To: Kien Chang

From: Loren Zaremba LZ

Date: December 22, 1986

Subject: Comparison of TEMPH and HEATING5 Results

As I noted in my comments to you on the BWIP report entitled "Thermal Analysis of Waste Package Preliminary Reliability Assessment", I had previously compared the results in this report with the temperature history predicted by the TEMPH code. This comparison is presented in Appendix B of our Demonstration Report. However, I did not have the values of thermal conductivity and specific heat used by BWIP at that time and used values from an earlier report. Since then, the values for these parameters have been published in the "Waste Package Preliminary Reliability Analysis Report". I have revised my data set accordingly and made new comparison runs. Also, I had only compared predicted temperatures at the container wall in the Demo report and I wanted to extend the comparison to include the other locations presented in the BWIP reports. The attached figures show my latest results.

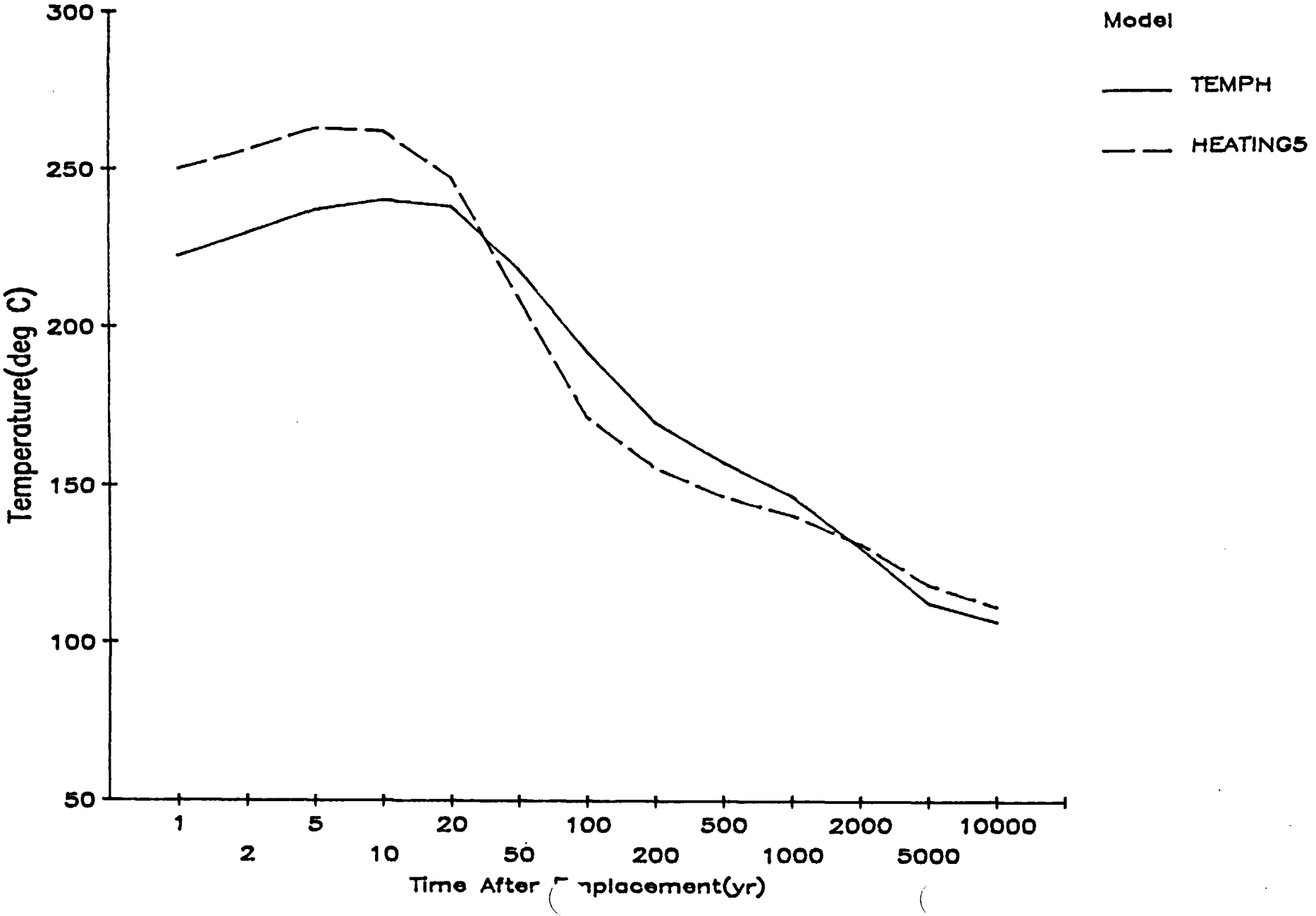
The first figure shows a comparison of the two predicted temperature histories at the centerline of the waste. At this location TEMPH predicts a lower temperature than HEATING5 in the first twenty years because it is not able to model the difference in the thermal properties of the wasteform, container and rock.

The second and third figure show the predicted temperature histories at the center and end of the container wall. In both cases the temperatures predicted by TEMPH are higher after ten years. I am unsure of the reason for this but TEMPH does appear to provide conservative estimates for the corrosion calculations which use this output.

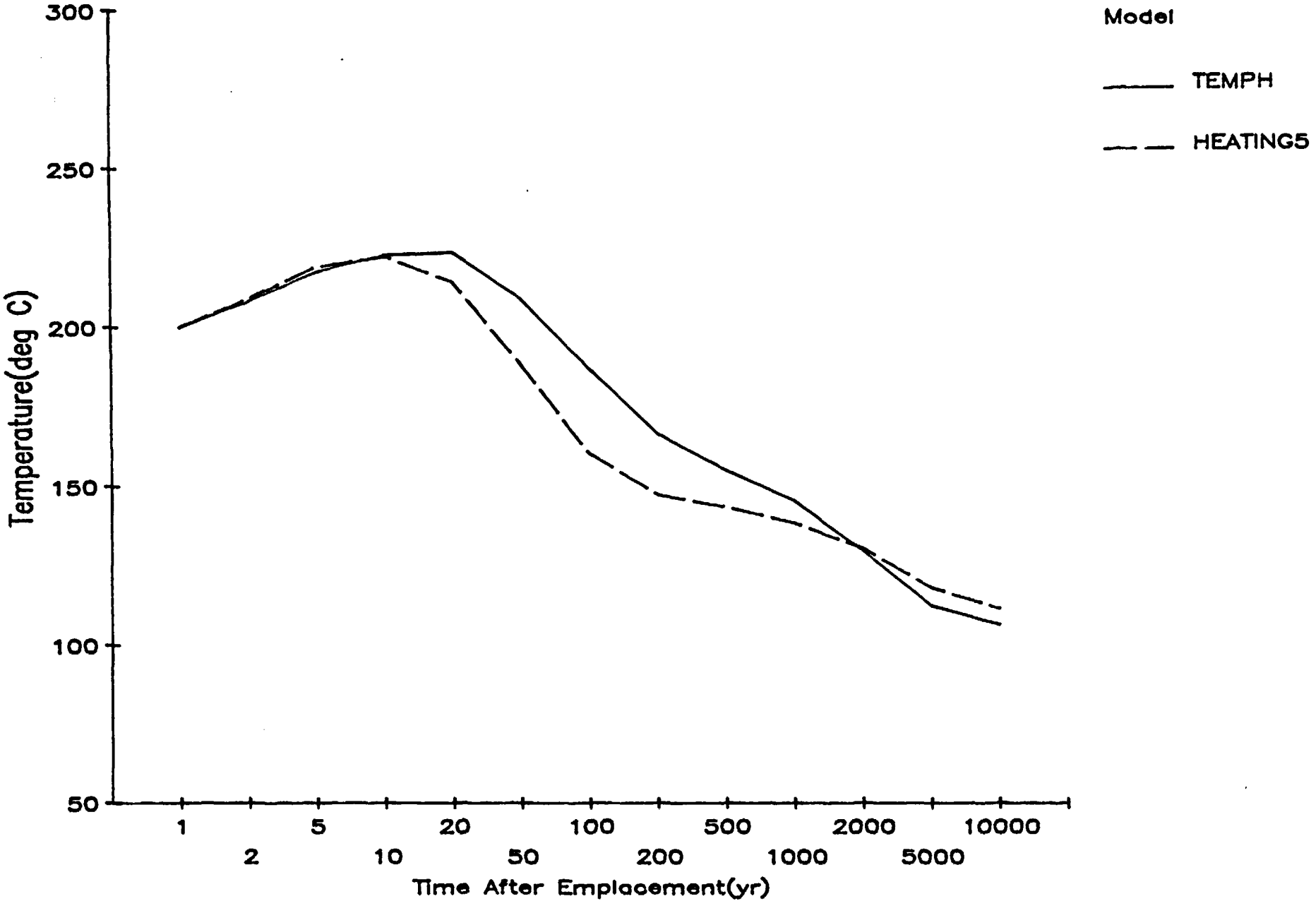
The next two figures show the temperature histories at the borehole inner surface and 1.6 meters from the waste center. In both cases the temperatures predicted by TEMPH are high throughout the first two thousand years. Again, I am unsure of the reason for this but hope to examine it further when time allows.

The last figure shows the comparison at the emplacement room center. This is the location where I expect the greatest discrepancy between the two models because Yung assumed that the tunnel was filled fifty years after burial of the waste, and this cannot be simulated by TEMPH because it is a uniform medium code. HEATING5 predicts that the temperature in the tunnel will be approximately ambient for the first fifty years (it does not include convection). After this, the temperature rises rapidly and eventually after two thousand years reaches the value predicted by TEMPH.

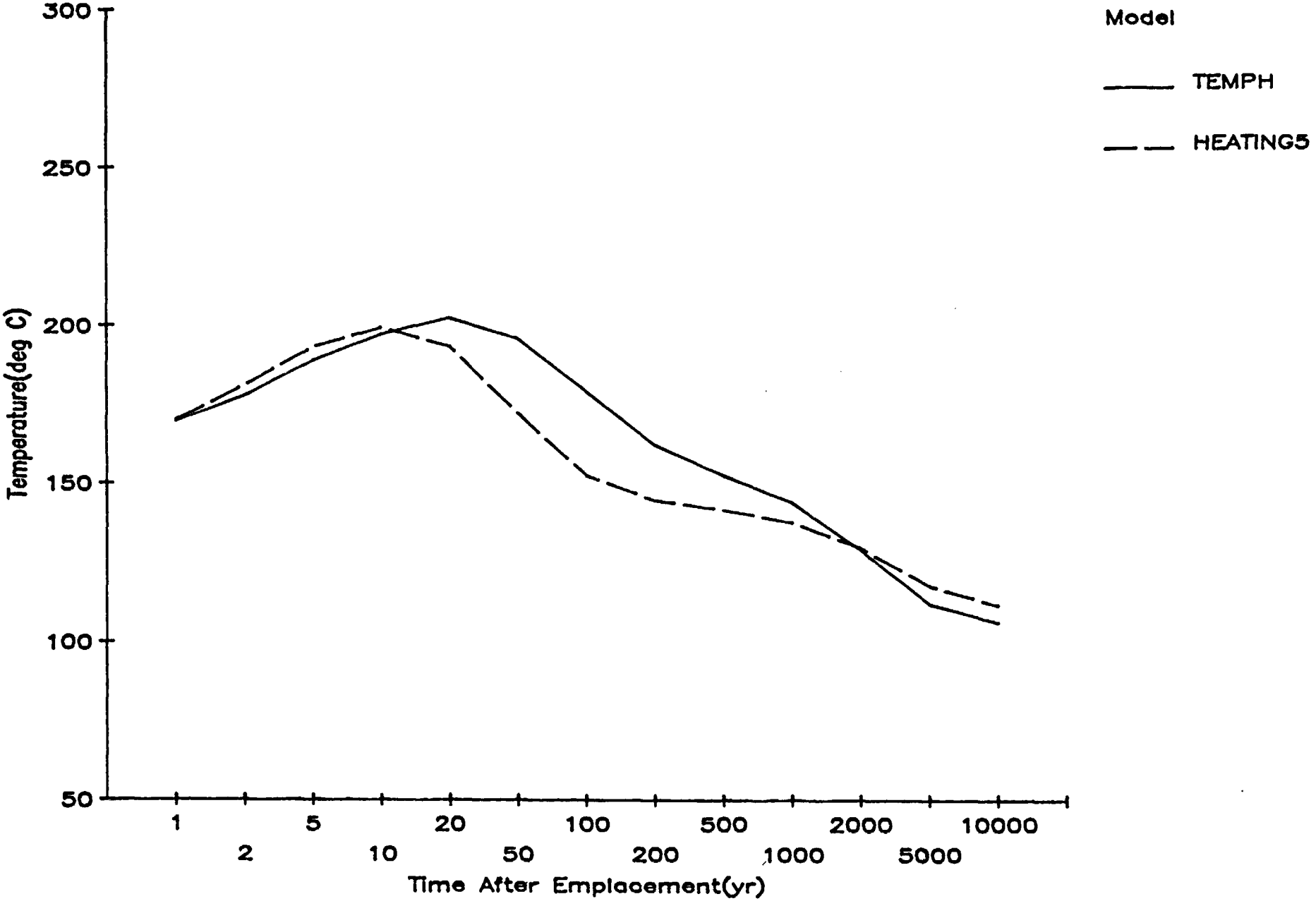
Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Waste Axial Center.



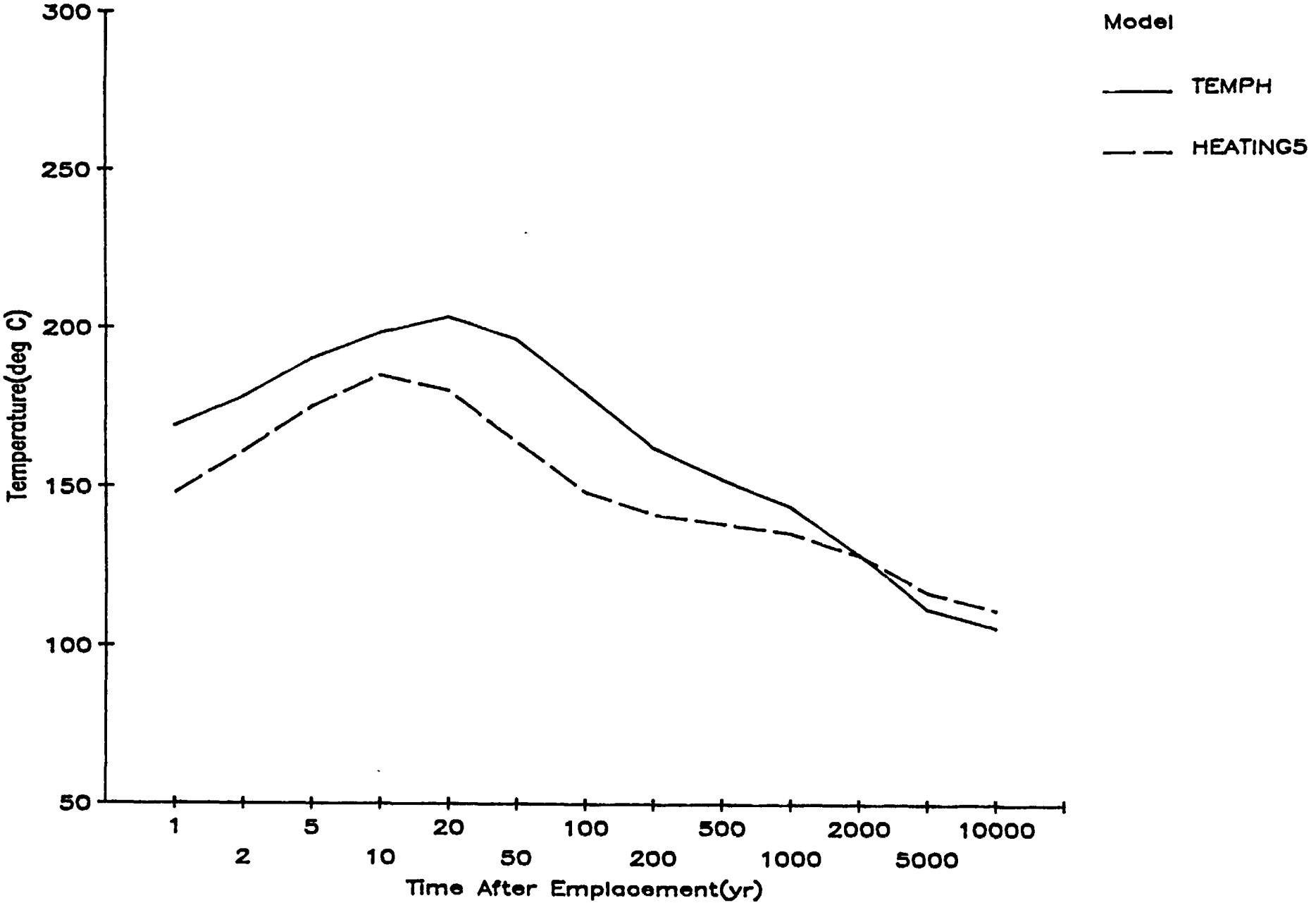
Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Container Axial Center.



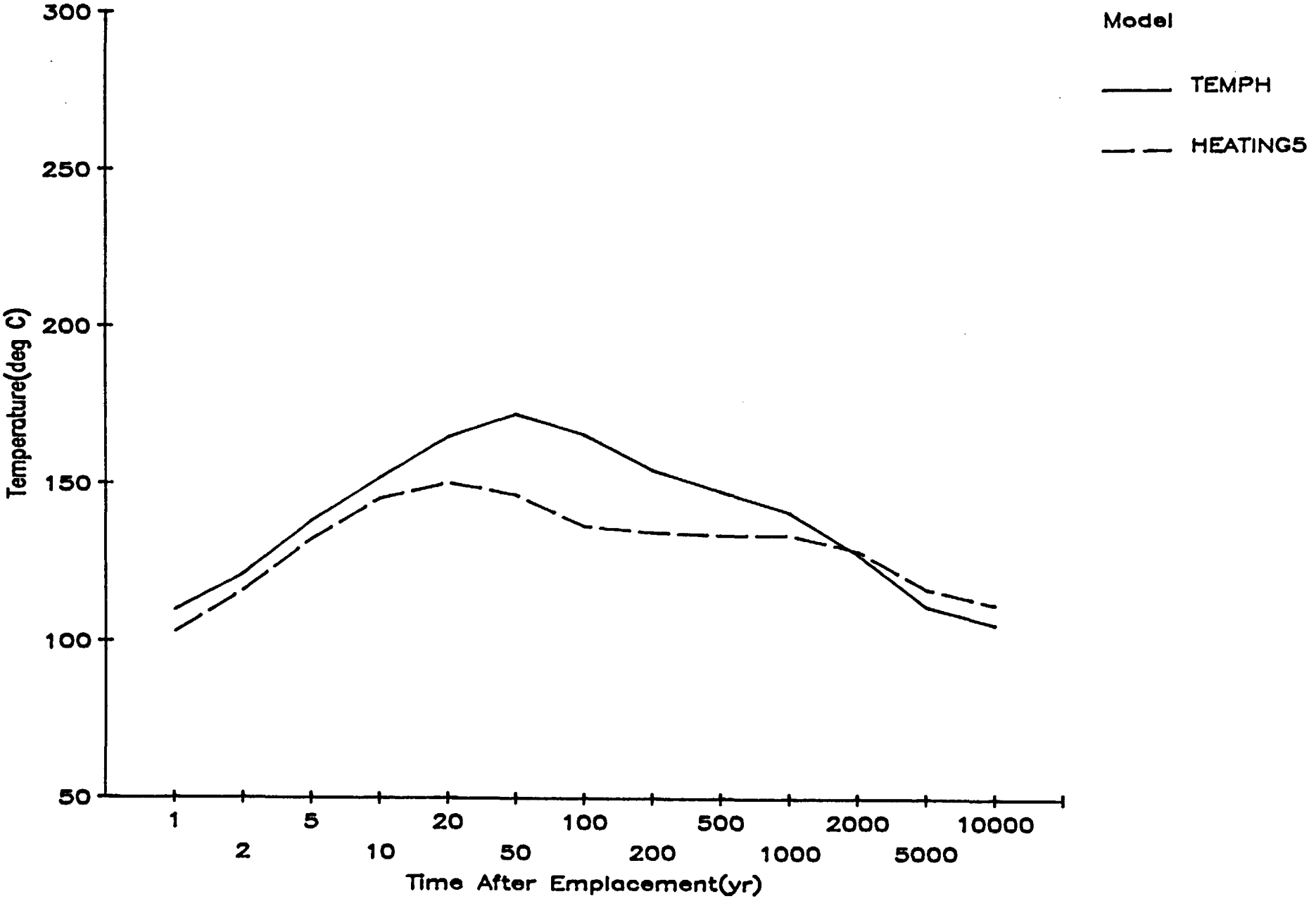
Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Container End.



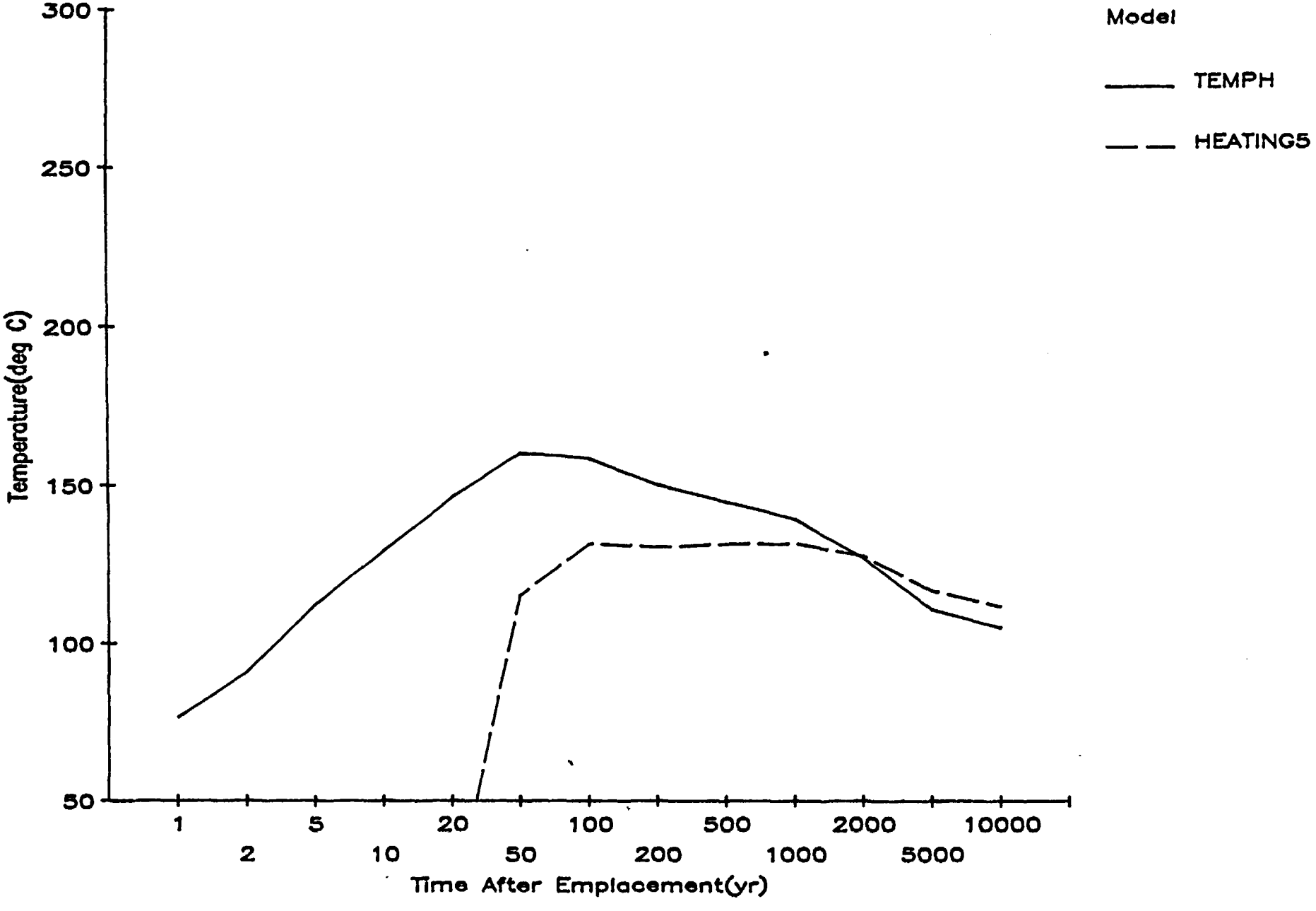
Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Borehole Inner Surface.



Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Basalt 1.6m from Waste Center.



Comparison of Basalt Repository Temperature Histories
Predicted by TEMPH and HEATING5. Emplacement Room Center.



HARDWARE COSTS & DELIVERY SCHEDULE — ATTACHMENT "A"
Date: November 30, 1986
Project: NRC Pilot Project - FY 86
Project Title: "Demonstration of Laser Disc Technology for Licensing Records

ITEM	HARDWARE/SOFTWARE DESCRIPTION	COST	PRO SUBMITTED	PO ASSIGNED	ACTUAL COST	PROMISED DELIVERY	ACTUAL DELIVERY
	MICROCOMPUTER						
1	IBM PC AT (Model 339)	$5,300	7/07/86	7/10/86	$3,865	9/15/86	9/03/86
2	Hercules Monochrome Graphics Board	$400				9/16/86	9/16/86
3	JRAM AT3 Memory Card	$500	9/08/86	9/18/96	$498	10/1/86	9/19/86
4	Additional Memory 128K RAM (256K Chips)	$80	7/17/86	7/31/86	$57	8/06/86	8/17/86
	MASS STORAGE DEVICE						
5	PRIAM ClusterTower (190MB + 60MB Tape Backup) -	$10,000	7/17/86	7/31/86	$7,714	8/06/86	8/15/86
6	SONY Writable Optical Disk Subsystem	$18,000	7/11/86	7/18/86	$14,545	8/15/86	8/05/86
	Writable Disk Drive WDD-3000 3 G bytes $8556						
	Writable Disk Controller WDC-2000 $5989						
7	PC Interface to Optical Disk	$1,800	7/11/86	7/18/86	$1,626	8/15/86	8/15/86
	OPTICAL SCANNING SYSTEM						
8	Display Subsystem	$4,875	9/08/86	9/09/86	$4,875	10/30/86	10/30/86
	* LV 610 Monitor Controller						
	* LV 630 Decompression Processor						
	* LV 700 High Resolution Page Oriented Display						
9	Scanner Subsystem						
	* Form Feed Scanner - RICOH IS-400	$8,000	8/30/86	9/01/86	$7,700	9/15/86	10/10/86
	* LV 810 Compression Proc./ Scanner Interface	$2,025	9/08/86	9/09/86	$2,025	10/30/86	10/30/86
10	SDD Compound Document Processor	$40,000	7/01/86	7/02/86	$31,675	7/08/86	7/08/86
	DISPLAY SYSTEM						
11	Roland High Res Model # MB142 (Sanyo)	$350	9/08/86	9/18/86	$140	9/19/86	9/19/86
	PRINTERS						
12	Laser Printer (8 ppm) & PC Interface	$4,500	9/08/86	9/09/86	$4,060	10/30/86	10/30/86
13	Matrix Printer	$400					
14	ADDITIONAL HARDWARE (Task 3)	$17,900					
	SYSTEM SOFTWARE						
15	Operating System (PC DOS 3.1)	$85			$62	9/03/86	9/03/86
16	Full Text Search Software	$2,000	7/17/86	7/21/86	$746	7/30/86	7/31/86
	SUPPLIES AND EXPENDIBLES						
17	Tape Cartridges & Printer Supplies	$6,000			$194		
		$122,215			$79,782		
		20%					
		$97,772					

MONTHLY COST EXPENDITURES - 1 NOVEMBER thru 30 NOVEMBER 1986 ATTACHMENT "B"

Project: NRC Pilot Project - FY 86
Project Title: Demonstration of Laser Disc Technology for Licensing Records
Contract Number: NRC-02-86-006

LABOR COSTS EXPENDITURES

NAME	HOURS	COST	CUM. HOURS	CUM. COST
B. Andersen	104	$7,865	574	$43,409
M. Whitley	141.5	$3,095	736	$16,100
S. Fullerton	0	$0	260	$12,344
A. Muller	22	$1,587	158	$11,396
A. Ratliff	2	$60	172	$5,169
R. Wells	24	$1,486	24	$1,486
Tech. Typist	3	$59	12.5	$247
	296.5	$14,152	1937	$90,149

HARDWARE COST EXPENDITURES

HARDWARE ITEM	MONTHLY COST	CUMULATIVE COST	DELIVERY		
Palantir CDP + Software		$31,675	7/08/86		
Group L Search Software		$756	7/31/86		
SONY Writable Optical Disk Sys.		$14,545	8/01/86		
PRIAM DataTower (160MB + 60MB Tape)		$7,714	8/15/86		
Instar Optical Disc Interface		$1,626	8/15/86		
PC DOS 3.1 & Misc. Software		$350	8/07/86		
IBM PC AT (Model 339)		$3,865	9/03/86		
JRAM AT3 Memory Board		$498	9/19/86		
Sanyo Monochrome Monitor		$135	9/19/86		
RICOH IS-400 Scanner		$7,700	10/10/86		
LaserData Display Subsystem		$4,875	10/30/86		
LaserData Comp. Proc./Scan. Interface		$2,025	10/30/86		
RICOH Laser Printer		$4,060	10/30/86		
	$0	$79,824			$79,824
					$169,973
				Misc. ODC's	$1,550
NASM Overhead and Support Services		$76,099			$171,523
SAIC Technical Support SubContract		$273,884		SAIC Fee @ 10%	$17,152
Total NRC Contract to Smithsonian/NASM		$349,983		Total Cumulative Cost	$188,675

Percent of Total Funds Allotted 54%
Percent of SAIC Technical Support Subcontract 69%

PROJECTED VS ACTUAL COST CURVE

Period 1 Jul. – 30 Nov. 1986