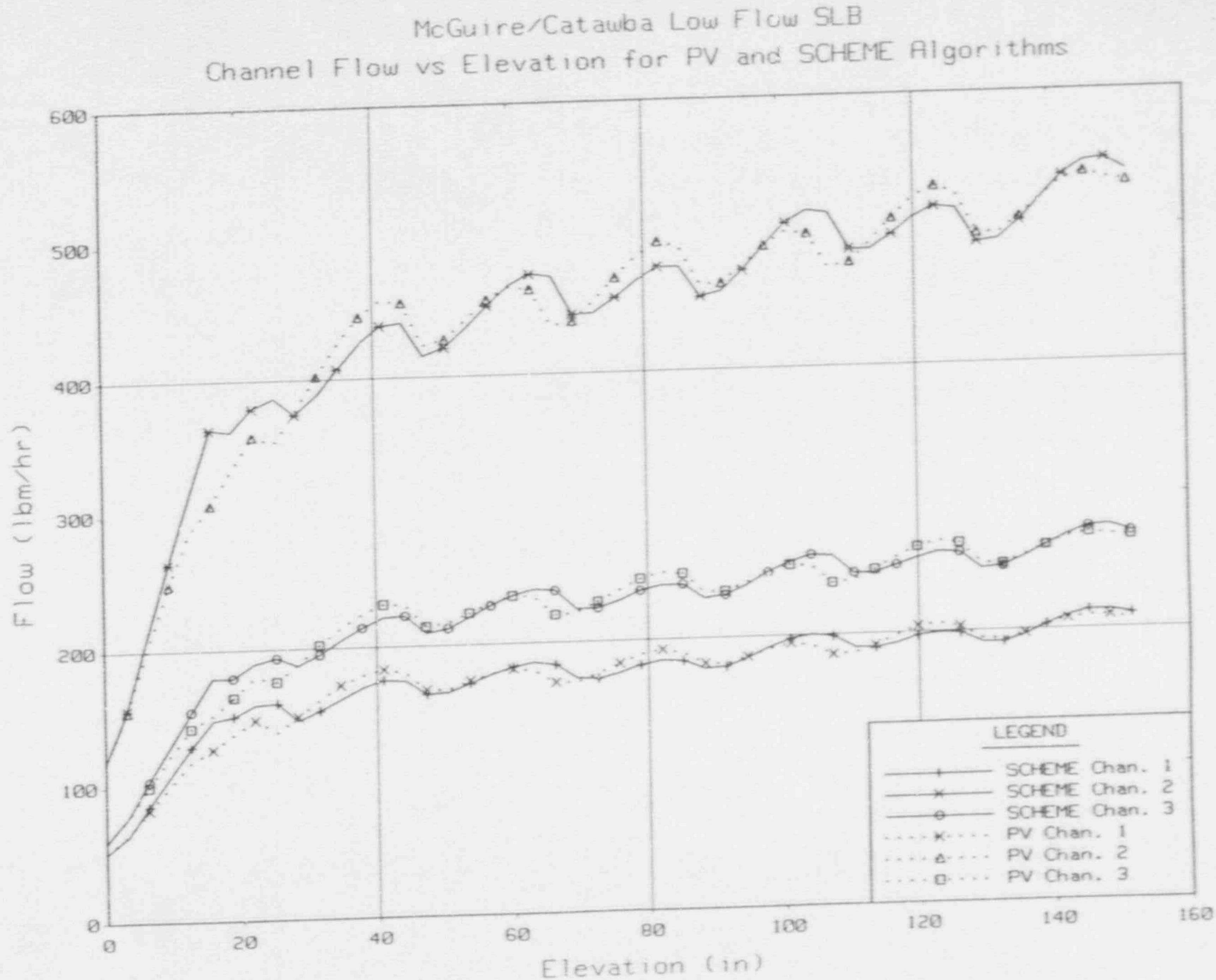

McGuire/Catawba Low Flow SLB
Channel Flow vs Elevation for PV and SCHEME Algorithms
Flow (lbm/hr)
0
100
200
300
400
500
600
Elevation (in)
0
20
40
60
80
100
120
140
160
LEGEND
SCHEME Chan. 1
SCHEME Chan. 2
SCHEME Chan. 3
PV Chan. 1
PV Chan. 2
PV Chan. 3

Figure 1

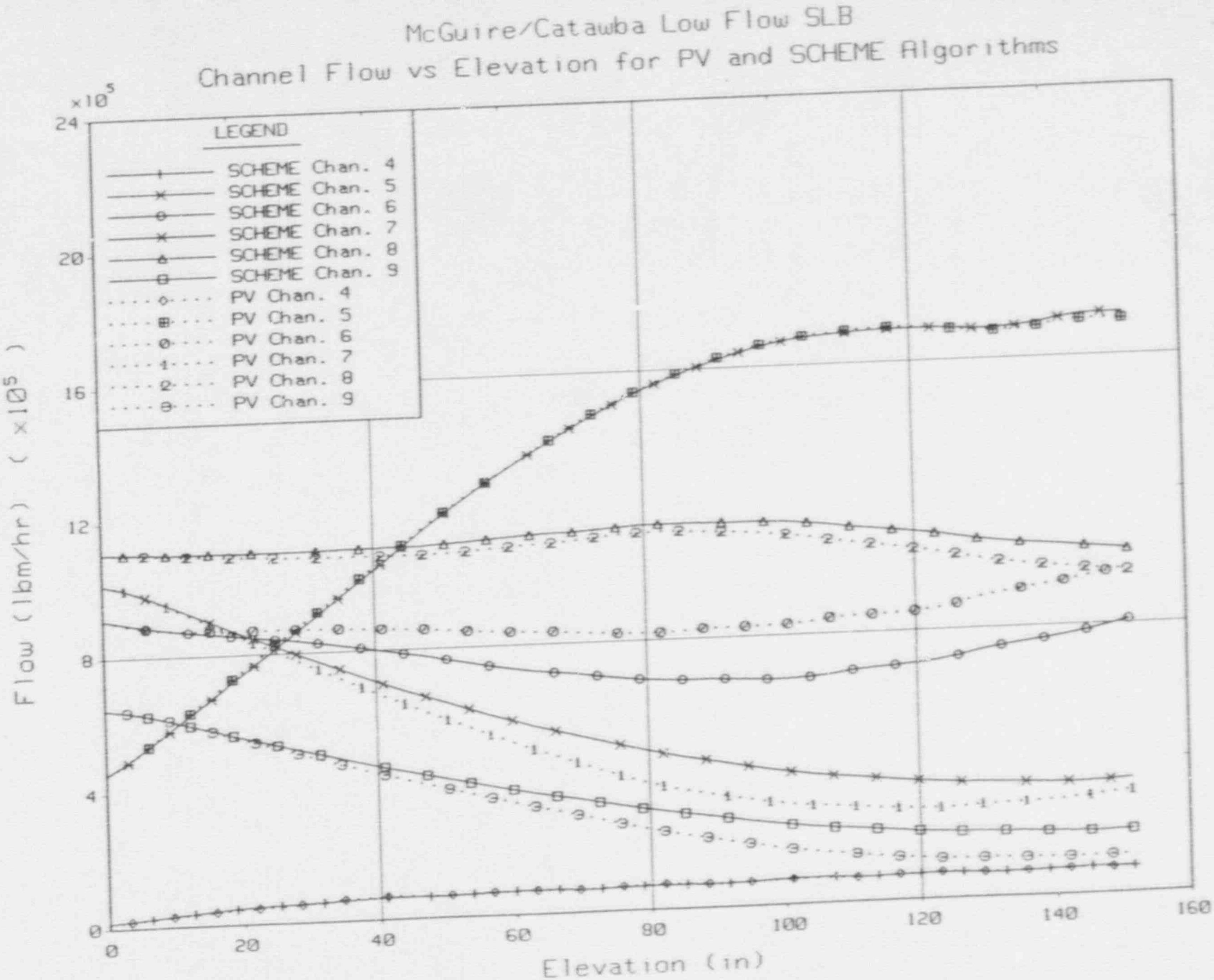

McGuire/Catawba Low Flow SLB
Channel Flow vs Elevation for PV and SCHEME Algorithms
LEGEND
SCHEME Chan. 4
SCHEME Chan. 5
SCHEME Chan. 6
SCHEME Chan. 7
SCHEME Chan. 8
SCHEME Chan. 9
PV Chan. 4
PV Chan. 5
PV Chan. 6
PV Chan. 7
PV Chan. 8
PV Chan. 9
Flow (lbm/hr) (x10^5)
Elevation (in)

Figure 2

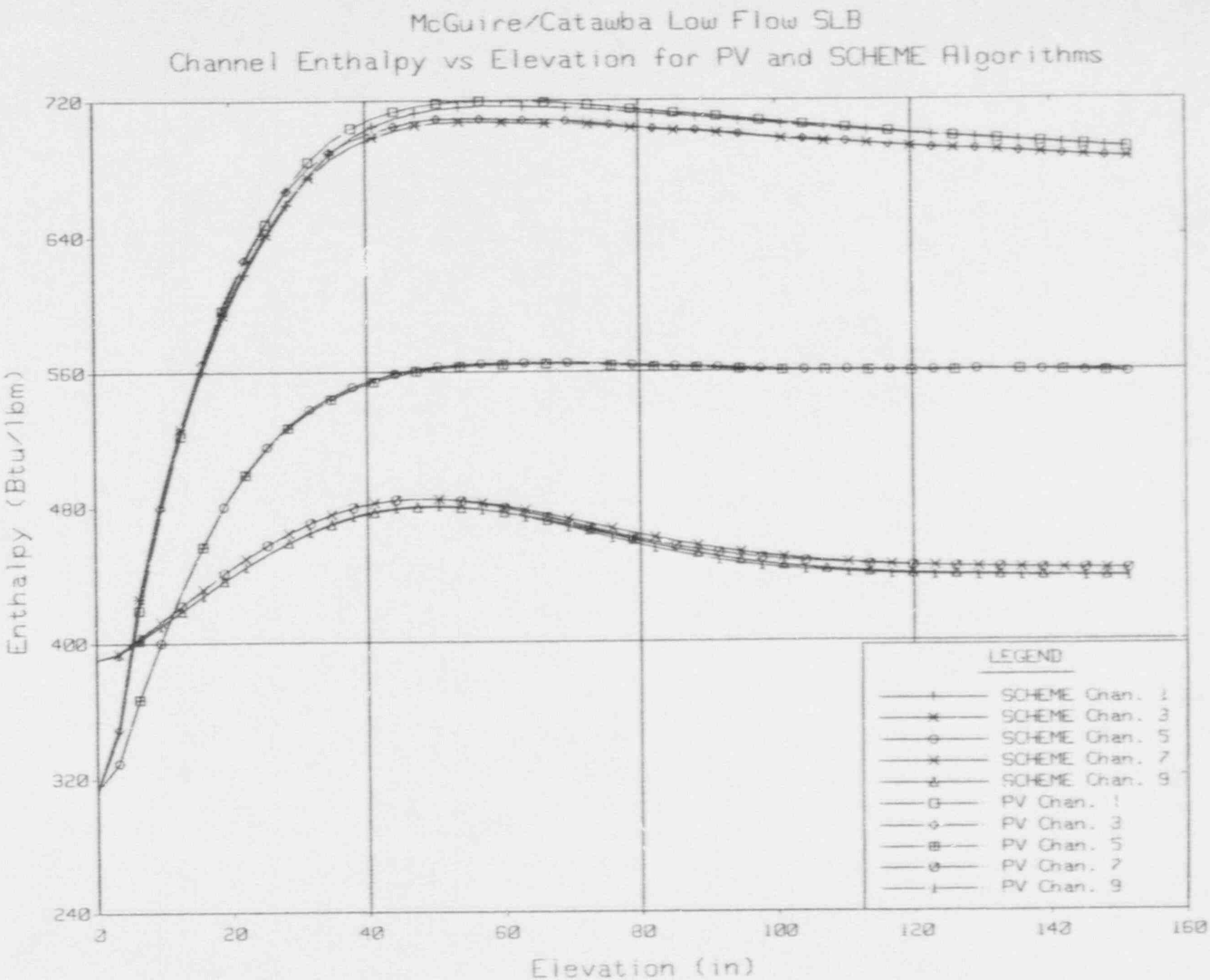

McGuire/Catawba Low Flow SLB
Channel Enthalpy vs Elevation for PV and SCHEME Algorithms
Enthalpy (Btu/lbm)
720
640
560
480
400
320
240
Elevation (in)
0
20
40
60
80
100
120
140
160
LEGEND
SCHEME Chan. 1
SCHEME Chan. 3
SCHEME Chan. 5
SCHEME Chan. 7
SCHEME Chan. 9
PV Chan. 1
PV Chan. 3
PV Chan. 5
PV Chan. 7
PV Chan. 9

Figure 3

McGuire/Catawba Low Flow SLB

Channel Enthalpy vs Elevation for PV and SCHEME Algorithms

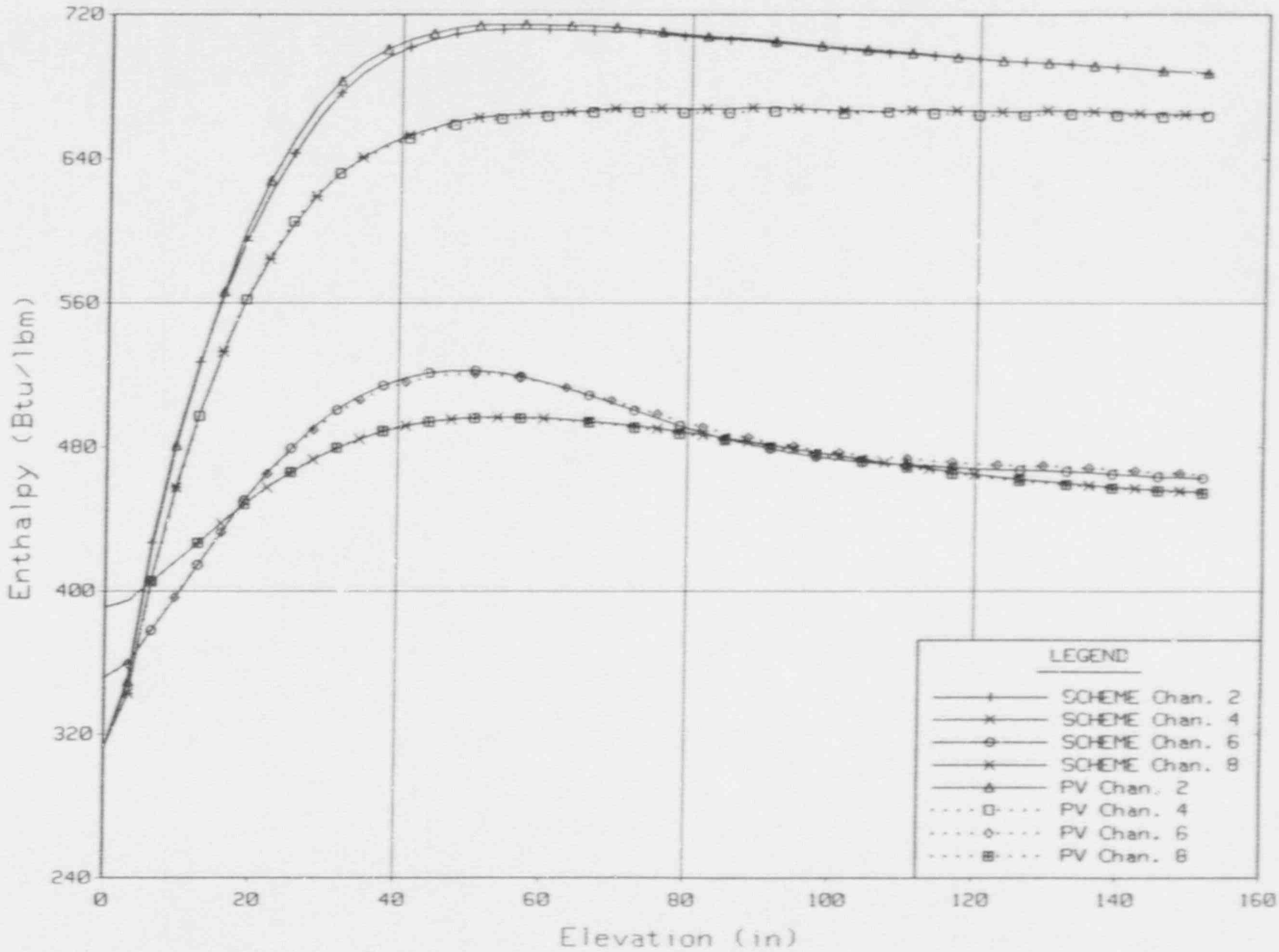
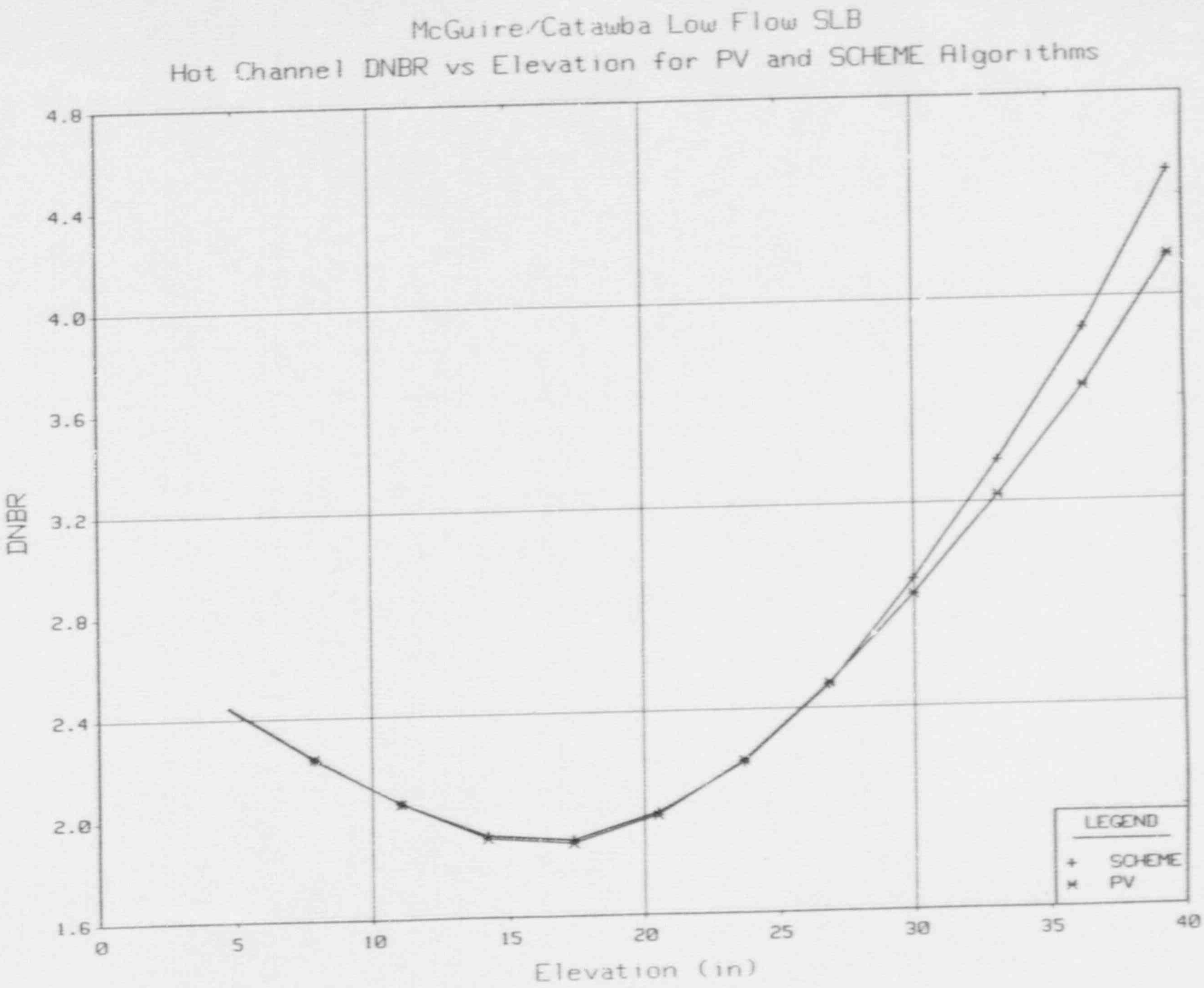


Figure 4



McGuire/Catawba Low Flow SLB
Hot Channel DNBR vs Elevation for PV and SCHEME Algorithms
DNBR
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
0
5
10
15
20
25
30
35
40
Elevation (in)
LEGEND
+ SCHEME
* PV

Figure 5