

SAND 84-7207

TABLE 1

TEMPERATURES COMPUTED FOR POINT 4 ($x = 0.0$, $y = 1.355$ m)
 FOR A FINITE RANGE OF SOURCES IN INFINITE REGION
 AT AN INITIAL TEMPERATURE OF 26°C

	Range of Heat Sources		
Time Years	36 m	65 m	104 m
	Temperature $^{\circ}\text{C}$		
1	138.35	138.35	138.35
2	158.22	158.22	158.22
3	168.55	168.57	168.57
4	174.89	175.02	175.02
5	179.00	179.39	179.39
6	181.67	182.51	182.51
7	183.35	184.82	184.82
8	184.30	186.56	186.58
9	184.77	187.90	187.93
10	184.70	188.92	188.98

TABLE 2

COMPARISON OF RESULTS OF TWO-DIMENSIONAL ANALYSES USING
THE THERM3D AND PORFLOW CODES

	Canister Centerline Temperature ^o C				
Code: Grid: Time Step:	THERM3D Standard ¹ 0.001	THERM3D Fine ² 0.0005	PROFLOW Standard 0.001	PROFLOW Standard 0.005	PORFLOW Fine 0.0025
Time (yrs)					
0.5	75.7	75.9	75.5	-	-
0.10	94.0	94.2	93.7	93.7	94.0
0.15	105.6	105.9	105.4	-	-
0.20	114.2	114.5	113.9	113.9	114.2
0.25	120.9	121.2	120.5	-	-
0.3	126.5	126.8	126.0	126.0	126.3
0.4	135.1	135.4	134.4	134.4	134.8
0.5	141.7	141.9	140.7	140.7	141.1

Note: 1 Standard Grid: 15 zones x 35 zones;

Domain: 22.9 x 100 m; Typical Resolution 0.5 m x 0.5 m

Note: 2 Fine Grid: 22 zones x 45 zones;

Domain: 22.9 x 50 m; Typical Resolution 0.3 m x 0.3 m

TABLE 3

COMPARISON OF HEAT FLUX TO THE VENTILATION AIR CALCULATED
USING THE THERM3D AND PORFLOW CODES

	Heat Loss: watts/meter of drift		
Code: Grid: Time Step:	THERM3D Standard ¹ 0.001 yr	PORFLOW Standard 0.005 yr	PORFLOW Fine ² 0.0025 yr
Time (yrs)			
0.1	-3.1	-45.9	-44.2
0.2	11.2	13.3	16.0
0.3	51.5	55.4	60.7
0.4	82.6	89.0	94.8
0.5	107.5	115.8	121.8
1.0	184.0	196.7	202.6
2.0	253.1	266.0	272.0
3.0	288.9	298.4	304.6
4.0	312.6	315.9	323.9
5.0	330.4	328.7	336.9

Note 1: Standard Grid - 15 zones x 35 zones

Note 2: Fine Grid - 22 zones x 45 zones

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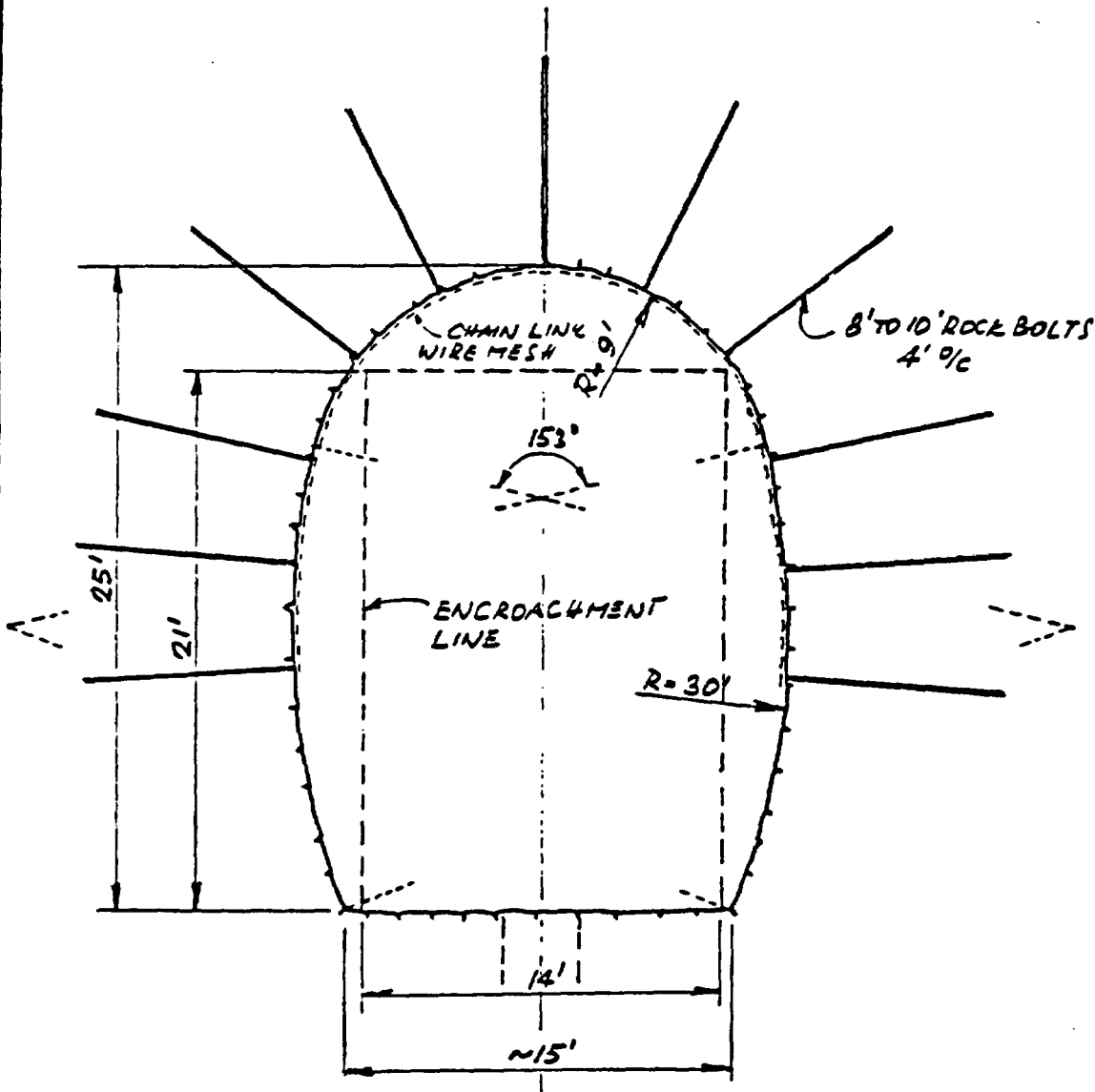
DATE 11-7-83

LOCATION NEVADA NUCLEAR WASTE STORAGE

DR I.L. CH

DESCRIPTION STORAGE DRIFT FOR VERT. EMPLACEMENT

REF _____



STORAGE DRIFT FOR VERT. EMPLACEMENT

NOTE: THE GROUND SUPPORT SHOWN IS PROPOSED FOR GOOD GROUND CONDITIONS (Q = 10 TO 40)

SHEET NO. 4/5

Figure 1. Geometry of Emplacement Drift - BWR - Spent Fuel

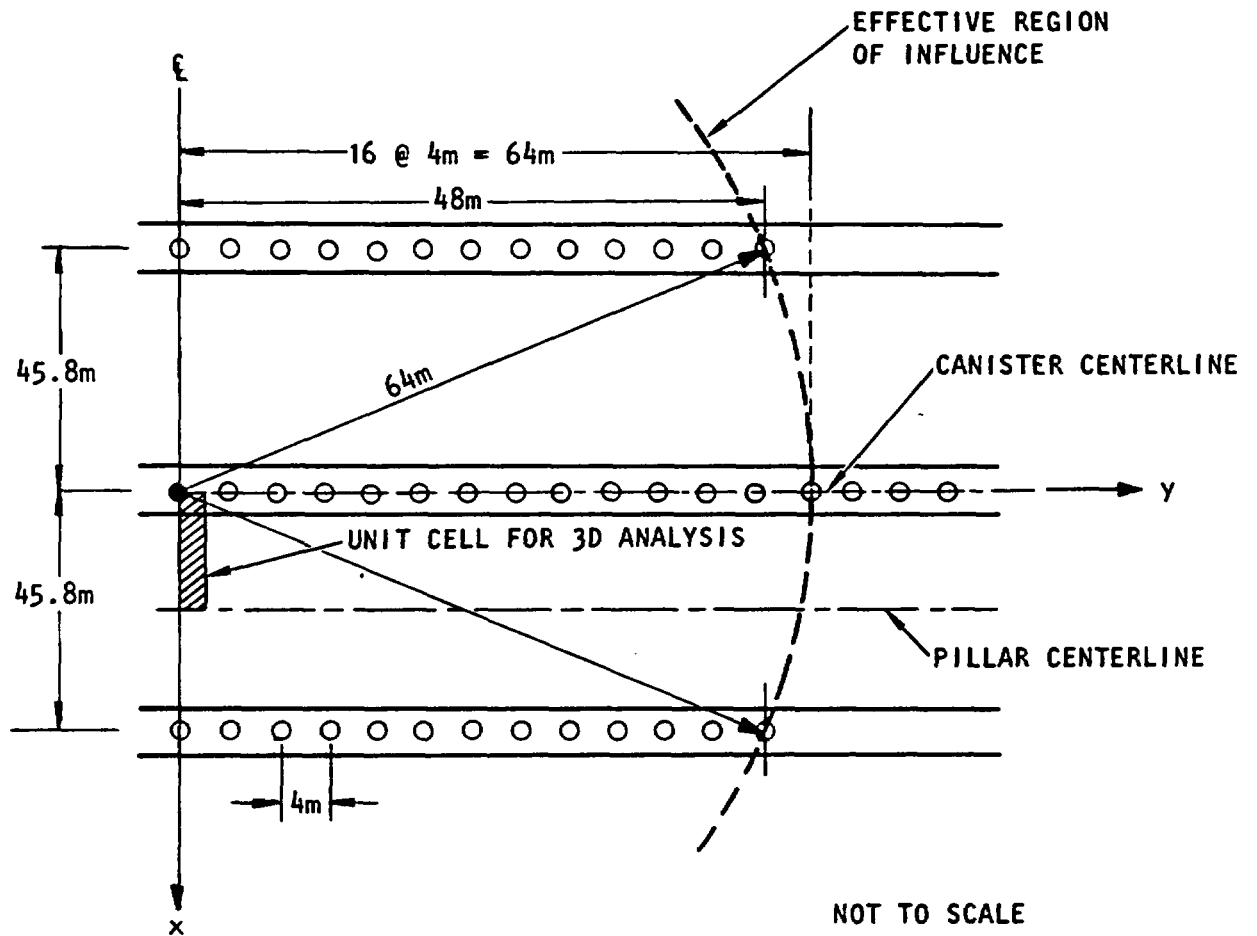
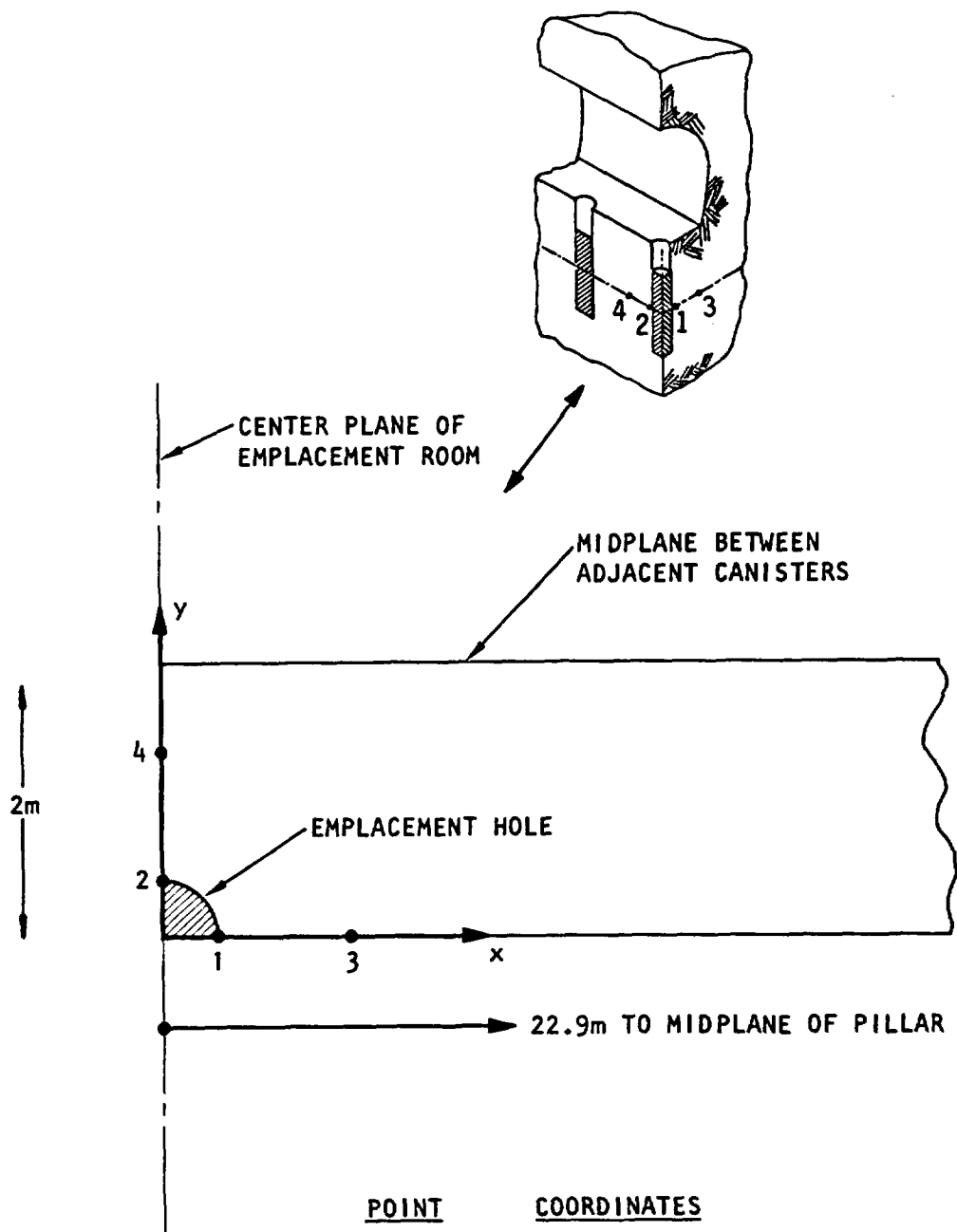


Figure 2. Schematic of Layout of Heat Sources for Analyses Using the TEMP3D Code



POINT	COORDINATES	
1	x = 0.355m	y = 0.m
2	x = 0.m	y = 0.355m
3	x = 1.355m	y = 0.m
4	x = 0.m	y = 1.355m

Figure 3. Location of Sample Points at Midplane of Canister Used For Both Closed-Form and Finite-Difference Models

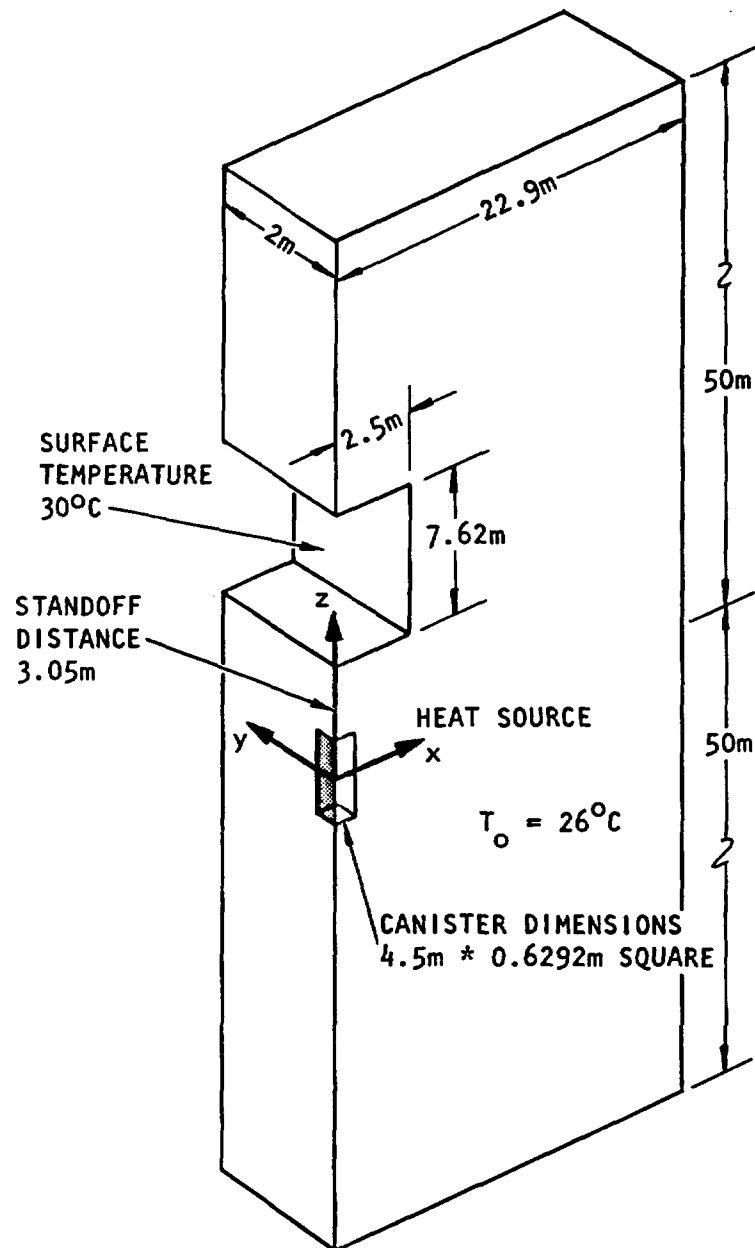


Figure 4. Schematic of the Three-Dimensional Geometry Modeled Using the THERM3D Code. The Interior Boundary Condition is for the Case of a Ventilated Drift

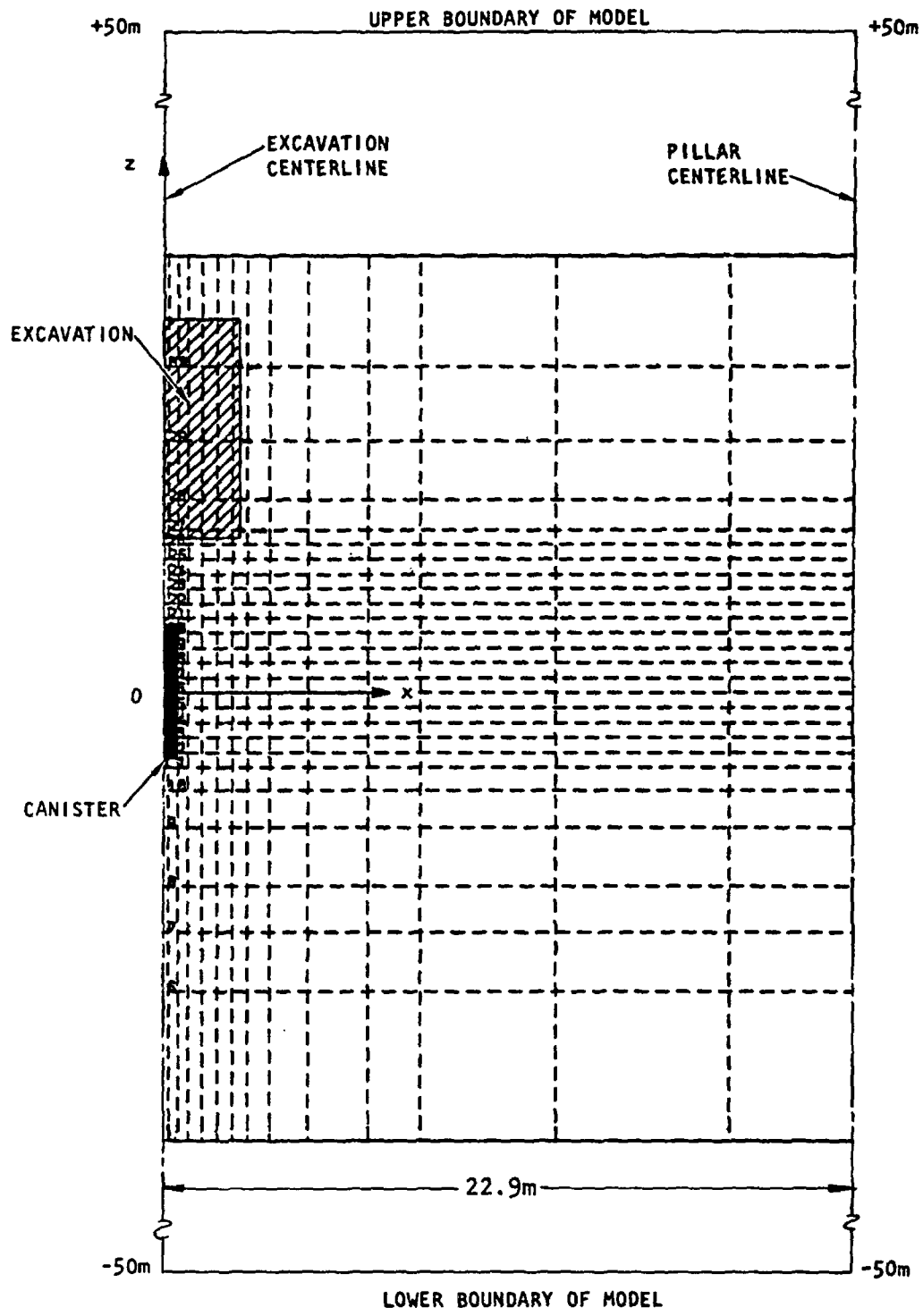
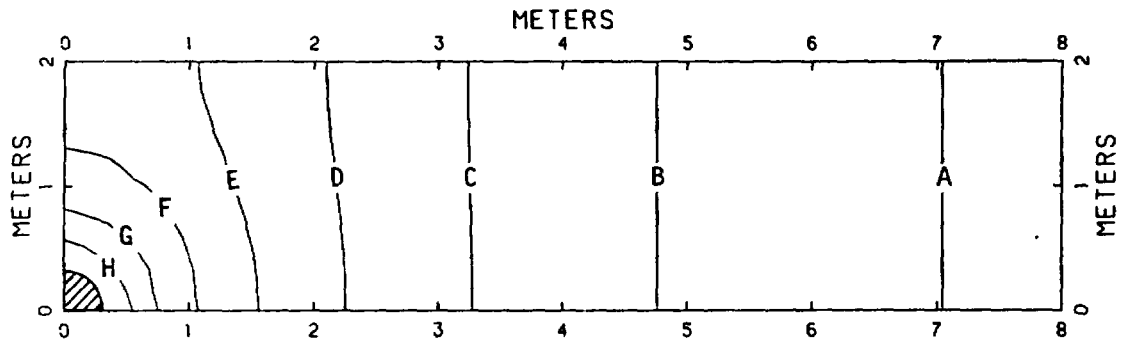
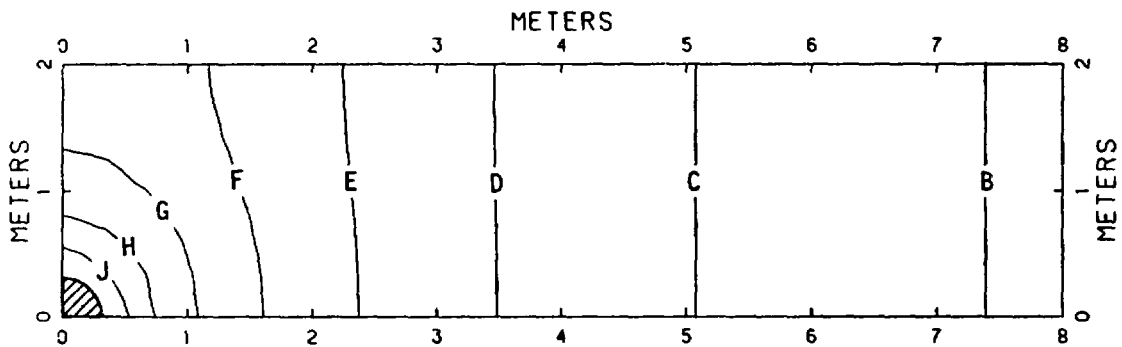


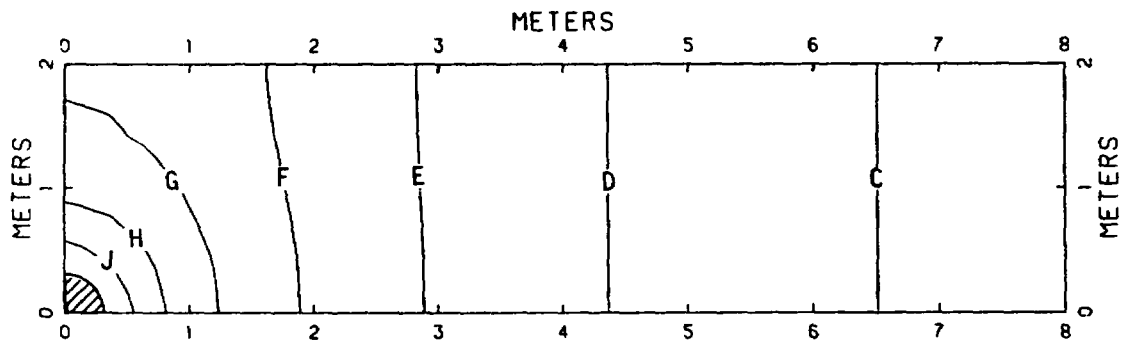
Figure 5. A Portion of the Finite-Difference Grid for PORFLOW Calculations Showing Canister and Drift Location in the Grid



(a) 2 years



(b) 5 years



(c) 10 years

KEY

TEMPERATURE (°C)

A 60.	F 160.
B 80.	G 180.
C 100.	H 200.
D 120.	J 220.
E 140.	

Figure 6. Temperature Contours at Canister Midplane 2, 5, and 10 Years After Emplacement. Closed-Form Solution for an Infinite Region

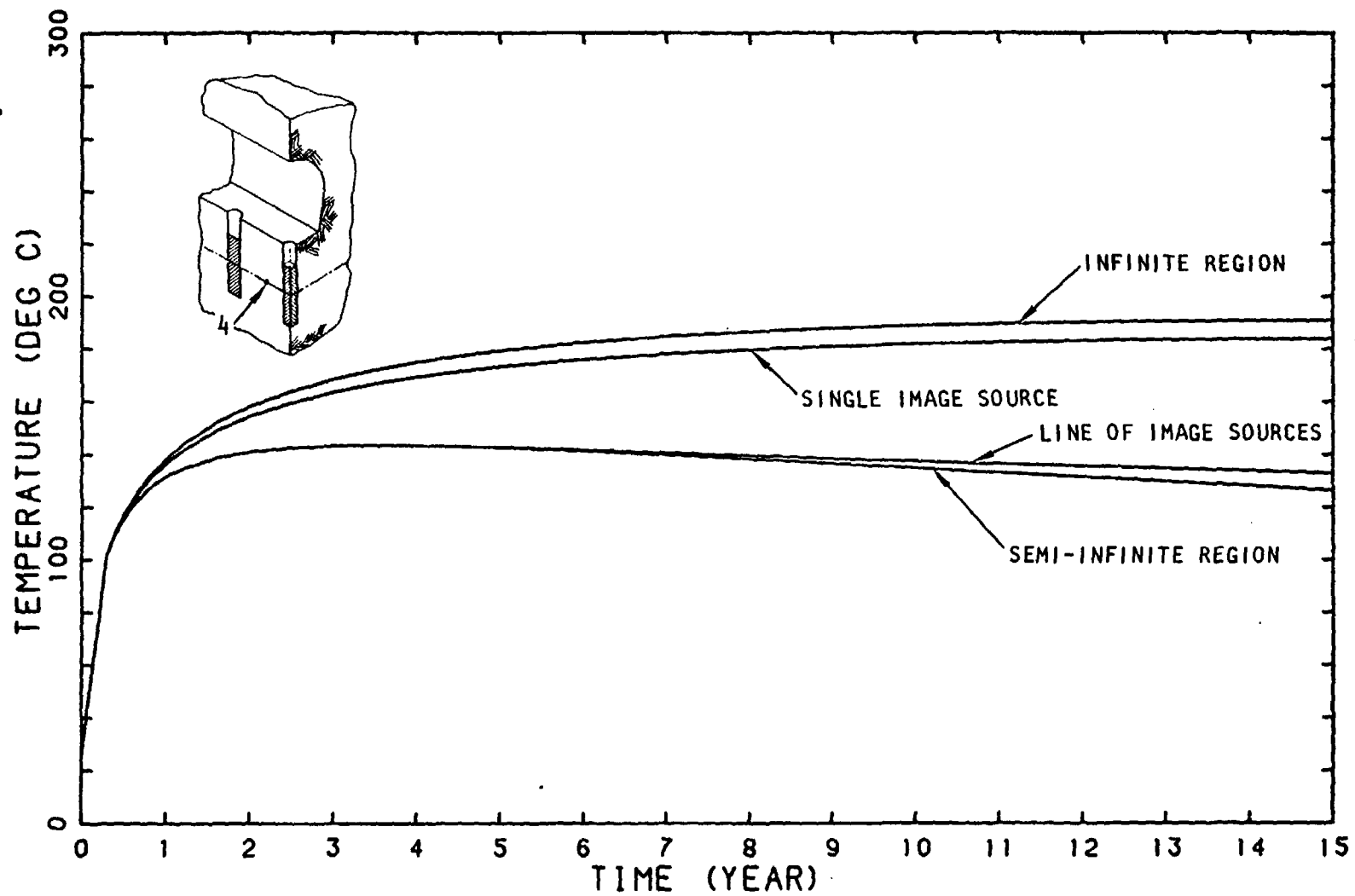


Figure 7. A Temperature History for Point 4 ($x = 0.0$, $y = 1.355$) in an Infinite Region. Computed for Four Boundary Conditions at the Excavation Floor

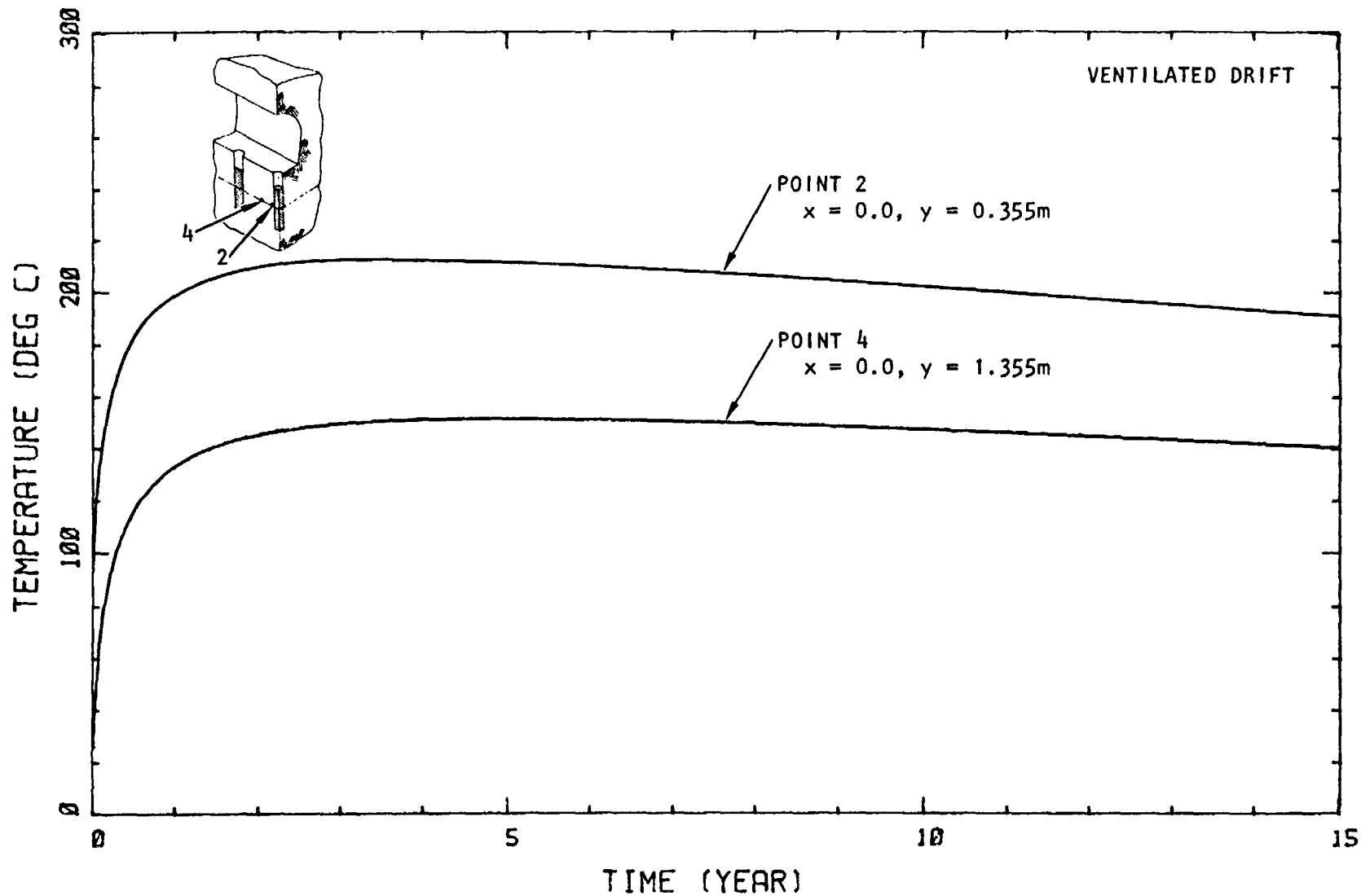


Figure 8. Temperature Histories for Sample Points 2 and 4 - Three-Dimensional THERM3D Solution, with Ventilated Drift

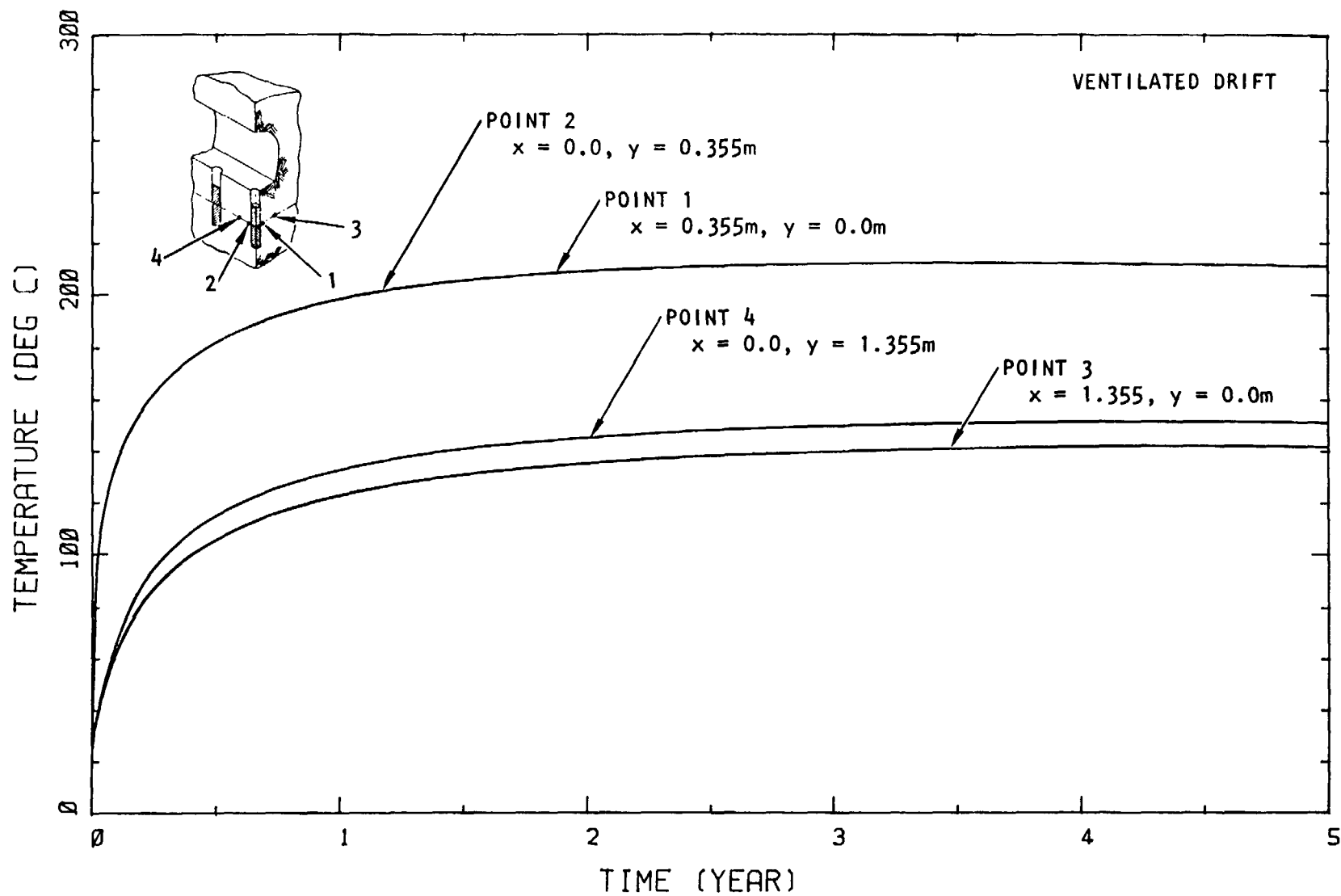
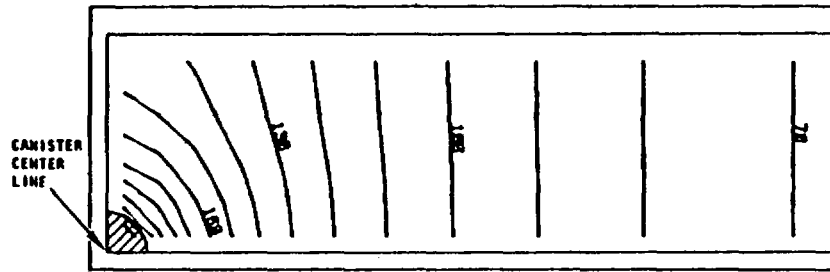
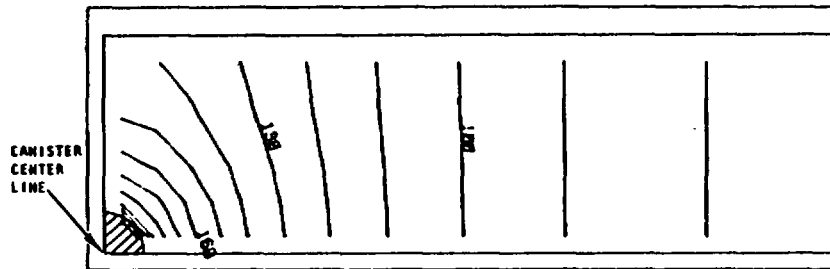


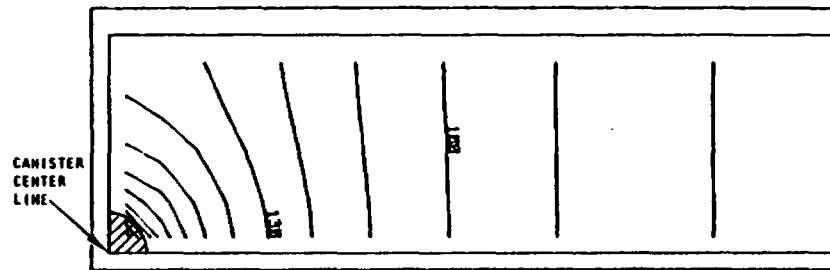
Figure 9. Temperature Histories for Sample Points 1 through 4 - Three-Dimensional THERM3D Solution, with Ventilated Drift



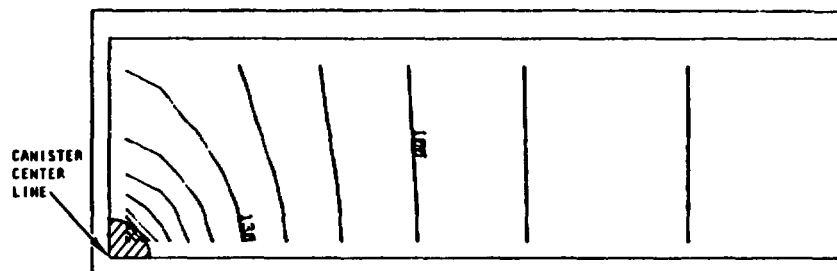
(a) 5 years



(b) 10 years



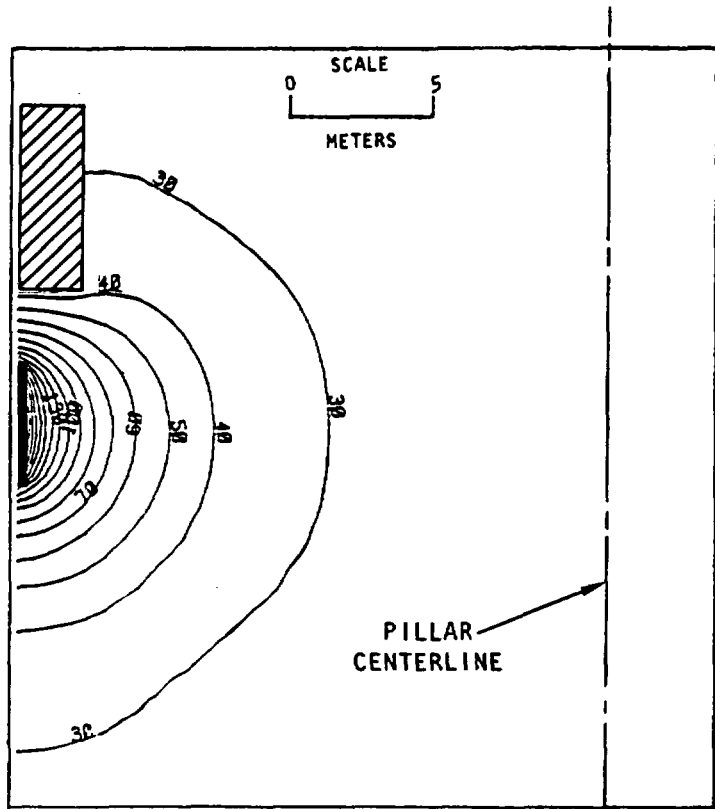
(c) 15 years



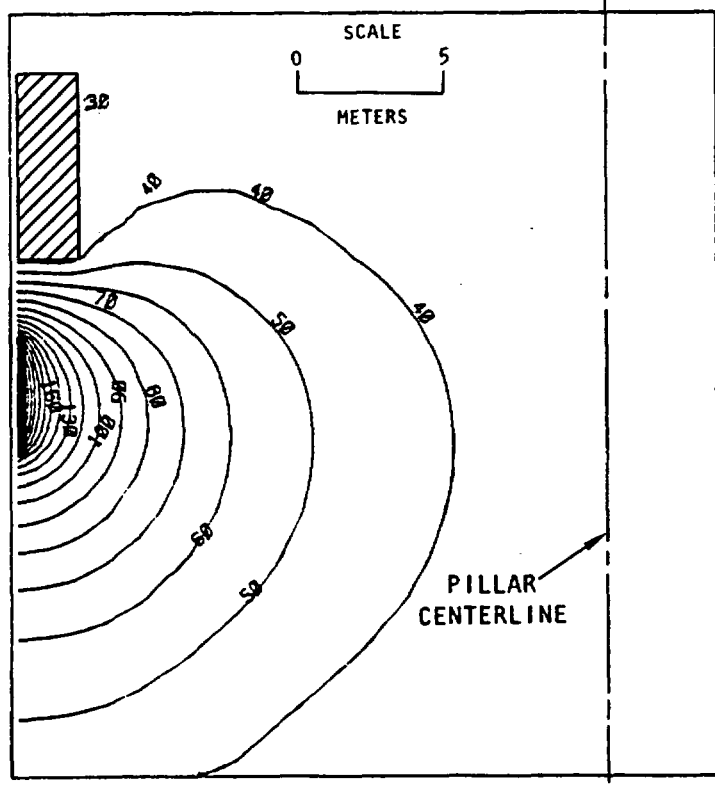
(d) 20 years

SCALE, m
0 1 2

Figure 10. Temperature Distribution in a Horizontal Plane at the Midheight of the Canisters - Three-Dimensional THERM3D Solution, with Ventilated Drift

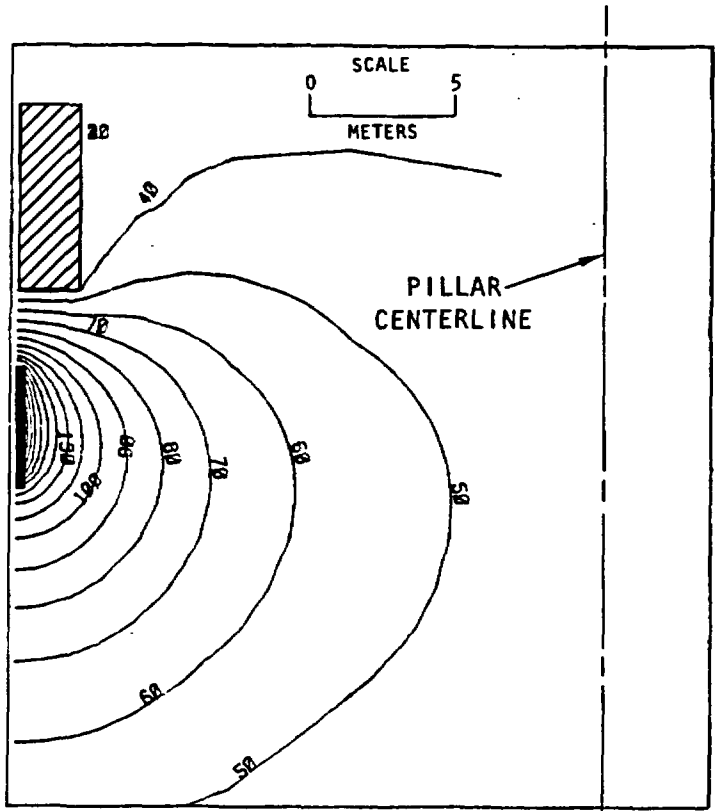


(a) 1 year

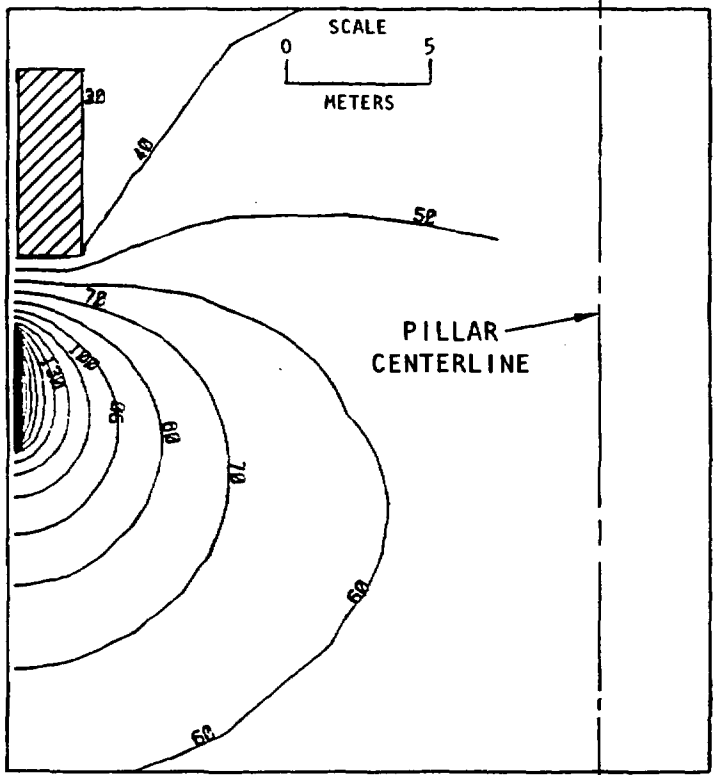


(b) 5 years

Figure 11. Temperature Distribution in a Vertical Plane Between Waste Canisters - Three-Dimensional THERM3D Solution, with Ventilated Drift



(c) 10 years



(d) 20 years

Figure 11. (Concluded)

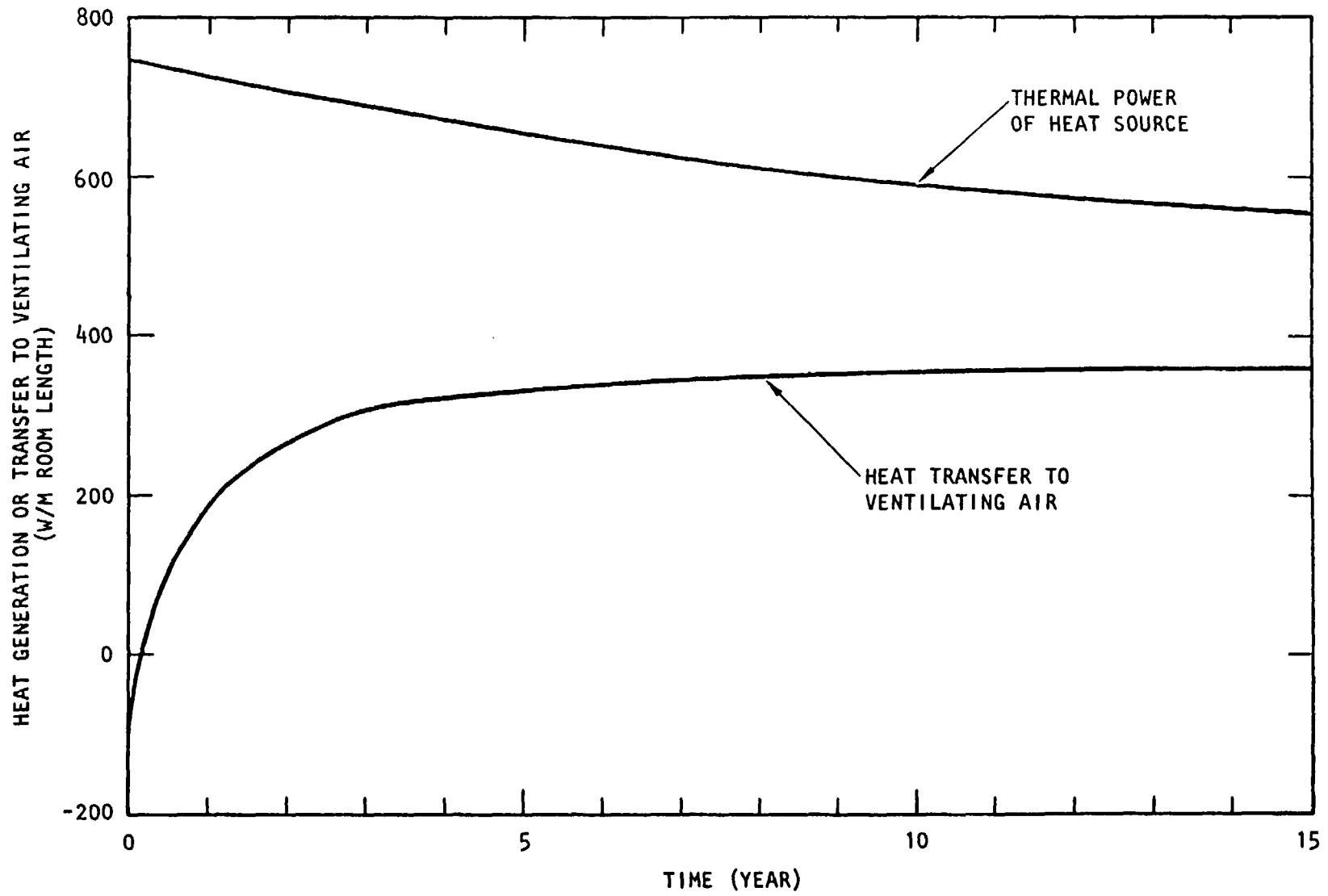
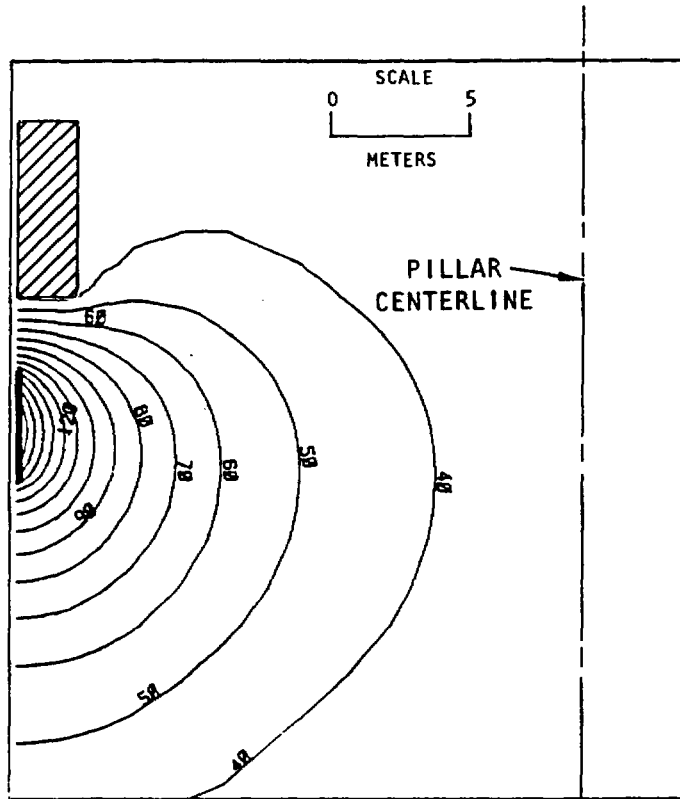
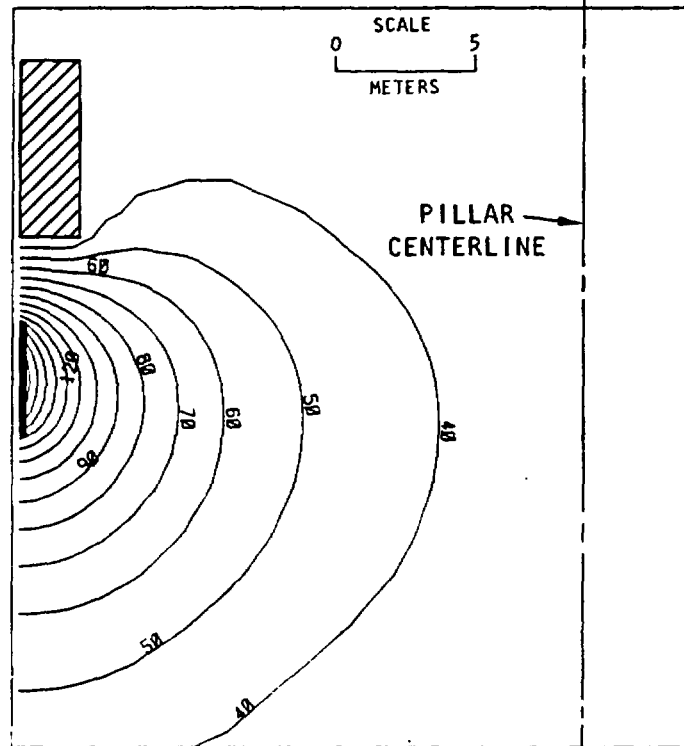


Figure 12. Heat Transfer to the Ventilating Air - Two-Dimensional PORFLOW Solution with Drift Maintained at 30 C

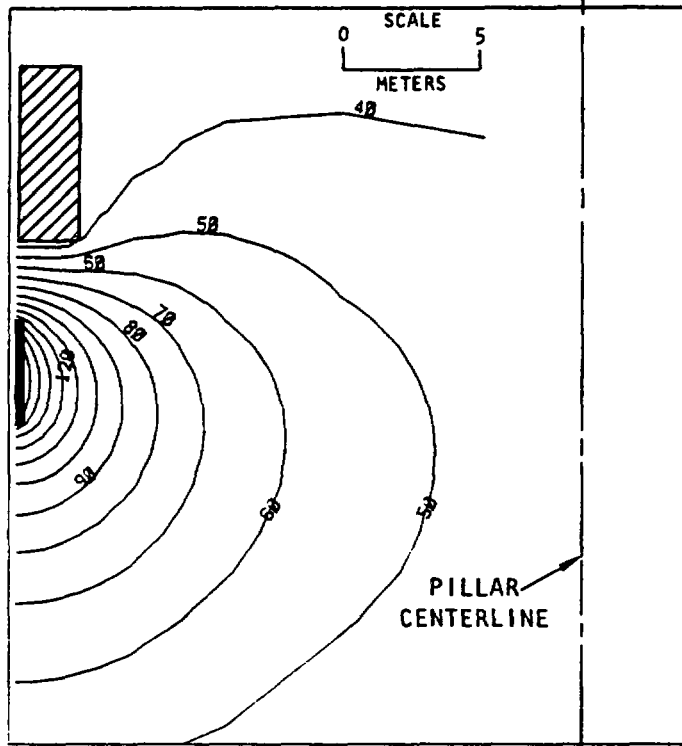


(a) 1 year

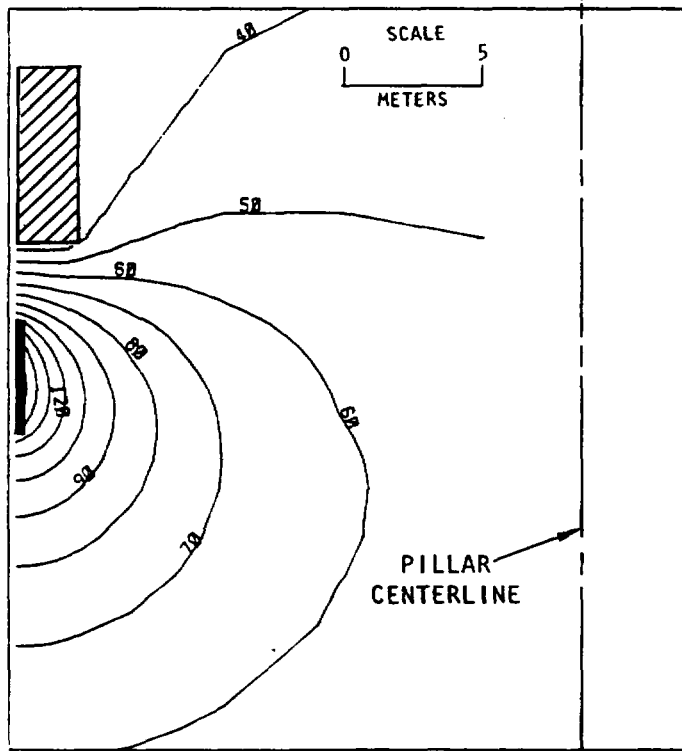


(b) 5 years

Figure 13. Temperature Distribution in a Vertical Plane - Two-Dimensional PORFLOW Solution, with Ventilated Drift



(c) 10 years



(d) 20 years

Figure 13. (Concluded)

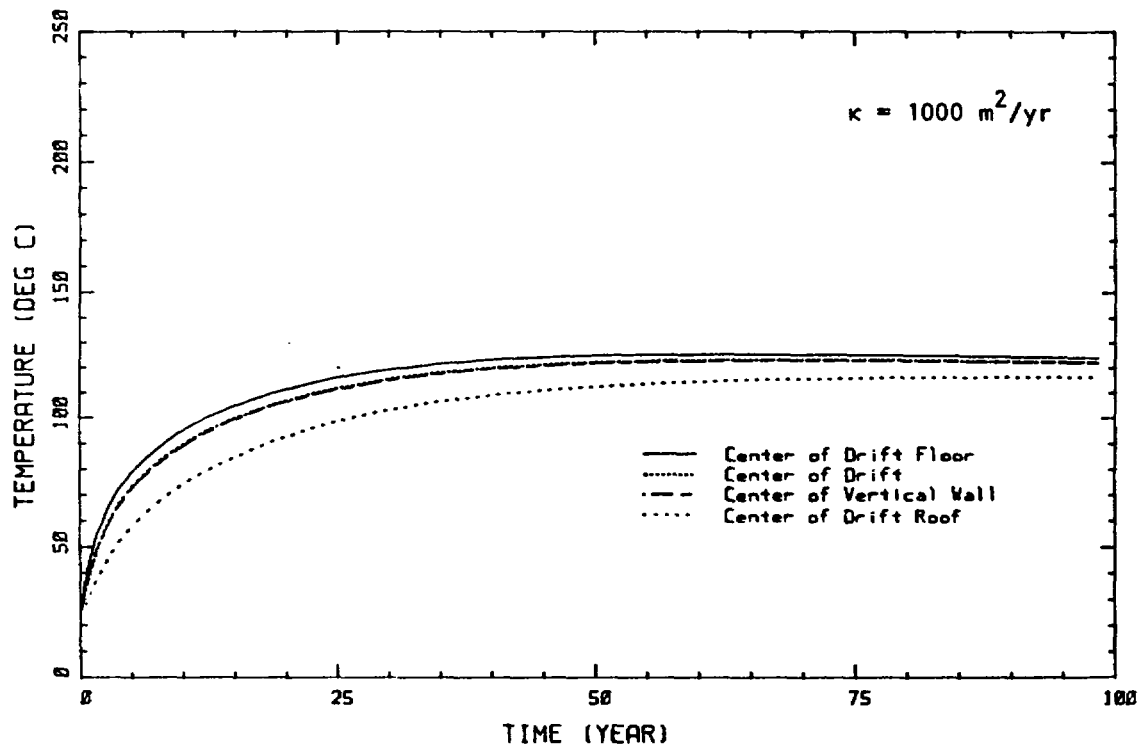
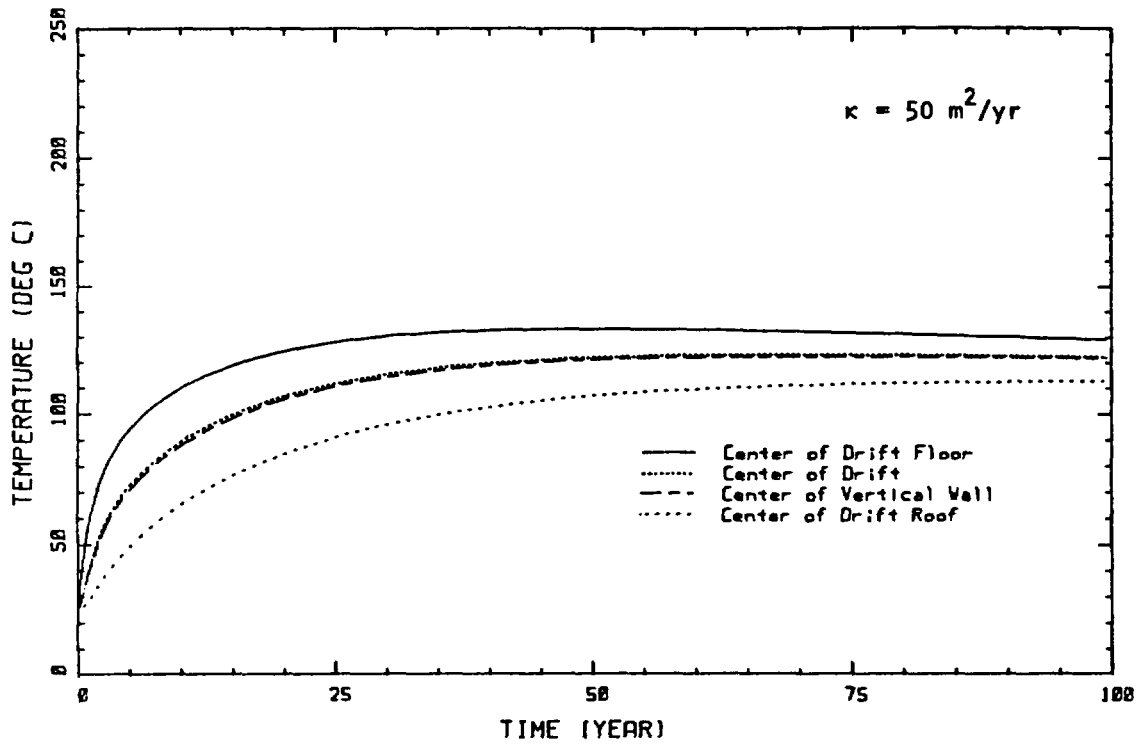


Figure 14. Temperature Histories for Alternative Equivalent Radiation Properties of Air in an Unventilated Drift - Two-Dimensional PORFLOW Calculations

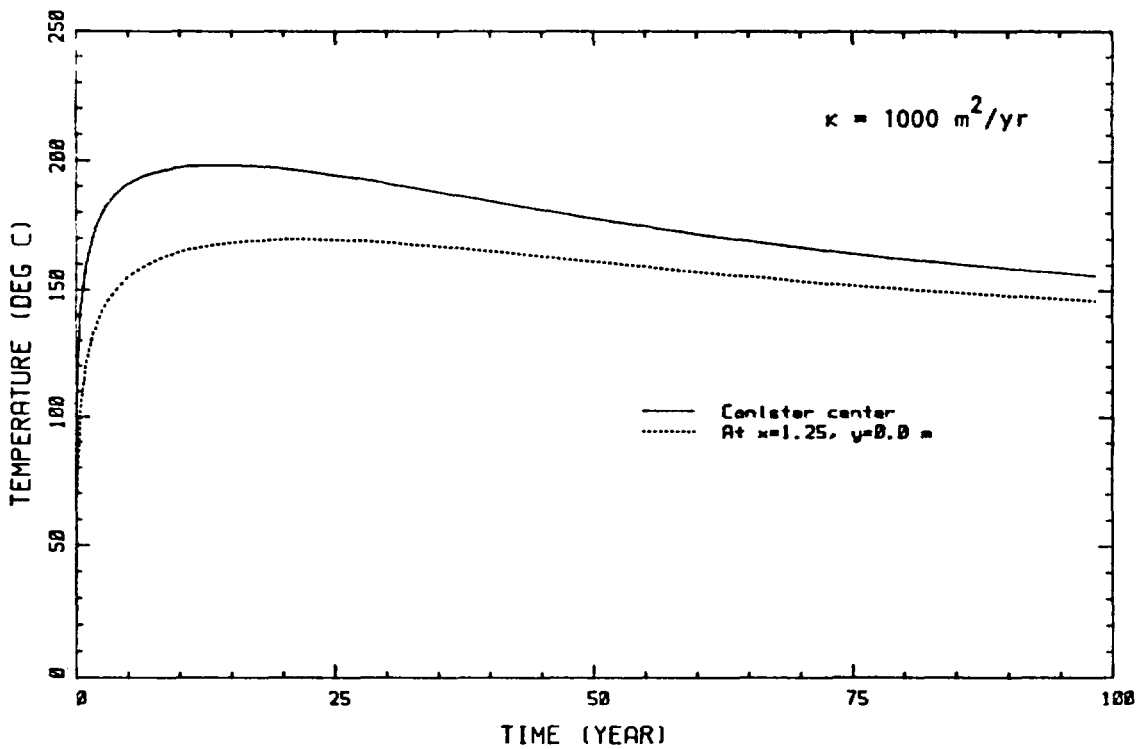
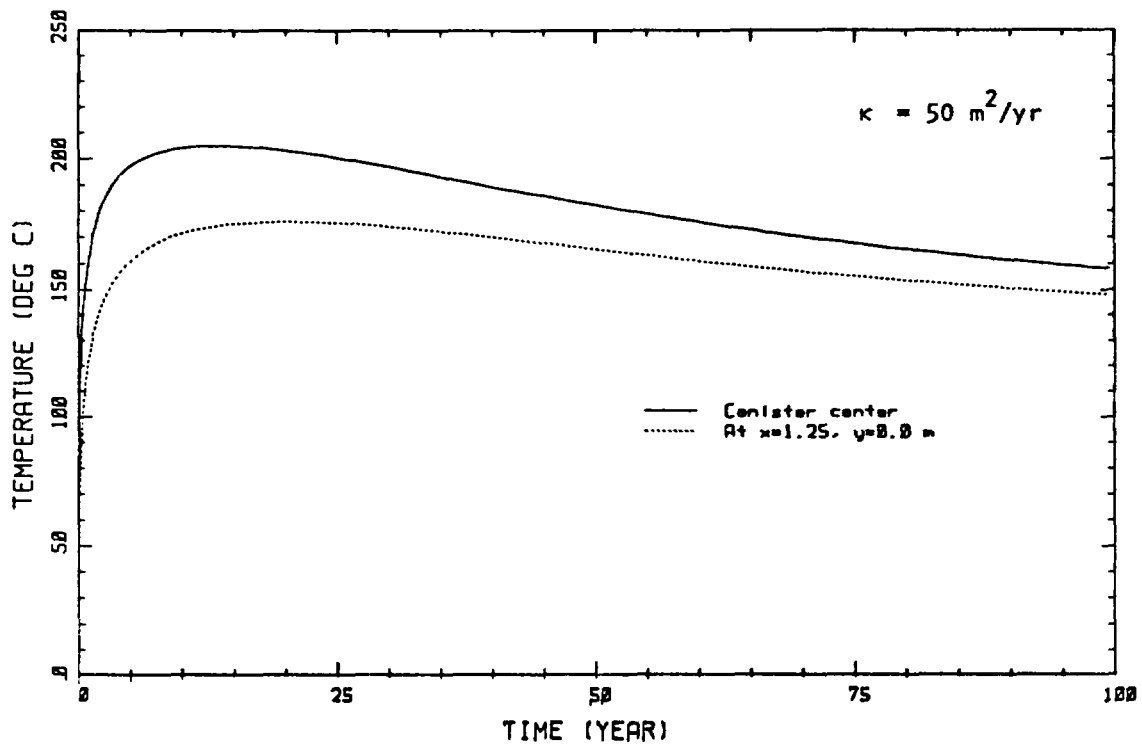


Figure 15. Near Field Temperature Histories for Alternative Equivalent Radiation Properties of Air in an Unventilated Drift - Two-Dimensional PORFLOW Calculations

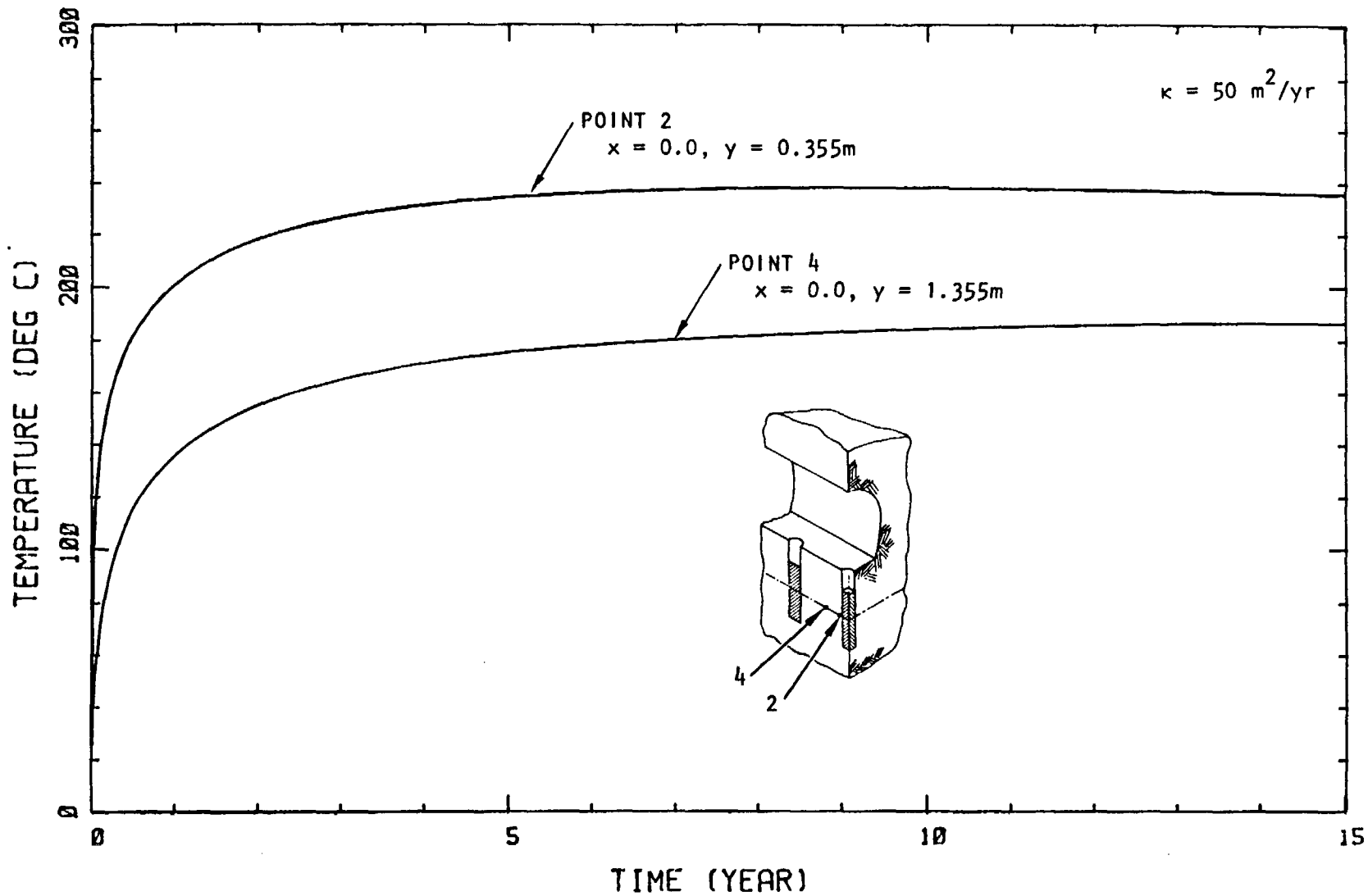
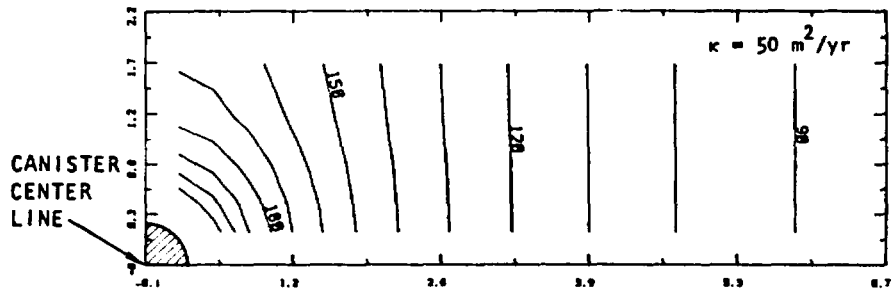
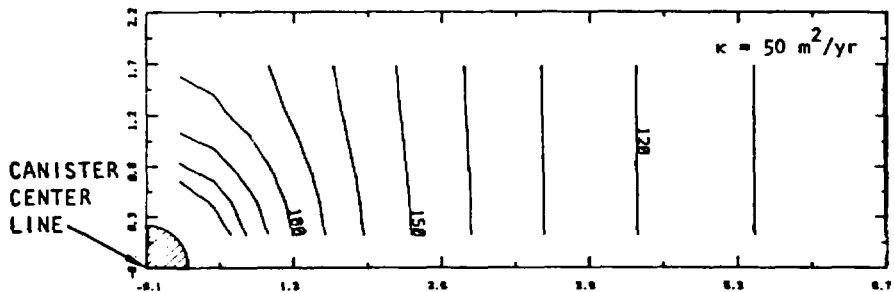


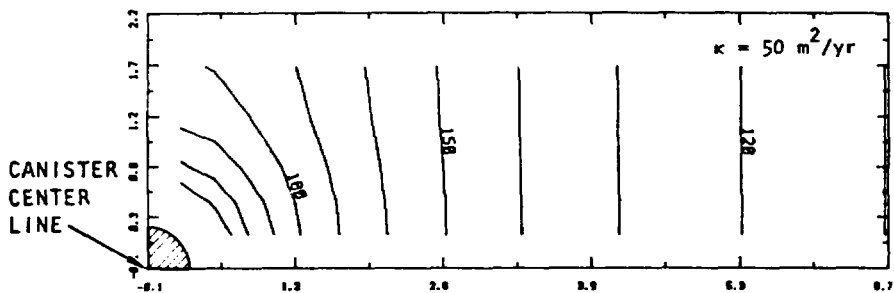
Figure 16. Temperature Histories for Sample Points 2 and 4 -
Three-Dimensional THERM3D Solution, with Unventilated Drift



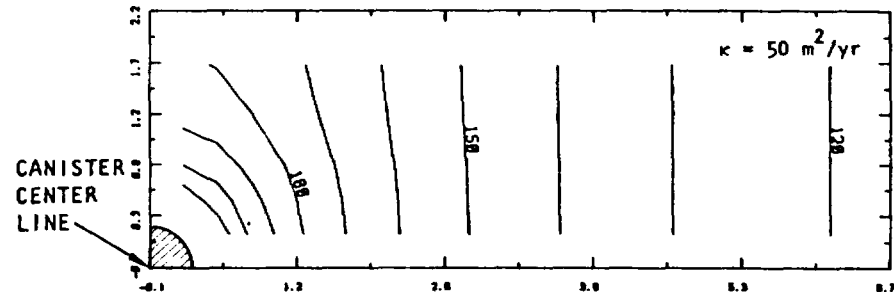
(a) 5 years



(b) 10 years



(c) 15 years



(d) 20 years

Figure 17. Temperature Distributions in a Horizontal Plane at the Midheight of the Canisters - Three-Dimensional THERM3D Solution, with Unventilated Drift

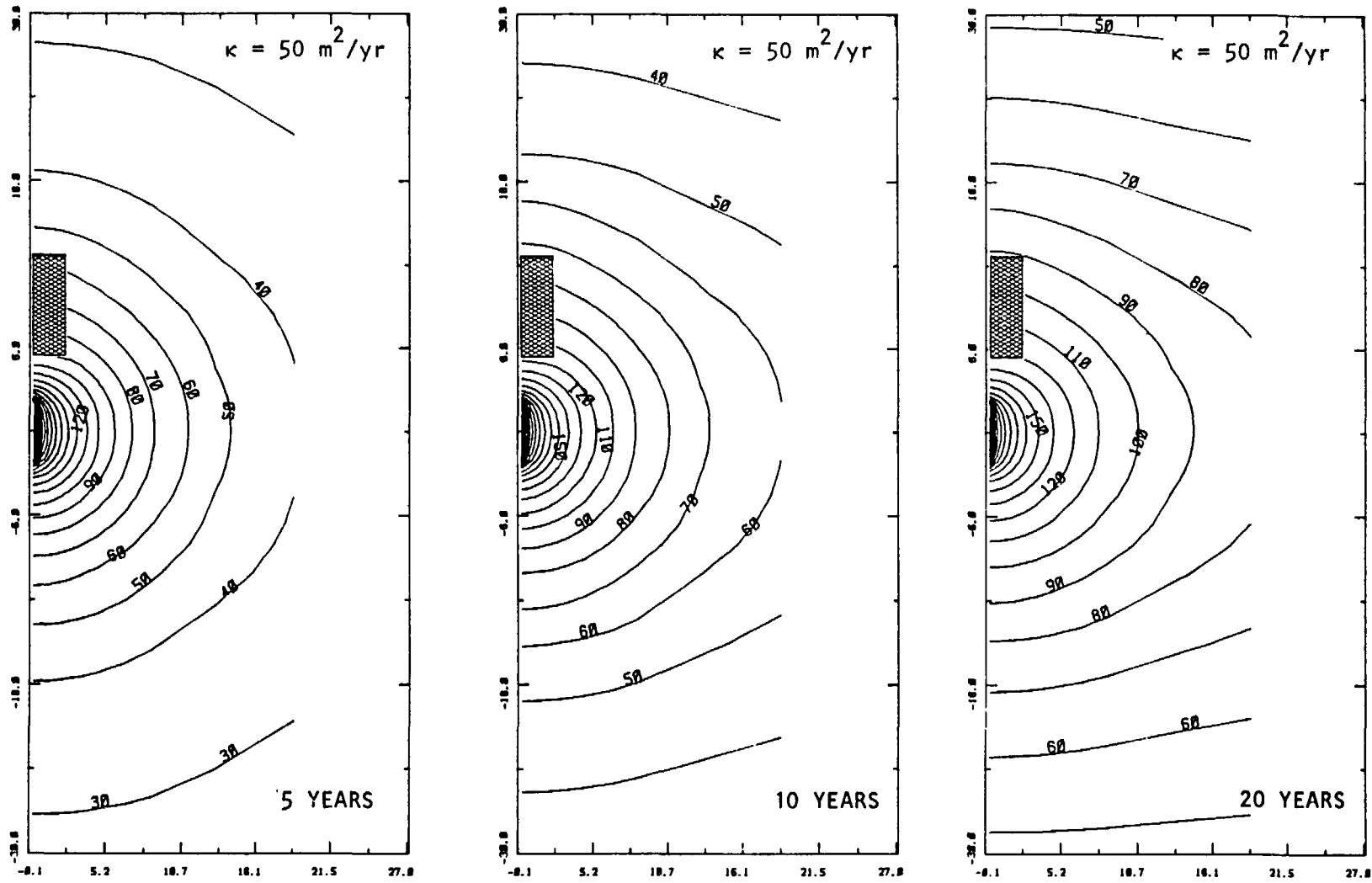


Figure 18. Temperature Distribution in a Vertical Plane Between Waste Canisters - Three-Dimensional THERM3D Solution with Unventilated Drift

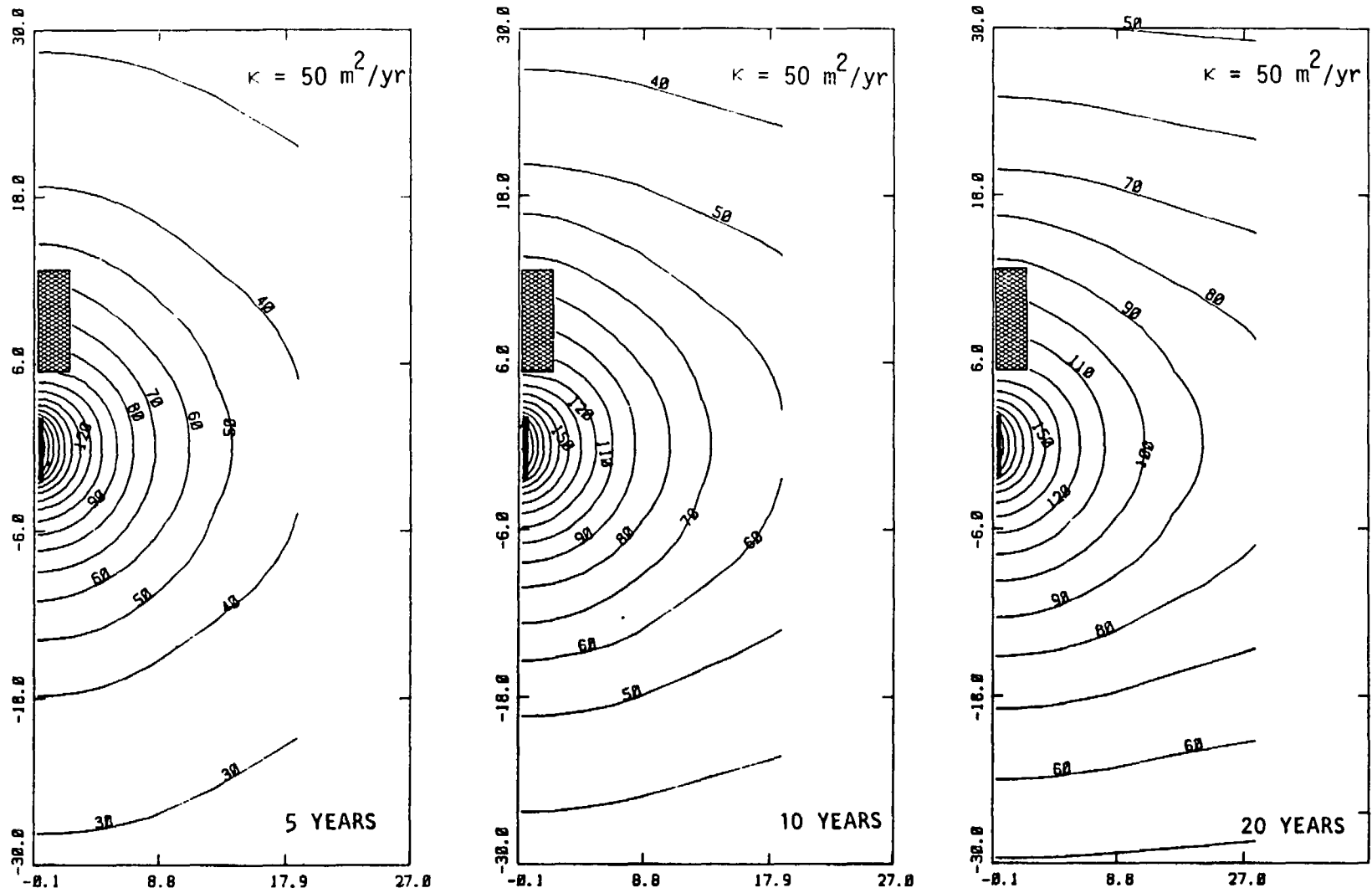


Figure 19. Temperature Distribution in a Vertical Plane - Two-Dimensional PORFLOW Solution with Low Diffusivity Approximation of Radiation ($\kappa = 50 \text{ m}^2/\text{yr}$)

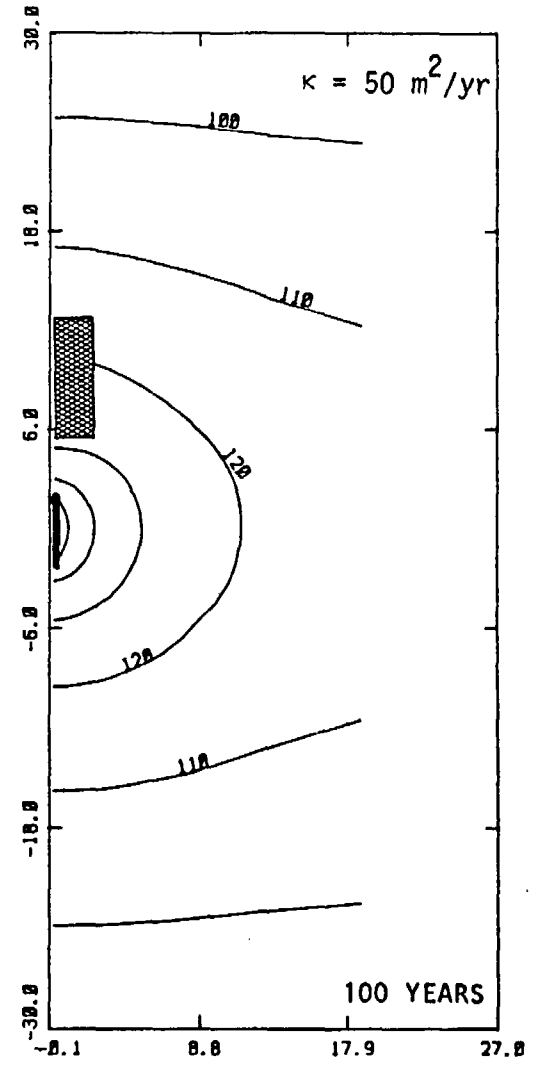
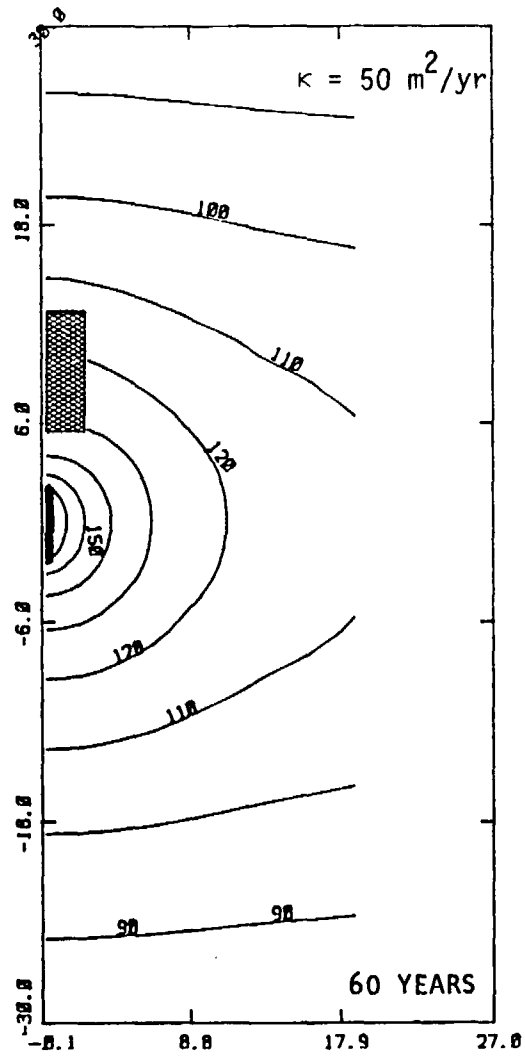
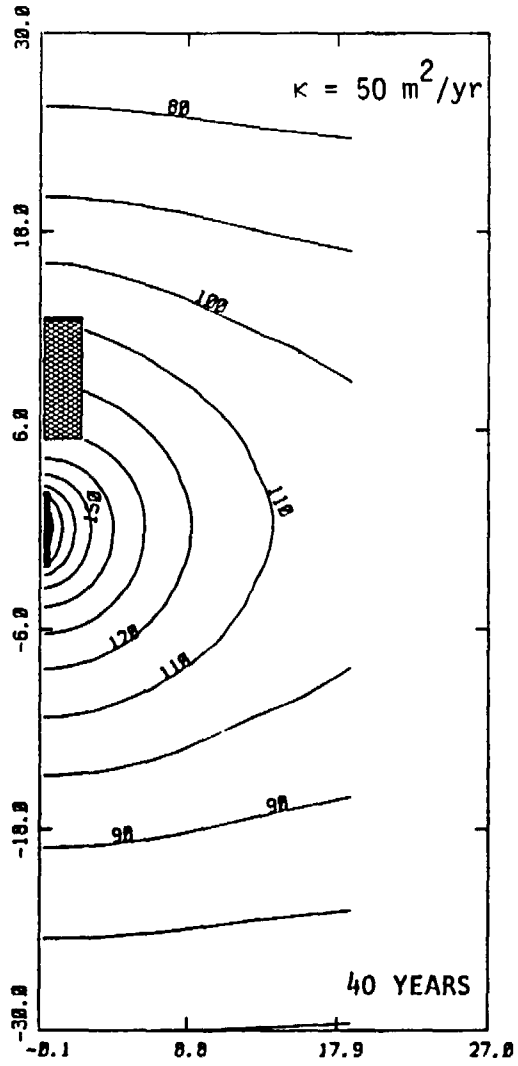


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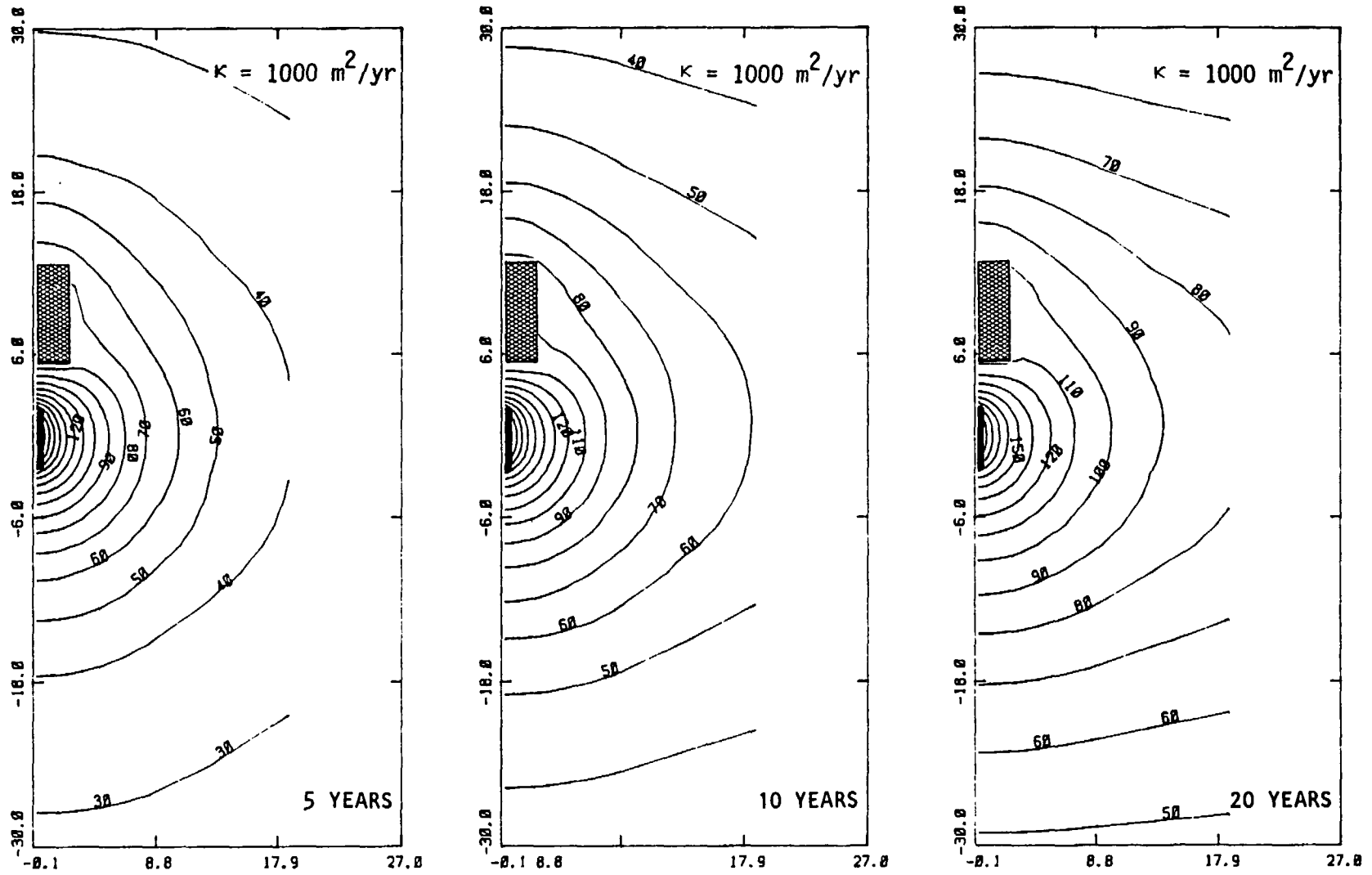


Figure 20. Temperature Distribution in a Vertical Plane -
Two-Dimensional PORFLOW Solution with High Diffusivity
Approximation of Radiation ($\kappa = 1000 \text{ m}^2/\text{yr}$)

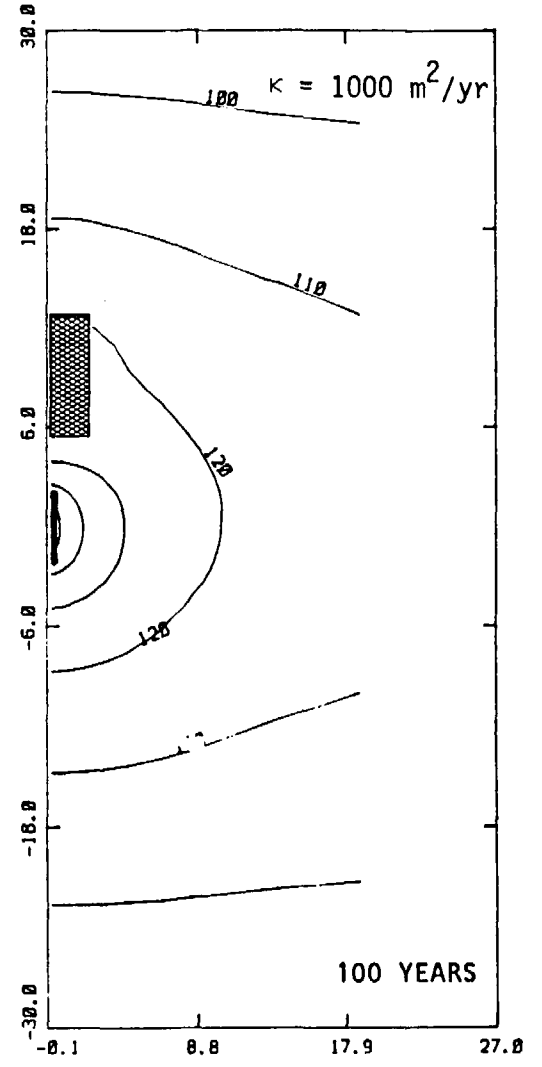
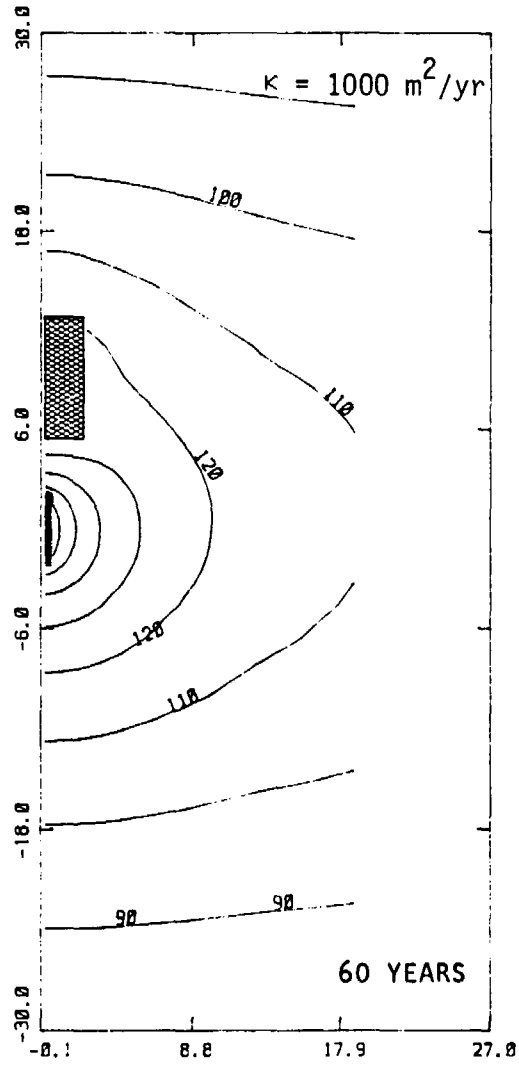
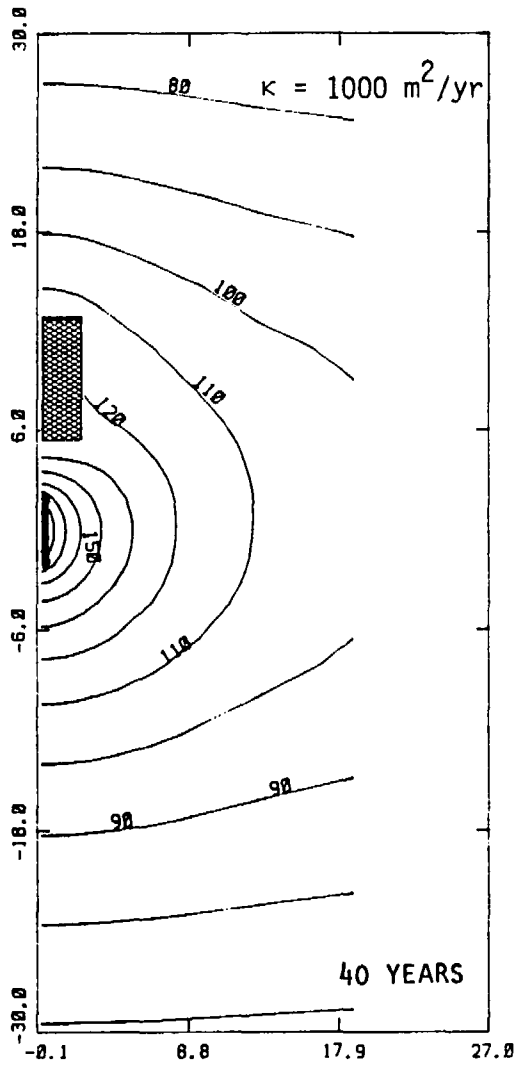


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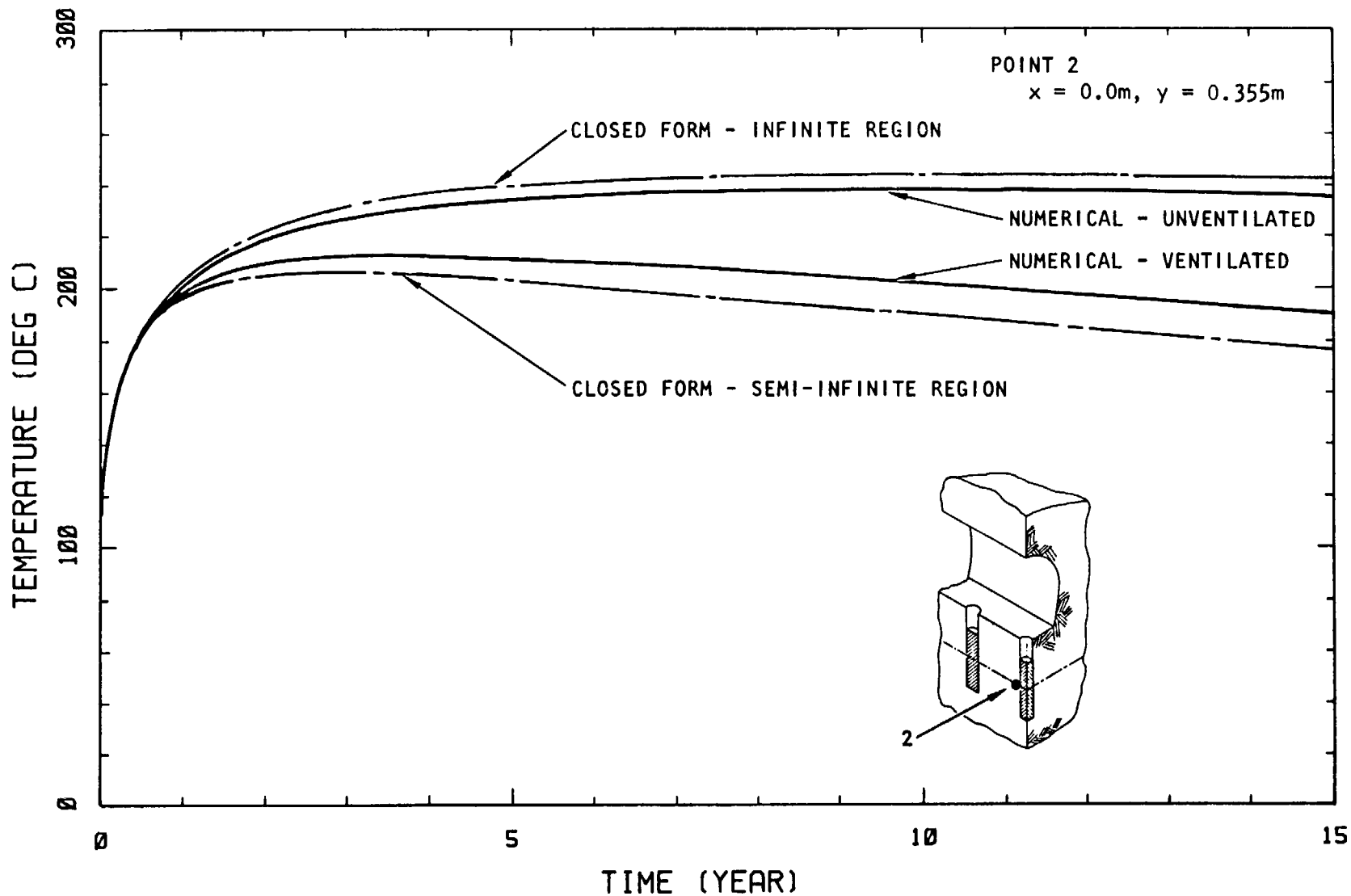


Figure 21. A Comparison of the Temperature History of Points at the Canister Wall (Point 2) and 1m from the Canister Wall (Point 4). Results Obtained Using Several Different Three-Dimensional Models.

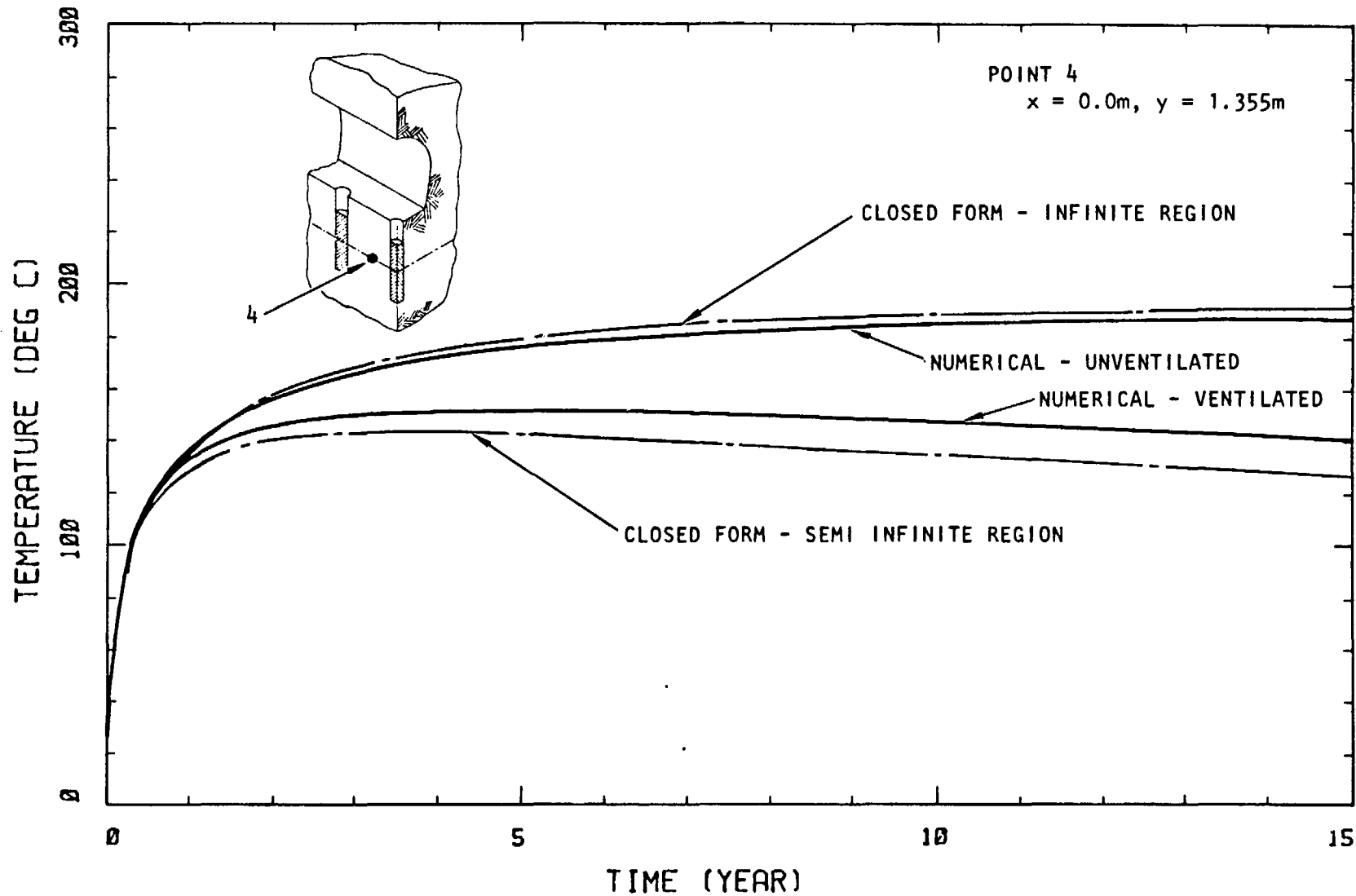


FIGURE 21. (Concluded)

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