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Contents | Page

INITIAL ENTRY - THIS IS A CONTINUATION OF NOTEBOOK #150 - THE INITIAL ENTRY IS IN NOTEBOOK #62.

THERMAL HYDROLOGY KTI PROJECT / TEF KTI

10-10-97

— CONTINUATION OF PAGE 304 - NOTEBOOK # 150:

RUN "5.5-1.dat" CRASHED ~~[illegible]~~ AT t = 48.62 YRS, MK 4/10/01
TIMESTEP # 410 WITH THE FOLLOWING MESSAGE:
TERMINATING METRA
RECEIVED signal 11 (SIGSEGV)
SEGMENTATION FAULT

10-27-97 AR — RE-RUNNING "5.5-1.dat" - SEE IF MORE HAS CHANGED CODE.

10-28-97 AR — RUN "5.5-1.dat" CRASHED IN SAME PLACE AGAIN ON 10-10-97.
WHEN RUN WITH INFILTRATION = ~~0~~ AR 5.0 mm/yr - MK 4/10/01
JUST TO SEE WHAT HAPPENS - WILL CALL PETER
LATER AND DISCUSS

10-28-97 AR — STARTED 2 NEW METRA RUNS:
"3d-10.0-5.dat" = IDENTICAL TO "3d-10.0-4.dat"
EXCEPT ROCK PROPERTIES (POKR) ALTERED TO
MATCH VALUES IN TPA CODE.
"3d-LOSS.dat" — STEADY-STATE RUN FOR INFILTRATION
RATES 1.0 mm/yr.

BOTH RUNS IN
/home/bilbo/grice/3d

AR 10-30-97
9186 CPUs.
229 TIMESTEPS
1.1×10^6 YRS

10-30-97 AR — RUN "3d-LOSS.dat" RAN TO COMPLETION BUT
"3d-10.0-5.dat" CRASHED AT TIMESTEP 562, t = 756.7 YRS
MESSAGE: "STOP: temperature beyond table look-up
range in pvtfunc". ← ON SCREEN
MESSAGE IN ___ errs FILE SAYS: "temperature out of
range ~~in~~ AR tk = -0.283120E+02". MK 4/10/01

10-31-97 AR — NOTE - THE STEADY-STATE RUN MENTIONED ABOVE ("3d-LOSS.dat")
USED MATERIAL PROPERTIES FROM TSPA '95. WHEN THE
TSPA MATERIAL PROPERTIES WERE USED, THE

10-31-97 DR — Run finished in 456 timesteps, 20,964 CPU seconds.

11-3-97 DR — Run: "3d-10-1.dat" crashed at timestep 746, time = 1431 years — message: "temperature beyond table-look-up range in putfunc".

New run: "3d-10-2.dat" — same as "3d-10-1.dat" except output of ...-1.dat @ 1000 sec used as initial conditions.

11-4-97 DR — "3d-loss-old.dat" crashed @ timestep 305, t = 224.4 yrs. Re-running with heat capacity of upper layer reduced to 10^9 J/(K) from 10^{11}.

Run on Sisyphus in: /home/bilbo/grice/3d/oldbase

"3d-10-2.dat" crashed @ timestep 745, t = 1789 yrs. In: /home/bilbo/grice/3d/newbase

New run: ~~"10.0ss.dat"~~ MK 4/10/01 DR "10.0ss-2.dat" — identical to "3d-10.0ss.dat" except 'equil' option invoked. In: ~~/home/st~~ MK 4/10/01 DR /home/bilbo/grice/3d/oldbase

11-5-97 DR — Run "10.0ss-2.dat" completed in 469 timesteps, 13,622 CPUs.
Started "10.0-old-1.dat" — uses output of "10.0ss-2.dat" as initial conditions. In: /home/bilbo/grice/3d/oldbase

Run "3d-1.0ss-old.dat" completed in 480 timesteps, 27,365 timesteps.

11-5-97 DR — "5.5-old-1.dat" crashed @ timestep # 692, time = 2075 yrs. "temperature beyond table look-up range".

— Re-run "5.5-old-1.dat" with specific heat of layer 1 equal to 10^{-8} J/(K) instead of 10^{-10}.

11-7-97 DR — Run "10.0-old-1.dat" ran to completion (10^4 yrs). Timesteps = 1494, CPU time = 101,1125 (sneeze)

Run "5.5-old-1.dat" ran to completion (10^4 yrs). Timesteps = 1311, CPU time = 66,349 s (fox trot)

11-8-97 DR — Re-running "5.5-1.dat" with heat capacity reduced from ~~10^8~~ MK 4/10/01 10^{10} J/K (?) to 10^8.

Re-run of "5.5-1.dat" crashed earlier than it had before — 21.73 yrs vs 48.62 yrs

Re-running "5.5-1.dat" with heat capacity increased to 10^{12} vs 10^8.

Re-run of "5.5-1.dat" crashed even earlier: 0.7558 yrs vs 21.73 yrs —

Re-running "5.5-1.dat" with heat capacity reduced to 10^6!

11-9-97 DR — Re-run crashed @ 386 timesteps, t = 43.61 yrs. Message = "Received signal 11 (SIGSEGV)" ("segmentation fault")

Re-running "5.5-1.dat" with thermal conductivity of air in dazet reduced to 0.9 W/m(K) from 20.

11-9-97 MR — RE-RUN OF "5.5-1.dat" CRASHED @ TIMESTEP=37, TIME= 0.03424 yrs. - "FLOATING POINT EXCEPTION 7".

RE-RUNNING "5.5-1.dat" WITH THERMAL CONDUCTIVITY OF "AIR" CHANGED BACK TO 20 w/m°C (?) AND HYDRAULIC CONDUCTIVITY OF AIR INCREASED FROM 1.0E-14 m^2 TO 1.0E-10 m^2.

11-10-97 MR — RUN "5.5-1.dat" CRASHED @ TIMESTEP = 366, t = 14.84 yrs ON FOXTROT - MESSAGE = "Floating point exception 7, invalid operand, occurred at address 86ea4."

11-11-97 MR — RE-RUN OF "5.5-1.dat" ON SHEEET - CRASHED AT SAME TIMESTEP, SAME TIME, SAME MESSAGE.

- 3 NEW RUNS STARTED: "1.0-old-2.dat", "5.5-old-2.dat", + "10.0-old-2.dat", EACH IDENTICAL TO PREVIOUS RUNS EXCEPT THAT THE PERMEABILITY OF "air" IN THE DRIFT WAS INCREASED FROM 1.0×10^{-14} m^2 TO 1.0×10^{-10} m^2.

IN: /home/bilbo/grice/3d/oldbase.

RUN "10.0-old-2.dat" CRASHED @ TIMESTEP #17, TIME = 1.07×10^{-3} yr. - RE-RUN WITH "ipvcal" set TO 1 INSTEAD OF ϕ

NOTE - THE METRA RUNS THAT ARE GENERATING TEMP + RH TABLES FOR USE IN THE TPA CODE ARE BEING RUN FOR 10^4 yrs - 5 km. - 1 REALIZATION ONLY - OUTPUT IN: /home/bilbo/grice/tparun/*-old-t-rh-*

MR 11-12-97

11-12-97 MR — "5.5-old-2.dat" CRASHED ON SISYPHUS @ TIMESTEP = 581, t = 38.63 yrs.

RE-RUN "5.5-old-2.dat" WITH "ipvcal" CHANGED FROM ϕ TO 1.

"1.0-old-2" CRASHED ON FOXTROT @ TIMESTEP = 1773, t = 1376 ~~YR~~ AR yrs. MH 4/10/01

RE-RUN "1.0-old-2.dat" WITH 'ipvcal' CHANGED FROM ϕ TO 1

11-13-97 MR — "1.0-old-2.dat" CRASHED ON FOXTROT @ TIMESTEP = 784, t = 84.07 yrs. - RERUNNING w/ ipvcal CHANGED BACK TO ~~1~~ ϕ, SOLVER CHANGED FROM # 4 TO # 3 MR MH 4/10/01

11-14-97 MR — RUN "10.0-old-2.dat" CRASHED ON SHEEEY @ TIMESTEP = 2362, TIME = 15.74 yrs, MESSAGE: "FLOATING POINT EXCEPTION 4".

~~RE-RUN WITH~~ MH 4/10/01 MR 11-14-97

NEW RUN: "10.0-old-~~2~~ 3.dat" - IDENTICAL TO "10-old-2.dat" EXCEPT PERMEABILITY OF "AIR" DECREASED FROM 10^{-10} m^2 TO 10^{-12} m^2.

11-17-97 AR — RUN "10.0-old-3.dat" CRASHED @ TIMESTEP = 1700, t = 4337 yrs - MESSAGE: "bad up press in putvA.f"

KILLED RUN "1.0-old-2.dat" AFTER 4939 TIMESTEPS, CPU TIME = 3601 min, t = 8.857 yrs, $\Delta t = 7.58 \times 10^{-5}$ yrs.

MH 4/10/01 RE-RUN "5.5-1.dat" WITH "ipvcal" CHANGED FROM 1 TO ϕ. ~~IN~~ AR ALSO PERMEABILITY OF "AIR" DECREASED FROM 10^{-10} m^2 TO 10^{-12} m^2. IN: /home/bilbo/grice/3d/newbase

11-17-97
MR

"5.5-1.dat" CRASHED @ TIMESTEP # 48, t = 0.8558 yrs.
RERUN w/ 'iprint' = 1.

- "5.5-0H-2.dat" CRASHED OR FORTROT @ TIMESTEP #1928, TIME = 1707 yrs.

- "5.5-1.dat" CRASHED OR SNEEZY @ TIMESTEP # 206, TIME = 9.692 yrs.

- RE-RUN "5.5-1.dat" WITH PERMEABILITY OF "AIR" REDUCED FROM 10^{-12} m^2 TO 10^{-16} m^2.

11-18-97
MR

"5.5-1.dat" CRASHED @ TIMESTEP = 56, t = 1.789 yrs.

"5.5-1.dat" RE-RUN WITH PERMEABILITY OF "AIR" INCREASED FROM — CANCEL — UNCHANGED FROM ABOVE - ONLY CHANGE = 'swext' OF AIR, FROM 0.005 TO 10 Pa.

"5.5-1.dat" CRASHED @ TIMESTEP = 105, t = 6.334 yrs

NEW RUN: "5.5-2.dat" - IDENTICAL TO "5.5-1.dat" EXCEPT PERMEABILITY OF "AIR" INCREASED FROM 10^{-16} m^2 TO 10^{-14} m^2.

- RUN "5.5-2.dat" CRASHED @ TIMESTEP # 418, t = 52.22 yrs.

11-19-97
MR

DRIFT SCALE HEATER TESTS

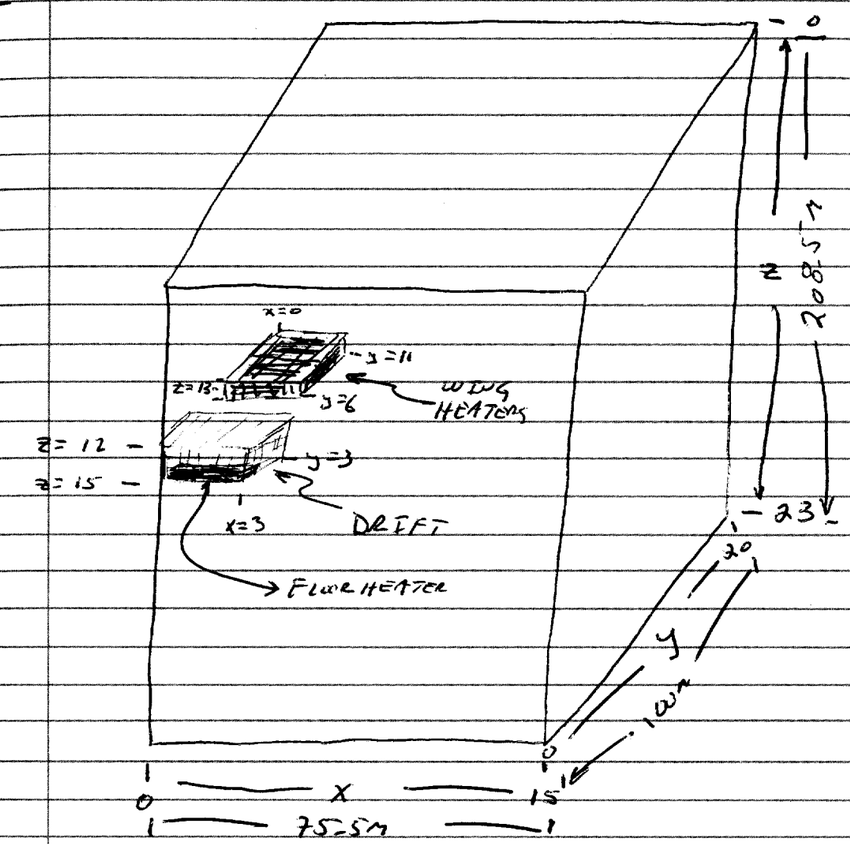
STEADY-STATE RUN: "gt3ss.dat" IN:

/home/bilbo/grice/3d/heattest

MR
11-19-97

11-19-97
MR

3-D MODEL : DRIFT-SCALE HEATER TEST



DRIFT-SCALE HEATER TEST RUN:

"tester.dat" - IN:

/home/bilbo/grice/3d/heattest

OBJECT OF RUN: GET TEMPERATURE @ DRIFT WALL ≈ 200°C @ 2 yrs.

RUN CRASHED @ TIMESTEP = 64, t = 9.771×10^{-3} yrs, "FLOATING POINT EXCEPTION 4, OVERFLOW OCCURRED AT ADDRESS 0f78e98"

- RE-RUN "tester.dat" - IDENTICAL TO PREVIOUS

11-19-97
MR

RUN EXCEPT POWER OF WTG HEATERS REDUCED FROM 200,000 WATTS TO 100,000 WATTS AND RESIDUAL SATURATION OF DRIFT + HEATERS CHANGED FROM 0.05 TO 0.005.

- NOTE - POWER IN "TESTER.dat" REDUCED TO ACCOUNT FOR FACT THAT MODEL IS ~~1/4 OF~~ MK 4/10/97
A 1/4 REPRESENTATION ALONG THE DRIFT AND
1/2 REPRESENTATION ALONG THE WTG HEATERS.
SO - ACCORDING TO "TEST DESIGN, PLANS AND LAYOUT REPORT FOR THE ESF THERMAL TEST" SEPT 20, 1996, pg xii, THE MAXIMUM POWER OUTPUT OF THE FLOOR HEATER IS 80KW, + FOR THE WTG HEATERS IS 200KW. THE TEST IS TENTATIVELY TO BE RUN AT 80% AND 100% OF MAXIMUM POWER FOR THE FLOOR + WTG HEATERS, RESPECTIVELY.

MR 11-20-97
WRONG → SHOULD BE 1/4 FOR WTG HEATERS ALSO

THUS - $0.8(80{,}000\,w)\frac{1}{4} = 16{,}000\,w$ - FLOOR HEATER
$1.0(200{,}000\,w)\frac{1}{2} = 100{,}000\,w$ - WTG HEATERS.

11-20-97
MR

NOTE - RUN OF "TESTER.dat" WITH 16,000 w + 50,000 w FOR FLOOR + WTG HEATERS RESPECTIVELY CRASHED @ TIMESTEP # 128, t = 0.1329 yrs, MAX TEMP @ WTG HEATERS = 136.8 C.
ERROR MESSAGE: "bad vapor press in blkm = 2806."

RUN "TESTER.dat" w/ 16,000 w FOR FLOOR HEATER + 100,000 w FOR WTG HEATERS

ERROR - WTG HEATERS ALSO AT 1/4 REPRESENTATION, THUS: 16,000 w + 50,000 w.

RUN "Tester.dat" w/ 'iputab' set to ϕ INSTEAD OF 1.

- "TESTER.dat" CRASHED AT TIMESTEP 115,

11-20-97
MR

t = 0.1182 yrs, "temperature beyond table look-up range in putfcns".

RUN "tester2.dat" - IDENTICAL TO "tester.dat" EXCEPT 'iprtab' set back TO 1 AND iplwr CHANGED FROM 1 TO ϕ.

CALCULATING RELATIVE HUMIDITY:
FROM: HILLEL, 'SOIL + WATER', pg 58, 1971

$$RH = EXP\left[\frac{\phi_m}{RT}\right],$$ WHERE:

ϕ = CAPILLARY PRESSURE
R = GAS CONSTANT FOR WATER VAPOR
= R(UNIVERSAL)/MW WATER

$$= 8.314\,J/K\text{-}mol \;\frac{mol}{18\,g}\;\frac{10^3\,g}{Kg} = \frac{8314\,J}{18\;K\text{-}Kg}$$

$$= 461.89\,\frac{Kg\cdot m^2}{s^2\,K\text{-}Kg} = \frac{461.89\,m^2}{s^2\,K}$$

T = TEMPERATURE, K

CHECK - FROM TABLE 3.1 IN HILLEL:

FOR:
CAPILLARY PRESSURE = -5100 cm H_2O MR 11-20-97
T = 20 C = 393K → WRONG, SHOULD BE 293 K

RH = 0.99637

↓

CALCULATION

11-20-97
JR

$$RH = EXP\left[\frac{-5100\ cm\ H_2O\ 1\ ATM\ 101300\ Pa\ K\ N\ K\ T\ m^3}{1033\ cm\ H_2O\ 373K\ ATM\ 462\ m^2\ m^2\ Pa\ K^2\ N\ 10^3\ kg}\right]$$

$$= EXP\left[\frac{-5100\ (101300)}{1033(373)(462)10^3}\right] = e^{-0.00275} = 0.9972$$

WRONG, T SHOULD = 293K!

JR 11-20-97

CORRECTED CALCULATION:

$$RH = EXP\left[\frac{-5100(101300)}{1033(293)462(1000)}\right] = e^{-3.69\times10^{-3}} = 0.99631$$

TWO NEW RUNS TO COMPARE RELATIVE HUMIDITIES CALCULATED BY METRA VS RH'S CALCULATED BY FORMULA ABOVE:

VAPOR-PRESSURE-LOWERING ON — METRA WILL CALCULATE RH'S:
"vp-low-on.dat"

VAPOR-PRESSURE LOWERING OFF — METRA WILL NOT CALCULATE RH'S:
"vp-low-off.dat"

BOTH RUNS IN:

JR mkt 4/10/01

/home/bilbo/grice/3d/~~rh~~ rh-test

11-21-97
JR

"tester2.dat" CRASHED @ TIMESTEP 271, t=0.2187 yrs.
RUNNING "tester3.dat" — IDENTICAL TO "tester2.dat" USING METRA14.

NEW RUN: "tester4.dat" — IDENTICAL TO "TESTER2.dat"

11-21-97
JR

EXCEPT NEW MATERIAL TYPE CREATED FOR HEATERS (#3) AND POROSITY & PERMEABILITY OF HEATERS SET TO ZERO.

RUN "vp-low-on.dat" COMPLETED IN 317 TIMESTEPS, 8271.3 CPUS.

RUN "vp-low-off.dat" COMPLETED IN 395 TIMESTEPS, 9990.54 CPUS.

NEW RUN: "tester3.dat" — IDENTICAL TO "tester.dat" BUT BEING RUN BY METRA14. ON:
/home/bilbo/grice/3d/heattest

11-22-97
JR

"tester4.dat" CRASHED @ TIMESTEP #407, t=0.278 yrs

"Tester3.dat" CRASHED @ TIMESTEP #126, TIME=0.1329 yrs — METRA14 —

ATTEMPTING TO ISOLATE REASON THAT BASECASE RUNS USING TPA CODE 3.1.1 PARAMETER VALUES CRASH WHILE RUNS THAT USE VALUES FROM TSPA '93/95 DON'T. CHANGING PARAMETERS ONE AT A TIME IN RUNS TO SEE WHAT TPA PARAMETERS ARE CAUSING THE TROUBLE. IN:

/home/bilbo/grice/3d/old-new

RUN "mat-lambda" — VAN GENUCHTEN lambda OF MATRIX FOR TSw CHANGED FROM 0.444 TO 0.333 — SNEEZY

RUN "frac-lambda.dat" van GENUCHTEN lambda OF FRACTURE FOR TSw CHANGED FROM 0.7656 TO 0.667 — FOX TROT

11-23-97
MR

- "frac-lambda.dat" COMPLETED ON FOXTROT IN 1412 TIMESTEPS, CPU TIME = 72,296 S.

- NEW RUN: "mat-por.dat" - REPLACED TSPA '93/'95 VALUE OF MATRIX POROSITY (TSw) WITH VALUE FROM TPA CODE BASECASE, 0.139 → 0.12. ON FOXTROT

- NEW RUN: "frac-por.dat" - REPLACED TSPA '93/'95 VALUE OF ~~MATRIX P~~ MR FRACTURE POROSITY (TSw) WITH VALUE FROM TPA CODE BASECASE (3-1.1), 0.0018 → 0.001. IN:

MR 11/25/97

/home/bilbo/grice/3d/old-new

11-24-97
MR

- "mat-lambda.dat" COMPLETED ON SNEEZY IN 1240 TIMESTEPS, CPU TIME = 118,781 S.

"mat-por.dat" COMPLETED ON FOXTROT, 1481 TIMESTEPS, RUN TIME = 68,143 CPU S.

11-25-97
MR

MR 11-25-97

Comparison of Relative Humidities (at drift wall)

RH values with vapor pressure lowering on were calculated by METRA. Values with vapor pressure lowering off calculated with the equation: RH = EXP[CP/(R*T*1000)], where:

CP = capillary pressure (from METRA), R = gas constant for water vapor (J-mol/(K-mol-g)), T = temperature (K, from METRA)

Runs in: /home/bilbo/grice/3d-rh-test

			Vapor Pressure Lowering On, t=3 yrs			Vapor Pressure Lowering Off, t=3 yrs		
x	y	z	temp	cap-pres	rh	temp	cap-pres	rh
2.72	0.50	342.10	96.46	-2.40E+03	1.00E+00	96.52	-2.47E+03	1.00E+00
2.72	1.50	342.10	95.15	-1.96E+03	1.00E+00	95.21	-2.00E+03	1.00E+00
2.72	0.50	342.60	99.14	-6.24E+04	1.00E+00	99.20	-6.73E+04	1.00E+00
2.72	0.50	343.60	99.36	-1.36E+05	9.99E-01	99.42	-1.50E+05	9.99E-01

			Vapor Pressure Lowering On, t=10 yrs			Vapor Pressure Lowering Off, t=10 yrs		
x	y	z	temp	cap-pres	rh	temp	cap-pres	rh
2.72	0.50	342.10	119.80	-1.78E+07	9.01E-01	118.80	-4.98E+07	7.60E-01
2.72	1.50	342.10	118.70	-1.37E+07	9.23E-01	118.00	-2.37E+07	8.77E-01
2.72	2.50	342.10	116.60	-4.72E+06	9.73E-01	116.40	-3.16E+06	9.83E-01
2.72	4.00	342.10	113.10	-1.92E+05	9.99E-01	113.10	-1.32E+05	9.99E-01
2.72	6.00	342.10	108.90	-2.08E+04	1.00E+00	109.00	-1.95E+04	1.00E+00

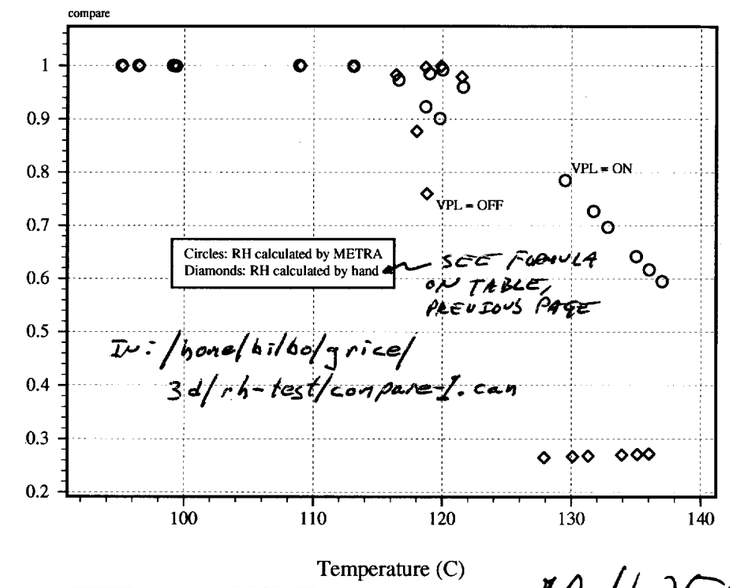
			Vapor Pressure Lowering On, t=20 yrs			Vapor Pressure Lowering Off, t=20 yrs		
x	y	z	temp	cap-pres	rh	temp	cap-pres	rh
2.72	0.50	342.10	132.80	-6.31E+07	6.97E-01	131.30	-2.46E+08	2.68E-01
2.72	1.50	342.10	131.70	-5.57E+07	7.27E-01	130.10	-2.46E+08	2.67E-01
2.72	2.50	342.10	129.50	-4.21E+07	7.85E-01	127.90	-2.46E+08	2.65E-01
2.72	6.00	342.10	121.60	-7.05E+06	9.60E-01	121.50	-3.90E+06	9.79E-01
2.72	8.00	342.10	1.20E+02	-1.38E+06	9.92E-01	119.90	-2.52E+05	9.99E-01
2.72	0.50	342.60	1.36E+02	-8.47E+07	6.17E-01	135.10	-2.46E+08	2.71E-01
2.72	1.50	342.60	1.36E+02	-7.76E+07	6.42E-01	133.90	-2.46E+08	2.70E-01
2.72	0.50	343.40	1.37E+02	-9.13E+07	5.95E-01	136.00	-2.46E+08	2.72E-01
2.72	0.50	344.60	1.19E+02	-2.56E+06	9.85E-01	118.70	-5.65E+05	9.97E-01

MR 11-25-97

11-25-97
MR

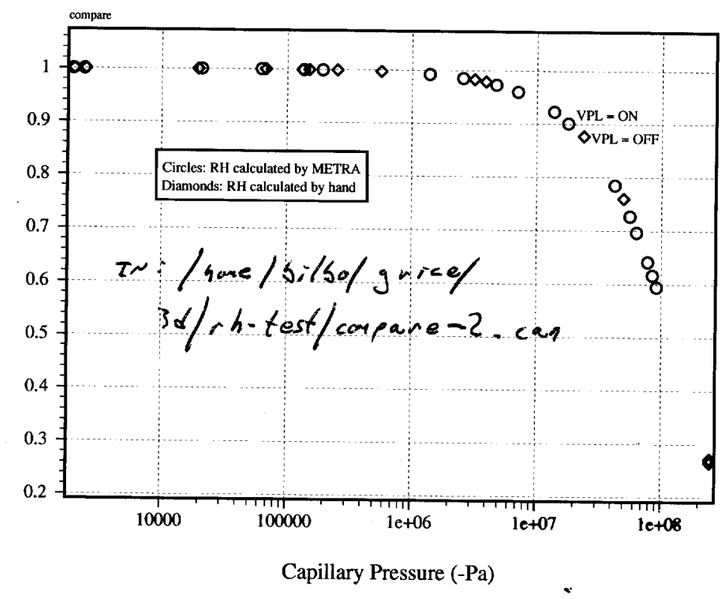
MR 11-25-97

Effect of Vapor Pressure Lowering on Relative Humidity



MR 11-25-97

Effect of Vapor Pressure Lowering on Relative Humidity

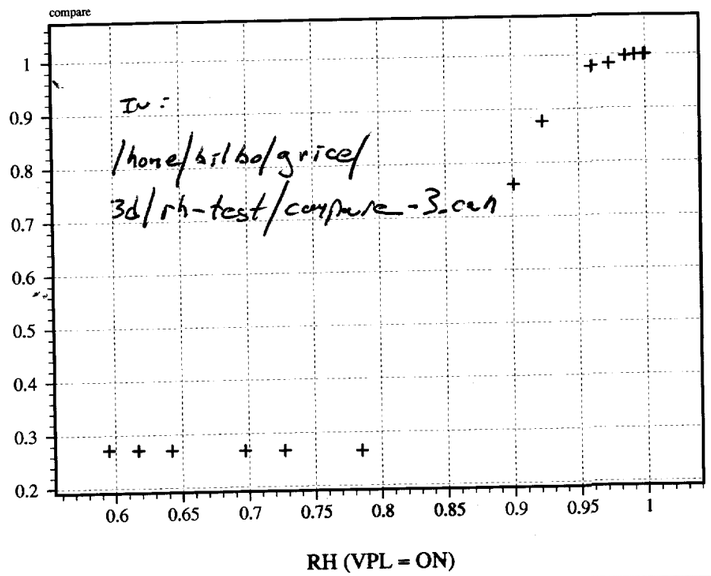


MR 11-25-97

11-25-97
MR

MR 11-25-97

Effect of Vapor Pressure Lowering on Relative Humidity



MR 11-25-97

11-26-97
MR

RUN "mat-perm.dat" CRASHED @ TIMESTEP #1708, t = 6624 YRS. MESSAGE: "bad vp press in put.f"
THIS RUN REPLACED TSPA '93/'95 VALUE OF TSw MATRIX PERMEABILITY WITH VALUE FROM TPA 3.1.1.

MR 11-26-97

NEW RUN: "old-tsw-~~perm~~ perms.dat" - ALL TSw PARAMETER VALUES CHANGED TO VALUES FROM TPA CODE 3.1.1 EXCEPT VALUES OF MATRIX + FRACTURE PERMEABILITY — THESE LEFT AT TSPA '93/95 VALUES. RUN ON FOXROT IN:

/home/bilbo/grice/3d/old-new

11-27-97
MR

"old-tsw-perms.dat" CRASHED @ TIMESTEP # 552, t = 2613 YRS.
MESSAGE: "TEMPERATURE BEYOND TABLE LOOK-UP RANGE"

NEW RUN: "old-tsw-perms-2.dat" - IDENTICAL TO EXCEPT 'iprcal' CHANGED FROM Ø TO ~~1~~ 1.

MR 11/28/97

11-28-97
MR

RUN "old-tsw-perms-2.dat" CRASHED @ TIMESTEP #3378, t = 1840 YRS — MESSAGE: "FLOATING POINT EXCEPTION 3, DIVISION BY ZERO, OCCURRED AT ADDRESS 8712c.

NEW RUN: "old-tsw-perms-vanGs.dat" - IDENTICAL TO "old-tsw-perms.dat" EXCEPT VAN GENUCHTEN lambdas OF MATRIX + FRACTURE (TSw) SET TO old VALUES (TSPA '93/95)

12-1-97
MR

RUN "old-tsw-perms-vanGs.dat" FINISHED IN 1083 TIMESTEPS, CPU TIME = 53,471 s.

NEW RUN: "old-tsw-p-v-chn.dat" - IDENTICAL TO "old-tsw-perms-vanGs.dat" EXCEPT TPA 3.1.1 BASECASE VALUES USED FOR CHnv AND CHnz

MR 12-1-97

Parameter	Old Values (TSPA '93 & '95)	New Values (TPA Code 3.1.1)
TSw		
van Genuchten lambda - matrix	0.444	0.333
van Genuchten lambda - fracture	0.7636	0.667
matrix porosity	0.139	0.12
fracture porosity	0.0018	0.001
matrix permeability	2.131E-18	2.0E-19
fracture permeability	3.9E-12	8.0E-13
CHnv		
van Genuchten lambda - matrix	0.593	0.231
van Genuchten lambda - fracture	0.7636	0.667
matrix porosity	0.331	0.33
fracture porosity	0.0018	0.001
matrix permeability	1.118E-16	2.0E-14
fracture permeability	3.9E-13	8.0E-13
CHnz		
van Genuchten lambda - matrix	0.414	0.565
van Genuchten lambda - fracture	0.7636	0.667
matrix porosity	0.306	0.32
fracture porosity	0.0018	0.001
matrix permeability	1.617E-18	5.0E-18
fracture permeability	3.9E-12	6.0E-13

In: pt. 1 jorel
C:\ jorel
memos\old-new\flux\

MR 12-1-97

12-1-97 MR

METRA INPUT: "old-tsw-perms-vanGs.dat"
IN: /home/bilbo/grice/3d/old-new

MR 12-1-97

```
Simulation of Yucca Mountain
Drift Scale
:
: Attempting to isolate reason for crashes. Run "5.5-old-1.dat" ran to
: 10,000 years in 66,349 CPU sec.
:
: Identical to "5.5-old-1.dat" except all the TSPA '93/'95 values
: been replaced by value from TPA 3.1.1 basecase - except values of
: TSw matrix and fracture permeability and van Genuchten parameters. These kept at TSPA value
:
: 29 November 1997
:
: This uses material properties from the TPA basecase prior to 9/22/97
: (TSPA '93 & '95 values). See notes from Rui Chen, tables on printout
: dated 9/17/97.
:
: Initial conditions from steady state run: 5.5ss-old.dat - modified so
: initial saturations of drift and WP = 0.001 (gas sat = .999)
:
RSTART  0
:
:       XYZ                     = 1 table look-up,; pref = ref. press.
:       RADIAL                  = 0 correlations;   tref = ref temp.
:       OTHER                     ^
:                                 |
:grid  geometry  nx ny   nz ivplwr ipvcal  iout    pref tref  href
Grid   XYZ       8  6   23  1       0      3     0    0
:
Monitor 433
:
: ***********************************************************************
: i - sequential number of material types
: type - the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm - irreducible liquid saturation for the matrix
: rpmm - Van Genuchten parameter for matrix
: alpham - Van Genuchten parameter for matrix
: swext - liquid saturation below which the capillary pressure is calculated based
:         on the slope dPcw/dSw evaluated at SWEXT.
: sgc - residual (immobile) gas saturation, fraction
: iecm - Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1 invoke, 2 ECM with
: swirf - residual liquid saturation for fracture, fraction
: alphaf - parameter in Van-Genuchten equation for fracture (1/Pa)
: phim - matrix porosity (fraction)
: phif - fracture porosity (fraction)
: permm - intinsic matrix permeability (m^2)
: permf - intrinsic fracture permeability
:
Pckr                          :relative perm and pc keyword
:   i  type-curv    swirm   rpmm(lamda) alpham      swext   sgc      iecm
:                   swirf   rpmf(lamda) alphaf      phim          phif    permm    permf
: (TCw)
    1  Van-Gen      0.021   0.3830      7.907e-7    0.0     0.0      1
                    0.040   0.764       1.23e-3     0.087   .0018  2.083e-18  3.9e-12
: (PTn)
    2  Van-Gen      0.154   0.578       5.559e-5    0.0     0.0      1
                    0.040   0.764       1.40e-3     0.421   .0018  3.879e-14  3.9e-13
: (TSw)
    3  Van-Gen      0.045   0.444       1.355e-6    0.0     0.0      1
                    0.040   0.7636       1.22e-3    0.12    .001  2.131e-18  3.9e-12
: (TSv)
    4  Van-Gen      0.118   0.551       2.193e-7    0.0     0.0      1
                    0.040   0.764       1.31e-3     0.065   .0018  9.967e-19  3.9e-12
: (CHnv)
    5  Van-Gen      0.097   0.593       2.786e-6    0.0     0.0      1
                    0.040   0.764       1.22e-3     0.331   .0018  1.118e-16  3.9e-13
: (CHnz)

    6  Van-Gen      0.121   0.414       5.943e-7    0.0     0.0
                    0.040   0.764       7.30e-4     0.306   .0018  1.617e-18  3.9e-12
:
: ******************
:  Backfill material
: ******************
    7  Van-Gen      0.01    0.7000      1.106e-5    0.0     0.0      1
                    0.04    0.764       1.305e-5    0.50   1.8e-3    3.9e-14    3.9e-12
:
: *******************
: Metal Waste Package
: *******************
    8  Van-Gen      0.0001  0.4400      5.80e-7     0.0     0.0      0
:                   0.0001  0.764       1.305e-5    0.0            0.0  0.0e-99  0.0e-99
:
: *****
:  Air
: *****
:   9  Van-Gen      0.0001  0.4400      1.355e-6    0.0     0.0      1
:                   0.0001  0.764       1.22e-3     0.139   .0018    2.131e-18  3.9e-12
```

MR 12-1-97

12-1-97 MR

MR 12-1-97

MR 12-1-97

MR 12-1-97

MR 12-1-97

```
:
:      Type          swirm   rpmm        alpham      swext   sgc      iecm
   9  Linear         0.00    0           0           0.005   0.0      0
:
: *********
:  Fracture
: *********
  10  Van-Gen        0.080   0.4400      5.8e-7      0.0     0.0      1
                     0.040   0.764       1.305e-5    0.139          1.8e-3  1.0e-12  1.0e-12
:
0            :  blank line to end pckr data
:
: ***************
:  Debug options
: ***************
Debug  1
0
:
: ********************
:  Thermal properties
: ********************
: no - sequential number of data set
: rho - rock density (kg/m^3)
: cpr - rock specific heat (J/kg-K)
: ckdry - thermal conductivity of dry rock (J/s/m-K)
: cksat - thermal conductivity of liquid saturated rock (J/s/m-K)
: crp - pore compressibility with pressure at constant T (1/Pa)
: crt - absolute value of pore compressibility with pressure at constant T (1/Pa)
: tau - tortuosity for binary diffusion
: cdiff - vapor-dir diffusion coefficient, (m^2/s)
: cexp - exponent for binary diffusion
: enbd - enhanced binary diffusion coefficient
:
Thermal-prop
: no rho        cpr    ckdry  cksat   crp  crt   tau  cdiff    cexp  enbd
  1  2.580e+03 728.    1.69   2.23    0    0    .5  2.13e-5  1.8   0.
  2  2.580e+03 422.    0.61   0.81    0    0    .5  2.13e-5  1.8   0.
  3  2.580e+03 840.    2.10   2.78    0    0    .5  2.13e-5  1.8   0.
  4  2.580e+03 948.    1.28   1.69    0    0    .5  2.13e-5  1.8   0.
  5  2.580e+03 488.    0.84   1.11    0    0    .5  2.13e-5  1.8   0.
  6  2.580e+03 526.    1.42   1.88    0    0    .5  2.13e-5  1.8   0.
  7  2.580e+03 1e+8    1.69   2.23    0    0    .5  2.13e-5  1.8   0.
:
: ******************
:  Backfill material
: ******************

  8  2.580e+03 840.0   0.26   0.49    0    0    .5  2.13e-5  1.8   0.
:
: *******************
: Metal Waste Package
: *******************
:
  9 7.800e+03 450.0    50.0   50.0    0    0    .5  2.13e-5  1.8   0.
:
: *****
:  Air
: *****
:
 10 1.2       57.4     20.0   20.0    0    0    .5  2.13e-5  1.8   0.
:
: ********
: Fracture
: ********
:
 11 2.580e+03 840.0    2.10   2.78    0    0    .5  2.13e-5  1.8   0.
:
0
: ****************************
:  Define size of grid-blocks
: ****************************
: igrid - grid-type (0 - block centered, 1 - point-distributed, 2 - boundary node at the surf
: dx - block sizes in x-direction
: dy - block sizes in y-direction
: dz - block sizes in z-direction
:
:     igrid   rw      re
DXYZ   0
: (dx(i),i=1,nx)
0.4 0.4 0.4 0.5 0.515 1.0 3.0 4.785
: (dy(j),j=1,ny)
1. 1.  1.  2.  2.  2.
: (dz(k),k=1,nz)
45.0 50.0 53.0 100.0 60.0 30.0 3.785 0.715 0.7 0.4
0.4 0.4 0.4  1.415 7.785 30.0 60.0 30.0 8.0 40.0
41.0 60.0 61.0
PhiK
: i1 i2 j1 j2 k1 k2 iist ithrm vb  por permx permy  permz  porma permm
  1  8  1  6  1  1  1    7    0.                          : TCw - huge heat capacity, heat sink
  1  8  1  6  2  2  1    1    0.                          : TCw
  1  8  1  6  3  3  2    2    0.                          : PTn
  1  8  1  6  4 18  3    3    0.                          : TSw
  1  8  1  6 19 19  4    4    0.                          : TSv
```

12-1-97
MR

```
  1   8  1  6 20 21  5   5    0.                    : CHnv
  1   8  1  6 22 23  6   6    0.                    : CHnz
:
: NOTE: Drift, Waste, & Backfill have the rock properties (iist)
:       of TSw (3) but their own thermal properties. Residual saturation
:       of drift reduced so it can dry out.
:
  1   5  1  6  8 14  9  10    0.  0.99 1.0e-14 1.0e-14 1.0e-14 : Drift ("air")
  1   2  1  3 10 13  3   9    0.  0.0 0.0 0.0 0.0 : Waste Package
  1   5  1  6 14 14  3   8    0.                  : Backfill/Pedestal/Floor
  1   8  1  6 23 23  6   6    1.0E12              : Sink for water
  0
:
Init  5.5ss
:
:Equil  depth  pdepth   tdepth   tgrad  param iequil
:Equil   684   101325    27.    0.02047   0.    -1
:
Recurrent
:
Source   2   0.0624   1.
:  isl is2 jsl js2 ksl ks2  istyp
    1   8   1   6   1   1    12
: NOTE - infiltration rate calculated as kg/(s-m^3)
: per unit pore volume. 10.0 mm/yr = 8.09E-08
  0 13.05  4.45E-08
0
:SKIP
:Power decay data from Randy Manteufel, 4/25/96
:  is  js  ks  istyp
    1 2   1 3  10 13    32
  0.3156E+06  0.8469E+04
  0.9467E+07  0.8423E+04
  0.1578E+08  0.8391E+04
  0.3156E+08  0.8314E+04
  0.3541E+08  0.8296E+04
  0.3973E+08  0.8276E+04
  0.4458E+08  0.8253E+04
  0.5002E+08  0.8228E+04
  0.5612E+08  0.8199E+04
  0.6297E+08  0.8168E+04
  0.7065E+08  0.8131E+04
  0.7927E+08  0.8089E+04
  0.8894E+08  0.8043E+04
  0.9979E+08  0.7993E+04
  0.1120E+09  0.7937E+04
  0.1256E+09  0.7876E+04
  0.1410E+09  0.7810E+04
  0.1582E+09  0.7737E+04
  0.1775E+09  0.7658E+04
  0.1991E+09  0.7572E+04
  0.2234E+09  0.7477E+04
  0.2507E+09  0.7355E+04
  0.2813E+09  0.7224E+04
  0.3156E+09  0.7084E+04
  0.3541E+09  0.6936E+04
  0.3973E+09  0.6780E+04
  0.4458E+09  0.6615E+04
  0.5002E+09  0.6443E+04
  0.5612E+09  0.6250E+04
  0.6297E+09  0.6029E+04
  0.7065E+09  0.5802E+04
  0.7927E+09  0.5571E+04
  0.8894E+09  0.5326E+04
  0.9979E+09  0.5059E+04
  0.1120E+10  0.4793E+04
  0.1256E+10  0.4541E+04
  0.1410E+10  0.4298E+04
  0.1582E+10  0.4002E+04
  0.1775E+10  0.3675E+04
  0.1991E+10  0.3393E+04
  0.2234E+10  0.3126E+04
  0.2507E+10  0.2880E+04
  0.2813E+10  0.2666E+04
  0.3156E+10  0.2464E+04
  0.3541E+10  0.2273E+04
  0.3973E+10  0.2093E+04
  0.4458E+10  0.1925E+04
  0.5002E+10  0.1767E+04
  0.5612E+10  0.1623E+04
  0.6297E+10  0.1523E+04
  0.7065E+10  0.1429E+04
  0.7927E+10  0.1339E+04
  0.8894E+10  0.1255E+04
  0.9979E+10  0.1179E+04
```

MR 12-1-97

```
  0.1120E+11  0.1107E+04
  0.1256E+11  0.1036E+04
  0.1410E+11  0.9655E+03
  0.1582E+11  0.8926E+03
  0.1775E+11  0.8164E+03
  0.1991E+11  0.7463E+03
  0.2234E+11  0.6821E+03
  0.2507E+11  0.6231E+03
  0.2813E+11  0.5691E+03
  0.3156E+11  0.5179E+03
  0.3541E+11  0.4650E+03
  0.3973E+11  0.4174E+03
  0.4458E+11  0.3746E+03
  0.5002E+11  0.3361E+03
  0.5612E+11  0.3016E+03
  0.6297E+11  0.2713E+03
  0.7065E+11  0.2519E+03
  0.7927E+11  0.2339E+03
  0.8894E+11  0.2172E+03
  0.9979E+11  0.2049E+03
  0.1120E+12  0.1961E+03
  0.1256E+12  0.1877E+03
  0.1410E+12  0.1797E+03
  0.1582E+12  0.1719E+03
  0.1775E+12  0.1630E+03
  0.1991E+12  0.1545E+03
  0.2234E+12  0.1465E+03
  0.2507E+12  0.1389E+03
  0.2813E+12  0.1317E+03
  0.3156E+12  0.1247E+03
  0
:
:NOSKIP
:
Output   A-1  C-1
:
:  isolv  newtnmn  newtnmx
Solve 4     2        7        2
:
:AUTO-step  DPMXE    DSMXE  DTMPMXE   DP2MXe
AUTO-step   5.0E+4   0.03    5.0       1.e4
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE
Tolr   1. 5.e-4  5.e-3  1.    1.e-3 1.e-3 1.e-3  1.e-12  1.e-12   1.e-12
:
:Limit dpmx    dsmx dtmpmx dp2mx dtmn dtmx icutmx
LIMIT  1.e5    .08    10.   1.e5 1.e-9 1.e5
:
:      target  dt    dpmx   dsmx   dp2mx   dtmpmx
:
:      print all at every target time
PLOTS 1 1 4
:
: 385 - layer 9, 1st element - air above heater
: 433 - layer 10, 1st element - top of heater
: 534 - layer 12, 6th element - drift wall across from heater
:
385, 433, 534, 582
rstart 1 0
Time[y]  1.0E+01
Time[y]  1.0E+02
Time[y]  1.0E+03
Time[y]  1.0E+04
:
```

MR 12-1-97

12-1-97
MR

RUN "tester5.dat" – IDENTICAL TO "tester4.dat" EXCEPT RESIDUAL SATURATION ~~(SWRT)~~ MR (swir) SET TO ZERO. IN: /home/bilbo/grice/3d/heattest

MR 4/10/01

12-2-97
MR

RUN "old-tsw-p-v-chn.dat" CRASHED AT TIMESTEP # 888, t = 2135 YRS. MESSAGE: "temperature beyond table look-up range in putfunc". RE-RUN "old-tsw-p-v-chn.dat" WITH 'ipvcal' CHANGED FROM ϕ TO 1 – ON FOXTROT

RUN "tester5.dat" CRASHED AT TIMESTEP 115, t = 0.1182 YRS.

MISTAKE – RAN "tester.dat" INSTEAD OF tester5.dat

12-3-97
MR

RUN "old-tsw-p-v-chn.dat" RAN TO COMPLETION, CPU TIME ON FOXTROT = 54598 s. IN: home/bilbo/grice/3d/old-new

RUN "tester5.dat" CRASHED ON SNOOZY @ TIMESTEP # 436, t = 0.2773 YRS

RE-RUN "tester5.dat" WITH ~~"ipvtab" SET TO~~ 'ipvpwr' SET TO 1 (ON) INSTEAD OF ϕ (OFF)

MR 12-3-97

12-8-97
MR

"tester5.dat" CRASHED AT TIMESTEP # 157, 0.1762 YRS. RE-RUN WITH 'ipvtab' CHANGED FROM 1 TO ϕ. – ON ~~FOXTROT~~ SNOOZY MR 12-8-97

MR 4/10/01

12-8-97
MR

"tester5.dat" CRASHED @ TIMESTEP # 77, t = 9.637×10^{-2} YRS. MESSAGE: "temperature beyond table look-up range in putfunc".

12-9-97
MR

NEW RUN - "noheat.dat" IDENTICAL TO "tester5.dat" (w/ iuplwr + iputch = 1) EXCEPT HEAT TURNED OFF.

"noheat.dat" CRASHED WHEN WRITING TO DISK @ 0.2 YRS. REMOVED INSTRUCTIONS TO WRITE - WAIT UNTIL RUN COMPLETED. RE-RUN "noheat.dat"

"noheat.dat" RAN TO COMPLETION - 78 TIMESTEPS

NEW RUN: "0.1heat.dat" - SAME AS "tester5.dat" EXCEPT HEAT OUTPUT REDUCED BY A FACTOR OF 10. IN:
/home/bilbo/grice/3d/heattest

12-9-97
MR

"0.1heat.dat" FINISHED IN 81 TIMESTEPS - 5 YRS. TEMPERATURE @ DRIFT WALL @ 2 YRS = 50.1 C.

NEW RUN: "0.5heat.dat" - IDENTICAL TO "tester5.dat" EXCEPT HEAT OUTPUT REDUCED BY FACTOR OF 2. - ON FOXTROT

NEW RUN: "0.2heat.dat" - IDENTICAL TO "tester5.dat" EXCEPT HEAT OUTPUT REDUCED BY FACTOR OF 5. ON SWEETY.

RUN "0.5heat.dat" CRASHED @ TIMESTEP 160, t = 0.68 YRS, MAX T = ~~163~~ MR 136 C, T ON DRIFT WALL = 101 C.

MR 4/20/01

NEW RUN: "0.4heat.dat" - IDENTICAL TO "tester5.dat" EXCEPT HEAT AT 40% OF FULL POWER. IN:
/home/bilbo/grice/3d/heattest

12-10-97
MR

"0.4heat.dat" CRASHED @ TIMESTEP 151, t = 0.9225 YRS. MAX T = 130 C, MAX T ON DRIFT WALL = 101 C. MAX TEMPS ARE AT LAST TIMESTEP - TEMPERATURE RISING

12-10-97
MR

RUN "0.2heat.dat" FINISHED IN ~~187~~ 190 TIMESTEPS MR 12-10-97
MAX T @ 2 YRS = 103 C, T @ DRIFT WALL @ 2 YRS = 81.3 C - MAX T OF RUN = 119 C @ 4 YRS

NEW RUN: "0.3heat.dat" SAME AS "tester5.dat" EXCEPT POWER @ 30% OF "tester5.dat" RUN.

RE-RUN "0.4heat.dat" WITH SOLVER = 3 INSTEAD OF 4 ON FOXTROT IN: /home/bilbo/grice/3d/heattest

MR 4/20/01

NEW RUN: "0.4-noecm-heat.dat" - IDENTICAL TO "0.4heat.dat" WITH ~~HEAT~~ MR SOLVER = 4 BUT ECM FOR TSW TURNED OFF. IN: /home/bilbo/grice/3d/heattest - ON SWEETY

12-15-97
MR

"0.3heat.dat" CRASHED ON SWEETY AT TIMESTEP # 109, t = 1.345 YRS. MESSAGE: "bad up press in putup.f". MAX TEMP OCCURS AT LAST TIMESTEP (1.3453 YRS) - TEMP @ DRIFT WALL = 99.85 C, TEMP @ HEATERS = 117 C.

"0.4heat.dat" CRASHED ON FOXTROT AT TIMESTEP # 272, t = 0.57834 YRS. MESSAGE: "bad up press in putup.f". MAX TEMP OCCURS AT LAST RECORDED TIME (0.57834 YRS) - TEMP @ DRIFT WALL = 80.6 C, TEMP @ HEATERS = 111.8 C.

MR 4-23-98

4-23-98

NEW METRA CODE: metra_dcm -
DUAL CONTINUUM MODEL - FRACTURE + MATRIX

NEW STRATIGRAPHY:

AL 4-22-98

STRATIGRAPHY FROM:
"SITE-SCALE UNSATURATED ZONE
MODEL OF YUCCA MOUNTAIN, NEVADA"
LBNL 39315, AUG. 1996.

		Vertical Permeability (m^2)	
Unit	Thickness (m)	Matrix	Fracture
TCw11	25 - 55	1.55e-18	5.23e-12
TCw12	6	1.14e-16	6.40e-12
TCw13	3	6.41e-17	5.76e-12
PTn21	3	2.40e-13	-
PTn23	3	2.30e-15	-
PTn24	5 - 6	3.26e-15	-
PTn25	10 - 16	4.41e-13	-
TSw31	3 - 4	1.62e-16	6.31e-12
TSw32	35 - 45	6.14e-15	4.22e-12
TSw33	6 - 45	9.86e-18	6.16e-12
TSw34	6 - 10	3.07e-17	4.01e-12
TSw35	60 - 71	7.51e-18	6.95e-12
TSw36	90 - 106	9.15e-17	4.01e-12
TSw37	18 - 30	3.24e-17	4.01e-12
CH1vc	25 - 30	1.57e-12	7.24e-13
CH1zc	25 - 30	5.62e-16	1.00e-13
CH2zc	13 - 19	2.03e-18	2.47e-13
CH3zc	42 - 52	2.03e-18	2.47e-13
CH4zc	17 - 20	5.47e-18	1.00e-13
PP3vp	25 - 50	1.01e-16	3.01e-14
PP2zp	0 - 10	6.11e-17	1.00e-13

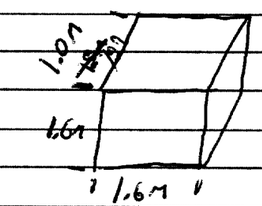
AR 4-22-98

NOTE - PERMEABILITIES IN TABLE ABOVE WERE NOT USED IN METRA. FOR A LISTING OF HYDRAULIC PROPERTIES USED IN METRA, SEE INPUT FILE BELOW.

5-8-98
AR

CALCULATING HEAT FACTORS FOR 1-D METRA SIMULATIONS.

DIMENSIONS OF HEATER ELEMENT IN 62 ELEMENT RUNS:



INITIAL AMOUNT OF POWER SUPPLIED BY DECAYING WASTE = 8.469 KW

INITIAL POWER DESIRED ACROSS REPOSITORY = 83 KW/AC

USING THE '31' OPTION FOR SPECIFYING POWER INPUT (SEE MULTIFLO USERS MANUAL, 1.2A, pgs 61 & 62).

SOLVE FOR HEAT FACTOR 'F' (SCALH)

$$F \frac{8.469\ KW}{1A\ 1.6M} \frac{4047\ M^2}{AC} = \frac{83\ KW}{AC}$$

$$F = \frac{83\ (1.6)}{(8.469)\ 4047} = 3.87 \times 10^{-3}$$

UNITS FOR POWER INPUT = W $\left(\frac{J}{s}\right)$

5-8-98
MR

USING THE '32' METHOD OF SPECIFYING HEAT (POWER INPUT) - SEE MULTIFLO MANUAL, 1.2P, pgs 61+62 (PER UNIT VOLUME BASIS):

$$F \frac{8.469\,kw\,(1.6^2 m^3)}{(1m/1.6m)\ \cancel{(1m/1.6m)}} \frac{4047\,m^2}{AC} = \frac{83\,kw}{AC}$$

MR
MR 4/16/01

$$F = \frac{83}{8.469\,(1.6\,m^3)\,4047} = \frac{1.51\times10^{-3}}{m^3}$$

UNITS FOR METHOD '32' = $\frac{J}{s\text{-}m^3}$

5-12-98
MR

1-D DCM RUN: 'newheat2.dat'
RUN WITH: metra_dcm2* - USED FOR WAITE-UP - NRC.

MR 5-12-98

MR 5-12-98

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METRA-DCM, 83 kW/ac
May 7 , 1998
:
: New stratigraphy. Unit thickness are averages of values presented in LBL document:
: 'Site-Scale Unsaturated Zone Model of Yucca Mountain, Nevada', 8/96, pg. 437 (LBNL-39315).
: Permeabilities and van Genuchten parameters for units taken from LBL document:
: 'The Site-Scale Unsaturated
: Zone Model of Yucca Mountain, Nevada for the Viability Assessment', 6/97, pgs
: 6-32 thru 6-34 ( calibrated values, Fm = 0.492 (LBNL-40376)). Residual saturations,
: porosities, and thermal properties taken from TSPA-93 and TSPA-95 (PP values assumed to be
: TSw values).
:
: Infiltration rate = 1.0 mm/yr.
:
: 1-D
:
:
RSTART 0
:
:       XYZ                           = 1 table look-up,; pref = ref. press.
:       RADIAL                        = 0 correlations;   tref = ref temp.
:       OTHER                             ^
:                                         |
:grid  geometry  nx ny   nz ivplwr ipvcal  iout  gravity  pref tref  href
Grid   DCMXYZ     1  1   62  1       1       1      0       0    0     0
:
: ********************************************************************
: i - sequential number of material types
: type - the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm - irreducible liquid saturation for the matrix
: rpmm - Van Genuchten parameter for matrix
: alpham - Van Genuchten parameter for matrix
```

IN: /home/bilbo/grice
/dkm

5-12-98
MR

MR 5-12-98

MR 5-12-98

MR 5-12-98

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: swext - liquid saturation below which the capillary pressure is calculated based
:          on the slope dPcw/dSw evaluated at SWEXT.
: sgc - residual (immobile) gas saturation, fraction
: iecm - Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1 invoke, 2 ECM with
: swirf - residual liquid saturation for fracture, fraction
: alphaf - parameter in Van-Genuchten equation for fracture (1/Pa)
: phim - matrix porosity (fraction)
: phif - fracture porosity (fraction)
: permm - intinsic matrix permeability (m^2)
: permf - intrinsic fracture permeability
:
Pckr                              :relative perm and pc keyword
:   i  type-curv   swirm   rpmm(lamda) alpham      swext   sgc      iecm
:
: (TCw11 - matrix)
    1  Van-Gen     0.021   0.232       1.17e-6     0.0     0.0      0
:
: (TCw11 - fracture)
    2  Van-Gen     0.04    0.492       2.95e-4     0.0     0.0      0
:
: (TCw12 - matrix)
    3  Van-Gen     0.021   0.236       1.32e-6     0.0     0.0      0
:
: (TCw12 - fracture)
    4  Van-Gen     0.04    0.492       2.95e-4     0.0     0.0      0
:
: (TCw13 - matrix)
    5  Van-Gen     0.021   0.427       6.46e-7     0.0     0.0      0
:
: (TCw13 - fracture)
    6  Van-Gen     0.04    0.492       9.12e-5     0.0     0.0      0
:
:   i  type-curv   swirm   rpmm(lamda) alpham      swext   sgc      iecm

: (PTn21 - matrix)
    7  Van-Gen     0.154   0.231       3.80e-5     0.0     0.0      0
:
: (PTn21 - fracture)
    8  Van-Gen     0.04    0.492       1.10e-3     0.0     0.0      0
:
: (PTn23 - matrix)
    9  Van-Gen     0.154   0.287       4.57e-5     0.0     0.0      0
:
: (PTn23 - fracture)
   10  Van-Gen     0.04    0.492       3.39e-3     0.0     0.0      0
:
: (PTn24 - matrix)
   11  Van-Gen     0.154   0.349       4.27e-5     0.0     0.0      0
:
: (PTn24 - fracture)
   12  Van-Gen     0.04    0.492       9.33e-4     0.0     0.0      0
:
:   i  type-curv   swirm   rpmm(lamda) alpham      swext   sgc      iecm
:
: (PTn25 - matrix)
   13  Van-Gen     0.154   0.279       1.95e-4     0.0     0.0      0
:
: (PTn25 - fracture)
   14  Van-Gen     0.04    0.279       1.95e-4     0.0     0.0      0
:
: (TSw31 - matrix)
   15  Van-Gen     0.045   0.237       1.00e-5     0.0     0.0      0
:
: (TSw31 - fracture)
   16  Van-Gen     0.04    0.481       3.98e-5     0.0     0.0      0
:
: (TSw32 - matrix)
   17  Van-Gen     0.045   0.273       2.29e-5     0.0     0.0      0
:
: (TSw32 - fracture)
   18  Van-Gen     0.04    0.488       9.33e-5     0.0     0.0      0
:
:   i  type-curv   swirm   rpmm(lamda) alpham      swext   sgc      iecm
:
: (TSw33 - matrix)
   19  Van-Gen     0.045   0.247       6.76e-6     0.0     0.0      0
:
: (TSw33 - fracture)
   20  Van-Gen     0.04    0.492       1.78e-4     0.0     0.0      0
:
: (TSw34 - matrix)
   21  Van-Gen     0.045   0.322       1.02e-6     0.0     0.0      0
:
: (TSw34 - fracture)
   22  Van-Gen     0.04    0.492       9.77e-5     0.0     0.0      0
:
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5-12-98 MR

MR 5-12-98

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: (TSw37 - matrix)
  27  Van-Gen      0.045    0.387       1.55e-6      0.0      0.0      0
:
: (TSw37 - fracture)
  28  Van-Gen      0.04     0.492       1.17e-4      0.0      0.0      0
:
: (CH1vc - matrix)
  29  Van-Gen      0.121    0.190       6.61e-5      0.0      0.0.     0
:
: (CH1vc - fracture)
  30  Van-Gen      0.04     0.492       1.17e-3      0.0      0.0      0
:
:   i  type-curv    swirm    rpmm(lamda) alpham       swext    sgc      iecm
:
: (CH1zc - matrix)
  31  Van-Gen      0.097    0.366       8.32e-7      0.0      0.0      0
:
: (CH1zc - fracture)
  32  Van-Gen      0.04     0.492       1.12e-3      0.0      0.0      0
:
: (CH2zc - matrix) Note: van Gen values assumed to be same as CH3zc - see pg
: 437 in 1996 doc mentioned above.
  33  Van-Gen      0.097    0.220       1.95e-6      0.0      0.0      0
:
: (CH2zc - fracture) Note: van Gen values assumed to be same as CH3zc - see pg
: 437 in 1996 doc mentioned above.
  34  Van-Gen      0.04     0.492       1.23e-3      0.0      0.0      0
:
: (CH3zc - matrix)
  35  Van-Gen      0.097    0.220       1.95e-6      0.0      0.0      0
:
: (CH3zc - fracture)
  36  Van-Gen      0.04     0.492       1.23e-3      0.0      0.0      0
:
:   i  type-curv    swirm    rpmm(lamda) alpham       swext    sgc      iecm
:
: (CH4zc - matrix)
  37  Van-Gen      0.097    0.477       7.76e-6      0.0      0.0      0
:
: (CH4zc - fracture)
  38  Van-Gen      0.04     0.492       1.15e-3      0.0      0.0      0
:
: (PP3vp - matrix)
  39  Van-Gen      0.045    0.311       1.74e-5      0.0      0.0      0
:
: (PP3vp - fracture)
  40  Van-Gen      0.04     0.492       1.41e-3      0.0      0.0      0
:
: (PP2zp - matrix)
  41  Van-Gen      0.045    0.316       1.66e-6      0.0      0.0      0
:
: (PP2zp - fracture)
  42  Van-Gen      0.04     0.492       3.72e-4      0.0      0.0      0
:
: *******************
:  Backfill material / Waste Package
: *******************
  43  Van-Gen      0.0      0.7000      1.106e-5     0.0      0.0      0
:
: *******************
: Metal Waste Package
: *******************
:   8  Van-Gen      0.0001   0.4400      5.80e-7      0.0      0.0      0
:
: *****
:  Air
```

MR 5-12-98

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: *****
:   9  Van-Gen      0.0001   0.4400      5.80e-7      0.0      0.0      0
:
: *********
:  Fracture - TSw fracture properties
: *********
:   7  Van-Gen      0.04     0.764       1.22e-3      0.0      0.0      0
0            :  blank line to end pckr data
:
: ****************
:  Debug options
: ****************
Debug  1
0
:
: ********************
:  Thermal properties
: ********************
: no - sequential number of data set
: rho - rock density (kg/m^3)
: cpr - rock specific heat (J/kg-K)
: ckdry - thermal conductivity of dry rock (J/s/m-K)
: cksat - thermal conductivity of liquid saturated rock (J/s/m-K)
: crp - pore compressibility with pressure at constant T (1/Pa)
: crt - absolute value of pore compressibility with pressure at constant T (1/Pa)
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5-12-98 MR

MR 5-12-98


```
: tau - tortuosity for binary diffusion
: cdiff - vapor-dir diffusion coefficient, (m^2/s)
: cexp - exponent for binary diffusion
: enbd - enhanced binary diffusion coefficient
:
Thermal-prop
: no rho        cpr     ckdry  cksat   crp   crt   tau  cdiff    cexp  enbd
  1  2.580e+03 728.    1.69   1.69    0     0    .5  2.13e-5  1.8   0. : TCw
  2  2.580e+03 422.    0.61   0.61    0     0    .5  2.13e-5  1.8   0. : PTn
  3  2.580e+03 840.    2.10   2.10    0     0    .5  2.13e-5  1.8   0. : TSw
: 4  2.580e+03 948.    1.28   1.28    0     0    .5  2.13e-5  1.8   0. : TSv
4  2.580e+03 488.    0.84   0.84    0     0    .5  2.13e-5  1.8   0. : CHnv
  5  2.580e+03 526.    1.42   1.42    0     0    .5  2.13e-5  1.8   0. : CHnz
  6  2.580e+03 1e+12   1.69   1.69    0     0    .5  2.13e-5  1.8   0. : TCw - Heat Sink
:
: *******************
:  Backfill material
: *******************
:
:  8  2.580e+03 840.0   0.26   0.49    0     0    .5  2.13e-5  1.8   0.
:
: *******************
: Metal Waste Package
: *******************
:
   7 7.800e+03 450.0    50.0   50.0    0     0    .5  2.13e-5  1.8   0.
:
: *****
:  Air
: *****
:
: 10 1.2       57.4     20.0   20.0    0     0    .5  2.13e-5  1.8   0.
:
: ********
: Fracture
: ********
:
:  8 2.580e+03 840.0    2.10   2.10    0     0    .5  2.13e-5  1.8   0.
:
0
: ****************************
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MR 5-12-98

```
:  Define size of grid-blocks
: ****************************
: igrid - grid-type (0 - block centered, 1 - point-distributed, 2 - boundary node at the surf
: dx - block sizes in x-direction
: dy - block sizes in y-direction
: dz - block sizes in z-direction
:
:     igrid   rw      re
DXYZ   0
: (dx(i),i=1,nx)
1.6
:0.4 0.4 0.4 0.5 0.515 1.0 3.0 4.785
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
:40.0 6.0  3.0  3.0  3.0  5.5  13.0  3.5  40.0  25.5 ; Thickness' of the 21 Units
:8.0  65.5 98.0 24.0 27.5 27.5 16.0  47.0 18.5  37.5
:5.0.
10.0 10.0 10.0 10.0  6.0  3.0  3.0  3.0  5.5  6.5
 6.5  3.5 10.0 10.0 10.0 10.0 10.0 10.0  5.5  8.0
10.0 10.0  6.0 5.95  1.6 5.95  6.0 10.0 10.0 10.0
10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0  8.0  4.0
10.0 10.0 10.0 10.0  7.5  7.5 10.0 10.0  8.0  8.0
 7.0 10.0 10.0 10.0 10.0 10.0  8.5 10.0 10.0 10.0
 7.5  5.0
PhiK
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm ithrmm
  1   1  1  1  1  1    2     6  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  1   6 : TCw11
  1   1  1  1  2  4    2     1  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  1   1 : TCw11
  1   1  1  1  5  5    4     1  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  3   1 : TCw12
  1   1  1  1  6  6    6     1  0. 1.0000 2.4e-12 2.4e-12 2.4e-12 0.087 4.9e-17  5   1 : TCw13
  1   1  1  1  7  7    8     2  0. 1.0000 3.0e-13 3.0e-13 3.0e-13 0.421 3.1e-14  7   2 : PTn21
  1   1  1  1  8  8   10     2  0. 1.0000 2.9e-12 2.9e-12 2.9e-12 0.421 8.3e-14  9   2 : PTn23
  1   1  1  1  9  9   12     2  0. 1.0000 1.2e-13 1.2e-13 1.2e-13 0.421 1.1e-13 11   2 : PTn24
  1   1  1  1 10 11   14     2  0. 1.0000 2.5e-13 2.5e-13 2.5e-13 0.421 2.5e-13 13   2 : PTn25
  1   1  1  1 12 12   16     3  0. 1.0000 1.7e-12 1.7e-12 1.7e-12 0.139 4.9e-17 15   3 : TSw31
  1   1  1  1 13 16   18     3  0. 1.0000 1.8e-12 1.8e-12 1.8e-12 0.139 2.8e-16 17   3 : TSw32
  1   1  1  1 17 19   20     3  0. 1.0000 8.9e-13 8.9e-13 8.9e-13 0.139 1.1e-17 19   3 : TSw33
  1   1  1  1 20 20   22     3  0. 1.0000 4.5e-13 4.5e-13 4.5e-13 0.139 4.1e-18 21   3 : TSw34
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm ithrmm
  1   1  1  1 21 24   24     3  0. 1.0000 1.4e-12 1.4e-12 1.4e-12 0.139 1.5e-17 23   3 : TSw35
  1   1  1  1 25 25   43     7  0. 1.0000 1.4E-12 1.4e-12 1.4E-12 0.01  1.5E-17 43   7 : TSw35
  1   1  1  1 26 29   24     3  0. 1.0000 1.4e-12 1.4e-12 1.4e-12 0.139 1.5e-17 23   3 : TSw35
  1   1  1  1 30 39   26     3  0. 1.0000 1.2e-12 1.2e-12 1.2e-12 0.139 8.9e-17 25   3 : TSw36
  1   1  1  1 40 42   28     3  0. 1.0000 1.2e-12 1.2e-12 1.2e-12 0.139 1.3e-17 27   3 : TSw37
  1   1  1  1 43 45   30     4  0. 1.0000 1.7e-13 1.7e-13 1.7e-13 0.331 1.3e-12 29   4 : CH1vc
  1   1  1  1 46 48   32     5  0. 1.0000 2.4e-14 2.4e-14 2.4e-14 0.306 1.4e-17 31   5 : CH1sc
  1   1  1  1 49 50   34     5  0. 1.0000 1.2e-14 1.2e-14 1.2e-14 0.306 9.1e-18 33   5 : CH2sc
  1   1  1  1 51 55   36     5  0. 1.0000 1.2e-14 1.2e-14 1.2e-14 0.306 9.1e-18 35   5 : CH3sc
  1   1  1  1 56 57   38     5  0. 1.0000 1.5e-14 1.5e-14 1.5e-14 0.306 1.5e-17 37   5 : CH4sc
  1   1  1  1 58 61   40     3  0. 1.0000 6.9e-13 6.9e-13 3.9e-13 0.306 2.0e-15 39   3 : PP3vp
  1   1  1  1 62 62   42     3  1.0e99 1.0000 6.5e-14 6.5e-14 6.4e-14 0.306 5.8e-17 41   3 : PP
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MR 5-12-98

MR 5-12-98

5-12-98
MR

MR 5-12-98

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:
: NOTE: Drift, Waste, & Backfill have the rock properties (iist)
:       of T&W (3) but their own thermal properties.
:
: 1   5  1  1  8 15  3  10    0.                    : Drift
: 1   2  1  1 10 13  3   9    0.  0.0 0.0 0.0 0.0 : Waste Package
: 1   5  1  1 14 15  3   8    0.                    : Backfill/Pedestal/Floor
: 1   8  1  1 23 23  7   8    1.0E16 0.0018 3.9e-12 3.9e-12 3.9e-12 0.306 1.617e-18 6 6 : C
 0
:
Init
:
: Initial conditions from '1x62-dcmss.dat' except saturation of heater element 251 set
: to ~0 (sat gas -1).
:
:                 Cut & Paste Initilization Variables for Restart
:                 -----------------------------------------------
:
:    Time =  0.323770E+13 secs    Days =  0.374734E+08    years =  0.102667E+06
:
: i1  i2  j1  j2  k1  k2          p          t          sg         xg2         pm         tm
:
  1   1   1   1   1   1  1 9.49398E+04  13.0907 9.7293E-01 0.0000E+00 9.4940E+04 1.3091E+01 2.
  1   1   1   1   2   2  2 9.50524E+04  13.3463 1.0000E+00 9.8392E-01 9.5052E+04 1.3346E+01 3.
  1   1   1   1   3   3  3 9.51651E+04  13.6020 1.0000E+00 9.8367E-01 9.5165E+04 1.3602E+01 3.
  1   1   1   1   4   4  4 9.52778E+04  13.8578 1.0000E+00 9.8342E-01 9.5278E+04 1.3858E+01 3.
  1   1   1   1   5   5  5 9.53680E+04  14.0624 1.0000E+00 9.8322E-01 9.5368E+04 1.4062E+01 4.
  1   1   1   1   6   6  6 9.54187E+04  14.1775 9.1436E-01 0.0000E+00 9.5419E+04 1.4178E+01 1.
  1   1   1   1   7   7  7 9.54527E+04  14.3222 1.0000E+00 9.8294E-01 9.5453E+04 1.4322E+01 4.
  1   1   1   1   8   8  8 9.54867E+04  14.5348 1.0000E+00 9.8271E-01 9.5487E+04 1.4535E+01 5.
  1   1   1   1   9   9  9 9.55347E+04  14.8360 1.0000E+00 9.8237E-01 9.5535E+04 1.4836E+01 5.
  1   1   1   1  10  10 10 9.56024E+04  15.2612 6.5963E-01 0.0000E+00 9.5602E+04 1.5261E+01 5.
  1   1   1   1  11  11 11 9.56756E+04  15.7220 5.8446E-01 0.0000E+00 9.5676E+04 1.5722E+01 5.
  1   1   1   1  12  12 12 9.57333E+04  15.9886 7.9775E-01 0.0000E+00 9.5733E+04 1.5989E+01 2.
  1   1   1   1  13  13 13 9.58092E+04  16.1277 8.6932E-01 0.0000E+00 9.5809E+04 1.6128E+01 3.
  1   1   1   1  14  14 14 9.59217E+04  16.3339 8.6667E-01 0.0000E+00 9.5922E+04 1.6334E+01 3.
  1   1   1   1  15  15 15 9.60342E+04  16.5400 8.5679E-01 0.0000E+00 9.6034E+04 1.6540E+01 3.
  1   1   1   1  16  16 16 9.61468E+04  16.7462 8.1330E-01 0.0000E+00 9.6147E+04 1.6746E+01 2.
  1   1   1   1  17  17 17 9.62594E+04  16.9524 8.8501E-01 0.0000E+00 9.6258E+04 1.6952E+01 8.
  1   1   1   1  18  18 18 9.63721E+04  17.1586 8.9431E-01 0.0000E+00 9.6372E+04 1.7159E+01 9.
  1   1   1   1  19  19 19 9.64594E+04  17.3185 9.0378E-01 0.0000E+00 9.6459E+04 1.7319E+01 1.
  1   1   1   1  20  20 20 9.65355E+04  17.4577 9.1580E-01 0.0000E+00 9.6535E+04 1.7458E+01 3.
  1   1   1   1  21  21 21 9.66370E+04  17.6434 9.0954E-01 0.0000E+00 9.6637E+04 1.7643E+01 9.
  1   1   1   1  22  22 22 9.67497E+04  17.8497 9.1158E-01 0.0000E+00 9.6750E+04 1.7850E+01 9.
  1   1   1   1  23  23 23 9.68400E+04  18.0148 9.1449E-01 0.0000E+00 9.6840E+04 1.8015E+01 1.
  1   1   1   1  24  24 24 9.69074E+04  18.1381 9.1813E-01 0.0000E+00 9.6907E+04 1.8138E+01 1.
: 1   1   1   1  25  25 25 9.69500E+04   18.2160 9.2087E-01 0.0000E+00 9.6949E+04 1.8216E+01 1
  1   1   1   1  25  25 25 9.69500E+04  18.2160 1.0000E-00 0.0000E+00 9.6949E+04 1.8216E+01 9.
  1   1   1   1  26  26 26 9.69926E+04  18.2940 9.2659E-01 0.0000E+00 9.6993E+04 1.8294E+01 1.
  1   1   1   1  27  27 27 9.70600E+04  18.4173 9.3745E-01 0.0000E+00 9.7060E+04 1.8417E+01 1.
  1   1   1   1  28  28 28 9.71503E+04  18.5824 9.6252E-01 0.0000E+00 9.7150E+04 1.8582E+01 1.
  1   1   1   1  29  29 29 9.72633E+04  18.7889 1.0000E+00 9.7783E-01 9.7263E+04 1.8789E+01 2.
  1   1   1   1  30  30 30 9.73763E+04  18.9953 1.0000E+00 9.7767E-01 9.7376E+04 1.8995E+01 2.
  1   1   1   1  31  31 31 9.74895E+04  19.2018 1.0000E+00 9.7739E-01 9.7489E+04 1.9202E+01 2.
  1   1   1   1  32  32 32 9.76026E+04  19.4083 1.0000E+00 9.7711E-01 9.7603E+04 1.9408E+01 1.
  1   1   1   1  33  33 33 9.77158E+04  19.6149 1.0000E+00 9.7683E-01 9.7716E+04 1.9615E+01 1.
  1   1   1   1  34  34 34 9.78290E+04  19.8214 1.0000E+00 9.7654E-01 9.7829E+04 1.9821E+01 1.
  1   1   1   1  35  35 35 9.79423E+04  20.0280 1.0000E+00 9.7625E-01 9.7942E+04 2.0028E+01 1.
  1   1   1   1  36  36 36 9.80556E+04  20.2347 1.0000E+00 9.7595E-01 9.8056E+04 2.0235E+01 1.
  1   1   1   1  37  37 37 9.81689E+04  20.4413 1.0000E+00 9.7566E-01 9.8169E+04 2.0441E+01 9.
  1   1   1   1  38  38 38 9.82822E+04  20.6480 1.0000E+00 9.7536E-01 9.8282E+04 2.0648E+01 7.
  1   1   1   1  39  39 39 9.83842E+04  20.8340 1.0000E+00 9.7508E-01 9.8384E+04 2.0834E+01 5.
  1   1   1   1  40  40 40 9.84522E+04  20.9580 9.7186E-01 0.0000E+00 9.8452E+04 2.0958E+01 1.
  1   1   1   1  41  41 41 9.85316E+04  21.1027 9.6119E-01 0.0000E+00 9.8532E+04 2.1103E+01 1.
  1   1   1   1  42  42 42 9.86451E+04  21.3095 9.4421E-01 0.0000E+00 9.8645E+04 2.1309E+01 9.
  1   1   1   1  43  43 43 9.87606E+04  21.6713 1.0000E+00 9.7382E-01 9.8761E+04 2.1671E+01 4.
  1   1   1   1  44  44 44 9.88739E+04  22.1882 1.0000E+00 9.7299E-01 9.8874E+04 2.2188E+01 3.
  1   1   1   1  45  45 45 9.89729E+04  22.6406 9.7403E-01 0.0000E+00 9.8973E+04 2.2641E+01 2.
  1   1   1   1  46  46 46 9.90698E+04  22.9494 1.0000E+00 9.7190E-01 9.9070E+04 2.2949E+01 1.
  1   1   1   1  47  47 47 9.91885E+04  23.2172 1.0000E+00 9.7146E-01 9.9189E+04 2.3217E+01 1.
  1   1   1   1  48  48 48 9.93224E+04  23.5233 1.0000E+00 9.7095E-01 9.9322E+04 2.3523E+01 9.
  1   1   1   1  49  49 49 9.94527E+04  23.7988 1.0000E+00 9.7049E-01 9.9453E+04 2.3799E+01 1.
  1   1   1   1  50  50 50 9.95808E+04  24.0437 1.0000E+00 9.7010E-01 9.9581E+04 2.4044E+01 1.
  1   1   1   1  51  51 51 9.97027E+04  24.2734 1.0000E+00 9.6974E-01 9.9703E+04 2.4273E+01 1.
  1   1   1   1  52  52 52 9.98422E+04  24.5336 1.0000E+00 9.6931E-01 9.9842E+04 2.4534E+01 1.
  1   1   1   1  53  53 53 1.00007E+05  24.8398 1.0000E+00 9.6880E-01 1.0001E+05 2.4840E+01 1.
  1   1   1   1  54  54 54 1.00170E+05  25.1461 1.0000E+00 9.6826E-01 1.0017E+05 2.5146E+01 1.
  1   1   1   1  55  55 55 1.00331E+05  25.4523 1.0000E+00 9.6771E-01 1.0033E+05 2.5452E+01 1.
  1   1   1   1  56  56 56 1.00527E+05  25.7585 1.0000E+00 9.6717E-01 1.0053E+05 2.5758E+01 6.
```

MR 5-12-98

```
  1   1   1   1  57  57 57 1.00766E+05  26.0417 1.0000E+00 9.6668E-01 1.0077E+05 2.6042E+01 6.
  1   1   1   1  58  58 58 1.00922E+05  26.2753 1.0000E+00 9.6625E-01 1.0092E+05 2.6275E+01 5.
  1   1   1   1  59  59 59 1.01038E+05  26.4823 1.0000E+00 9.6585E-01 1.0104E+05 2.6482E+01 4.
  1   1   1   1  60  60 60 1.01154E+05  26.6894 1.0000E+00 9.6544E-01 1.0115E+05 2.6689E+01 3.
  1   1   1   1  61  61 61 1.01254E+05  26.8706 1.0000E+00 9.6509E-01 1.0125E+05 2.6871E+01 1.
  1   1   1   1  62  62 62 1.01325E+05  27.0000 0.0000E+00 2.1370E-22 1.0132E+05 2.7000E+01 0.
  0   0
```

5-12-98
MR

MR 5-12-98

MR 5-12-98

```
DCMPARA
: i1 i2 j1 j2 k1 k2   volf  areamodf  xlm ylm zlm
   1  1  1  1  1  1   0.80  100.0     0.1 0.0 0.1
   1  1  1  1  2 62   0.01    1.0     0.1 0.0 0.1
   1  1  1  1 25 25   0.01    1.0     1.6 0.0 1.6
0
:
:Equil  depth  pdepth   tdepth   tgrad  param iequil
:Equil  514.5  101325    27.     0.0273  0.    -1
:
Recurrent
:
Source   2   1.51e-3   1.
:  is1 is2 js1 js2 ks1 ks2  istyp
   1   1   1   1   1   1    12
: NOTE: FLUX UNITS = kg/(s-m^3)! Based on pore volume.
: Top element = 1.0x1.6x10 m^3 x 0.087, see pg 5-14 of Manual.
: TIMEQ   QHT    QMT
   0     13.0   3.64E-8
0
:SKIP
:Power decay data from Randy Manteufel, 4/25/96
:  is  js  ks  istyp
   1 1   1 1  25 25    32
  0.3156E+06  0.8469E+04
  0.9467E+07  0.8423E+04
  0.1578E+08  0.8391E+04
  0.3156E+08  0.8314E+04
  0.3541E+08  0.8296E+04
  0.3973E+08  0.8276E+04
  0.4458E+08  0.8253E+04
  0.5002E+08  0.8228E+04
  0.5612E+08  0.8199E+04
  0.6297E+08  0.8168E+04
  0.7065E+08  0.8131E+04
  0.7927E+08  0.8089E+04
```

MR 5-12-98

```
  0.1991E+12  0.1545E+03
  0.2234E+12  0.1465E+03
  0.2507E+12  0.1389E+03
  0.2813E+12  0.1317E+03
  0.3156E+12  0.1247E+03
  0
:
:NOSKIP
:
Output   A-1  C-1
:
:  isolv  newtnmn  newtnmx  north  nitmax  level
Solve 3      2        12      2     100      1
:
:AUTO-step  DPMXE    DSMXE  DTMPMXE   DP2MXe TACCEL   IAUTODT   FAC1
AUTO-step   5.0E+4   0.03    5.0       1.e4  1.0e-3     0        0
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
Tolr   1. 5.e-4  5.e-3  1.    1.e-3 1.e-3 1.e-3  1.e-12  1.e-12   1.e-12
:
:Limit dpmx    dsmx dtmpmx dp2mx    dtmn    dtmx   icutmx
LIMIT  1.e5    .08    10.   1.e5    1.e-18  1.e5
```

MR 5-12-98

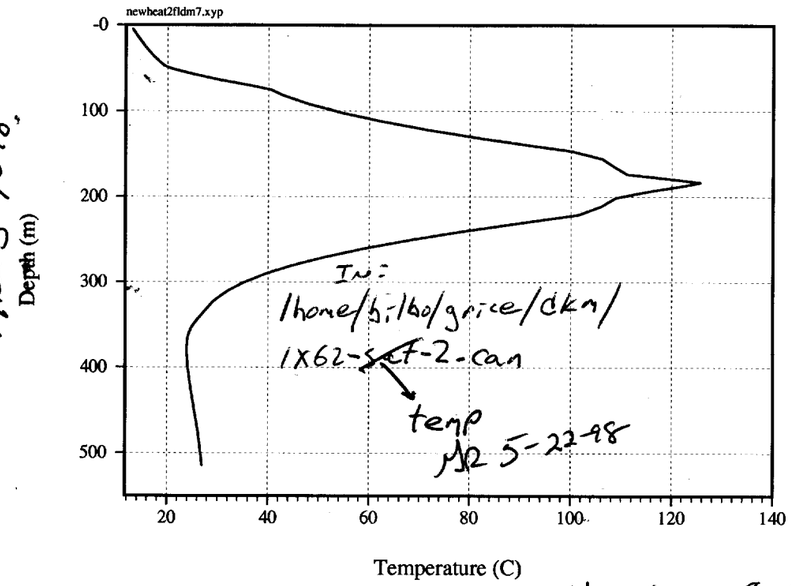
```
:
:      target  dt    dpmx   dsmx   dp2mx   dtmpmx
:
:       print all at every target time
PLOTS 1 1 5
48, 49, 50, 51, 52
rstart 1 0
Time[y]  1.0E-01
Time[y]  1.0E+00
Time[y]  1.0E+01
Time[y]  2.0E+01
Time[y]  3.0E+01
Time[y]  4.0E+01
Time[y]  1.0E+02
Time[y]  1.0E+03
Time[y]  1.0E+04
:
:rstart 1 0
:
:STEADY[y] 1.0E+00 1.0E-04 1.0E-04
Ends
```

MR 5-12-98

5-12-98 MR

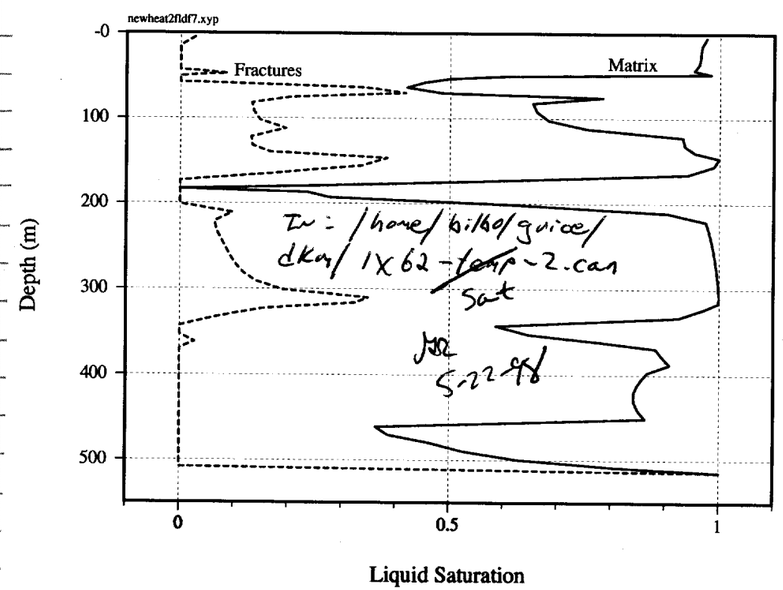
RESULTS OF 'newheat2.dat'

METRA DCM, Temperature at 100 Years



MR 5-12-98

METRA DCM, Saturation at 100 Years



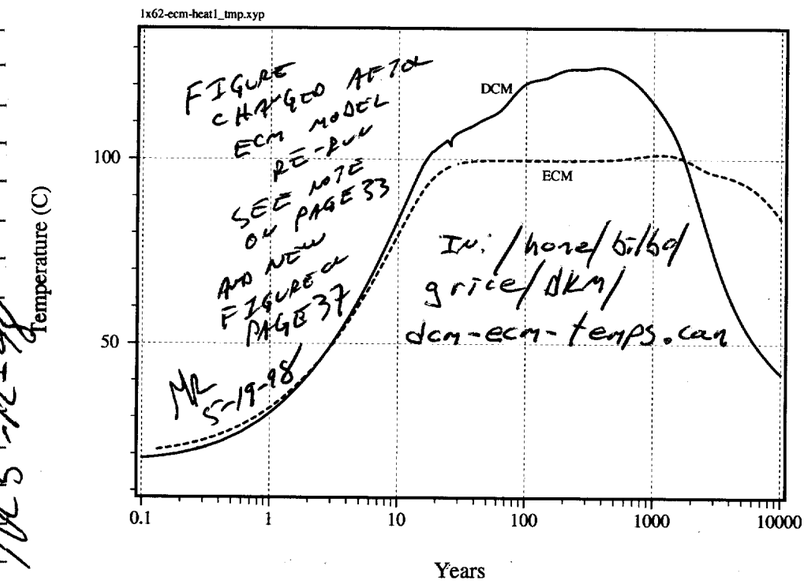
MR 5-12-98

5-12-98 MR

COMPARE RESULTS OF DCM('newheat2.dat')
AND ECM('1X62-ecm-heat1.dat') SIMULATIONS

MR 5-12-98

Temperature Comparison at Waste Package, DCM and ECM



MR 5-12-98

5-13-98 MR

ECM SIMULATION - RUN TO COMPARE WITH RESULTS FROM DCM SIMULATION (SEE ABOVE) '1X62-ecm-heat1.dat'

MR 5-13-98

```
METRA-DCM Steady-State
May 7, 1998
:
: New stratigraphy. Unit thickness are averages of values presented in LBL document:
: 'Site-Scale Unsaturated Zone Model of Yucca Mountain, Nevada', 8/96, pg. 437 (LBNL-39315).
: Permeabilities and van Genuchten parameters for units taken from LBL document:
: 'The Site-Scale Unsaturated
: Zone Model of Yucca Mountain, Nevada for the Viability Assessment', 6/97, pgs
: 6-32 thru 6-34 ( calibrated values, Pm = 0.492 (LBNL-40376)). Residual saturations,
: porosities, and thermal properties taken from TSPA-93 and TSPA-95 (PP values assumed to be
: TSw values).
:
: Infiltration rate = 1.0 mm/yr.
:
: 1-D
:
:
RESTART  0
:
:      XYZ                    = 1 table look-up,; pref = ref. press.
:      RADIAL                 = 0 correlations;   tref = ref temp.
:      OTHER                    ^
:                               |
:grid  geometry  nx ny   nz ivplwr ipvcal  iout  gravity  pref tref  href
@grid  XYZ       1  1    62   1      1      1     0       0    0     0
```

In: /home/bilbo/grice/dkm

5-13-98 MR

MR 5-13-98

5-13-98 MR

```
:
: ***************************************************************************
: i - sequential number of material types
: type - the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm - irreducible liquid saturation for the matrix
: rpmm - Van Genuchten parameter for matrix
: alpham - Van Genuchten parameter for matrix
: swext - liquid saturation below which the capillary pressure is calculated based
:         on the slope dPcw/dSw evaluated at SWEXT.
: sgc - residual (immobile) gas saturation, fraction
: iecm - Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1 invoke, 2 ECM with
: swirf - residual liquid saturation for fracture, fraction
: alphaf - parameter in Van-Genuchten equation for fracture (1/Pa)
: phim - matrix porosity (fraction)
: phif - fracture porosity (fraction)
: permm - intinsic matrix permeability (m^2)
: permf - intrinsic fracture permeability
:
Pckr                          :relative perm and pc keyword
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (TCw11)
   1  Van-Gen      0.021   0.232       1.17e-6    0.0     0.0     1
                   0.04    0.492       2.95e-4    0.087   0.0018  5.4E-18 6.0E-12
:
: (TCw12)
   2  Van-Gen      0.021   0.236       1.32e-6    0.0     0.0     1
                   0.04    0.492       2.95e-4    0.087   0.0018  5.4E-18 6.0E-12
:
: (TCw13)
   3  Van-Gen      0.021   0.427       6.46e-7    0.0     0.0     1
                   0.04    0.492       9.12e-5    0.087   0.0018  5.4E-18 6.0E-12
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (PTn21)
   4  Van-Gen      0.154   0.231       3.80e-5    0.0     0.0     1
                   0.04    0.492       1.10e-3    0.421   0.0018  3.1E-14 3.0E-12
:
: (PTn23)
   5  Van-Gen      0.154   0.287       4.57e-5    0.0     0.0     1
                   0.04    0.492       3.39e-3    0.421   0.0018  8.3E-14 2.9E-12
:
: (PTn24)
   6  Van-Gen      0.154   0.349       4.27e-5    0.0     0.0     1
                   0.04    0.492       9.33e-4    0.421   0.0018  1.1E-13 1.2E-13
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (PTn25)
   7  Van-Gen      0.154   0.279       1.95e-4    0.0     0.0     1
                   0.04    0.279       1.95e-4    0.421   0.0018  2.5E-13 2.5E-13
:
: (TSw31)
   8  Van-Gen      0.045   0.237       1.00e-5    0.0     0.0     1
                   0.04    0.481       3.98e-5    0.139   0.0018  4.9E-17 1.7E-12
:
: (TSw32)
   9  Van-Gen      0.045   0.273       2.29e-5    0.0     0.0     1
                   0.04    0.488       9.33e-5    0.139   0.0018  2.8E-16 1.8E-12
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (TSw33)
  10  Van-Gen      0.045   0.247       6.76e-6    0.0     0.0     1
                   0.04    0.492       1.78e-4    0.139   0.0018  1.1E-17 8.9E-13
:
: (TSw34)
  11  Van-Gen      0.045   0.322       1.02e-6    0.0     0.0     1
                   0.04    0.492       9.77e-5    0.139   0.0018  4.1E-18 4.5E-13
:
: (TSw35 - matrix: Repository horizon)
  12  Van-Gen      0.045   0.229       3.31e-6    0.0     0.0     1
                   0.04    0.492       1.10e-4    0.139   0.0018  1.5E-17 1.4E-12
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (TSw36)
  13  Van-Gen      0.045   0.414       7.41e-7    0.0     0.0     1
                   0.04    0.492       1.32e-4    0.139   0.0018  8.9E-17 1.2E-12
:
: (TSw37)
  14  Van-Gen      0.045   0.387       1.55e-6    0.0     0.0     1
                   0.04    0.492       1.17e-4    0.139   0.0018  1.3E-17 1.2E-12
:
: (CH1vc)
  15  Van-Gen      0.121   0.190       6.61e-5    0.0     0.0     1
                   0.04    0.492       1.17e-3    0.331   0.0018  1.3E-12 1.7E-13
```

MR 5-13-98

MR 5-13-98


```
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (CH1zc)
  16  Van-Gen      0.097   0.366       8.32e-7    0.0     0.0     1
                   0.04    0.492       1.12e-3    0.306   0.0018  1.4E-17 2.4E-14
:
: (CH2zc) Note: van Gen values assumed to be same as CH3zc - see pg
: 437 in 1996 doc mentioned above.
  17  Van-Gen      0.097   0.220       1.95e-6    0.0     0.0     1
                   0.04    0.492       1.23e-3    0.306   0.0018  9.1E-18 1.2E-14
:
: (CH3zc)
  18  Van-Gen      0.097   0.220       1.95e-6    0.0     0.0     1
                   0.04    0.492       1.23e-3    0.306   0.0018  9.1E-18 1.2E-14
:
:   i  type-curv   swirm   rpmm(lamda) alpham     swext   sgc     iecm
:                  swirf   rpmf        alphaf     phim    phif    permm   permf
:
: (CH4zc)
  19  Van-Gen      0.097   0.477       7.76e-6    0.0     0.0     1
                   0.04    0.492       1.15e-3    0.306   0.0018  1.5E-17 1.5E-14
:
: (PP3vp)
  20  Van-Gen      0.045   0.311       1.74e-5    0.0     0.0     1
                   0.04    0.492       1.41e-3    0.306   0.0018  2.8E-15 6.9E-13
:
: (PP2zp)
  21  Van-Gen      0.045   0.316       1.66e-6    0.0     0.0     1
                   0.04    0.492       3.72e-4    0.306   0.0018  5.8E-17 6.4E-14
:
: ******************
: Backfill Material / Waste Package
: ******************
  22  Van-Gen      0.0     0.7000      1.106e-5   0.0     0.0     1
                   0.0     0.7000      1.106E-05  0.01    0.01    1.0E-22 1.0E-22
:
: ******************
: Metal Waste Package
: ******************
   8  Van-Gen      0.0001  0.4400      5.80e-7    0.0     0.0     0
:
: *****
: Air
: *****
   9  Van-Gen      0.0001  0.4400      5.80e-7    0.0     0.0     0
:
: *********
: Fracture - TSw fracture properties
: *********
   7  Van-Gen      0.04    0.764       1.22e-3    0.0     0.0     0
0          :  blank line to end pckr data
:
: ***************
: Debug options
: ***************
Debug  1
0
:
: ********************
: Thermal properties
: ********************
: no - sequential number of data set
: rho - rock density (kg/m^3)
: cpr - rock specific heat (J/kg-K)
: ckdry - thermal conductivity of dry rock (J/s/m-K)
: cksat - thermal conductivity of liquid saturated rock (J/s/m-K)
: crp - pore compressibility with pressure at constant T (1/Pa)
: crt - absolute value of pore compressibility with pressure at constant T (1/Pa)
: tau - tortuosity for binary diffusion
: cdiff - vapor-dir diffusion coefficient, (m^2/s)
: cexp - exponent for binary diffusion
: enbd - enhanced binary diffusion coefficient
:
Thermal-prop
: no rho        cpr    ckdry  cksat   crp  crt   tau  cdiff    cexp  enbd
  1  2.580e+03 728.    1.69   1.69    0    0    .5  2.13e-5  1.8   0. : TCw
  2  2.580e+03 422.    0.61   0.61    0    0    .5  2.13e-5  1.8   0. : PTn
  3  2.580e+03 840.    2.10   2.10    0    0    .5  2.13e-5  1.8   0. : TSw
  4  2.580e+03 948.    1.28   1.28    0    0    .5  2.13e-5  1.8   0. : TSv
  4  2.580e+03 488.    0.84   0.84    0    0    .5  2.13e-5  1.8   0. : CHnv
  5  2.580e+03 526.    1.42   1.42    0    0    .5  2.13e-5  1.8   0. : CHnz
  6  2.580e+03 1e+12   0.0001 0.0001  0    0    .5  2.13e-5  1.8   0. : TCw - Heat Sink
```

MR 5-13-98

MR 5-13-98

NOTE: PERMEABILITIES DIFFERENT THAN VALUES IN DCM (pg27). SHOULD BE THE ECM W/SAME VALUES AS ECM - CAN'T TODAY - NETWORK DOWN

MR 5-13-98

5-13-98
MR

MR 5-13-98

```
:
: ********************
: Backfill material
: ********************
:
:  8  2.580e+03 840.0    0.26   0.49      0     0    .5  2.13e-5  1.8  0.
:
: ********************
: Metal Waste Package
: ********************
:
  7 7.800e+03 450.0     50.0   50.0      0     0    .5  2.13e-5  1.8  0.
:
: *****
: Air
: *****
:
: 10 1.2        57.4     20.0   20.0      0     0    .5  2.13e-5  1.8  0.
:
: ********
: Fracture
: ********
:
:  8 2.580e+03 840.0     2.10   2.10      0     0    .5  2.13e-5  1.8  0.
:
@
: ******************************
: Define size of grid-blocks
: ******************************
: igrid = grid-type (0 - block centered, 1 - point-distributed, 2 - boundary node at the surf
: dx = block sizes in x-direction
: dy = block sizes in y-direction
: dz = block sizes in z-direction
:
:     igrid   rw       re
DXYZ   0
: (dx(i),i=1,nx)
1.6
:0.4 0.4 0.4 0.5 0.515 1.0 3.0 4.785
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
:40.0 6.0  3.0  3.0  3.0  5.5  13.0  3.5  40.0  25.5
:8.0  65.5 98.0 24.0 27.5 27.5 16.0  47.0 18.5  37.5
:5.0
10.0 10.0 10.0 10.0  6.0  3.0  3.0  3.0  5.5  6.5
 6.5  3.5 10.0 10.0 10.0 10.0 10.0 10.0  5.5  8.0
10.0 10.0  6.0 5.95  1.6 5.95  6.0 10.0 10.0 10.0
10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0  8.0  4.0
10.0 10.0 10.0 10.0  7.5  7.5 10.0 10.0  8.0  8.0
 7.0 10.0 10.0 10.0 10.0 10.0  8.5 10.0 10.0 10.0
 7.5  5.0
PhiK
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm ithrmm
  1  1  1  1  1  1    1     6  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  1  6 : TCw11
  1  1  1  1  2  4    1     6  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  1  6 : TCw11
  1  1  1  1  5  5    2     1  0. 1.0000 6.0e-12 6.0e-12 6.0e-12 0.087 5.4e-18  2  1 : TCw12
  1  1  1  1  6  6    3     1  0. 1.0000 2.4e-12 2.4e-12 2.4e-12 0.087 4.9e-17  3  1 : TCw13
  1  1  1  1  7  7    4     2  0. 1.0000 3.0e-13 3.0e-13 3.0e-13 0.421 3.1e-14  4  2 : PTn21
  1  1  1  1  8  8    5     2  0. 1.0000 2.9e-12 2.9e-12 2.9e-12 0.421 8.3e-14  5  2 : PTn23
  1  1  1  1  9  9    6     2  0. 1.0000 1.2e-13 1.2e-13 1.2e-13 0.421 1.1e-13  6  2 : PTn24
  1  1  1  1 10 11    7     2  0. 1.0000 2.5e-13 2.5e-13 2.5e-13 0.421 2.5e-13  7  2 : PTn25
```

MR 5-13-98

```
  1  1  1  1 12 12    8     3  0. 1.0000 1.7e-12 1.7e-12 1.7e-12 0.139 4.9e-17  8  3 : TSw31
  1  1  1  1 13 16    9     3  0. 1.0000 1.8e-12 1.8e-12 1.8e-12 0.139 2.8e-16  9  3 : TSw32
  1  1  1  1 17 19   10     3  0. 1.0000 8.9e-13 8.9e-13 8.9e-13 0.139 1.1e-17 10  3 : TSw33
  1  1  1  1 20 20   11     3  0. 1.0000 4.5e-13 4.5e-13 4.5e-13 0.139 4.1e-18 11  3 : TSw34
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm ithrmm
  1  1  1  1 21 24   12     3  0. 1.0000 1.4e-12 1.4e-12 1.4e-12 0.139 1.5e-17 12  3 : TSw35
  1  1  1  1 25 25   12     7  0. 1.0000 1.4e-12 1.4e-12 1.4e-12 0.139 1.5e-17 12  7 : TSw35
  1  1  1  1 26 29   12     3  0. 1.0000 1.4e-12 1.4e-12 1.4e-12 0.139 1.5e-17 12  3 : TSw35
  1  1  1  1 30 39   13     3  0. 1.0000 1.2e-12 1.2e-12 1.2e-12 0.139 8.9e-17 13  3 : TSw36
  1  1  1  1 40 42   14     3  0. 1.0000 1.2e-12 1.2e-12 1.2e-12 0.139 1.3e-17 14  3 : TSw37
  1  1  1  1 43 45   15     4  0. 1.0000 1.7e-13 1.7e-13 1.7e-13 0.331 1.3e-12 15  4 : CH1vc
  1  1  1  1 46 48   16     5  0. 1.0000 2.4e-14 2.4e-14 2.4e-14 0.306 1.4e-17 16  5 : CH1zc
  1  1  1  1 49 50   17     5  0. 1.0000 1.2e-14 1.2e-14 1.2e-14 0.306 9.1e-18 17  5 : CH2zc
  1  1  1  1 51 55   18     5  0. 1.0000 1.2e-14 1.2e-14 1.2e-14 0.306 9.1e-18 18  5 : CH3zc
  1  1  1  1 56 57   19     5  0. 1.0000 1.5e-14 1.5e-14 1.5e-14 0.306 1.5e-17 19  5 : CH4zc
  1  1  1  1 58 61   20     3  0. 1.0000 6.9e-13 6.9e-13 3.9e-13 0.306 2.8e-15 20  3 : PP3vp
  1  1  1  1 62 62   21     3  1.0e19 1.0000 6.5e-14 6.5e-14 6.4e-14 0.306 5.8e-17 21  3 : PP
:                                                                                     wa
  0
:
```

MR 5-13-98

5-13-98
MR

MR 5-13-98

```
Init
: From 'lx62-ecm-ss.dat', saturation of heater element (#25) set
: to -0.0.
:                Cut & Paste Initilization Variables for Restart
:                ================================================
:
:    Time =  0.315360E+13 secs   Days =  0.365000E+08   years =  0.100000E+06
:
:
: i1  i2  j1  j2  k1  k2        p          t          sg         xg2        sgm
:
   1   1   1   1   1   1  8.67392E+04   13.0000 1.0478E-01 0.0000E+00 1.0478E-01
   1   1   1   1   2   2  8.68407E+04   13.7412 9.2168E-02 0.0000E+00 9.2168E-02
   1   1   1   1   3   3  8.69422E+04   16.8924 7.8225E-02 0.0000E+00 7.8225E-02
   1   1   1   1   4   4  8.70437E+04   17.0450 6.3112E-02 0.0000E+00 6.3112E-02
   1   1   1   1   5   5  8.71251E+04   17.1682 5.5475E-02 0.0000E+00 5.5475E-02
   1   1   1   1   6   6  8.71708E+04   17.2380 2.6268E-02 0.0000E+00 2.6268E-02
   1   1   1   1   7   7  8.72013E+04   17.3261 3.5116E-01 0.0000E+00 3.5116E-01
   1   1   1   1   8   8  8.72318E+04   17.4561 4.2905E-01 0.0000E+00 4.2905E-01
   1   1   1   1   9   9  8.72752E+04   17.6415 4.6335E-01 0.0000E+00 4.6335E-01
   1   1   1   1  10  10  8.73365E+04   17.9061 4.9823E-01 0.0000E+00 4.9823E-01
   1   1   1   1  11  11  8.74027E+04   18.1969 5.6510E-01 0.0000E+00 5.6510E-01
   1   1   1   1  12  12  8.74535E+04   18.3679 3.2412E-01 0.0000E+00 3.2412E-01
   1   1   1   1  13  13  8.75221E+04   18.4580 5.0087E-01 0.0000E+00 5.0087E-01
   1   1   1   1  14  14  8.76237E+04   18.5922 5.0083E-01 0.0000E+00 5.0083E-01
   1   1   1   1  15  15  8.77255E+04   18.7272 5.0057E-01 0.0000E+00 5.0057E-01
   1   1   1   1  16  16  8.78272E+04   18.8633 4.9987E-01 0.0000E+00 4.9987E-01
   1   1   1   1  17  17  8.79291E+04   19.0004 2.8383E-01 0.0000E+00 2.8383E-01
   1   1   1   1  18  18  8.80309E+04   19.1385 3.0716E-01 0.0000E+00 3.0716E-01
   1   1   1   1  19  19  8.81100E+04   19.2463 3.4019E-01 0.0000E+00 3.4019E-01
   1   1   1   1  20  20  8.81788E+04   19.3407 1.5884E-01 0.0000E+00 1.5884E-01
   1   1   1   1  21  21  8.82707E+04   19.4672 2.6508E-01 0.0000E+00 2.6508E-01
   1   1   1   1  22  22  8.83728E+04   19.6086 2.6975E-01 0.0000E+00 2.6975E-01
   1   1   1   1  23  23  8.84545E+04   19.7226 2.7484E-01 0.0000E+00 2.7484E-01
   1   1   1   1  24  24  8.85155E+04   19.8083 2.7992E-01 0.0000E+00 2.7992E-01
:  1   1   1   1  25  25  8.85541E+04   19.8626 2.8401E-01 0.0000E+00 2.8401E-01
   1   1   1   1  25  25  8.85541E+04   19.8626 9.9999E-01 0.0000E+00 9.9999E-01
   1   1   1   1  26  26  8.85927E+04   19.9171 2.8826E-01 0.0000E+00 2.8826E-01
   1   1   1   1  27  27  8.86538E+04   20.0036 2.9594E-01 0.0000E+00 2.9594E-01
   1   1   1   1  28  28  8.87357E+04   20.1198 3.0891E-01 0.0000E+00 3.0891E-01
   1   1   1   1  29  29  8.88381E+04   20.2660 3.2947E-01 0.0000E+00 3.2947E-01
   1   1   1   1  30  30  8.89405E+04   20.4133 2.3582E-01 0.0000E+00 2.3582E-01
   1   1   1   1  31  31  8.90430E+04   20.5616 2.1718E-01 0.0000E+00 2.1718E-01
   1   1   1   1  32  32  8.91456E+04   20.7110 1.9825E-01 0.0000E+00 1.9825E-01
   1   1   1   1  33  33  8.92482E+04   20.8615 1.7845E-01 0.0000E+00 1.7845E-01
   1   1   1   1  34  34  8.93508E+04   21.0131 1.5846E-01 0.0000E+00 1.5846E-01
```

MR 5-13-98

```
   1   1   1   1  35  35  8.94535E+04   21.1657 1.3810E-01 0.0000E+00 1.3810E-01
   1   1   1   1  36  36  8.95563E+04   21.3195 1.1779E-01 0.0000E+00 1.1779E-01
   1   1   1   1  37  37  8.96591E+04   21.4744 9.7713E-02 0.0000E+00 9.7713E-02
   1   1   1   1  38  38  8.97620E+04   21.6305 7.8261E-02 0.0000E+00 7.8261E-02
   1   1   1   1  39  39  8.98546E+04   21.7719 6.1699E-02 0.0000E+00 6.1699E-02
   1   1   1   1  40  40  8.99164E+04   21.8668 1.2654E-01 0.0000E+00 1.2654E-01
   1   1   1   1  41  41  8.99885E+04   21.9780 9.9823E-02 0.0000E+00 9.9823E-02
   1   1   1   1  42  42  9.00916E+04   22.1377 6.2836E-02 0.0000E+00 6.2836E-02
   1   1   1   1  43  43  9.01947E+04   22.4191 3.4318E-01 0.0000E+00 3.4318E-01
   1   1   1   1  44  44  9.02981E+04   22.8260 3.5457E-01 0.0000E+00 3.5457E-01
   1   1   1   1  45  45  9.03886E+04   23.1884 3.8343E-01 0.0000E+00 3.8343E-01
   1   1   1   1  46  46  9.04662E+04   23.4396 1.4721E-01 0.0000E+00 1.4721E-01
   1   1   1   1  47  47  9.05570E+04   23.6599 1.3218E-01 0.0000E+00 1.3218E-01
   1   1   1   1  48  48  9.06606E+04   23.9141 1.1440E-01 0.0000E+00 1.1440E-01
   1   1   1   1  49  49  9.07542E+04   24.1453 1.5300E-01 0.0000E+00 1.5300E-01
   1   1   1   1  50  50  9.08379E+04   24.3527 1.4843E-01 0.0000E+00 1.4843E-01
   1   1   1   1  51  51  9.09163E+04   24.5489 1.4337E-01 0.0000E+00 1.4337E-01
   1   1   1   1  52  52  9.10052E+04   24.7730 1.3668E-01 0.0000E+00 1.3668E-01
   1   1   1   1  53  53  9.11097E+04   25.0390 1.2692E-01 0.0000E+00 1.2692E-01
   1   1   1   1  54  54  9.12142E+04   25.3079 1.1506E-01 0.0000E+00 1.1506E-01
   1   1   1   1  55  55  9.13185E+04   25.5797 1.0063E-01 0.0000E+00 1.0063E-01
   1   1   1   1  56  56  9.14241E+04   25.8544 5.2113E-01 0.0000E+00 5.2113E-01
   1   1   1   1  57  57  9.15241E+04   26.1110 5.3992E-01 0.0000E+00 5.3992E-01
   1   1   1   1  58  58  9.16213E+04   26.3248 5.1468E-01 0.0000E+00 5.1468E-01
   1   1   1   1  59  59  9.17245E+04   26.5159 4.5976E-01 0.0000E+00 4.5976E-01
   1   1   1   1  60  60  9.18277E+04   26.7083 3.5677E-01 0.0000E+00 3.5677E-01
   1   1   1   1  61  61  9.19180E+04   26.8780 1.7008E-01 0.0000E+00 1.7008E-01
   1   1   1   1  62  62  1.01325E+05   27.0000 0.0000E+00 8.8339E-21 0.0000E+00
   0   0
:
:Equil  depth  pdepth   tdepth   tgrad  param iequil
:Equil  514.5  101325    27.     0.0273   0.    -1
:
Recurrent
:
```

MR 5-13-98

END INPUT: 'X62-ECM-newT1.dat'

5-13-98 MR

MR 5-13-98

```
Source   2   1.51e-3   1.
:  is1 is2 js1 js2 ks1 ks2  istyp
   1   1   1   1   1   1    12
: NOTE: FLUX UNITS = kg/(s-m^3)! Based on pore volume.
: see pg 5-14 of Manual.
: TIMEQ    QHT     QMT
   0      13.0    3.64E-08
0
:SKIP
:Power decay data from Randy Manteufel, 4/25/96
:  is  js  ks  istyp
   1 1   1 1  25  25    32
  0.3156E+06  0.8469E+04
  0.9467E+07  0.8423E+04
  0.1578E+08  0.8391E+04
  0.3156E+08  0.8314E+04
  0.3541E+08  0.8296E+04
  0.3973E+08  0.8276E+04
  0.4458E+08  0.8253E+04
  0.5002E+08  0.8228E+04
  0.5612E+08  0.8199E+04
  0.6297E+08  0.8168E+04
  0.7065E+08  0.8131E+04
  0.7927E+08  0.8089E+04
  0.8894E+08  0.8043E+04
```

MR 5-13-98

MR 5-13-98

```
:
:NOSKIP
:
Output   A-1  C-1
:
:  isolv  newtnmn  newtnmx  north  nitmax  level
Solve 1      2        12      2     100      1
:
:AUTO-step  DPMXE    DSMXE  DTMPMXE   DP2MXe TACCEL   IAUTODT  FAC1
AUTO-step   5.0E+4   0.03    5.0        1.e4  1.0e-3     0       0
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
Tolr   1. 5.e-4  5.e-3  1.    1.e-3 1.e-3 1.e-3  1.e-12  1.e-12   1.e-12
:
:Limit dpmx    dsmx dtmpmx dp2mx    dtmn    dtmx   icutmx
LIMIT  1.e5    .08    10.   1.e5    1.e-18  1.e5
:
:    target  dt    dpmx   dsmx   dp2mx   dtmpmx
:
:        print all at every target time
PLOTS 1 1 2
24, 25
rstart 1 0
Time[y]  1.0E-01
Time[y]  1.0E+02
Time[y]  1.0E+03
Time[y]  1.0E+04
:
:rstart 1 0
:
:STEADY[y] 1.0E+00 1.0E-04 1.0E-04
Ends
```

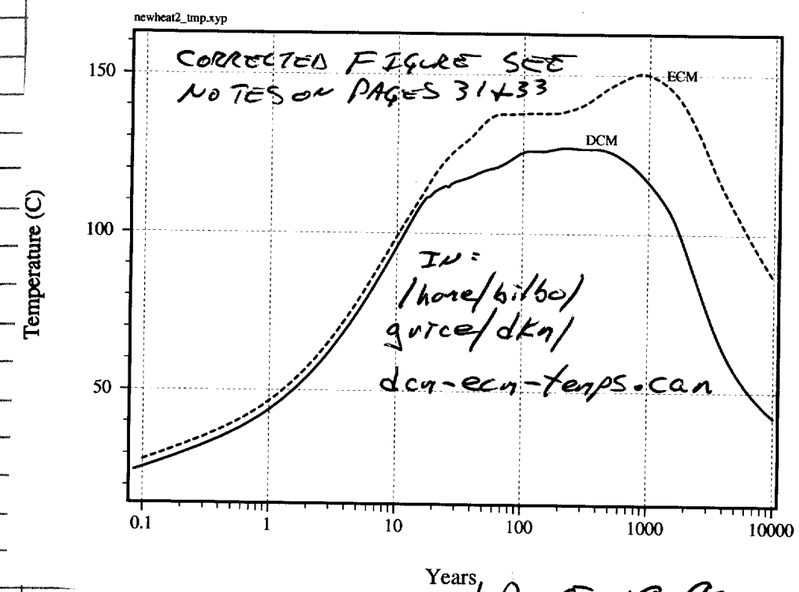
MR 5-13-98

MR 5-19-98

5-19-98 MR

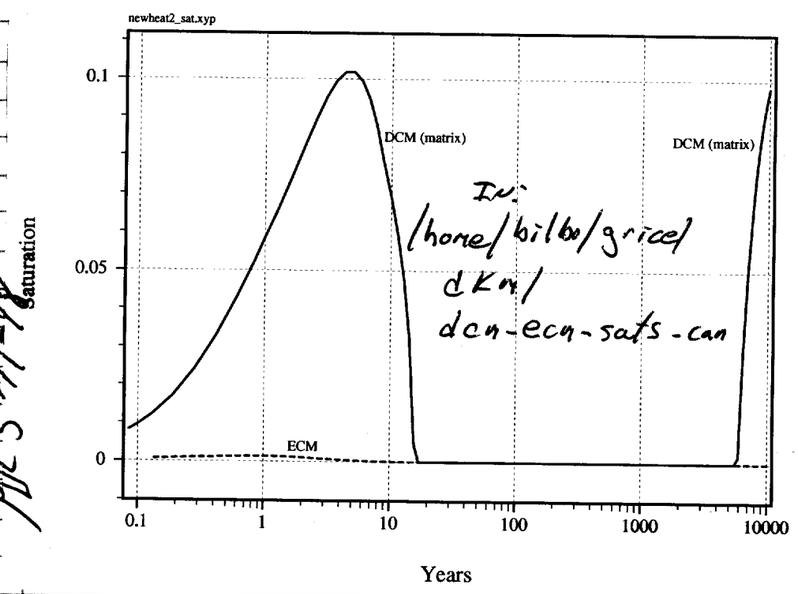
MR 5-19-98

Temperature Comparison at Waste Package, DCM and ECM



MR 5-19-98

Saturation Comparison at Waste Package, DCM and ECM

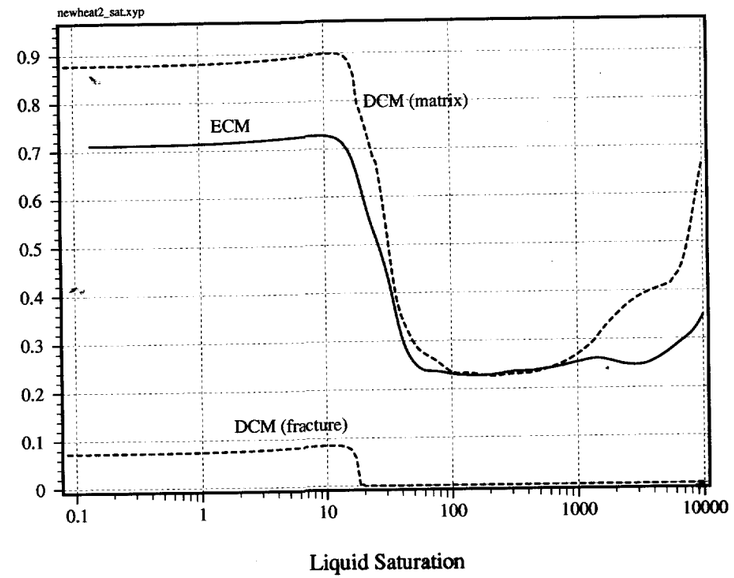


MR 5-19-98

5-19-98
MR

MR 5-19-98

Saturations Immediately Below Heater



MR 5-19-98

5-20-98
MR

· SPOKE W/ PETER LICHTNER RE 'VZ' OUTPUT FROM METRA DCM.

VELOCITY UNITS = M/S

FLUX UNITS = KG/M²-S

MR 4/10/01

FIRST APPEARANCE OF 'FIX/FZ' IS FLUX OF LIQUID THROUGH FRACTURE IN Z DIRECTION. THE ~~NEXT~~ IS FLUX ACROSS INTERFACE BETWEEN FRACTURE ELEMENTS:

MR

F ↓	FM
F	M

5-20-98

THE SECOND APPEARANCE OF 'FIX/FFZ' SHOULD READ 'FIX/FMZ' AND REPRESENTS FLUX ACROSS INTERFACE BETWEEN FRACTURE AND MATRIX ELEMENTS:

F →	M
F	M

7-14-98
MR

CALCULATING FLUX SOURCE TERM FOR METRA - SOURCE TYPE '12' - SEE PAGES 61 & 62 IN 'MULTIFLO USER'S MANUAL' - MARCH 31 1998

ASSUME - FLOW RATE = 1.0 gpm/ft
BLOCK DIMENSIONS = 0.4 X 1.0 X 10.0 m³
POROSITY = 0.087

SOURCE TERM:

$$\frac{10^{-3}\,m}{yr}\;\frac{0.4\,m\;1.0\,m}{0.4\,m\;1.0\,m\;10.0\,m}\;\frac{yr}{365\,days}\;\frac{day}{86400\,s}\;\frac{10^{3}\,kg}{m^{3}}\;\frac{1}{0.087}$$

$$= \frac{10^{-3}\;10^{3}\;kg}{10\,m^{3}\,s\;0.087}\;\frac{1}{365\,(86{,}400)} = \frac{3.64\times10^{-8}\,kg}{m^{3}\text{-}s}$$

MR
7-20-98

7-20-98

MR 7-20-98

jorja/memos/1998/dcm/fluxes.xls — ON PC

1-D Runs

Lower boundary condition = huge volume for water to enter so that no element becomes saturated.

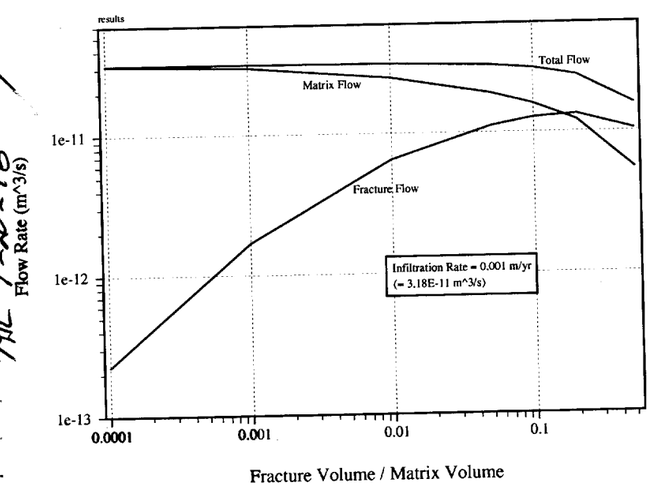
Run ID	infil rate (m/yr)	Depth (m)	sigmaf	ar-mod	xim (m)	yim (m)	zim (m)	ar-mf	aperture (m)
trans-1	1.00E-03	20.0E+0	1.00E-04	1.0E+0	999.9E-3	000.0E+0	000.0E+0	2.0E+0	1.00E-04
trans2	1.00E-03	20.0E+0	1.00E-03	1.0E+0	999.0E-3	000.0E+0	000.0E+0	2.0E+0	1.00E-03
trans3	1.00E-03	20.0E+0	1.00E-02	1.0E+0	990.0E-3	000.0E+0	000.0E+0	2.0E+0	1.00E-02
trans4	1.00E-03	20.0E+0	5.00E-02	1.0E+0	950.0E-3	000.0E+0	000.0E+0	2.0E+0	[illegible]E-02
trans5	1.00E-03	20.0E+0	1.00E-01	1.0E+0	900.0E-3	000.0E+0	000.0E+0	2.0E+0	1.00E-01
trans6	1.00E-03	20.0E+0	2.00E-01	1.0E+0	800.0E-3	000.0E+0	000.0E+0	2.0E+0	2.00E-01
trans7	1.00E-03	20.0E+0	5.00E-01	1.0E+0	500.0E-3	000.0E+0	000.0E+0	2.0E+0	5.00E-01

Run ID	Fracture vfiz (m/s)	Fracture Q (m3/s)	Matrix vimz (m/s)	Matrix Q (m3/s)	Tot flux Mat+Frac (m3/m2-yr)	Tot flux Mat+Frac (m3/s)
trans-1	2.26E-09	2.26E-13	3.16E-11	3.16E-11	1.00E-03	3.18E-11
trans-2	1.70E-09	1.70E-12	3.01E-11	3.01E-11	1.00E-03	3.18E-11
trans-3	6.52E-10	6.52E-12	2.52E-11	2.50E-11	9.93E-04	3.15E-11
trans-4	2.22E-10	1.11E-11	2.01E-11	1.91E-11	9.53E-04	3.02E-11
trans-5	1.27E-10	1.27E-11	1.77E-11	1.59E-11	9.02E-04	2.86E-11
trans-6	6.66E-11	1.33E-11	1.51E-11	1.21E-11	8.02E-04	2.54E-11
trans-7	2.08E-11	1.04E-11	1.10E-11	5.51E-12	5.01E-04	1.59E-11

SEE NOTE ON NEXT PAGE MR 7-23-98

MR 7-20-98

1-D DCM Sensitivity to Fracture / Matrix Ratio



MR 7-20-98

MR 7-20-98

7-23-98
MR

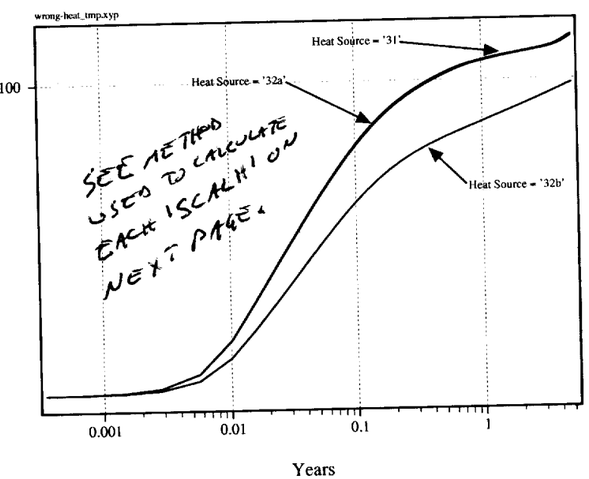
NOTE – THE MASS BALANCES SHOWN ON THE PREVIOUS PAGE ARE CORRECT BECAUSE THE INFILTRATING WATER ONLY FLOWS INTO THE MATRIX – NOT THE FRACTURE. THUS, FOR A 1M X 1M GRID WITH A 50% FRACTURE POROSITY (APERTURE = 0.5M), THE AMOUNT OF INFILTRATING WATER IS 0.5(1)(INFIL. RATE) INSTEAD OF 1(1)(INFIL RATE).

7-27-98

THE FOLLOWING PLOT IS IN: /home/bilbo/grice/dkm/2d/heat-check.can

MR 7-27-98

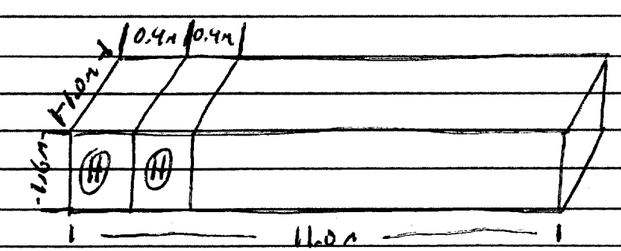
Different 'ISTYPE' Calculations



SEE METHOD USED TO CALCULATE EACH ISCALH ON NEXT PAGE.

MR 7-28-98

HEATER SET-UP IN MULTIFLO:



(H) = HEATER

INITIAL HEATER STRENGTH = 8.469 KW

7-27-98
MR

FOR HEAT SOURCE ('ISTYPE') = '31'

ISTYPE 31 – HEATE SOURCE CALCULATION FOR EACH ELEMENT (F = SCALH):

$$F2\left[\frac{8.469\ kW}{1M\ 11M}\ \frac{4047\ M^2}{AC}\right] = \frac{83\ kW}{AC}$$

$$F = \frac{83(1)11}{(2)8.469(4047)} = 1.33\times10^{-2}\ \text{(NO UNITS)}$$

ISTYPE 32 – HEAT SOURCE CALCULATED ON A UNIT VOLUME BASIS – QUESTION – MULTIPLY TOP OR BOTTOM BY VOLUME?

CORRECT METHOD MR 7-27-98

FOR HEAT SOURCE '32a': (MULTIPLY TOP)

$$F\ 2\left[\frac{8.469\ kW\ 1.6M(1.0M)\ 0.4M}{11M\ (1M)}\ \frac{4047\ M^2}{AC}\right] = \frac{83\ kW}{AC}$$

$$F = \frac{83(1)11}{(2)\ 8.469(1.6)1(0.4)M^3\ 4047} = \frac{2.08\times10^{-2}}{M^3}$$

THUS – UNITS IN MODEL = $\frac{1}{M^3}\ kW = \frac{kW}{M^3}$

= CORRECT AND RESULTS IN SAME TEMPERATURE AS ISTYP 31.

7-27-98
MR

FOR HEAT SOURCE '326': (MULTIPLY BOTTOM)

$$F\ 2\left[\frac{8.469\ kW}{AC\ 1M(1M)}\ \frac{4047\ M^2}{1.6M\ 1.0M\ 0.4M}\right] = \frac{83\ kW}{AC}$$

MR 7-27-98

$$F = \frac{83(1)1.6(0.4)M^3}{8.469(4047)} = 1.70\times10^{-2}\ M^3$$

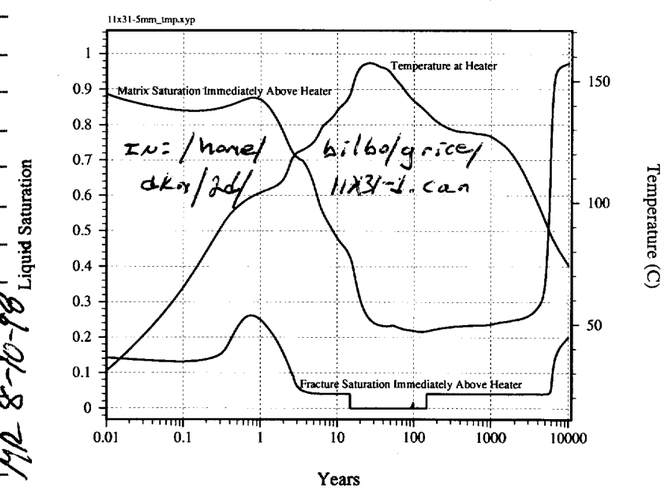
THUS UNITS IN MODEL = $kW\text{-}M^3$ – WRONG – RESULTS IN DIFFERENT TEMPERATURE DISTRIBUTION – SEE FIGURE ON pg 41.

8-10-98
MR

NOTE – THE FOLLOWING RESULTS ARE FROM: '11X31-5mm-dat' – TOOK ~ 2.7 DAYS CPU TIME ON SNEEZY. – SPECIFIC HEAT OF TOPMOST LAYER WAS NOT SPECIFIED CORRECTLY – TOP LAYER TEMPERATURE ~ 71C AT 10,000 YEARS.

MR 8-10-98

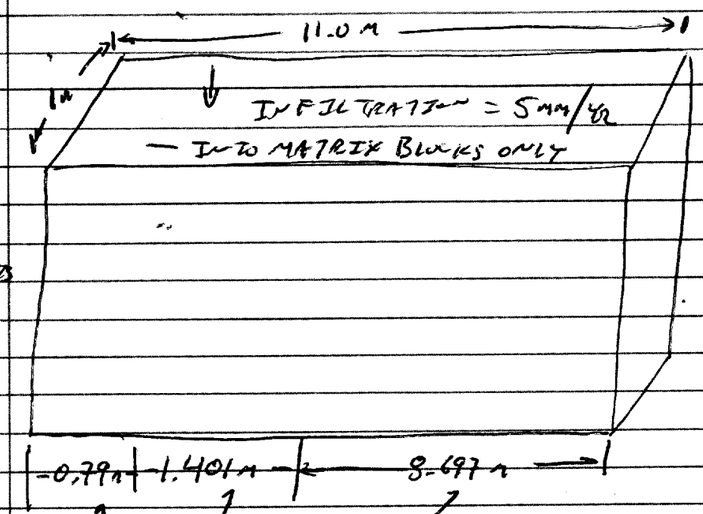
DCM, 11x31, 5 mm Infil,10 mm Fracs



MR 8-10-98

8-12-98 MR

CHECKING REPORTING OF FLUXES AND MASS BALANCE FOR LATEST VERSION OF METRA. STEADY-STATE RUN (~200,000 YRS) "3X31-5mm-SS-newmetra.dat".



TOTAL FLUX THROUGH SYSTEM:

$$\frac{5\times10^{-3}\,m}{YR}\,(1m)(0.79+1.401+8.697)\,m\,\frac{10^3\,Kg}{m^3} = \frac{54.44\,Kg}{YR}$$

MR 8-12-98

SPREADSHEET ON FOLLOWING PAGES GIVES TOTAL FLUX AS:

$$0.0544\,\frac{m^3}{YR},\quad \frac{0.0544\,m^3}{YR}\,\frac{10^3\,Kg}{m^3} = \frac{54.4\,Kg}{YR}$$

8-12-98 MR

MR 8-12-98

METRA DCM
Steady-State Run (~200,000 Yrs)
Sum of Fluxes at Depth = 102 m
Data From:
'3x31-5mm-ss-newmetra_out':
Gives total flux into system at 200,000 yrs as 54.4 kg/yr.
'3x31-5mm-ss-newmetravz4.xyp':
Gives velocities below.
Cross sectional area of fractures (m^2)
x=0.4, 0.8-0.79=0.01
x=1.5075, 1.415-1.401=0.014
x=6.6075, 8.785-8.697=0.0878
Cross sectional area of matrix blocks (m^2)
x=0.4, 0.8[0.9875]=0.79
x=1.5075, 1.415[0.99]=1.401
x=6.6075, 8.785[0.99]=8.697

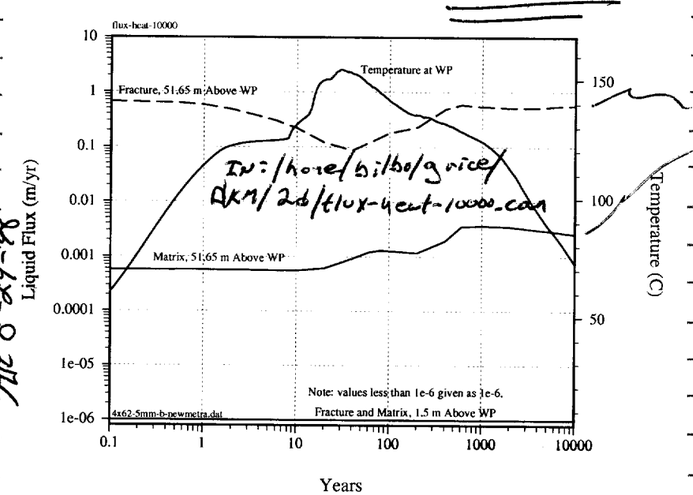
ON PC IN: c:/jorge/memos/1998/dcm/FLUXES2.xls

MR 8-12-98

x	vlfz	Area frac	Flux Frac	vlmz	Area Matx	Flux Matx		Total Flux
	m/yr	m^2	m^3/yr	m/yr	m^2	m^3/yr		m^3/yr
0.4	0.38662	0.01	0.003866	1.03E-03	0.79	0.00081		0.004676
1.5075	0.38669	0.014	0.005414	1.03E-03	1.401	0.001436		0.00685
6.6075	0.38679	0.0878	0.03396	1.02E-03	8.697	0.008914		0.042874
							Total	0.054399

8-24-98 MR

MR 8-24-98



MR 8-24-98

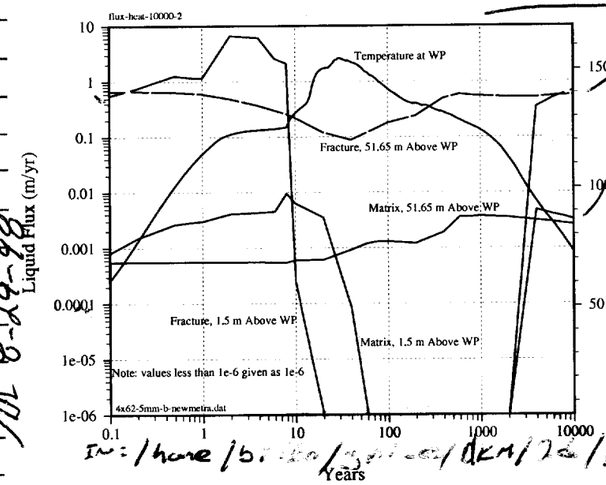
IN: /home/bilbo/grice/dkm/2d/flux-heat-10000.com

STEADY-STATE (NO HEAT, 10,000 YRS) VALUE: FRACTURE: 0.67 MATRIX: 3.2×10^{-3} SEE: /home/bilbo/grice/dkm/2d/4x62-5mm-b-SS.dat, OUTPUT.

8-24-98

MH 8-24-98

DCM, Fluxes Along Side WP (x = 1.5 m)



MH 8-24-98

STEADY STATE VALUE (NO HEAT, 10,000 YRS):
FRACTURE: 0.53
MATRIX: 2.7×10^{-3}

IN: /home/b... /DCM/2d/flux-heat-10000-2

7/15/99 Beginning a new phase of runs to evaluate the effect of a lower heat load (60 MTU/ACRE) in the potential HLW repository at YM. Provided with an initial input file by Debra Hughson, which is provided below: (see p 47 of this notebook)

Input file provided by D. Hughson

```
Skip

Debra:

I have made several changes in your data file, the significant ones
include (a) letting swext variable to be 0. for all those capillary
pressure tables for which van genuchten parameters do not compute
excessively high capillary pressure near the residual liquid saturation,
and (b) changing the default parameters for many variables in the recurrent
data.

You can perhaps 'diff' your original file with this to see the exact
changes made. If still does not run on your machine (or your version
of metra), let me know.

I have not gone back to identify the cause of your restart run not
working after 10 yrs. May be, I will do it if you again encounter
such restart problem with another run.

See a partial screen dump appended to the data for comparison. It took
much cpu time...

MOhan...

NOskip
:
 METRA-DCM, Patterned after T. Buscheck Case 3 of Drift Scale
 Near-Field/Altered-Zone Models Report UCRL-ID-129179
:
: This is my attempt to reproduce the results for Drift Scale Thermohydrologic
:
: Infiltration rate = 16.0 mm/yr.
:
: 2-D
:
: This is the input file for steady state initial condition calibration
:
RSTART 0
:
:grid geometry nx ny nz wpiwr ipvcal iout gravity pref tref href
Grid DCMXYZ 8 1 80 1 1 1 0 0 0 0
:
:*****************************************************************
: i = sequential number of material types
: type = the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm = irreducible liquid saturation for the matrix
: rpmm = Van Genuchten parameter for matrix
: alpham = Van Genuchten parameter for matrix
: swext = liquid saturation below which the capillary pressure is calculated based
:       on the slope dPcw/dSw evaluated at SWEXT.
: sgc = residual (immobile) gas saturation, fraction
: iecm = Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1 invoke, 2 ECM with tables)
: swirf = residual liquid saturation for fracture, fraction
: alphaf = parameter in Van-Genuchten equation for fracture (1/Pa)
: phim = matrix porosity (fraction)
: phif = fracture porosity (fracture)
```

Line 41

15

M. Hill 7/15/99

```
: permm = intinsic matrix permeability (m^2)
: permf = intrinsic fracture permeability
:
Pckr                    :relative perm and pc keyword
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (TCw11 - matrix)
   1  Van-Gen    0.13  0.231      1.15e-6  -1.0e+8  0.0    0
:
: (TCw11 - fracture)
   2  Van-Gen    0.01  0.667      2.37e-3  -0.0e+8  0.0    0
:
: (TCw12 - matrix)
   3  Van-Gen    0.13  0.2447     2.01e-6  -1.0e+8  0.0    0
:
: (TCw12 - fracture)
   4  Van-Gen    0.01  0.669      2.37e-3  -0.0e+8  0.0    0
:
: (TCw13 - matrix)
   5  Van-Gen    0.33  0.4548     3.74e-6  -0.0e+8  0.0    0
:
: (TCw13 - fracture)
   6  Van-Gen    0.01  0.669      9.12e-4  -0.0e+8  0.0    0
:
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (PTn21 - matrix)
   7  Van-Gen    0.10  0.2531     3.98e-5  -1.0e+8  0.0    0
:
: (PTn21 - fracture)
   8  Van-Gen    0.01  0.669      1.10e-3  -0.0e+8  0.0    0
:
: (PTn22 - matrix)
   9  Van-Gen    0.14  0.4925     7.94e-6  -0.0e+8  0.0    0
:
: (PTn22 - fracture)
  10  Van-Gen    0.01  0.669      1.85e-3  -0.0e+8  0.0    0
:
: (PTn23 - matrix)
  11  Van-Gen    0.17  0.3002     5.44e-5  -0.0e+8  0.0    0
:
: (PTn23 - fracture)
  12  Van-Gen    0.01  0.667      3.45e-3  -0.0e+8  0.0    0
:
: (PTn24 - matrix)
  13  Van-Gen    0.10  0.3859     3.43e-5  -0.0e+8  0.0    0
:
: (PTn24 - fracture)
  14  Van-Gen    0.01  0.667      9.13e-4  -0.0e+8  0.0    0
:
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (PTn25 - matrix)
  15  Van-Gen    0.10  0.3195     1.81e-4  -0.0e+8  0.0    0
:
: (PTn25 - fracture)
```

M. Hill 7/15/98


```
  16  Van-Gen    0.10  0.320      1.81e-4  -0.0e+8  0.0    0
:
: (TSw31 - matrix)
  17  Van-Gen    0.11  0.2304     5.84e-5  -1.0e+8  0.0    0
:
: (TSw31 - fracture)
  18  Van-Gen    0.01  0.566      1.44e-4  -0.0e+8  0.0    0
:
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (TSw33 - matrix)
  19  Van-Gen    0.06  0.2479     6.21e-6  -1.0e+8  0.0    0
:
: (TSw33 - fracture)
  20  Van-Gen    0.01  0.667      1.73e-3  -0.0e+8  0.0    0
:
: (TSw35 - matrix: Repository horizon)
  21  Van-Gen    0.08  0.1983     4.01e-6  -1.0e+8  0.0    0
:
: (TSw35 - fracture: Repository horizon)
  22  Van-Gen    0.01  0.667      1.26e-3  -0.0e+8  0.0    0
:
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (TSw36 - matrix)
:  23  Van-Gen    0.18  0.5138     8.08e-7  -0.0e+8  0.0    0
   23  Van-Gen    0.18  0.5138     2.272e-6 -0.0e+8  0.0    0
:
: (TSw36 - fracture)
  24  Van-Gen    0.01  0.667      1.32e-3  -0.0e+8  0.0    0
:
: (TSw37 - matrix)
:  25  Van-Gen    0.50  0.3709     5.30e-7  -0.0e+8  0.0    0
   25  Van-Gen    0.50  0.3709     7.3856e-6 -0.0e+8  0.0    0
:
: (TSw37 - fracture)
  26  Van-Gen    0.01  0.659      1.19e-3  -0.0e+8  0.0    0
:
: (CH1vc - matrix)
  27  Van-Gen    0.04  0.1592     7.60e-5  -1.0e+8  0.0    0
:
: (CH1vc - fracture)
  28  Van-Gen    0.01  0.669      1.18e-3  -0.0e+8  0.0    0
:
:  i type-curv   swirm   rpmm(lamda) alpham    swext  sgc    iecm
:
: (CH2vc - matrix)
  29  Van-Gen    0.06  0.2291     4.12e-5  -1.0e+8  0.0    0
:
: (CH2vc - fracture)
  30  Van-Gen    0.01  0.667      1.18e-3  -0.0e+8  0.0    0
:
: (CH3zc - matrix)
  31  Van-Gen    0.20  0.2119     2.16e-5  -1.0e+8  0.0    0
:
: (CH3zc - fracture)
```

M. Hill 7/15/98

```
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
 7.0  8.2  9.0  9.0 10.0 10.0 10.0 10.0 10.0  9.0
 8.0  6.3  4.5  7.0  7.0  4.6  6.9  7.0  7.0  7.5
 7.0  7.0  7.0  8.0 11.0 14.0 16.0 15.0 14.0 13.0
12.0 11.0 10.0  9.0  8.0  7.0  6.0  6.0  5.0  5.0
 5.0  5.0  5.0  5.0  5.0  5.0  3.48 2.08 1.44 1.0
 1.5  2.0  3.0  5.0  6.0  7.0  9.0 10.5 13.0 14.0
14.3 15.0 15.0 16.2 15.0 15.0 11.5  9.0  9.7 12.3
14.0 15.0 15.0 17.0 18.0 16.0 14.0 12.0  8.4  6.5
:
: fracture permeabilities modified from Buscheck by dividing by fracture porosity
PHIK
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm ithrmm
:
 1  8  1  1  1  6   2   1  0. 1.0000 2.59e-08 2.59e-08 9.83e-08 0.066 5.40e-18  1  1 :  TCw11
 1  8  1  1  7 12   4   2  0. 1.0000 2.02e-08 2.02e-08 4.62e-08 0.066 5.40e-18  3  2 :  TCw12
 1  8  1  1 13 13   6   3  0. 1.0000 3.40e-09 3.40e-09 4.00e-08 0.140 5.69e-17  5  3 :  TCw13
 1  8  1  1 14 14   8   4  0. 1.0000 1.08e-08 1.08e-08 1.08e-08 0.369 1.61e-14  7  4 :  PTn21
 1  8  1  1 15 15  10   5  0. 1.0000 4.04e-09 4.04e-09 4.04e-09 0.234 3.30e-15  9  5 :  PTn22
 1  8  1  1 16 16  12   6  0. 1.0000 1.98e-09 1.98e-09 1.98e-09 0.353 5.40e-14 11  6 :  PTn23
 1  8  1  1 17 18  14   7  0. 1.0000 8.89e-10 8.89e-10 8.89e-10 0.469 8.80e-14 13  7 :  PTn24
 1  8  1  1 19 21  16   8  0. 1.0000 2.01e-09 2.01e-09 2.01e-09 0.464 3.18e-13 15  8 :  PTn25
 1  8  1  1 22 22  18   9  0. 1.0000 1.12e-08 1.12e-08 1.20e-07 0.042 7.76e-17 17  9 :  TSw31
 1  8  1  1 23 29  20  10  0. 1.0000 8.49e-09 8.49e-09 2.50e-07 0.135 2.04e-17 19 10 : TSw33
 1  8  1  1 30 53  22  11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-17 21 11 : TSw35
 1  1  1  1 30 48  22  11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-17 21 11 : TSw35
 1  1  1  1 49 49  41  21  0. .0000 1.00E-44 1.00e-44 1.00E-44 0.000 1.0E-44 41 21 : TSw35 - metal
container
 1  1  1  1 50 50  22  11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-12 21 11 : TSw35 - under
can
 1  1  1  1 51 53  22  11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-17 21 11 : TSw35
 1  8  1  1 54 58  24  12  0. 1.0000 3.01e-09 3.01e-09 3.01e-09 0.092 8.70e-18 23 12 : TSw36
 1  8  1  1 59 63  26  13  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.020 8.39e-18 25 13 : TSw37
 1  8  1  1 59 63  26  13  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.020 4.08e-18 25 13 : TSw37
 1  8  1  1 64 64  28  14  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.265 1.60e-12 27 14 : CH1vc
 1  8  1  1 65 68  30  15  0. 1.0000 4.03e-09 4.03e-09 4.03e-09 0.321 5.50e-14 29 15 : CH2vc
 1  8  1  1 69 69  32  16  0. 1.0000 1.06e-09 1.06e-09 2.28e-09 0.240 2.50e-18 31 16 : CH3zc
 1  8  1  1 70 71  34  17  0. 1.0000 1.41e-09 1.41e-09 2.28e-09 0.169 5.49e-18 33 17 : CH4zc
 1  8  1  1 72 74  36  18  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-15 35 18 : PP3vp
 1  8  1  1 75 79  38  19  0. 1.0000 5.87e-09 5.87e-09 2.28e-09 0.197 1.75e-17 37 19 : PP2zp
 1  8  1  1 80 80  40  20  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-15 39 20 : BF3vb
:
0
:
Init
:
:EQUIL depth  pdepth  tdepth  tgrad  param  iequil
:
:EQUIL 926.9  101325  30.  .013757   0.0    40
:
:i1  i2  j1  j2  k1  k2      p       t       sg      xg2     pm      tm      sgm     xgm
:
 1  8  1  1  1  1 9.33917E+04  20.0372 9.8730E-01 0.0000E+00 9.3221E+04 2.0037E+01 1.1052E-01
0.0000E+00
```



```
 1  8  1  1  2  2 9.34736E+04  20.1181 9.8738E-01 0.0000E+00 9.3248E+04 2.0118E+01 1.0749E-01
0.0000E+00
 1  8  1  1  3  3 9.35664E+04  20.2095 9.8747E-01 0.0000E+00 9.3338E+04 2.0210E+01 1.0367E-01
0.0000E+00
 1  8  1  1  4  4 9.36636E+04  20.3051 9.8756E-01 0.0000E+00 9.3445E+04 2.0305E+01 9.9145E-02
0.0000E+00
 1  8  1  1  5  5 9.37662E+04  20.4058 9.8766E-01 0.0000E+00 9.3562E+04 2.0406E+01 9.3693E-02
0.0000E+00
 1  8  1  1  6  6 9.38743E+04  20.5118 9.8755E-01 0.0000E+00 9.3682E+04 2.0512E+01 8.7108E-02
0.0000E+00
 1  8  1  1  7  7 9.39825E+04  20.6145 9.8759E-01 0.0000E+00 9.3789E+04 2.0615E+01 1.4139E-01
0.0000E+00
 1  8  1  1  8  8 9.40907E+04  20.7141 9.8774E-01 0.0000E+00 9.3899E+04 2.0714E+01 1.4098E-01
0.0000E+00
 1  8  1  1  9  9 9.41991E+04  20.8137 9.8793E-01 0.0000E+00 9.4008E+04 2.0814E+01 1.4057E-01
0.0000E+00
 1  8  1  1 10 10 9.43021E+04  20.9083 9.8815E-01 0.0000E+00 9.4113E+04 2.0908E+01 1.4018E-
01 0.0000E+00
 1  8  1  1 11 11 9.43943E+04  20.9929 9.8845E-01 0.0000E+00 9.4214E+04 2.0993E+01 1.3983E-
01 0.0000E+00
 1  8  1  1 12 12 9.44719E+04  21.0641 9.8928E-01 0.0000E+00 9.4329E+04 2.1064E+01 1.3954E-
01 0.0000E+00
 1  8  1  1 13 13 9.45306E+04  21.1410 9.8999E-01 0.0000E+00 9.4489E+04 2.1141E+01 3.1631E-
01 0.0000E+00
 1  8  1  1 14 14 9.45930E+04  21.3289 9.9000E-01 0.0000E+00 9.4593E+04 2.1329E+01 5.6106E-
01 0.0000E+00
 1  8  1  1 15 15 9.46689E+04  21.5548 9.9000E-01 0.0000E+00 9.4669E+04 2.1555E+01 6.2269E-
01 0.0000E+00
 1  8  1  1 16 16 9.47317E+04  21.6903 9.9000E-01 0.0000E+00 9.4732E+04 2.1690E+01 6.0979E-
01 0.0000E+00
 1  8  1  1 17 17 9.47940E+04  21.8472 9.8999E-01 0.0000E+00 9.4794E+04 2.1847E+01 7.1566E-
01 0.0000E+00
 1  8  1  1 18 18 9.48693E+04  22.0568 9.8999E-01 0.0000E+00 9.4869E+04 2.2057E+01 6.9258E-
01 0.0000E+00
 1  8  1  1 19 19 9.49452E+04  22.3028 7.4471E-01 0.0000E+00 9.4945E+04 2.2303E+01 7.4408E-
01 0.0000E+00
 1  8  1  1 20 20 9.50239E+04  22.5934 7.3060E-01 0.0000E+00 9.5024E+04 2.2593E+01 7.2995E-
01 0.0000E+00
 1  8  1  1 21 21 9.51025E+04  22.8787 7.0264E-01 0.0000E+00 9.5103E+04 2.2879E+01 7.0195E-
01 0.0000E+00
 1  8  1  1 22 22 9.51783E+04  23.0884 9.4771E-01 0.0000E+00 9.5177E+04 2.3088E+01 3.6845E-
01 0.0000E+00
 1  8  1  1 23 23 9.52543E+04  23.2011 9.8640E-01 0.0000E+00 9.5182E+04 2.3201E+01 2.7918E-
01 0.0000E+00
 1  8  1  1 24 24 9.53357E+04  23.2850 9.8646E-01 0.0000E+00 9.5237E+04 2.3285E+01 2.7835E-
01 0.0000E+00
 1  8  1  1 25 25 9.54389E+04  23.3913 9.8653E-01 0.0000E+00 9.5333E+04 2.3391E+01 2.7762E-
01 0.0000E+00
 1  8  1  1 26 26 9.55749E+04  23.5311 9.8662E-01 0.0000E+00 9.5467E+04 2.3531E+01 2.7747E-
01 0.0000E+00
 1  8  1  1 27 27 9.57381E+04  23.6989 9.8674E-01 0.0000E+00 9.5628E+04 2.3699E+01 2.7919E-
01 0.0000E+00
 1  8  1  1 28 28 9.59070E+04  23.8725 9.8685E-01 0.0000E+00 9.5791E+04 2.3873E+01 2.8500E-
01 0.0000E+00
 1  8  1  1 29 29 9.60652E+04  24.0356 9.8523E-01 0.0000E+00 9.5944E+04 2.4036E+01 2.9786E-
01 0.0000E+00
```

```
 1  8  1  1 30  30 9.62126E+04   24.1760 9.8509E-01 0.0000E+00 9.6098E+04 2.4176E+01 1.9432E-
01 0.0000E+00
 1  8  1  1 31  31 9.63491E+04   24.2942 9.8536E-01 0.0000E+00 9.6235E+04 2.4294E+01 1.9300E-
01 0.0000E+00
 1  8  1  1 32  32 9.64749E+04   24.4029 9.8565E-01 0.0000E+00 9.6361E+04 2.4403E+01 1.9189E-
01 0.0000E+00
 1  8  1  1 33  33 9.65898E+04   24.5021 9.8595E-01 0.0000E+00 9.6477E+04 2.4502E+01 1.9099E-
01 0.0000E+00
 1  8  1  1 34  34 9.66939E+04   24.5919 9.8628E-01 0.0000E+00 9.6582E+04 2.4592E+01 1.9029E-
01 0.0000E+00
 1  8  1  1 35  35 9.67871E+04   24.6722 9.8666E-01 0.0000E+00 9.6676E+04 2.4672E+01 1.8978E-
01 0.0000E+00
 1  8  1  1 36  36 9.68693E+04   24.7430 9.8714E-01 0.0000E+00 9.6762E+04 2.4743E+01 1.8947E-
01 0.0000E+00
 1  8  1  1 37  37 9.69407E+04   24.8044 9.8831E-01 0.0000E+00 9.6844E+04 2.4804E+01 1.8933E-
01 0.0000E+00
 1  8  1  1 38  38 9.70066E+04   24.8611 9.8996E-01 0.0000E+00 9.6936E+04 2.4861E+01 1.8936E-
01 0.0000E+00
 1  8  1  1 39  39 9.70670E+04   24.9131 9.9000E-01 0.0000E+00 9.7034E+04 2.4913E+01 1.8951E-
01 0.0000E+00
 1  8  1  1 40  40 9.71219E+04   24.9603 9.9000E-01 0.0000E+00 9.7106E+04 2.4960E+01 1.8967E-
01 0.0000E+00
 1  8  1  1 41  41 9.71769E+04   25.0076 9.9000E-01 0.0000E+00 9.7169E+04 2.5008E+01 1.8984E-
01 0.0000E+00
 1  8  1  1 42  42 9.72319E+04   25.0548 9.9000E-01 0.0000E+00 9.7228E+04 2.5055E+01 1.9004E-
01 0.0000E+00
 1  8  1  1 43  43 9.72869E+04   25.1021 9.9000E-01 0.0000E+00 9.7285E+04 2.5102E+01 1.9027E-
01 0.0000E+00
 1  8  1  1 44  44 9.73419E+04   25.1493 9.9000E-01 0.0000E+00 9.7341E+04 2.5149E+01 1.9054E-
01 0.0000E+00
 1  8  1  1 45  45 9.73970E+04   25.1966 9.9000E-01 0.0000E+00 9.7397E+04 2.5197E+01 1.9085E-
01 0.0000E+00
 1  8  1  1 46  46 9.74520E+04   25.2438 9.9000E-01 0.0000E+00 9.7452E+04 2.5244E+01 1.9121E-
01 0.0000E+00
 1  8  1  1 47  47 9.74988E+04   25.2839 9.9000E-01 0.0000E+00 9.7498E+04 2.5284E+01 1.9158E-
01 0.0000E+00
 1  8  1  1 48  48 9.75294E+04   25.3102 9.9000E-01 0.0000E+00 9.7528E+04 2.5310E+01 1.9186E-
01 0.0000E+00
 1  8  1  1 49  49 9.75488E+04   25.3268 9.9000E-01 0.0000E+00 9.7548E+04 2.5327E+01 1.9205E-
01 0.0000E+00
 1  8  1  1 50  50 9.75622E+04   25.3384 9.9000E-01 0.0000E+00 9.7561E+04 2.5338E+01 1.9219E-
01 0.0000E+00
 1  8  1  1 51  51 9.75760E+04   25.3502 9.9000E-01 0.0000E+00 9.7574E+04 2.5350E+01 1.9235E-
01 0.0000E+00
 1  8  1  1 52  52 9.75953E+04   25.3667 9.9000E-01 0.0000E+00 9.7583E+04 2.5367E+01 1.9258E-
01 0.0000E+00
 1  8  1  1 53  53 9.76229E+04   25.3904 9.9000E-01 0.0000E+00 9.7620E+04 2.5390E+01 1.9292E-
01 0.0000E+00
 1  8  1  1 54  54 9.76670E+04   25.4304 9.9000E-01 0.0000E+00 9.7659E+04 2.5430E+01 3.0103E-
01 0.0000E+00
 1  8  1  1 55  55 9.77277E+04   25.4872 9.9000E-01 0.0000E+00 9.7728E+04 2.5487E+01 2.7582E-
01 0.0000E+00
 1  8  1  1 56  56 9.77994E+04   25.5540 9.9000E-01 0.0000E+00 9.7803E+04 2.5554E+01 2.4181E-
01 0.0000E+00
 1  8  1  1 57  57 9.78877E+04   25.6357 9.9000E-01 0.0000E+00 9.7894E+04 2.5636E+01 1.9423E-
01 0.0000E+00
```

M. Zhell 7/15/99


```
 1  8  1  1 58  58 9.79954E+04   25.7347 9.8999E-01 0.0000E+00 9.8005E+04 2.5735E+01 1.3040E-
01 0.0000E+00
 1  8  1  1 59  59 9.81253E+04   25.8458 9.8997E-01 0.0000E+00 9.8131E+04 2.5846E+01 1.4634E-
01 0.0000E+00
 1  8  1  1 60  60 9.82747E+04   25.9665 9.8997E-01 0.0000E+00 9.8275E+04 2.5966E+01 1.4839E-
01 0.0000E+00
 1  8  1  1 61  61 9.84315E+04   26.0930 9.8997E-01 0.0000E+00 9.8431E+04 2.6093E+01 1.5418E-
01 0.0000E+00
 1  8  1  1 62  62 9.85940E+04   26.2241 9.8998E-01 0.0000E+00 9.8589E+04 2.6224E+01 1.7116E-
01 0.0000E+00
 1  8  1  1 63  63 9.87605E+04   26.3588 9.8998E-01 0.0000E+00 9.8721E+04 2.6359E+01 2.1971E-
01 0.0000E+00
 1  8  1  1 64  64 9.89339E+04   26.5565 9.9000E-01 0.0000E+00 9.8934E+04 2.6556E+01 4.7877E-
01 0.0000E+00
 1  8  1  1 65  65 9.91072E+04   26.8262 9.9000E-01 0.0000E+00 9.9107E+04 2.6826E+01 5.3153E-
01 0.0000E+00
 1  8  1  1 66  66 9.92740E+04   27.1024 9.8999E-01 0.0000E+00 9.9274E+04 2.7102E+01 4.7897E-
01 0.0000E+00
 1  8  1  1 67  67 9.94213E+04   27.3399 9.8996E-01 0.0000E+00 9.9421E+04 2.7340E+01 3.8461E-
01 0.0000E+00
 1  8  1  1 68  68 9.95354E+04   27.5148 9.8930E-01 0.0000E+00 9.9535E+04 2.7515E+01 1.7211E-
01 0.0000E+00
 1  8  1  1 69  69 9.96391E+04   27.6665 9.8985E-01 0.0000E+00 9.9639E+04 2.7666E+01 1.8613E-
01 0.0000E+00
 1  8  1  1 70  70 9.97582E+04   27.8301 9.9000E-01 0.0000E+00 9.9758E+04 2.7830E+01 1.1271E-
01 0.0000E+00
 1  8  1  1 71  71 9.99007E+04   28.0129 9.9000E-01 0.0000E+00 9.9901E+04 2.8013E+01 8.8706E-
02 0.0000E+00
 1  8  1  1 72  72 1.00062E+05   28.2399 9.9000E-01 0.0000E+00 1.0006E+05 2.8240E+01 5.5998E-
01 0.0000E+00
 1  8  1  1 73  73 1.00230E+05   28.4972 9.9000E-01 0.0000E+00 1.0023E+05 2.8497E+01 5.1341E-
01 0.0000E+00
 1  8  1  1 74  74 1.00408E+05   28.7637 9.8999E-01 0.0000E+00 1.0041E+05 2.8764E+01 4.1138E-
01 0.0000E+00
 1  8  1  1 75  75 1.00604E+05   29.0363 9.8999E-01 0.0000E+00 1.0060E+05 2.9036E+01 3.3780E-
01 0.0000E+00
 1  8  1  1 76  76 1.00789E+05   29.2880 9.8999E-01 0.0000E+00 1.0079E+05 2.9288E+01 3.2831E-
01 0.0000E+00
 1  8  1  1 77  77 1.00952E+05   29.5091 9.8999E-01 0.0000E+00 1.0095E+05 2.9509E+01 3.0418E-
01 0.0000E+00
 1  8  1  1 78  78 1.01094E+05   29.6987 9.8997E-01 0.0000E+00 1.0109E+05 2.9699E+01 2.4912E-
01 0.0000E+00
 1  8  1  1 79  79 1.01205E+05   29.8446 9.8993E-01 0.0000E+00 1.0121E+05 2.9845E+01 1.5106E-
01 0.0000E+00
 1  8  1  1 80  80 1.01289E+05   29.9521 9.8952E-01 0.0000E+00 1.0129E+05 2.9952E+01 9.1766E-
02 0.0000E+00
 0  0
:
DCMPARA
: i1 i2 j1 j2 k1 k2   volf  areamodf  xlm  ylm  zlm
:
 1  8  1  1  1  6   2.33e-4  5.00e-4  0.5  0.5  0.5  : TCw11
 1  8  1  1  7  12  2.99e-4  5.00e-4  0.5  0.5  0.5  : TCw12
 1  8  1  1  13 13  7.05e-5  5.00e-4  0.5  0.5  0.5  : TCw13
 1  8  1  1  14 14  4.84e-5  5.02e-1  0.5  0.5  0.5  : PTn21
 1  8  1  1  15 15  4.83e-5  5.00e-1  0.5  0.5  0.5  : PTn22
```

M. Zhell 7/15/99

```
4.7336E+08 709.00
6.3115E+08 649.00
9.4673E+08 550.00
1.2623E+09 471.00
1.5779E+09 408.00
1.8935E+09 358.00
2.2090E+09 317.00
2.5246E+09 283.00
2.8402E+09 256.00
5.9959E+09 144.00
9.1517E+09 114.00
1.2307E+10 97.80
1.5463E+10 85.60
3.1242E+10 50.40
6.2800E+10 27.30
9.4357E+10 21.50
1.5747E+11 17.80
3.1526E+11 12.90
0
:
:Output  A=1
Output  P=1 L=1 G=1 T=1 Q=1 B=1 S=-1  ! Look at the *_out. It is better format.
:
: isolv  newtnmn  newtnmx  north  nitmax  level
Solve 4    1      12     2    100    1
:
:AUTO-step  DPMXE   DSMXE  DTMPMXE  DP2MXe TACCEL  IAUTODT  FAC1
AUTO-step  1.0E+4  0.03   3     1.e4 1.0e-3    0    0
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
Tolr   1.0e1 1.e-4 1.e-3 1.0e1 1.e-3 1.e-5 1.e-3
:
:Limit dpmx   dsmx dtmpmx dpamx   dtmn   dtmx   dtfac
LIMIT  1.e+5   .08   6.  1.e+5   1.e-8  1.e5   .334
:
RSTArt 1
:
Plots 1 1 4
377 385  386 393
Time[y] 250.
Time[y] 500.
Time[y] 1000.
Time[y] 2500.
Time[y] 5000.
Time[y] 7500.
Time[y] 10000.
:
:STEADY[y] 1.0E-7 1.0E-07 1.0E-10
:
Ends
```

6 Data Lines Skipped

M. Hill 7/15/99


```
step   time [y]   dt [y]   newton   ncuts  icnv <... solver (cgstb) itrs ...>
  1  1.000E-07 1.000E-07  1(   1)  0(   0)  2   3
dPf(  4  1  70)= 1.12E+02  dSf(  1  1  70)= 1.22E-06  dTf(  1  1  64)=-5.31E-04

 101  9.325E-01 1.245E-02  2(  232)  0(   1)  2   6 10
dPm(  1  1  53)=-1.23E+03  dSm(  1  1  50)= 2.01E-02  dTf(  1  1  53)= 2.51E+00

 102  9.462E-01 1.367E-02  2(  234)  0(   1)  2   4 22
dPm(  1  1  53)=-1.13E+03  dSm(  1  1  50)= 2.42E-02  dTf(  1  1  53)= 2.44E+00

 103  9.614E-01 1.524E-02  2(  236)  0(   1)  2  22  6
dPm(  1  1  48)= 1.29E+03  dSm(  1  1  50)= 2.91E-02  dTf(  1  1  53)= 2.29E+00

 104  9.769E-01 1.548E-02  3(  239)  0(   1)  2   5  4  5
dPm(  1  1  48)= 1.39E+03  dSm(  1  1  50)= 3.14E-02  dTf(  1  1  53)= 1.99E+00

 105  9.920E-01 1.512E-02  3(  242)  0(   1)  2   8  6  5
dPm(  1  1  48)= 1.44E+03  dSm(  1  1  50)= 3.21E-02  dTf(  1  1  53)= 1.42E+00

---------------------------------------------------------------------------
step   time [y]   dt [y]   newton   ncuts  icnv <... solver (cgstb) itrs ...>
 106  1.000E+00 7.968E-03  1(  243)  0(   1)  2   4
dPm(  1  1  48)= 7.32E+02  dSm(  1  1  50)= 1.76E-02  dTf(  1  1  53)= 1.39E+00

--> metra: writing files to disk:  1.0000E+00[y]
      tfldm1.xyp
      tfldf1.xyp
      tvx1.xyp
      tvz1.xyp

---------------------------------------------------------------------------
step   time [y]   dt [y]   newton   ncuts  icnv <... solver (cgstb) itrs ...>
 197  1.000E+01 1.295E-01  3(  562)  0(   2)  2   6  6  3
dPm(  2  1  48)= 6.49E+03  dSf(  6  1  49)= 1.91E-02  dTf(  8  1  46)= 1.39E+00

--> metra: writing files to disk:  1.0000E+01[y]
      tfldm2.xyp
      tfldf2.xyp
      tvx2.xyp
      tvz2.xyp

 198  1.016E+01 1.646E-01  3(  565)  0(   2)  2   6  6  5
dPm(  2  1  48)= 8.08E+03  dSf(  6  1  53)= 2.42E-02  dTf(  8  1  46)= 1.71E+00

 199  1.035E+01 1.842E-01  4(  569)  0(   2)  2   7  6  5  5
dPm(  2  1  48)= 8.84E+03  dSf(  7  1  52)= 2.43E-02  dTf(  5  1  45)= 1.77E+00

 200  1.055E+01 1.963E-01  5(  574)  0(   2)  2   9 10  6  2  1
dPm(  2  1  48)= 8.98E+03  dSm(  2  1  51)= 9.56E-03  dTf(  5  1  45)= 2.25E+00
```

M. Hill 7/15/99

```
 201  1.061E+01 6.928E-02 2( 588) 1( 3) 2 6 6
dPm( 2 1 48)= 3.03E+03 dSm( 2 1 51)= 3.42E-03 dTf( 6 1 45)= 8.93E-01

 202  1.068E+01 6.928E-02 2( 590) 0( 3) 2 7 6
dPm( 2 1 48)= 2.92E+03 dSm( 2 1 51)= 3.45E-03 dTf( 6 1 45)= 9.23E-01

-----------------------------------------------------------------
 step  time [y]  dt [y]   newton  ncuts  icnv <... solver (cgstb) itrs ...>
 477  4.963E+01 1.336E-01 5( 2325) 0( 6) 2 11 13 3 1 5
dPm( 3 1 48)=-6.80E+02 dSm( 3 1 49)= 2.61E-03 dTf( 8 1 34)= 6.86E-01

 478  4.972E+01 8.924E-02 3( 2340) 1( 6) 2 11 10 6
dPm( 3 1 48)=-4.51E+02 dSm( 3 1 49)= 1.76E-03 dTf( 8 1 34)= 4.54E-01

 479  4.981E+01 8.924E-02 3( 2343) 0( 6) 2 11 11 3
dPm( 3 1 48)=-4.49E+02 dSm( 3 1 49)= 1.77E-03 dTf( 1 1 34)= 4.52E-01

 480  5.000E+01 1.890E-01 4( 2347) 0( 6) 2 11 11 3 1
dPm( 3 1 48)=-9.17E+02 dSm( 3 1 49)= 3.80E-03 dTf( 8 1 34)= 9.45E-01

 ==================================================
--> metra: writing files to disk:  5.0000E+01[y]
      tfldm3.xyp
      tfldf3.xyp
      tvx3.xyp
      tvz3.xyp
 ==================================================

 481  5.038E+01 3.780E-01 4( 2351) 0( 6) 1 11 11 5 2
dPm( 3 1 48)=-1.72E+03 dSm( 3 1 49)= 7.81E-03 dTf( 8 1 34)= 1.83E+00

 482  5.088E+01 4.989E-01 4( 2355) 0( 6) 1 11 12 4 5
dPm( 3 1 48)=-2.21E+03 dSm( 3 1 49)= 1.07E-02 dTf( 8 1 34)= 2.33E+00

 483  5.107E+01 1.907E-01 3( 2370) 1( 6) 2 10 10 7
dPm( 3 1 48)=-9.29E+02 dSm( 3 1 49)= 4.11E-03 dTf( 8 1 34)= 8.77E-01

-----------------------------------------------------------------
 562  9.432E+01 1.183E+00 5( 2920) 0( 7) 1 22 19 28 5 1
dPm( 2 1 53)=-3.63E+03 dSm( 3 1 51)= 1.11E-02 dTf( 3 1 30)= 2.55E+00

 563  9.561E+01 1.286E+00 9( 2929) 0( 7) 1 34 12 23 2 13 14 3 10 2
dPm( 2 1 53)=-3.88E+03 dSm( 3 1 51)= 1.20E-02 dTf( 1 1 30)= 2.49E+00

 564  9.655E+01 9.365E-01 5( 2934) 0( 7) 1 31 34 7 6 1
dPm( 2 1 53)=-2.86E+03 dSm( 3 1 51)= 8.73E-03 dTf( 8 1 29)= 1.81E+00

 565  9.779E+01 1.244E+00 7( 2941) 0( 7) 1 28 24 11 6 7 2 10
dPm( 3 1 53)=-3.70E+03 dSm( 3 1 51)= 1.16E-02 dTf( 6 1 29)= 2.99E+00

 566  9.861E+01 8.220E-01 7( 2948) 0( 7) 1 19 17 6 4 1 4 5
dPm( 3 1 53)=-2.46E+03 dSm( 3 1 51)= 7.59E-03 dTf( 1 1 29)= 2.28E+00

 567  9.924E+01 6.281E-01 6( 2954) 0( 7) 1 28 28 9 10 13 3
dPm( 3 1 53)=-1.89E+03 dSm( 3 1 51)= 5.77E-03 dTf( 8 1 29)= 1.79E+00
```

M. Hill 7/15/99


```
-----------------------------------------------------------------
 step  time [y]  dt [y]   newton  ncuts  icnv <... solver (cgstb) itrs ...>
 568  1.000E+02 7.588E-01 4( 2958) 0( 73) 1 32 28 24 3
dPm( 3 1 53)=-2.24E+03 dSm( 3 1 51)= 6.93E-03 dTf( 5 1 29)= 2.16E+00

 ==================================================
--> metra: writing files to disk:  1.0000E+02[y]
      tfldm4.xyp
      tfldf4.xyp
      tvx4.xyp
      tvz4.xyp
 ==================================================

 569  1.009E+02 9.054E-01 4( 2962) 0( 73) 1 28 27 16 2
dPm( 3 1 53)=-2.59E+03 dSm( 3 1 51)= 8.23E-03 dTf( 6 1 29)= 2.51E+00

-----------------------------------------------------------------
 step  time [y]  dt [y]   newton  ncuts  icnv <... solver (cgstb) itrs ...>
 764  1.885E+02 1.879E-01 10( 4251) 0( 110) 2 23 19 9 3 18 36 21 2 1 35
dPm( 4 1 47)= 8.59E+02 dSf( 8 1 62)=-9.63E-04 dTf( 1 1 45)= 2.67E-01

 774  1.901E+02 7.406E-02 2( 4358) 1( 115) 2 39 21
dPm( 4 1 47)= 3.16E+02 dSf( 8 1 63)=-7.46E-04 dTf( 1 1 45)= 1.31E-01

 775  1.902E+02 7.406E-02 1( 4359) 0( 115) 2 13
dPm( 4 1 47)= 3.16E+02 dSf( 8 1 63)=-7.75E-04 dTf( 1 1 45)= 1.37E-01

 776  1.903E+02 1.481E-01 6( 4365) 0( 115) 1 16 18 9 24 5 10
dPm( 1 1 46)= 6.31E+02 dSf( 8 1 63)=-1.63E-03 dTf( 1 1 45)= 2.77E-01

-----------------------------------------------------------------

 1360  9.811E+02 4.697E-01 6( 8366) 1( 259) 1 24 20 16 1 1 2
dPm( 8 1 58)=-1.35E+02 dSf( 8 1 42)=-1.47E-02 dTm( 1 1 49)=-4.48E-02

 1361  9.816E+02 4.697E-01 6( 8372) 0( 259) 1 21 30 18 9 12 1
dPm( 8 1 58)=-1.35E+02 dSf( 1 1 42)=-1.37E-02 dTf( 8 1 43)=-8.00E-02

 1362  9.823E+02 7.492E-01 4( 8376) 0( 259) 1 13 11 1 17
dPm( 8 1 58)=-2.15E+02 dSf( 1 1 42)=-3.71E-03 dTf( 1 1 43)=-1.32E-01

 1363  9.838E+02 1.498E+00 3( 8379) 0( 259) 1 26 24 26
dPm( 8 1 58)=-4.29E+02 dSf( 1 1 42)=-2.45E-03 dTf( 1 1 43)=-2.10E-01

 1364  9.868E+02 2.997E+00 5( 8384) 0( 259) 1 40 39 37 1 8
dPm( 8 1 58)=-8.55E+02 dSf( 1 1 42)=-2.71E-03 dTf( 1 1 43)=-3.84E-01

 1365  9.928E+02 5.993E+00 4( 8388) 0( 259) 1 46 57 12 6
dPm( 8 1 58)=-1.70E+03 dSm( 8 1 58)= 3.31E-03 dTf( 1 1 43)=-7.00E-01

-----------------------------------------------------------------
 step  time [y]  dt [y]   newton  ncuts  icnv <... solver (cgstb) itrs ...>
 1366  1.000E+03 7.183E+00 3( 8391) 0( 259) 1 49 53 13
dPm( 8 1 58)=-2.02E+03 dSm( 8 1 58)= 3.85E-03 dTf( 1 1 43)=-7.93E-01
```

M. Hill 7/15/99

```
--> metra: writing files to disk:  1.0000E+03[y]
      tfldm6.xyp
      tfldf6.xyp
      tvx6.xyp
      tvz6.xyp
```

Routines	cpu-seconds
read/initialization =	5.00
pvt =	5036.00
pckr =	357.00
accm_coefs =	2322.00
solve =	26870.00
updt(psk)(vpk) =	63.00
output =	34.00
Total Metra Exec. =	-51658.00
Gem read/initial =	.00
Gem masstran =	.00
Gem-Update =	.00
Total Metra + Gem =	-51658.00

Total Number of Steps = 1366
Total Newtonian Iters = 8391
Cumulative Inner Itrs = 122099
Total Time-Step Cuts = 259
Min Time Step Size = .100E-06 y
Max Time Step Size = .207E+02 y

M. Hill 7/15/99

MH 7/15/99

~~File: drift60. dat /home/sneezy/mhill/multi~~

amended file provided by D. Hughson p 47-58 of this notebook as follows: 1) changed # of elements from 8 to 15 & 2) changed heat multiplier from 0.13705 to 0.27990. Lastly 3) the size of the grid-blocks was changed.
MH 7/15/99 provided by D. Hughson

MH 7/15/99

* Note 3 pages of original file are missing from p 47-58 of this notebook & have been included below

```
 32 Van-Gen     0.01   0.654      1.12e-3   -0.0e+8  0.0    0
:
: i type-curv   swirm  rpmm(lamda) alpham    swext  sgc    iecm
:
: (CH4zc - matrix)
 33 Van-Gen     0.33   0.4322     1.03e-6   -0.0e+8  0.0    0
:
: (CH4zc - fracture)
 34 Van-Gen     0.01   0.667      1.14e-3   -0.0e+8  0.0    0
:
: (PP3vp - matrix)
 35 Van-Gen     0.07   0.3142     1.66e-5   -0.0e+8  0.0    0
:
: (PP3vp - fracture)
 36 Van-Gen     0.01   0.667      1.42e-3   -0.0e+8  0.0    0
:
: (PP2zp - matrix)
 37 Van-Gen     0.18   0.3568     8.39e-6   -0.0e+8  0.0    0
:
: (PP2zp - fracture)
 38 Van-Gen     0.01   0.667      1.14e-3   -0.0e+8  0.0    0
:
: (BF3vb - matrix)
 39 Van-Gen     0.07   0.3142     1.66e-5   -0.0e+8  0.0    0
:
: (Bf3vb - fracture)
 40 Van-Gen     0.01   0.667      1.42e-3   -0.0e+8  0.0    0
:
: ******************
: Metal Waste Package
: ******************
:
 41 Van-Gen     0.0001 0.4400     5.80e-7   -0.0e+8  0.0    0
:
0
: ***************
: Debug options
: ***************
Debug  1
0
:
: ********************
: Thermal properties
: ********************
: no = sequential number of data set
: rho = rock density (kg/m^3)
: cpr = rock specific heat (J/kg-K)
: ckdry = thermal conductivity of dry rock (J/s/m-K)
: cksat = thermal conductivity of liquid saturated rock (J/s/m-K)
: crp = pore compressibility with pressure at constant T (1/Pa)
: crt = absolute value of pore compressibility with pressure at constant T (1/Pa)
: tau = tortuosity for binary diffusion
: cdiff = vapor-dir diffusion coefficient, (m^2/s)
: cexp = exponent for binary diffusion
: enbd = enhanced binary diffusion coefficient
:
Thermal-prop
: no rho     cpr   ckdry cksat   crp  crt  tau cdiff  cexp  enbd
: (TCw11 - matrix)
 1 2.510e+03 847.   1.02  1.76   0    0   .5 2.13e-5 1.8  0.
: (TCw12 - matrix)
 2 2.510e+03 837.   1.28  1.88   0    0   .5 2.13e-5 1.8  0.
: (TCw13 - matrix)
 3 2.470e+03 857.   0.54  0.98   0    0   .5 2.13e-5 1.8  0.
: (PTn21 - matrix)
 4 2.340e+03 1080.  0.35  0.50   0    0   .5 2.13e-5 1.8  0.
: (PTn22 - matrix)
 5 2.400e+03 849.   0.44  0.97   0    0   .5 2.13e-5 1.8  0.
: (PTn23 - matrix)
 6 2.370e+03 1020   0.46  1.02   0    0   .5 2.13e-5 1.8  0.
: (PTn24 - matrix)
 7 2.260e+03 1330   0.35  0.82   0    0   .5 2.13e-5 1.8  0.
: (PTn25 - matrix)
 8 2.370e+03 1220   0.23  0.67   0    0   .5 2.13e-5 1.8  0.
: (TSw31 - matrix)
 9 2.510e+03 834    0.37  1.00   0    0   .5 2.13e-5 1.8  0.
: (TSw33 - matrix)
 10 2.510e+03 883   0.71  1.80   0    0   .5 2.13e-5 1.8  0.
: (TSw35 - matrix)
 11 2.540e+03 900   1.20  2.02   0    0   .5 2.13e-5 1.8  0.
: (TSw36 - matrix)
 12 2.560e+03 865   1.42  1.84   0    0   .5 2.13e-5 1.8  0.
: (TSw37 - matrix)
 13 2.360e+03 984   1.69  2.08   0    0   .5 2.13e-5 1.8  0.
: (CH1vc - matrix)
 14 2.310e+03 1060  0.70  1.31   0    0   .5 2.13e-5 1.8  0.
: (CH2vc - matrix)
 15 2.240e+03 1200  0.58  1.17   0    0   .5 2.13e-5 1.8  0.
: (CH3zc - matrix)
 16 2.350e+03 1150  0.61  1.20   0    0   .5 2.13e-5 1.8  0.
: (CH4zc - matrix)
 17 2.440e+03 1170  0.73  1.35   0    0   .5 2.13e-5 1.8  0.
: (PP3vp - matrix)
 18 2.580e+03 841   0.66  1.26   0    0   .5 2.13e-5 1.8  0.
: (PP2zp - matrix)
 19 2.510e+03 644   0.74  1.35   0    0   .5 2.13e-5 1.8  0.
: (BF3vb - matrix)
 20 2.580e+03 841   0.66  1.26   0    0   .5 2.13e-5 1.8  0.
:
: ******************
: Metal Waste Package
: ******************
:
 21 7.800e+03 450.0  50.0  50.0   0    0   .5 2.13e-5 1.8  0.
:
0
: ****************************
: Define size of grid-blocks
: ****************************
:
DXYZ  0
: (dx(i),i=1,nx)
1.49  1.67  1.8  1.8  1.8  1.8  1.8  1.84
```

M. Hill 7/15/99

```
1  8  1  1  16 16  1.30e-4  5.00e-1  0.5  0.5  0.5  : PTn23
1  8  1  1  17 18  6.94e-5  5.00e-1  0.5  0.5  0.5  : PTn24
1  8  1  1  19 21  3.86e-5  5.00e-1  0.5  0.5  0.5  : PTn25
1  8  1  1  22 22  8.92e-5  4.68e-1  0.5  0.5  0.5  : TSw31
1  8  1  1  23 29  1.05e-4  5.00e-4  0.5  0.5  0.5  : TSw33
1  8  1  1  30 53  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
1  8  1  1  54 58  3.99e-4  5.00e-4  0.5  0.5  0.5  : TSw36
1  8  1  1  59 63  4.92e-4  5.00e-4  0.5  0.5  0.5  : TSw37
1  8  1  1  64 64  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH1vc
1  8  1  1  65 68  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH2vc
1  8  1  1  69 69  1.10e-5  9.22e-1  0.5  0.5  0.5  : CH3vc
1  8  1  1  70 71  1.10e-5  5.00e-1  0.5  0.5  0.5  : CH4vc
1  8  1  1  72 74  7.14e-5  5.00e-4  0.5  0.5  0.5  : PP3vp
1  8  1  1  75 79  1.10e-5  5.00e-1  0.5  0.5  0.5  : PP2zp
1  8  1  1  80 80  7.14e-5  5.00e-4  0.5  0.5  0.5  : BF3vb
:
0
:
:
Recurrent
:
BCON 2
:
:itype  iface  i1  i2  j1  j2
 5  TOP  1  8  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
:0.0  1.e-9   93361.  20.  0.9  .0  0.0
0.0  1.e-9   93361.  20.  0.3  .0  0.0
0.0  5.06e-7  93361.  20.  0.95  .0  0.0
:
/
:itype  iface  i1  i2  j1  j2
 1  BOTTOM  1  8  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  0.0   101325.  30.  0.0  0.0  0.0
0.0  0.0   101325.  30.  0.0  0.0  0.0
:
/
:
Source  1   .13705  1.
:  is1 is2 js1 js2 ks1 ks2  istyp
:
   1 1  1 1  49 49   32
:
: This decay data is from "Characteristics of Spent Fuel, High-Level Waste, and
: Other Radioactive Wastes Which May Require Long-Term Isolation" DoE OCRWM
: DOE/RW-0184, Dec., 1997 Vol 2 of 6 Table 1C.7
: left column is time in seconds starting at 0.0 = 10 years
: right column is Watts per Metric Ton Uranium
: fuel is PWR 3000 MWd/MTU
: multiplier above converts this to Watts/bulk vol
:
0.0000E+00 1020.00
1.8935E+08 949.00
2.5246E+08 813.00
3.1556E+08 780.00
```

M. Hill 7/5/99

Amended File named: drift60.dat
/home/sneezy/mhill/multi

see p 61 orange areas highlight changes


```
$kip

Debra:

I have made several changes in your data file, the significant ones
include (a) letting swext variable to be 0. for all those capillary
pressure tables for which van genuchten parameters do not compute
excessively high capillary pressure near the residual liquid saturation,
and (b) changing the default parameters for many variables in the recurrent
data.

You can perhaps 'diff' your original file with this to see the exact
changes made. If still does not run on your machine (or your version
of metra), let me know.

I have not gone back to identify the cause of your restart run not
working after 10 yrs. May be, I will do it if you again encounter
such restart problem with another run.

See a partial screen dump appended to the data for comparison. It took
much cpu time...

MOhan...

NOskip
:
  METRA-DCM, Patterned after T. Buscheck Case 3 of Drift Scale
  Near-Field/Altered-Zone Models Report UCRL-ID-129179
:
: This is my attempt to reproduce the results for Drift Scale Thermohydrologi
:
: Infiltration rate = 16.0 mm/yr.
:
: 2-D
:
: This is the input file for steady state initial condition calibration
:
RSTART  0
:
:grid  geometry  nx ny   nz ivplwr ipvcal  iout  gravity  pref tref  href
Grid   DCMXYZ    15  1   80   1       1      1     0        0    0     0
:
: ************************************************************************
: i = sequential number of material types
: type = the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm = irreducible liquid saturation for the matrix
: rpmm = Van Genuchten parameter for matrix
: alpham = Van Genuchten parameter for matrix
: swext = liquid saturation below which the capillary pressure is calculated ba
:         on the slope dPcw/dSw evaluated at SWEXT.
: sgc = residual (immobile) gas saturation, fraction
: iecm = Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1 invoke
: swirf = residual liquid saturation for fracture, fraction
: alphaf = parameter in Van-Genuchten equation for fracture (1/Pa)
: phim = matrix porosity (fraction)
: phif = fracture porosity (fraction)
: permm = intinsic matrix permeability (m^2)
: permf = intrinsic fracture permeability
:
Pckr                                  :relative perm and pc keyword
```

M. Hill 7/15/99

	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
1		(TCw11 - matrix)						
	1	Van-Gen	0.13	0.231	1.15e-6	-1.0e+8	0.0	0
		(TCw11 - fracture)						
	2	Van-Gen	0.01	0.667	2.37e-3	-0.0e+8	0.0	0
2		(TCw12 - matrix)						
	3	Van-Gen	0.13	0.2447	2.01e-6	-1.0e+8	0.0	0
		(TCw12 - fracture)						
	4	Van-Gen	0.01	0.669	2.37e-3	-0.0e+8	0.0	0
3		(TCw13 - matrix)						
	5	Van-Gen	0.33	0.4548	3.74e-6	-0.0e+8	0.0	0
		(TCw13 - fracture)						
	6	Van-Gen	0.01	0.669	9.12e-4	-0.0e+8	0.0	0
	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
4		(PTn21 - matrix)						
	7	Van-Gen	0.10	0.2531	3.98e-5	-1.0e+8	0.0	0
		(PTn21 - fracture)						
	8	Van-Gen	0.01	0.669	1.10e-3	-0.0e+8	0.0	0
5		(PTn22 - matrix)						
	9	Van-Gen	0.14	0.4925	7.94e-6	-0.0e+8	0.0	0
		(PTn22 - fracture)						
	10	Van-Gen	0.01	0.669	1.85e-3	-0.0e+8	0.0	0
6		(PTn23 - matrix)						
	11	Van-Gen	0.17	0.3002	5.44e-5	-0.0e+8	0.0	0
		(PTn23 - fracture)						
	12	Van-Gen	0.01	0.667	3.45e-3	-0.0e+8	0.0	0
7		(PTn24 - matrix)						
	13	Van-Gen	0.10	0.3859	3.43e-5	-0.0e+8	0.0	0
		(PTn24 - fracture)						
	14	Van-Gen	0.01	0.667	9.13e-4	-0.0e+8	0.0	0
	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
8		(PTn25 - matrix)						
	15	Van-Gen	0.10	0.3195	1.81e-4	-0.0e+8	0.0	0
		(PTn25 - fracture)						
	16	Van-Gen	0.10	0.320	1.81e-4	-0.0e+8	0.0	0
9		(TSw31 - matrix)						
	17	Van-Gen	0.11	0.2304	5.84e-5	-1.0e+8	0.0	0
		(TSw31 - fracture)						
	18	Van-Gen	0.01	0.566	1.44e-4	-0.0e+8	0.0	0

M. Hill 7/15/99

	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
10		(TSw33 - matrix)						
	19	Van-Gen	0.06	0.2479	6.21e-6	-1.0e+8	0.0	0
		(TSw33 - fracture)						
	20	Van-Gen	0.01	0.667	1.73e-3	-0.0e+8	0.0	0
11		(TSw35 - matrix: Repository horizon)						
	21	Van-Gen	0.08	0.1983	4.01e-6	-1.0e+8	0.0	0
		(TSw35 - fracture: Repository horizon)						
	22	Van-Gen	0.01	0.667	1.26e-3	-0.0e+8	0.0	0
	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
12		(TSw36 - matrix)						
	23	Van-Gen	0.18	0.5138	8.08e-7	-0.0e+8	0.0	0
	23	Van-Gen	0.18	0.5138	2.272e-6	-0.0e+8	0.0	0
		(TSw36 - fracture)						
	24	Van-Gen	0.01	0.667	1.32e-3	-0.0e+8	0.0	0
13		(TSw37 - matrix)						
	25	Van-Gen	0.50	0.3709	5.30e-7	-0.0e+8	0.0	0
	25	Van-Gen	0.50	0.3709	7.3856e-6	-0.0e+8	0.0	0
		(TSw37 - fracture)						
	26	Van-Gen	0.01	0.659	1.19e-3	-0.0e+8	0.0	0
14		(CH1vc - matrix)						
	27	Van-Gen	0.04	0.1592	7.60e-5	-1.0e+8	0.0	0
		(CH1vc - fracture)						
	28	Van-Gen	0.01	0.669	1.18e-3	-0.0e+8	0.0	0
	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
15		(CH2vc - matrix)						
	29	Van-Gen	0.06	0.2291	4.12e-5	-1.0e+8	0.0	0
		(CH2vc - fracture)						
	30	Van-Gen	0.01	0.667	1.18e-3	-0.0e+8	0.0	0
16		(CH3zc - matrix)						
	31	Van-Gen	0.20	0.2119	2.16e-5	-1.0e+8	0.0	0
		(CH3zc - fracture)						
	32	Van-Gen	0.01	0.654	1.12e-3	-0.0e+8	0.0	0
	i	type-curv	swirm	rpmm(lamda)	alpham	swext	sgc	iecm
17		(CH4zc - matrix)						
	33	Van-Gen	0.33	0.4322	1.03e-6	-0.0e+8	0.0	0
		(CH4zc - fracture)						
	34	Van-Gen	0.01	0.667	1.14e-3	-0.0e+8	0.0	0
18		(PP3vp - matrix)						
	35	Van-Gen	0.07	0.3142	1.66e-5	-0.0e+8	0.0	0

M. Hill 7/15/99

```
:
: (PP3vp - fracture)
  36  Van-Gen      0.01     0.667       1.42e-3    -0.0e+8   0.0      0
:
: (PP2zp - matrix)
  37  Van-Gen      0.18     0.3568      8.39e-6    -0.0e+8   0.0      0
:
: (PP2zp - fracture)
  38  Van-Gen      0.01     0.667       1.14e-3    -0.0e+8   0.0      0
:
: (BF3vb - matrix)
  39  Van-Gen      0.07     0.3142      1.66e-5    -0.0e+8   0.0      0
:
: (Bf3vb - fracture)
  40  Van-Gen      0.01     0.667       1.42e-3    -0.0e+8   0.0      0
:
: ********************
: Metal Waste Package
: ********************
  41  Van-Gen      0.0001   0.4400      5.80e-7    -0.0e+8   0.0      0
:
0
: ****************
:  Debug options
: ****************
Debug  1
0
:
: ********************
:  Thermal properties
: ********************
: no = sequential number of data set
: rho = rock density (kg/m^3)
: cpr = rock specific heat (J/kg-K)
: ckdry = thermal conductivity of dry rock (J/s/m-K)
: cksat = thermal conductivity of liquid saturated rock (J/s/m-K)
: crp = pore compressibility with pressure at constant T (1/Pa)
: crt = absolute value of pore compressibility with pressure at constant T (
: tau = tortuosity for binary diffusion
: cdiff = vapor-dir diffusion coefficient, (m^2/s)
: cexp = exponent for binary diffusion
: enbd = enhanced binary diffusion coefficient
:
Thermal-prop
: no rho        cpr     ckdry   cksat   crp   crt   tau   cdiff    cexp   enbd
: (TCw11 - matrix)
  1  2.510e+03 847.     1.02    1.76    0     0     .5    2.13e-5  1.8    0.
: (TCw12 - matrix)
  2  2.510e+03 837.     1.28    1.88    0     0     .5    2.13e-5  1.8    0.
: (TCw13 - matrix)
  3  2.470e+03 857.     0.54    0.98    0     0     .5    2.13e-5  1.8    0.
: (PTn21 - matrix)
  4  2.340e+03 1080.    0.35    0.50    0     0     .5    2.13e-5  1.8    0.
: (PTn22 - matrix)
  5  2.400e+03 849.     0.44    0.97    0     0     .5    2.13e-5  1.8    0.
: (PTn23 - matrix)
  6  2.370e+03 1020     0.46    1.02    0     0     .5    2.13e-5  1.8    0.
: (PTn24 - matrix)
  7  2.260e+03 1330     0.35    0.82    0     0     .5    2.13e-5  1.8    0.
: (PTn25 - matrix)
```

M. Hill 7/15/99


```
  8  2.370e+03 1220     0.23    0.67    0     0     .5    2.13e-5  1.8    0.
: (TSw31 - matrix)
  9  2.510e+03 834      0.37    1.00    0     0     .5    2.13e-5  1.8    0.
: (TSw33 - matrix)
  10 2.510e+03 883      0.71    1.80    0     0     .5    2.13e-5  1.8    0.
: (TSw35 - matrix)
  11 2.540e+03 900      1.20    2.02    0     0     .5    2.13e-5  1.8    0.
: (TSw36 - matrix)
  12 2.560e+03 865      1.42    1.84    0     0     .5    2.13e-5  1.8    0.
: (TSw37 - matrix)
  13 2.360e+03 984      1.69    2.08    0     0     .5    2.13e-5  1.8    0.
: (CH1vc - matrix)
  14 2.310e+03 1060     0.70    1.31    0     0     .5    2.13e-5  1.8    0.
: (CH2vc - matrix)
  15 2.240e+03 1200     0.58    1.17    0     0     .5    2.13e-5  1.8    0.
: (CH3zc - matrix)
  16 2.350e+03 1150     0.61    1.20    0     0     .5    2.13e-5  1.8    0.
: (CH4zc - matrix)
  17 2.440e+03 1170     0.73    1.35    0     0.    .5    2.13e-5  1.8    0.
: (PP3vp - matrix)
  18 2.580e+03 841      0.66    1.26    0     0     .5    2.13e-5  1.8    0.
: (PP2zp - matrix)
  19 2.510e+03 644      0.74    1.35    0     0     .5    2.13e-5  1.8    0.
: (BF3vb - matrix)
  20 2.580e+03 841      0.66    1.26    0     0     .5    2.13e-5  1.8    0.
:
: ********************
: Metal Waste Package
: ********************
:
  21 7.800e+03 450.0    50.0    50.0    0     0     .5    2.13e-5  1.8    0.
:
0
: ******************************
:  Define size of grid-blocks
: ******************************
:
DXYZ    0
: (dx(i),i=1,nx)
[redacted]
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
 7.0  8.2  9.0  9.0 10.0 10.0 10.0 10.0 10.0  9.0
 8.0  6.3  4.5  7.0  7.0  4.6  6.9  7.0  7.0  7.5
 7.0  7.0  7.0  8.0 11.0 14.0 16.0 15.0 14.0 13.0
12.0 11.0 10.0  9.0  8.0  7.0  6.0  6.0  5.0  5.0
 5.0  5.0  5.0  5.0  5.0  5.0  3.48 2.08 1.44 1.0
 1.5  2.0  3.0  5.0  6.0  7.0  9.0 10.5 13.0 14.0
14.3 15.0 15.0 16.2 15.0 15.0 11.5  9.0  9.7 12.3
14.0 15.0 15.0 17.0 18.0 16.0 14.0 12.0  8.4  6.5
: fracture permeabilities modified from Buscheck by dividing by fracture porosit
PHIK
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm   istm
:
  1  [redacted] 1  1  1  6   2    1   0. 1.0000 2.59e-08 2.59e-08 9.83e-08 0.066 5.40e-
  1  [redacted] 1  1  7  12  4    2   0. 1.0000 2.02e-08 2.02e-08 4.62e-08 0.066 5.40e-
  1  [redacted] 1  1  13 13  6    3   0. 1.0000 3.40e-09 3.40e-09 4.00e-08 0.140 5.69e-
```

384.56 mt 12/21/99 ~~top of CHIVC~~ = 605.7
top of H2O table
.72

502.5 top of CHIVC

386

2.2
5.8
72
mk 7/27/99
7
3
7
13
15.9

header
root
385.28

ithrmm
1
2
3

M. Hill 7/15/99

```
  1  15  1  1  14  14   8    4  0. 1.0000 1.08e-08 1.08e-08 1.08e-08 0.369 1.61e-
  1  15  1  1  15  15  10    5  0. 1.0000 4.04e-09 4.04e-09 4.04e-09 0.234 3.30e-
  1  15  1  1  16  16  12    6  0. 1.0000 1.98e-09 1.98e-09 1.98e-09 0.353 5.40e-
  1  15  1  1  17  18  14    7  0. 1.0000 8.89e-10 8.89e-10 8.89e-10 0.469 8.80e-
  1  15  1  1  19  21  16    8  0. 1.0000 2.01e-09 2.01e-09 2.01e-09 0.464 3.18e-
  1  15  1  1  22  22  18    9  0. 1.0000 1.12e-08 1.12e-08 1.20e-07 0.042 7.76e-
  1  15  1  1  23  29  20   10  0. 1.0000 8.49e-09 8.49e-09 2.50e-07 0.135 2.04e-
  2  15  1  1  30  53  22   11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
  1   1  1  1  30  48  22   11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
  1   1  1  1  49  49  41   21  0. .0000 1.00E-44 1.00e-44 1.00E-44 0.000 1.0E-44
  1   1  1  1  50  50  22   11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
  1   1  1  1  51  53  22   11  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
  1  15  1  1  54  58  24   12  0. 1.0000 3.01e-09 3.01e-09 3.01e-09 0.092 8.70e-
  1  15  1  1  59  63  26   13  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.020 8.32e-
  1  15  1  1  59  63  26   13  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.020 4.08e-
  1  15  1  1  64  64  28   14  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.265 1.60e-
  1  15  1  1  65  68  30   15  0. 1.0000 4.03e-09 4.03e-09 4.03e-09 0.321 5.50e-
  1  15  1  1  69  69  32   16  0. 1.0000 1.06e-09 1.06e-09 2.28e-09 0.240 2.50e-
  1  15  1  1  70  71  34   17  0. 1.0000 1.41e-09 1.41e-09 2.28e-09 0.169 5.49e-
  1  15  1  1  72  74  36   18  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-
  1  15  1  1  75  79  38   19  0. 1.0000 5.87e-09 5.87e-09 2.28e-09 0.197 1.75e-
  1  15  1  1  80  80  40   20  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-
:
0
:
Init
:
:EQUIL depth  pdepth  tdepth  tgrad  param  iequil
:
:EQUIL 926.9  101325  30.  .013757     0.0       40
:
: i1  i2  j1  j2  k1  k2        p          t          sg          xg2       pm
:
   1  15   1   1   1   1 9.33917E+04   20.0372 9.8730E-01 0.0000E+00 9.3221E+04
   1  15   1   1   2   2 9.34736E+04   20.1181 9.8738E-01 0.0000E+00 9.3248E+04
   1  15   1   1   3   3 9.35664E+04   20.2095 9.8747E-01 0.0000E+00 9.3338E+04
   1  15   1   1   4   4 9.36636E+04   20.3051 9.8756E-01 0.0000E+00 9.3445E+04
   1  15   1   1   5   5 9.37662E+04   20.4058 9.8766E-01 0.0000E+00 9.3562E+04
   1  15   1   1   6   6 9.38743E+04   20.5118 9.8755E-01 0.0000E+00 9.3682E+04
   1  15   1   1   7   7 9.39825E+04   20.6145 9.8759E-01 0.0000E+00 9.3789E+04
   1  15   1   1   8   8 9.40907E+04   20.7141 9.8774E-01 0.0000E+00 9.3899E+04
   1  15   1   1   9   9 9.41991E+04   20.8137 9.8793E-01 0.0000E+00 9.4008E+04
   1  15   1   1  10  10 9.43021E+04   20.9083 9.8815E-01 0.0000E+00 9.4113E+04
   1  15   1   1  11  11 9.43943E+04   20.9929 9.8845E-01 0.0000E+00 9.4214E+04
   1  15   1   1  12  12 9.44719E+04   21.0641 9.8928E-01 0.0000E+00 9.4329E+04
   1  15   1   1  13  13 9.45306E+04   21.1410 9.8999E-01 0.0000E+00 9.4489E+04
   1  15   1   1  14  14 9.45930E+04   21.3289 9.9000E-01 0.0000E+00 9.4593E+04
   1  15   1   1  15  15 9.46689E+04   21.5548 9.9000E-01 0.0000E+00 9.4669E+04
   1  15   1   1  16  16 9.47317E+04   21.6903 9.9000E-01 0.0000E+00 9.4732E+04
   1  15   1   1  17  17 9.47940E+04   21.8472 9.8999E-01 0.0000E+00 9.4794E+04
   1  15   1   1  18  18 9.48693E+04   22.0568 9.8999E-01 0.0000E+00 9.4869E+04
   1  15   1   1  19  19 9.49452E+04   22.3028 7.4471E-01 0.0000E+00 9.4945E+04
   1  15   1   1  20  20 9.50239E+04   22.5934 7.3060E-01 0.0000E+00 9.5024E+04
   1  15   1   1  21  21 9.51025E+04   22.8787 7.0264E-01 0.0000E+00 9.5103E+04
   1  15   1   1  22  22 9.51783E+04   23.0884 9.4771E-01 0.0000E+00 9.5177E+04
   1  15   1   1  23  23 9.52543E+04   23.2011 9.8640E-01 0.0000E+00 9.5182E+04
   1  15   1   1  24  24 9.53357E+04   23.2850 9.8646E-01 0.0000E+00 9.5237E+04
   1  15   1   1  25  25 9.54389E+04   23.3913 9.8653E-01 0.0000E+00 9.5333E+04
   1  15   1   1  26  26 9.55749E+04   23.5311 9.8662E-01 0.0000E+00 9.5467E+04
   1  15   1   1  27  27 9.57381E+04   23.6989 9.8674E-01 0.0000E+00 9.5628E+04
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M. Hill 7/15/99


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   1  15   1   1  28  28 9.59070E+04   23.8725 9.8685E-01 0.0000E+00 9.5791E+04
   1  15   1   1  29  29 9.60652E+04   24.0356 9.8523E-01 0.0000E+00 9.5944E+04
   1  15   1   1  30  30 9.62126E+04   24.1760 9.8509E-01 0.0000E+00 9.6098E+04
   1  15   1   1  31  31 9.63491E+04   24.2942 9.8536E-01 0.0000E+00 9.6235E+04
   1  15   1   1  32  32 9.64749E+04   24.4029 9.8565E-01 0.0000E+00 9.6361E+04
   1  15   1   1  33  33 9.65898E+04   24.5021 9.8595E-01 0.0000E+00 9.6477E+04
   1  15   1   1  34  34 9.66939E+04   24.5919 9.8628E-01 0.0000E+00 9.6582E+04
   1  15   1   1  35  35 9.67871E+04   24.6722 9.8666E-01 0.0000E+00 9.6676E+04
   1  15   1   1  36  36 9.68693E+04   24.7430 9.8714E-01 0.0000E+00 9.6762E+04
   1  15   1   1  37  37 9.69407E+04   24.8044 9.8831E-01 0.0000E+00 9.6844E+04
   1  15   1   1  38  38 9.70066E+04   24.8611 9.8996E-01 0.0000E-00 9.6936E+04
   1  15   1   1  39  39 9.70670E+04   24.9131 9.9000E-01 0.0000E-00 9.7034E+04
   1  15   1   1  40  40 9.71219E+04   24.9603 9.9000E-01 0.0000E+00 9.7106E+04
   1  15   1   1  41  41 9.71769E+04   25.0076 9.9000E-01 0.0000E+00 9.7169E+04
   1  15   1   1  42  42 9.72319E+04   25.0548 9.9000E-01 0.0000E+00 9.7228E+04
   1  15   1   1  43  43 9.72869E+04   25.1021 9.9000E-01 0.0000E+00 9.7285E+04
   1  15   1   1  44  44 9.73419E+04   25.1493 9.9000E-01 0.0000E+00 9.7341E+04
   1  15   1   1  45  45 9.73970E+04   25.1966 9.9000E-01 0.0000E+00 9.7397E+04
   1  15   1   1  46  46 9.74520E+04   25.2438 9.9000E-01 0.0000E+00 9.7452E+04
   1  15   1   1  47  47 9.74988E+04   25.2839 9.9000E-01 0.0000E+00 9.7498E+04
   1  15   1   1  48  48 9.75294E+04   25.3102 9.9000E-01 0.0000E+00 9.7528E+04
   1  15   1   1  49  49 9.75488E+04   25.3268 9.9000E-01 0.0000E+00 9.7548E+04
   1  15   1   1  50  50 9.75622E+04   25.3384 9.9000E-01 0.0000E+00 9.7561E+04
   1  15   1   1  51  51 9.75760E+04   25.3502 9.9000E-01 0.0000E+00 9.7574E+04
   1  15   1   1  52  52 9.75953E+04   25.3667 9.9000E-01 0.0000E-00 9.7593E+04
   1  15   1   1  53  53 9.76229E+04   25.3904 9.9000E-01 0.0000E+00 9.7620E+04
   1  15   1   1  54  54 9.76670E+04   25.4304 9.9000E-01 0.0000E+00 9.7659E+04
   1  15   1   1  55  55 9.77277E+04   25.4872 9.9000E-01 0.0000E+00 9.7728E+04
   1  15   1   1  56  56 9.77994E+04   25.5540 9.9000E-01 0.0000E+00 9.7803E+04
   1  15   1   1  57  57 9.78877E+04   25.6357 9.9000E-01 0.0000E+00 9.7894E+04
   1  15   1   1  58  58 9.79954E+04   25.7347 9.8999E-01 0.0000E+00 9.8005E+04
   1  15   1   1  59  59 9.81253E+04   25.8458 9.8997E-01 0.0000E+00 9.8131E+04
   1  15   1   1  60  60 9.82747E+04   25.9665 9.8997E-01 0.0000E+00 9.8275E+04
   1  15   1   1  61  61 9.84315E+04   26.0930 9.8997E-01 0.0000E+00 9.8431E+04
   1  15   1   1  62  62 9.85940E+04   26.2241 9.8998E-01 0.0000E+00 9.8589E+04
   1  15   1   1  63  63 9.87605E+04   26.3588 9.8998E-01 0.0000E+00 9.8721E+04
   1  15   1   1  64  64 9.89339E+04   26.5565 9.9000E-01 0.0000E+00 9.8934E+04
   1  15   1   1  65  65 9.91072E+04   26.8262 9.9000E-01 0.0000E+00 9.9107E+04
   1  15   1   1  66  66 9.92740E+04   27.1024 9.8999E-01 0.0000E+00 9.9274E+04
   1  15   1   1  67  67 9.94213E+04   27.3399 9.8996E-01 0.0000E+00 9.9421E+04
   1  15   1   1  68  68 9.95354E+04   27.5148 9.8930E-01 0.0000E+00 9.9535E+04
   1  15   1   1  69  69 9.96391E+04   27.6665 9.8985E-01 0.0000E+00 9.9639E+04
   1  15   1   1  70  70 9.97582E+04   27.8301 9.9000E-01 0.0000E+00 9.9758E+04
   1  15   1   1  71  71 9.99007E+04   28.0129 9.9000E-01 0.0000E+00 9.9901E+04
   1  15   1   1  72  72 1.00062E+05   28.2399 9.9000E-01 0.0000E+00 1.0006E+05
   1  15   1   1  73  73 1.00230E+05   28.4972 9.9000E-01 0.0000E+00 1.0023E+05
   1  15   1   1  74  74 1.00408E+05   28.7637 9.8999E-01 0.0000E-00 1.0041E+05
   1  15   1   1  75  75 1.00604E+05   29.0363 9.8999E-01 0.0000E-00 1.0060E+05
   1  15   1   1  76  76 1.00789E+05   29.2880 9.8999E-01 0.0000E+00 1.0079E+05
   1  15   1   1  77  77 1.00952E+05   29.5091 9.8999E-01 0.0000E+00 1.0095E+05
   1  15   1   1  78  78 1.01094E+05   29.6987 9.8997E-01 0.0000E+00 1.0109E+05
   1  15   1   1  79  79 1.01205E+05   29.8446 9.8993E-01 0.0000E+00 1.0121E+05
   1  15   1   1  80  80 1.01289E+05   29.9521 9.8952E-01 0.0000E+00 1.0129E+05
   0   0
:
DCMPARA
: i1 i2 j1 j2 k1 k2   volf  areamodf  xlm ylm zlm
:
  1  15  1  1  1  6   2.33e-4  5.00e-4  0.5  0.5  0.5  : TCw11
  1  15  1  1  7  12  2.99e-4  5.00e-4  0.5  0.5  0.5  : TCw12
```

M. Hill 7/15/99

```
  1  15  1  1  13 13  7.05e-5  5.00e-4  0.5  0.5  0.5  : TCw13
  1  15  1  1  14 14  4.84e-5  5.02e-1  0.5  0.5  0.5  : PTn21
  1  15  1  1  15 15  4.83e-5  5.00e-1  0.5  0.5  0.5  : PTn22
  1  15  1  1  16 16  1.30e-4  5.00e-1  0.5  0.5  0.5  : PTn23
  1  15  1  1  17 18  6.94e-5  5.00e-1  0.5  0.5  0.5  : PTn24
  1  15  1  1  19 21  3.86e-5  5.00e-1  0.5  0.5  0.5  : PTn25
  1  15  1  1  22 22  8.92e-5  4.68e-1  0.5  0.5  0.5  : TSw31
  1  15  1  1  23 29  1.05e-4  5.00e-4  0.5  0.5  0.5  : TSw33
  1  15  1  1  30 53  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  1  15  1  1  54 58  3.99e-4  5.00e-4  0.5  0.5  0.5  : TSw36
  1  15  1  1  59 63  4.92e-4  5.00e-4  0.5  0.5  0.5  : TSw37
  1  15  1  1  64 64  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH1vc
  1  15  1  1  65 68  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH2vc
  1  15  1  1  69 69  1.10e-5  9.22e-1  0.5  0.5  0.5  : CH3vc
  1  15  1  1  70 71  1.10e-5  5.00e-1  0.5  0.5  0.5  : CH4vc
  1  15  1  1  72 74  7.14e-5  5.00e-4  0.5  0.5  0.5  : PP3vp
  1  15  1  1  75 79  1.10e-5  5.00e-1  0.5  0.5  0.5  : PP2zp
  1  15  1  1  80 80  7.14e-5  5.00e-4  0.5  0.5  0.5  : BF3vb
:
0
:
:
Recurrent
:
BCON 2
:
:itype  iface  i1  i2  j1  j2
   5  TOP  1  8  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
:0.0  1.e-9    93361.  20. 0.9  .0  0.0
0.0  1.e-9    93361.  20. 0.3  .0  0.0
0.0  5.06e-7  93361.  20.  0.95  .0  0.0
:
/
:itype  iface  i1  i2  j1  j2
 1  BOTTOM  1  8  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  0.0    101325.  30.  0.0  0.0  0.0
0.0  0.0    101325.  30.  0.0  0.0  0.0
:
/
:
Source   1    27990   1.
:  is1 is2 js1 js2 ks1 ks2  istyp
:
    1 1   1 1  49 49    32
:
: This decay data is from "Characteristics of Spent Fuel, High-Level Waste, and
: Other Radioactive Wastes Which May Require Long-Term Isolation" DoE OCRWM
: DOE/RW-0184, Dec., 1997 Vol 2 of 6 Table 1C.7
: left column is time in seconds starting at 0.0 = 10 years
: right column is Watts per Metric Ton Uranium
: fuel is PWR 3000 MWd/MTU
: multiplier above converts this to Watts/bulk vol
:
0.0000E+00 1020.00
1.8935E+08 949.00
2.5246E+08 813.00
3.1558E+08 780.00
4.7336E+08 709.00
```

M. Hill 7/15/99


```
6.3115E+08 649.00
9.4673E+08 550.00
1.2623E+09 471.00
1.5779E+09 408.00
1.8935E+09 358.00
2.2090E+09 317.00
2.5246E+09 283.00
2.8402E+09 256.00
5.9959E+09 144.00
9.1517E+09 114.00
1.2307E+10 97.80
1.5463E+10 85.60
3.1242E+10 50.40
6.2800E+10 27.30
9.4357E+10 21.50
1.5747E+11 17.80
3.1526E+11 12.90
0
:
:Output   A=1
Output  P=1 L=1 G=1 T=1 Q=1 B=1 S=-1  ! Look at the *_out. It is better format
:
:  isolv  newtnmn  newtnmx  north  nitmax  level
Solve 4      1        12      2     100      1
:
:AUTO-step  DPMXE    DSMXE  DTMPMXE  DP2MXe TACCEL   IAUTODT  FAC1
AUTO-step   1.0E+4   0.03     3       1.e4  1.0e-3      0      0
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
Tolr   1.0e1 1.e-4 1.e-3 1.0e1 1.e-3 1.e-5 1.e-3
:
:Limit dpmx    dsmx dtmpmx dpamx    dtmn    dtmx   dtfac
LIMIT  1.e+5    .08    6.  1.e+5    1.e-8  1.e5   .334
:
RSTArt 1
:
Plots 1 1 4
377 385  386 393
Time[y] 250.
Time[y] 500.
Time[y] 1000.
Time[y] 2500.
Time[y] 5000.
Time[y] 7500.
Time[y] 10000.
:
:STEADY[y] 1.0E-7 1.0E-07 1.0E-10
:
Ends

 ============================
      6  Data Lines Skipped
 ============================

-------------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...>
    1  1.000E-07 1.000E-07  1(    1)  0(   0)  2   3
dPf(  4  1  70)= 1.12E+02  dSf(  1  1  70)= 1.22E-06  dTf(  1  1  64)=-5.31E-04

  101  9.325E-01 1.245E-02  2(  232)  0(   1)  2   6 10
```

M. Hill 7/15/99

```
dPm(  1  1  53)=-1.23E+03  dSm(  1  1  50)= 2.01E-02  dTf(  1  1  53)= 2.51E+00

  102  9.462E-01 1.367E-02  2(  234)  0(   1)  2   4 22
dPm(  1  1  53)=-1.13E+03  dSm(  1  1  50)= 2.42E-02  dTf(  1  1  53)= 2.44E+00

  103  9.614E-01 1.524E-02  2(  236)  0(   1)  2  22  6
dPm(  1  1  48)= 1.29E+03  dSm(  1  1  50)= 2.91E-02  dTf(  1  1  53)= 2.29E+00

  104  9.769E-01 1.548E-02  3(  239)  0(   1)  2   5  4  5
dPm(  1  1  48)= 1.39E+03  dSm(  1  1  50)= 3.14E-02  dTf(  1  1  53)= 1.99E+00

  105  9.920E-01 1.512E-02  3(  242)  0(   1)  2   8  6  5
dPm(  1  1  48)= 1.44E+03  dSm(  1  1  50)= 3.21E-02  dTf(  1  1  53)= 1.42E+00

-------------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...>
  106  1.000E+00 7.968E-03  1(  243)  0(   1)  2   4
dPm(  1  1  48)= 7.32E+02  dSm(  1  1  50)= 1.76E-02  dTf(  1  1  53)= 1.39E+00

    ==========================================
--> metra: writing files to disk:  1.0000E+00[y]
          tfldm1.xyp
          tfldf1.xyp
          tvx1.xyp
          tvz1.xyp
    ==========================================


-------------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...>
  197  1.000E+01 1.295E-01  3(  562)  0(   2)  2   6  6  3
dPm(  2  1  48)= 6.49E+03  dSf(  6  1  49)= 1.91E-02  dTf(  8  1  46)= 1.39E+00

    ==========================================
--> metra: writing files to disk:  1.0000E+01[y]
          tfldm2.xyp
          tfldf2.xyp
          tvx2.xyp
          tvz2.xyp
    ==========================================


  198  1.016E+01 1.646E-01  3(  565)  0(   2)  2   6  6  5
dPm(  2  1  48)= 8.08E+03  dSf(  6  1  53)= 2.42E-02  dTf(  8  1  46)= 1.71E+00

  199  1.035E+01 1.842E-01  4(  569)  0(   2)  2   7  6  5  5
dPm(  2  1  48)= 8.84E+03  dSf(  7  1  52)= 2.43E-02  dTf(  5  1  45)= 1.77E+00

  200  1.055E+01 1.963E-01  5(  574)  0(   2)  2   9 10  6  2  1
dPm(  2  1  48)= 8.98E+03  dSm(  2  1  51)= 9.56E-03  dTf(  5  1  45)= 2.25E+00

  201  1.061E+01 6.928E-02  2(  588)  1(   3)  2   6  6
dPm(  2  1  48)= 3.03E+03  dSm(  2  1  51)= 3.42E-03  dTf(  6  1  45)= 8.93E-01

  202  1.068E+01 6.928E-02  2(  590)  0(   3)  2   7  6
dPm(  2  1  48)= 2.92E+03  dSm(  2  1  51)= 3.45E-03  dTf(  6  1  45)= 9.23E-01

-------------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...>
  477  4.963E+01 1.336E-01  5( 2325)  0(  62)  2  11 13  3  1  5
```

M. Hill 7/15/99


```
dPm(  3  1  48)=-6.80E+02  dSm(  3  1  49)= 2.61E-03  dTf(  8  1  34)= 6.86E-01

  478  4.972E+01 8.924E-02  3( 2340)  1(  63)  2  11 10  6
dPm(  3  1  48)=-4.51E+02  dSm(  3  1  49)= 1.76E-03  dTf(  8  1  34)= 4.54E-01

  479  4.981E+01 8.924E-02  3( 2343)  0(  63)  2  11 11  3
dPm(  3  1  48)=-4.49E+02  dSm(  3  1  49)= 1.77E-03  dTf(  1  1  34)= 4.52E-01

  480  5.000E+01 1.890E-01  4( 2347)  0(  63)  2  11 11  3  1
dPm(  3  1  48)=-9.17E+02  dSm(  3  1  49)= 3.80E-03  dTf(  8  1  34)= 9.45E-01

    ==========================================
--> metra: writing files to disk:  5.0000E+01[y]
          tfldm3.xyp
          tfldf3.xyp
          tvx3.xyp
          tvz3.xyp
    ==========================================


  481  5.038E+01 3.780E-01  4( 2351)  0(  63)  1  11 11  5  2
dPm(  3  1  48)=-1.72E+03  dSm(  3  1  49)= 7.81E-03  dTf(  8  1  34)= 1.83E+00

  482  5.088E+01 4.989E-01  4( 2355)  0(  63)  1  11 12  4  5
dPm(  3  1  48)=-2.21E+03  dSm(  3  1  49)= 1.07E-02  dTf(  8  1  34)= 2.33E+00

  483  5.107E+01 1.907E-01  3( 2370)  1(  64)  2  10 10  7
dPm(  3  1  48)=-9.29E+02  dSm(  3  1  49)= 4.11E-03  dTf(  8  1  34)= 8.77E-01

-------------------------------------------------------------------------------
  562  9.432E+01 1.183E+00  5( 2920)  0(  73)  1  22 19 28  5  1
dPm(  2  1  53)=-3.63E+03  dSm(  3  1  51)= 1.11E-02  dTf(  3  1  30)= 2.55E+00

  563  9.561E+01 1.286E+00  9( 2929)  0(  73)  1  34 12 23  2 13 14  3 10  2
dPm(  2  1  53)=-3.88E+03  dSm(  3  1  51)= 1.20E-02  dTf(  1  1  30)= 2.49E+00

  564  9.655E+01 9.365E-01  5( 2934)  0(  73)  1  31 34  7  6  1
dPm(  2  1  53)=-2.86E+03  dSm(  3  1  51)= 8.73E-03  dTf(  8  1  29)= 1.81E+00

  565  9.779E+01 1.244E-00  7( 2941)  0(  73)  1  28 24 11  6  7  2 10
dPm(  3  1  53)=-3.70E-03  dSm(  3  1  51)= 1.16E-02  dTf(  6  1  29)= 2.99E+00

  566  9.861E+01 8.220E-01  7( 2948)  0(  73)  1  19 17  6  4  1  4  5
dPm(  3  1  53)=-2.46E+03  dSm(  3  1  51)= 7.59E-03  dTf(  1  1  29)= 2.28E+00

  567  9.924E+01 6.281E-01  6( 2954)  0(  73)  1  28 28  9 10 13  3
dPm(  3  1  53)=-1.89E+03  dSm(  3  1  51)= 5.77E-03  dTf(  8  1  29)= 1.79E+00

-------------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...>
  568  1.000E+02 7.588E-01  4( 2958)  0(  73)  1  32 28 24  3
dPm(  3  1  53)=-2.24E+03  dSm(  3  1  51)= 6.93E-03  dTf(  5  1  29)= 2.16E+00

    ==========================================
--> metra: writing files to disk:  1.0000E+02[y]
          tfldm4.xyp
          tfldf4.xyp
          tvx4.xyp
          tvz4.xyp
    ==========================================
```

M. Hill 7/15/99

```
 569  1.009E+02 9.054E-01  4( 2962)  0(  73)  1  28 27 16  2
dPm(  3  1  53)=-2.59E+03  dSm(  3  1  51)= 8.23E-03  dTf(  6  1  29)= 2.51E-01

-----------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...
 764  1.885E+02 1.879E-01 10( 4251)  0( 110)  2  23 19  9  3 18 36 21  2  1
dPm(  4  1  47)= 8.59E+02  dSf(  8  1  62)=-9.63E-04  dTf(  1  1  45)= 2.67E-01

 774  1.901E+02 7.406E-02  2( 4358)  1( 115)  2  39 21
dPm(  4  1  47)= 3.16E+02  dSf(  8  1  63)=-7.46E-04  dTf(  1  1  45)= 1.31E-01

 775  1.902E+02 7.406E-02  1( 4359)  0( 115)  2  13
dPm(  4  1  47)= 3.16E+02  dSf(  8  1  63)=-7.75E-04  dTf(  1  1  45)= 1.37E-01

 776  1.903E+02 1.481E-01  6( 4365)  0( 115)  1  16 18  9 24  5 10
dPm(  1  1  46)= 6.31E+02  dSf(  8  1  63)=-1.63E-03  dTf(  1  1  45)= 2.77E-01

-----------------------------------------------------------------------------

1360  9.811E+02 4.697E-01  6( 8366)  1( 259)  1  24 20 16  1  1  2
dPm(  8  1  58)=-1.35E+02  dSf(  8  1  42)=-1.47E-02  dTm(  1  1  49)=-4.48E-01

1361  9.816E+02 4.697E-01  6( 8372)  0( 259)  1  21 30 18  9 12  1
dPm(  8  1  58)=-1.35E+02  dSf(  1  1  42)=-1.37E-02  dTf(  8  1  43)=-8.00E-01

1362  9.823E+02 7.492E-01  4( 8376)  0( 259)  1  13 11  1 17
dPm(  8  1  58)=-2.15E+02  dSf(  1  1  42)=-3.71E-03  dTf(  1  1  43)=-1.32E-01

1363  9.838E+02 1.498E+00  3( 8379)  0( 259)  1  26 24 26
dPm(  8  1  58)=-4.29E+02  dSf(  1  1  42)=-2.45E-03  dTf(  1  1  43)=-2.10E-01

1364  9.868E+02 2.997E+00  5( 8384)  0( 259)  1  40 39 37  1  8
dPm(  8  1  58)=-8.55E+02  dSf(  1  1  42)=-2.71E-03  dTf(  1  1  43)=-3.84E-01

1365  9.928E+02 5.993E+00  4( 8388)  0( 259)  1  46 57 12  6
dPm(  8  1  58)=-1.70E+03  dSm(  8  1  58)= 3.31E-03  dTf(  1  1  43)=-7.00E-01

-----------------------------------------------------------------------------
 step   time [y]   dt [y]    newton   ncuts  icnv <... solver (cgstb) itrs ...
1366  1.000E+03 7.183E+00  3( 8391)  0( 259)  1  49 53 13
dPm(  8  1  58)=-2.02E+03  dSm(  8  1  58)= 3.85E-03  dTf(  1  1  43)=-7.93E-01

    ==========================================
--> metra: writing files to disk:  1.0000E+03[y]
           tfldm6.xyp
           tfldf6.xyp
           tvx6.xyp
           tvz6.xyp
    ==========================================


=====================================
      Routines            cpu-seconds
=====================================
 read/initialization  =        5.00
        pvt           =     5036.00
        pckr          =      357.00
```

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```
      accm-coefs        =    2322.00
        solve           =   26870.00
   updt(psk)(vpk)       =      63.00
        output          =      34.00
   Total Metra Exec.    =  -51658.00
   Gem  read/initial    =        .00
     Gem masstran       =        .00
     Gem-Update         =        .00
   Total Metra + Gem    =  -51658.00

Total Number of Steps =       1366
Total Newtonian Iters =       8391
Cumulative Inner Itrs =     122099
Total Time-Step Cuts  =        259
Min Time Step Size    =  .100E-06  y
Max Time Step Size    =  .207E+02  y
=====================================
```

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7/19/99 File: drift60-1.dat in vulcan: /home/mhill/multi

file same as drift 60.dat except that the # of time steps was increased in order to zoom in on heat climax (viewed *_out file).

```
:
Plots 1 1 4
377 385  386 393
Time[y] 250.
Time[y] 1000.
Time[y] 2000.
Time[y] 2500.
Time[y] 2700.
Time[y] 3000.
Time[y] 3500.
Time[y] 3700.
Time[y] 3900.
Time[y] 4500.
Time[y] 10000.
```

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File d60-2.dat /home/sneezy/mhill

```
: multiplier above co.
:
0.0000E+00 510
1.8935E+08 475
2.5246E+08 407
3.1558E+08 390
4.7336E+08 355
6.3115E+08 325
9.4673E+08 275
1.2623E+09 236
1.5779E+09 204
1.8935E-09 358.00
2.2090E-09 317.00
2.5246E+09 283.00
2.8402E+09 256.00
5.9959E+09 144.00
9.1517E+09 114.00
1.2307E+10 97.80
1.5463E+10 85.60
3.1242E+10 50.40
6.2800E+10 27.30
9.4357E+10 21.50
1.5747E-11 17.80
3.1526E-11 12.90
0
Skip
0.0000E+00 1020.00
1.8935E+08 949.00

2.5246E+08 813.00
3.1558E+08 780.00
4.7336E+08 709.00
6.3115E+08 649.00
9.4673E+08 550.00
1.2623E+09 471.00
1.5779E+09 408.00
NOSKIP
:
```

modified → reduced heat by 50% for first 50 years per DOE ventilation

note: need to re-run to obtain same level of accuracy as original (to 2 decimal places)

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original

M. Hill 7/19/99

M. Hill 7/19/99

7/20/99 Reran d60-2.dat /home/sneezy/mhill

```
:
0.0000E+00 510
1.8935E+08 474.5
2.5246E+08 408.5
3.1558E+08 390
4.7336E+08 355.5
6.3115E+08 324.5
9.4673E+08 275
1.2623E+09 235.5
1.5779E+09 204
1.8935E+09 358.00
2.2090E+09 317.00
2.5246E+09 283.00
2.8402E+09 256.00
5.9959E+09 144.00
9.1517E+09 114.00
1.2307E+10 97.80
1.5463E+10 85.60
3.1242E+10 50.40
6.2800E+10 27.30
9.4357E+10 21.50
1.5747E+11 17.80
3.1526E+11 12.90
0
Skip
0.0000E+00 1020.00
1.8935E+08 949.00
```

← increased # of significant figures

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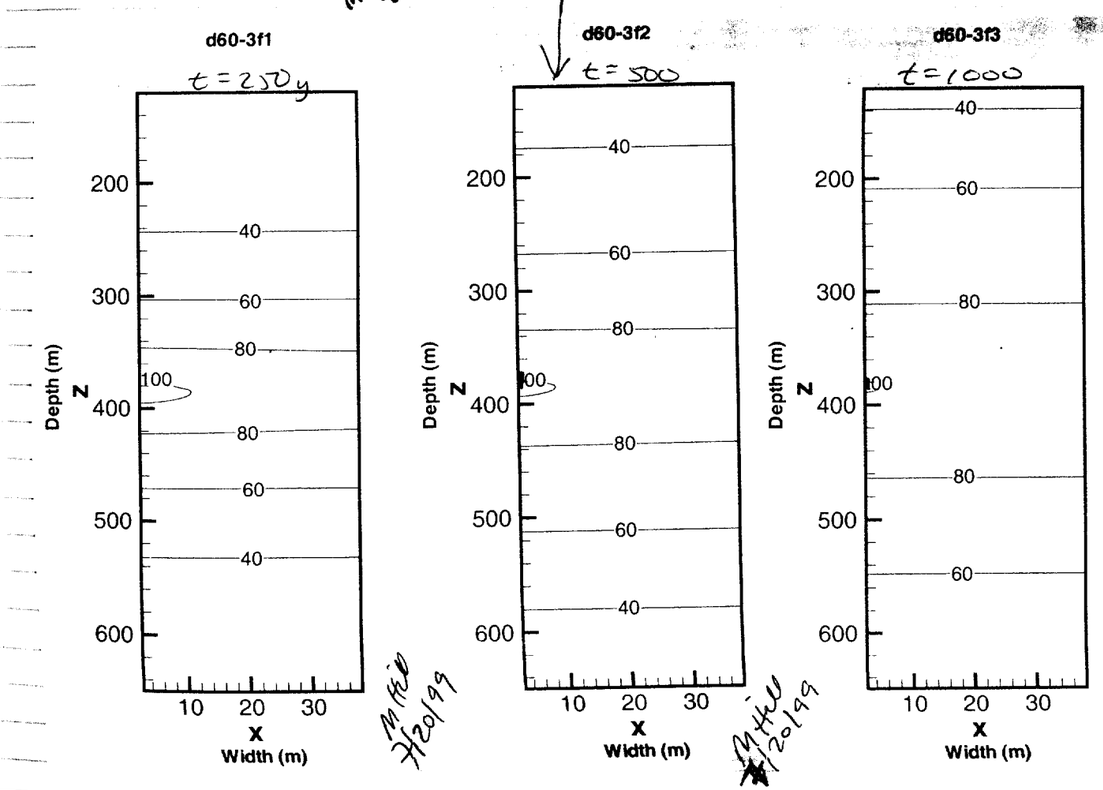
File : d60-3.dat /home/sneezy/mhill

```
:
0.0000E+00 816
1.8935E+08 758.2
2.5246E+08 [illegible]
3.1558E+08 [illegible]
4.7336E+08 567.2
6.3115E+08 519.2
9.4673E+08 440
1.2623E+09 376.8
1.5779E+09 326.4
1.8935E+09 358.00
2.2090E+09 317.00
2.5246E+09 283.00
2.8402E+09 256.00
5.9959E+09 144.00
9.1517E+09 114.00
1.2307E+10 97.80
1.5463E+10 85.60
3.1242E+10 50.40
6.2800E+10 27.30
9.4357E+10 21.50
1.5747E+11 17.80
3.1526E+11 12.90
0
Skip
0.0000E+00 1020.00
1.8935E+08 949.00
```

← reduced heat by 20% for 1st 50 yrs per Leppala's measurements of ventilation

M Hill 7/20/99

contour variable is heat



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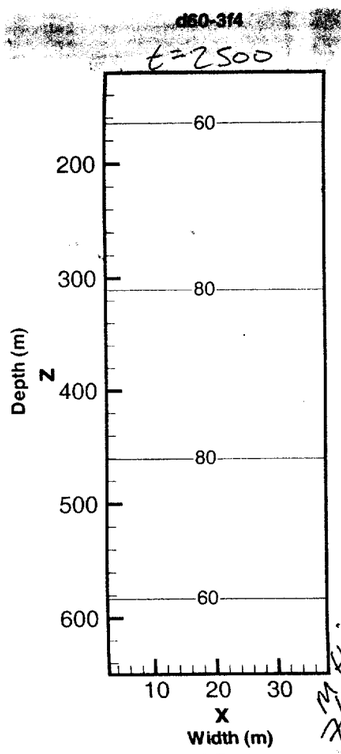
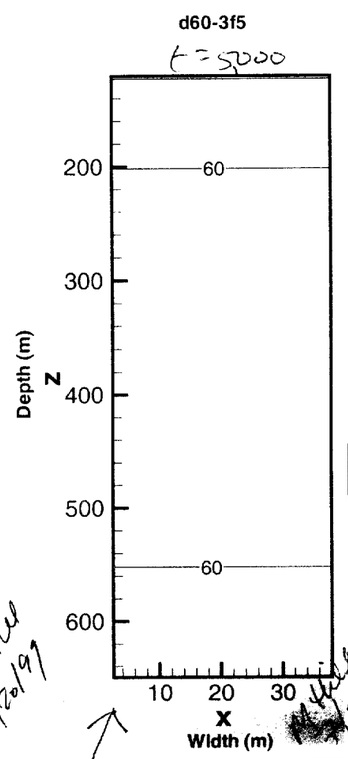
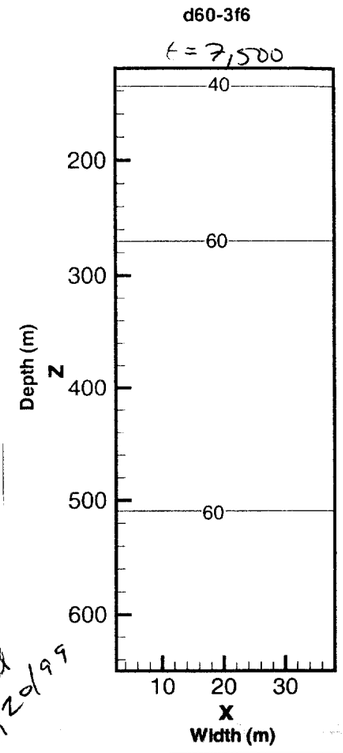
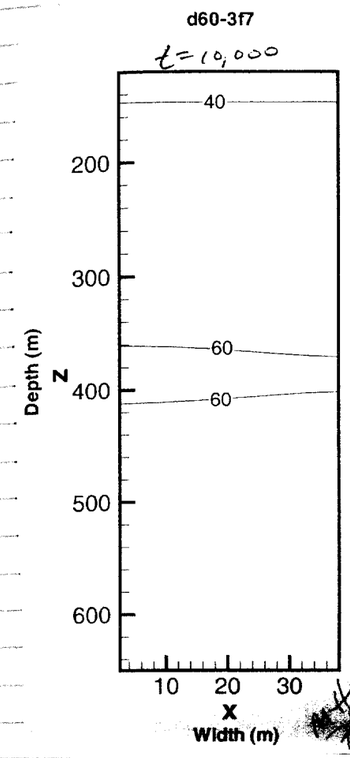
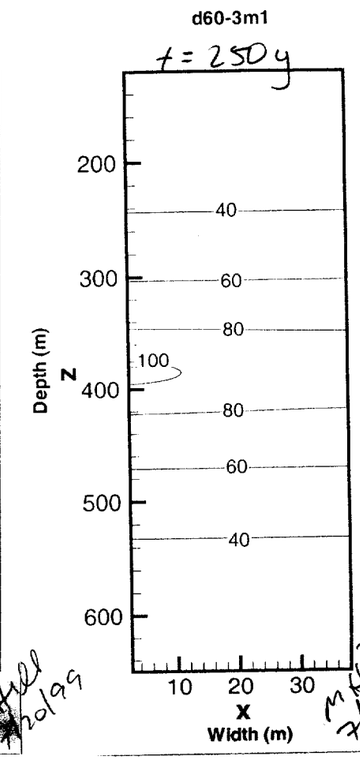


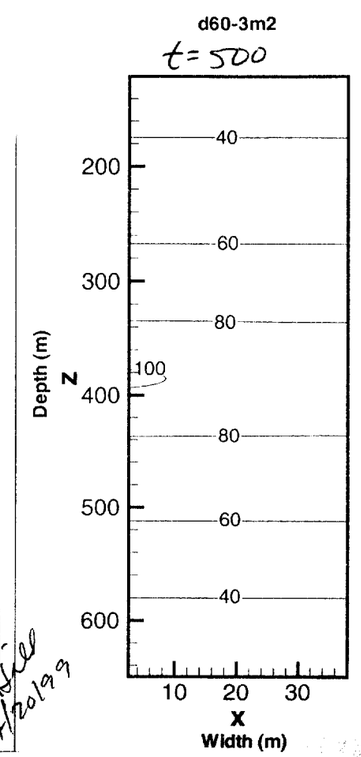




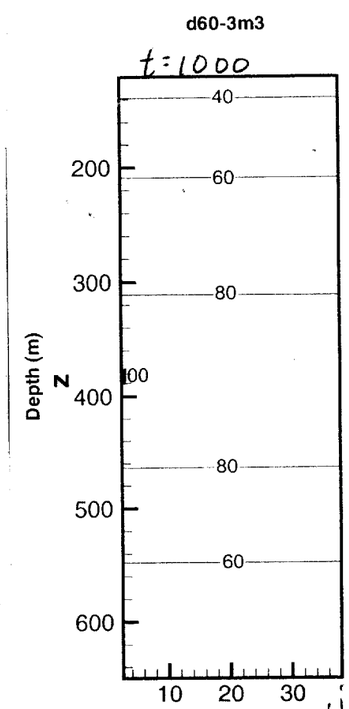
contour variable is heat







contour variable is heat



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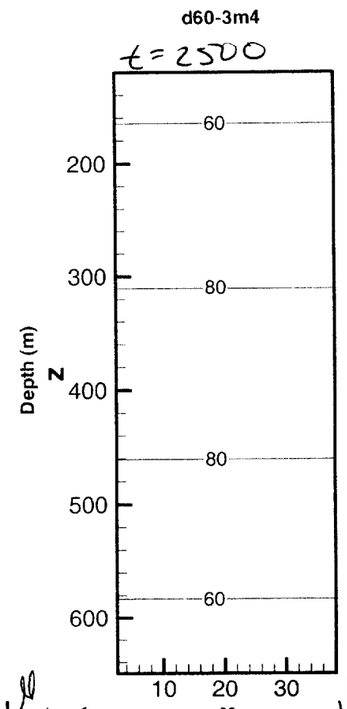

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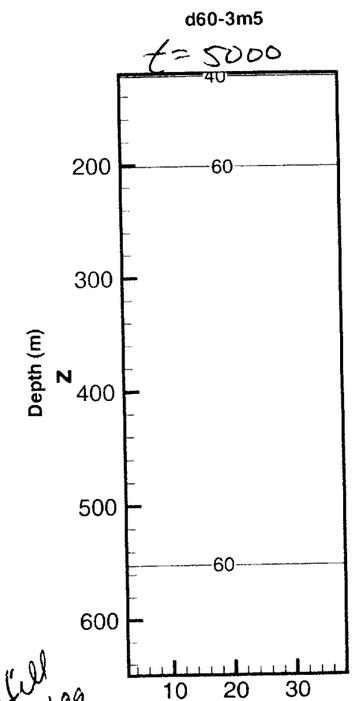
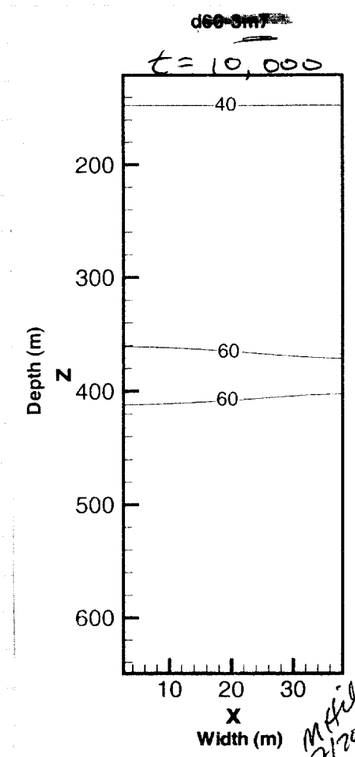


contour variable is heat

* note: out of order



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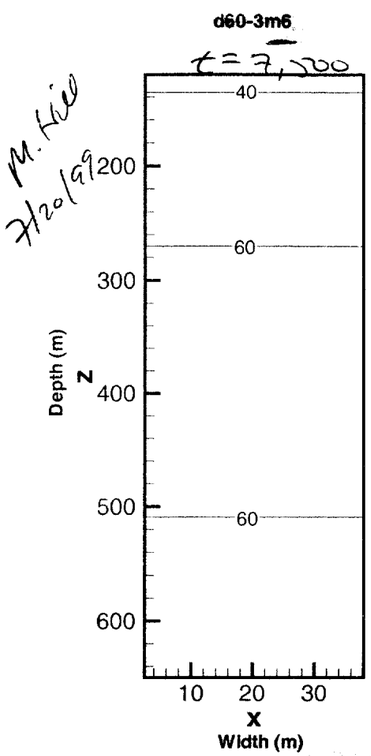

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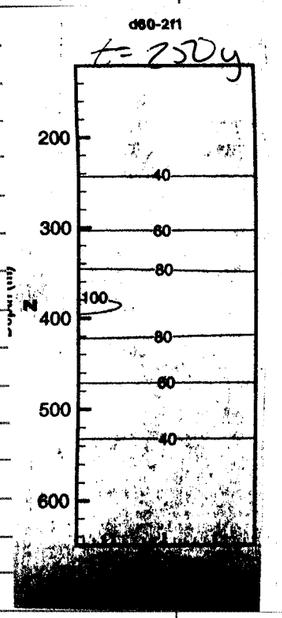
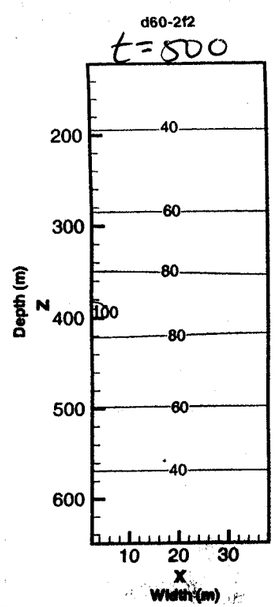
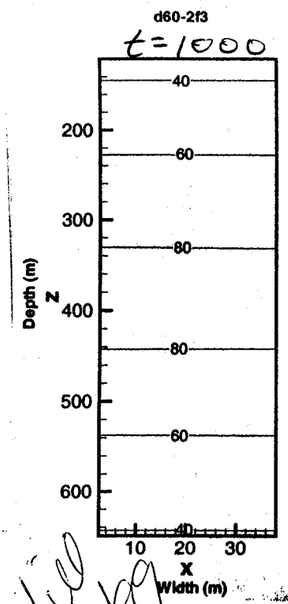
contour variable is heat

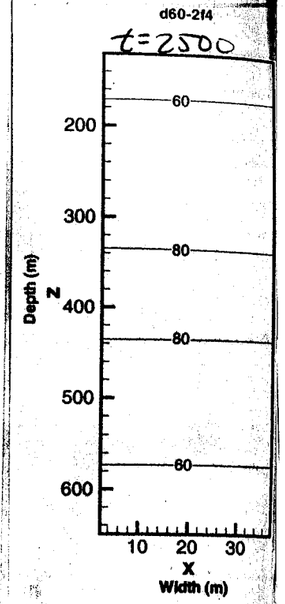
MH 7/27/99 * 50% reduction due to ventilation p 74 of this notebook

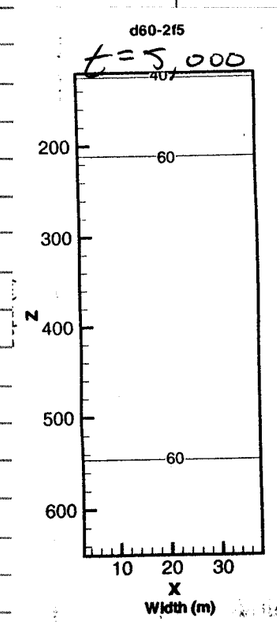
File: d60-2.dat /home/sneezin/mhil

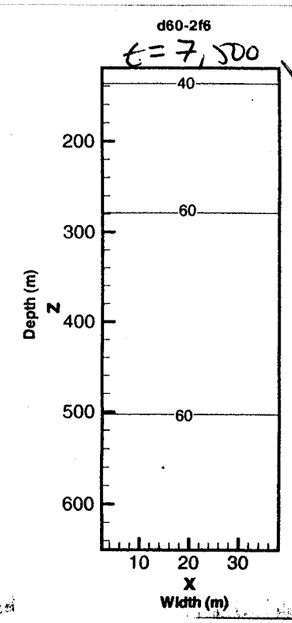


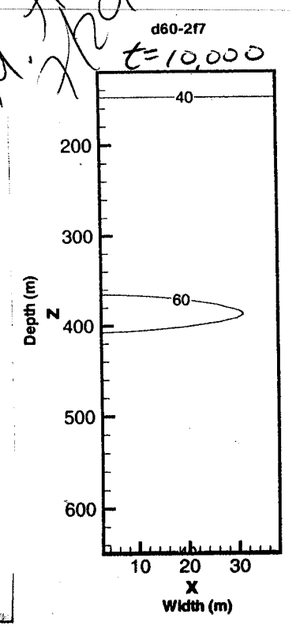


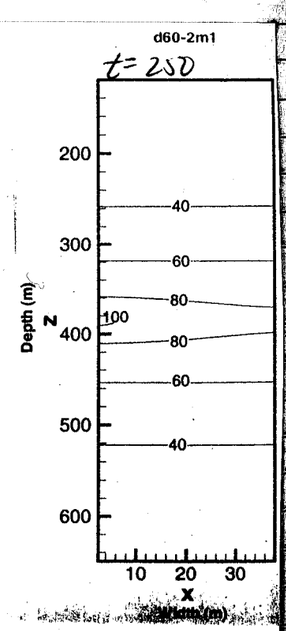




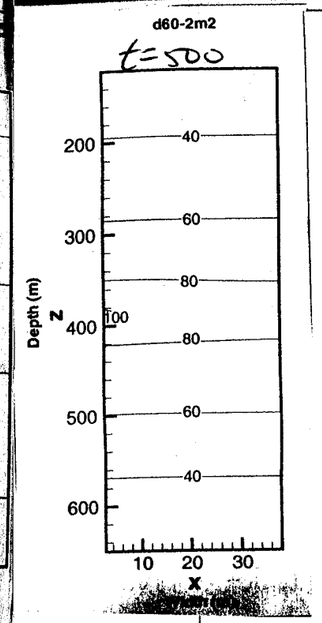


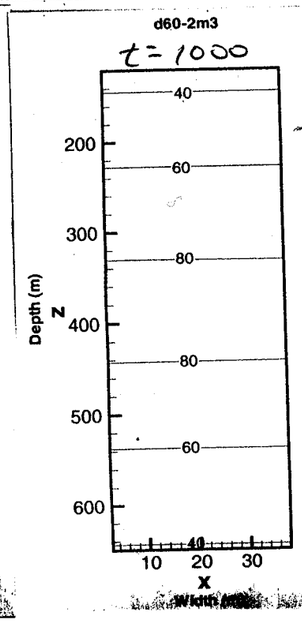


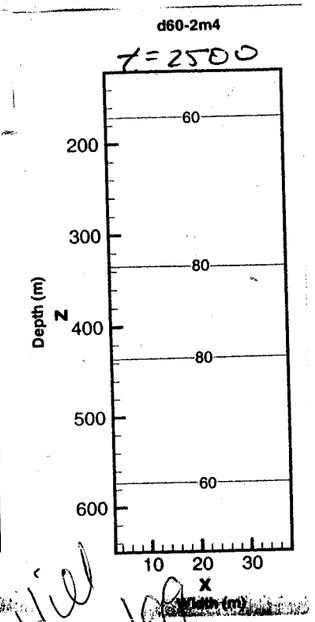


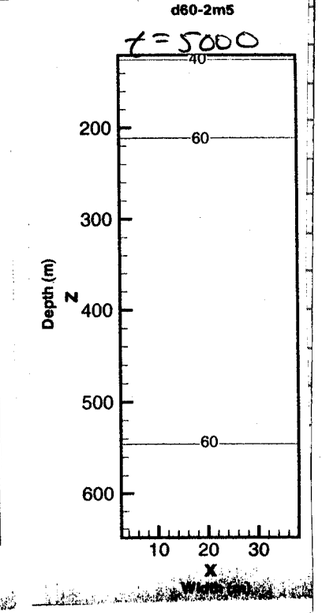


M. Hill 7/20/99









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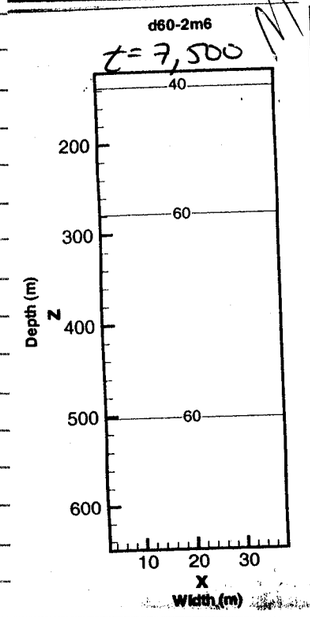
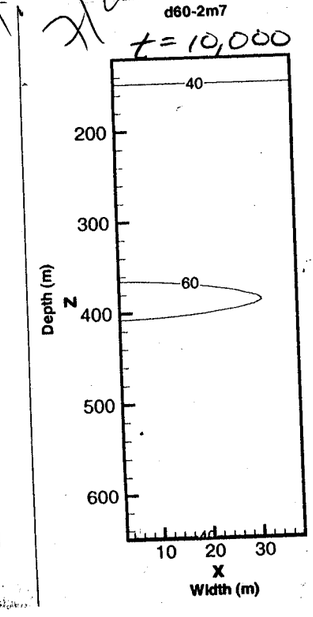




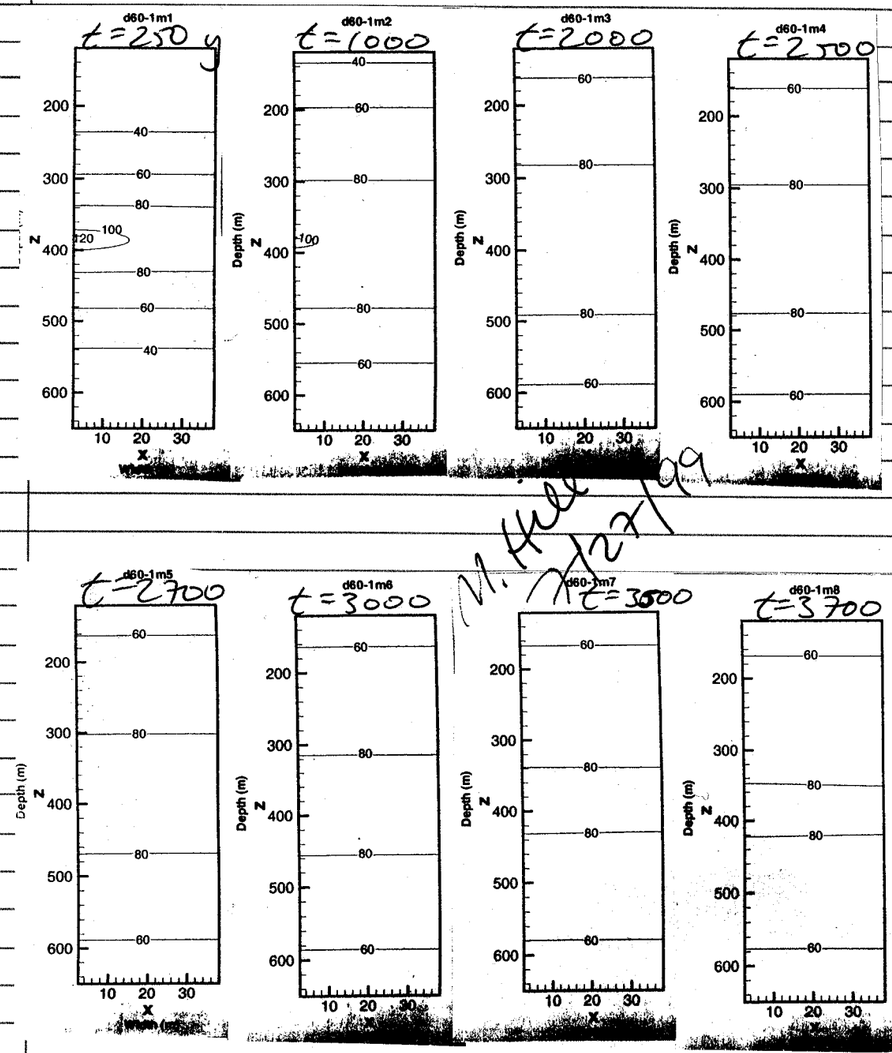
M Hill 7/20/99

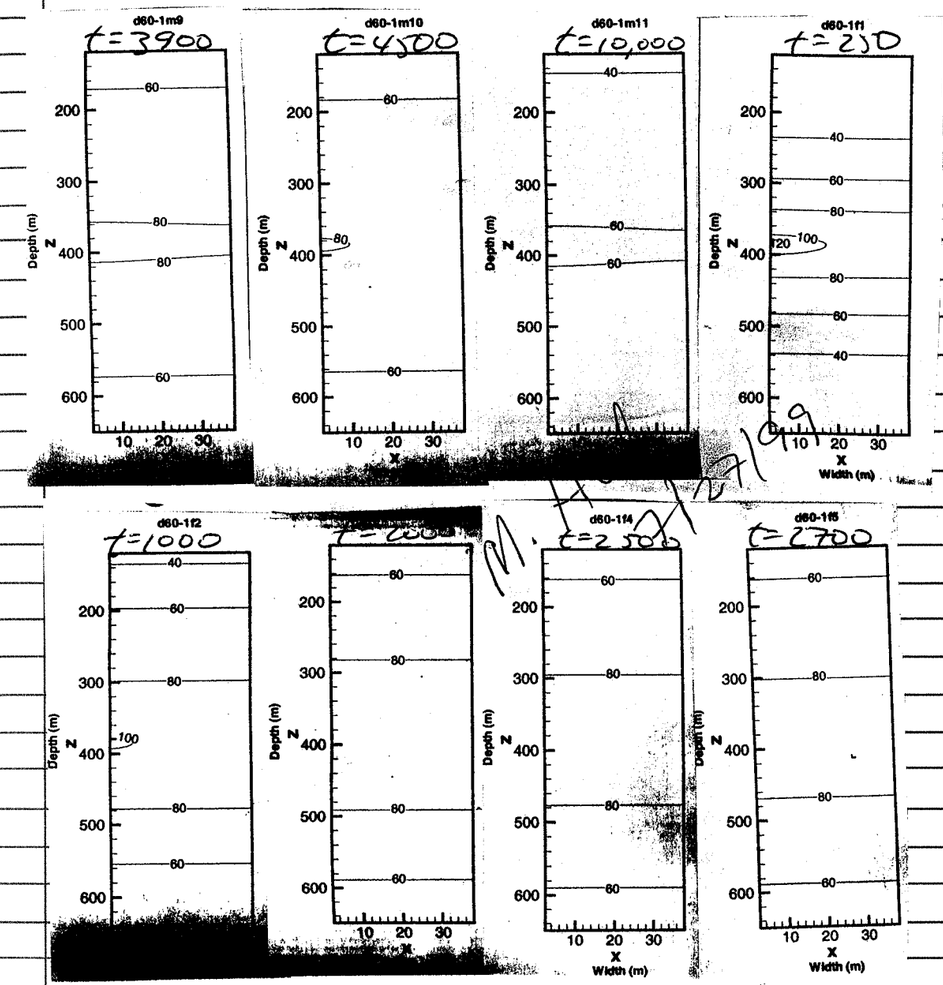
MH 7/27/99

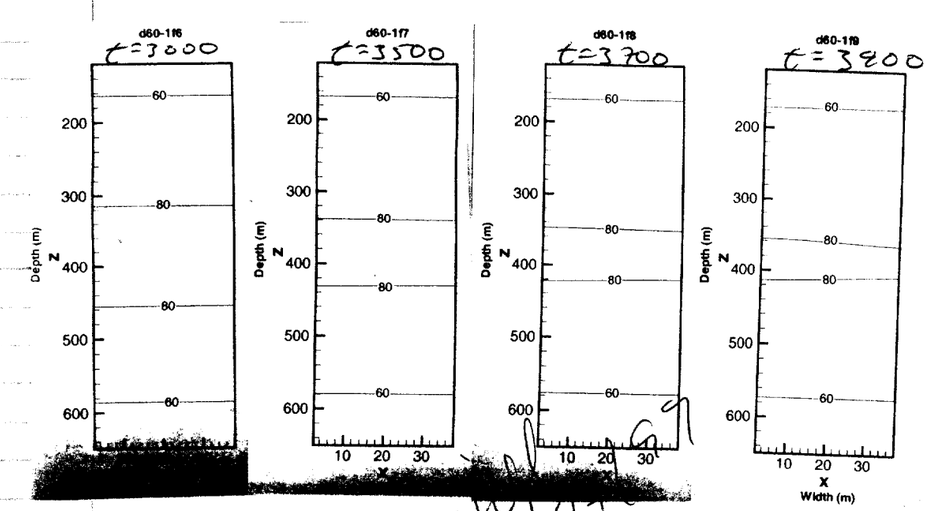
drift60-1.dat

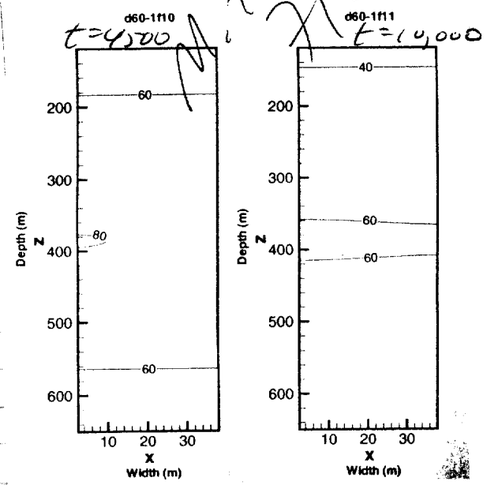
7/27/99 Output for: ~~drift60.dat~~ (no ventilation)

/home/sneezy/mhill









Amended file d60-3.dat (zoomed in on heat climax by increasing time steps)
Amended file named: d60-3b.dat

```
Time[y] 25.
Time[y] 50.
Time[y] 100.
Time[y] 150.
Time[y] 200.
Time[y] 350.
Time[y] 500.
Time[y] 750.
Time[y] 1000.
```

M. Hill 7/27/99

M Hill 7/27/99

7/29/99 Amended file d60-3b.dat (increased # of time steps). ~~Renamed~~ MH 7/29/99
Wrote to file as d60-3bc.dat

	(y)
Time =	25
" =	50
"	100
"	150
"	200
"	350
"	500
"	750
"	1000
"	1500
"	2000
"	2500

Amended files: drift60-1bt, d60-3bc.dat & d60-2.dat as follows:

changed the elements for data to be printed at each time step to element 706, 722 & 735

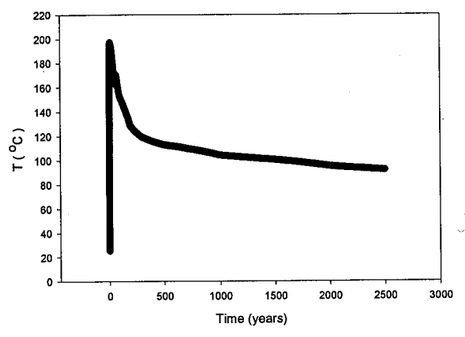
706 → drift ceiling
722 → drift wall
735 → pillar

wrote to file as: drift60-1b.dat, d60-3bcd.dat & d60-2b.dat, respectively.

matrix MH 7/29/99

Temperature vs. Time
d60-3bcdtmp
20 % reduction in heat due to ventilation first 50 years

node 706
drift ceiling →
MH 7/30/99



MHill 7/29/99

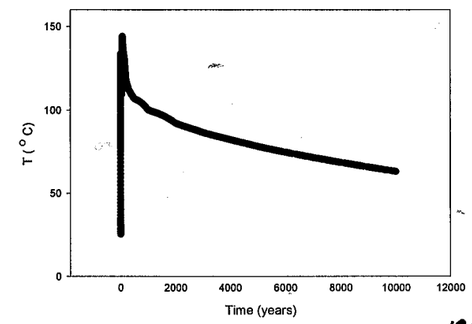
From: d60-3bcd_tmp.xyp

MHill 7/29/99

7/30/99

node 706
drift ceiling

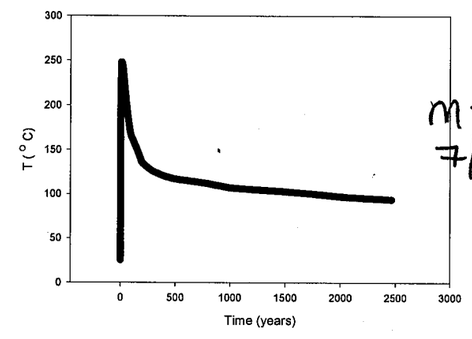
Temperature Matrix vs. Time
d60-2btmp
50% reduction in heat due to ventilation first 50 years



MHill 7/30/99

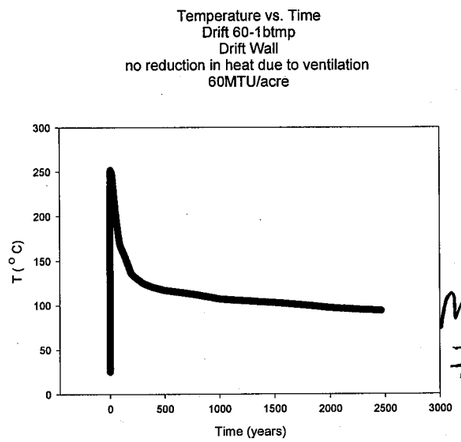
Temperature Matrix vs. Time
drift60-1btmp
no reduction in heat due to ventilation
60 MTU/acre heat load

node 706
drift ceiling



MHill 7/30/99

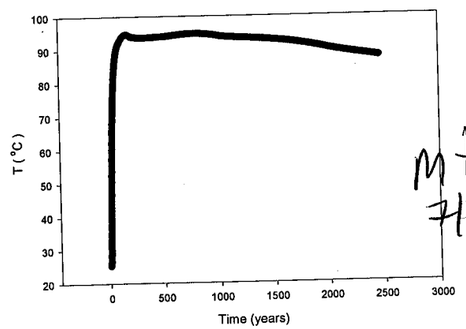
node 722
drift wall



M Hill
7/30/99

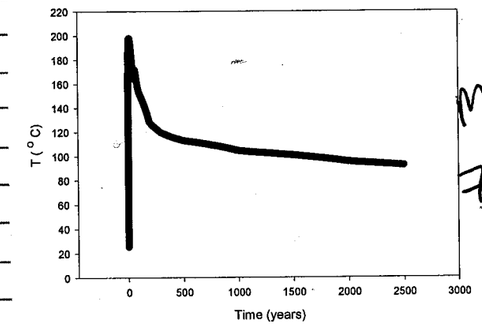
Temperature vs. Time
drift60-1btmp
Drift pillar
no reduction in heat due to ventilation
60MTU/acre

node 735
pillar



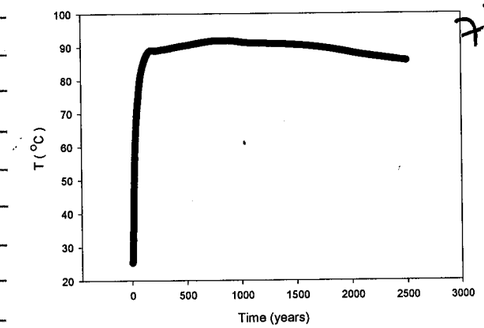
M Hill
7/30/99

Time vs. Temperature
d60-3bcd
Drift Wall
20% reduction in heat due to ventilation



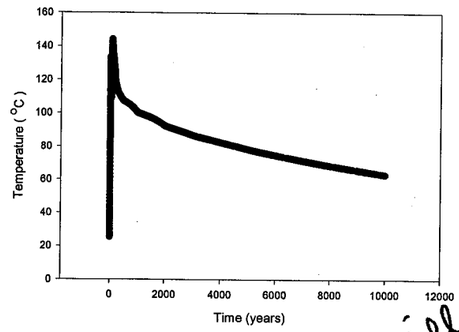
M Hill
7/30/99

Temperature vs. Time
drift60-3bcd
Drift pillar
20% reduction in heat load due to ventilation
60MTU/acre



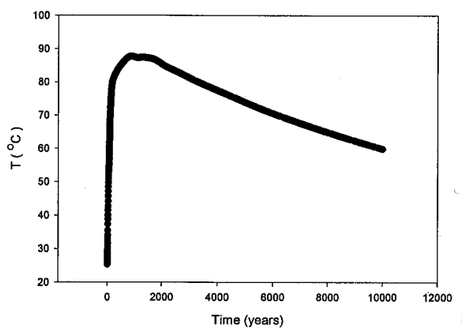
M Hill
7/30/99

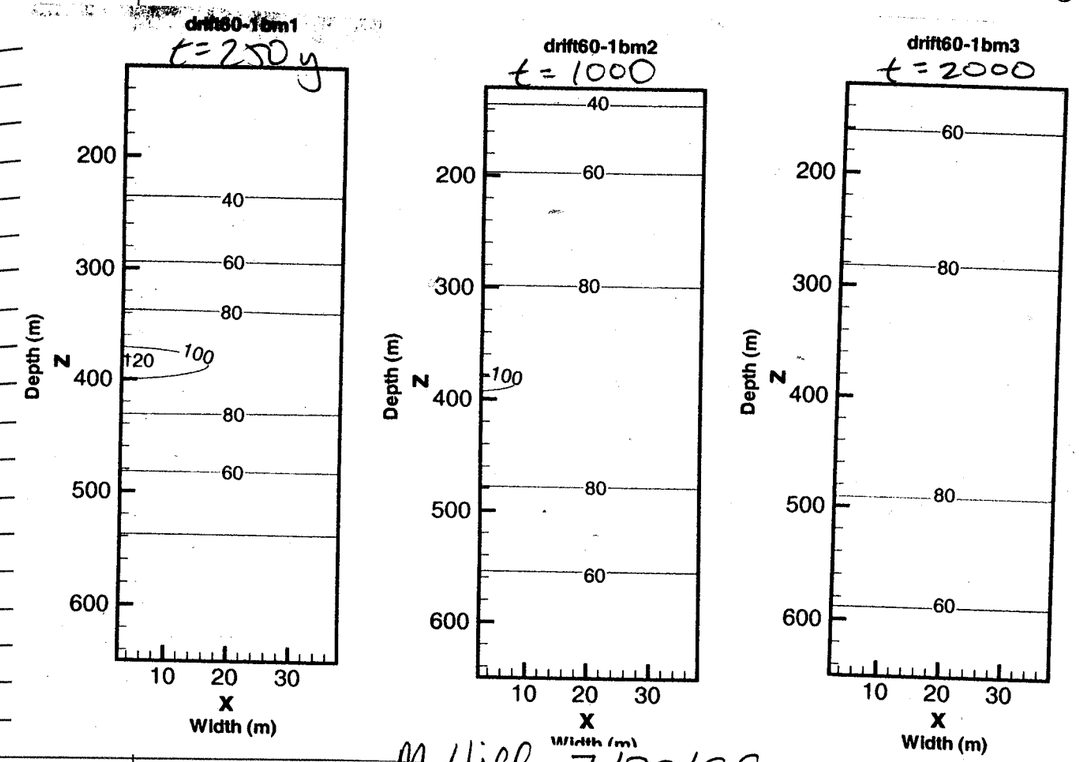
Temperature vs. Time
d60-2btmp
Drift Wall
50% reduction in heat load due to ventilation
60MTU/acre



M. Hill 7/30/99

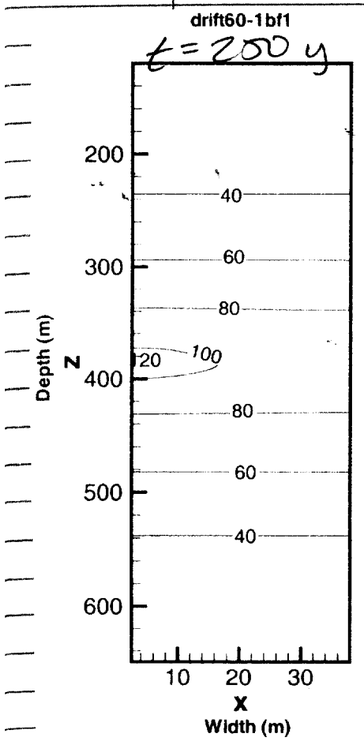
Temperature vs. Time
d60-2btmp
Drift pillar
50% reduction in heat load due to ventilation
60MTU/acre

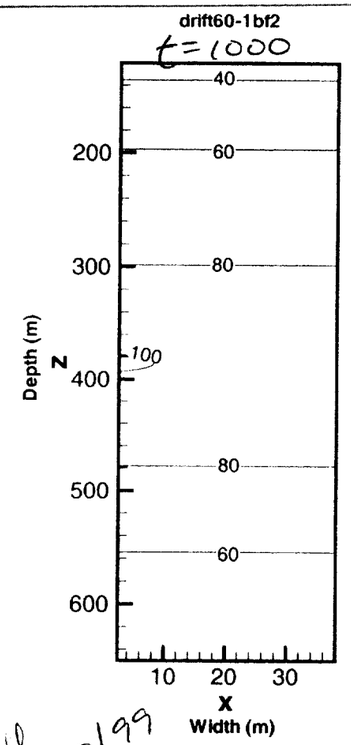


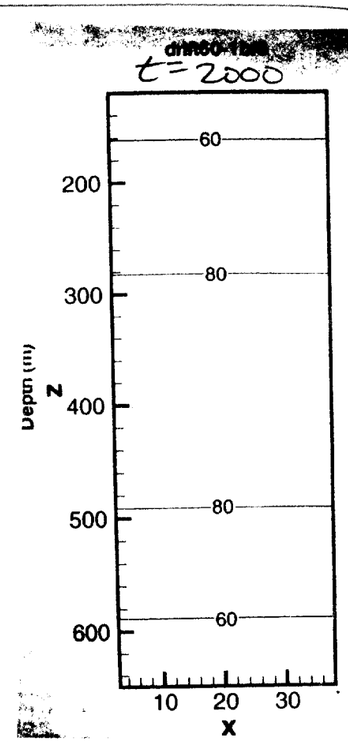


M Hill 7/30/99

No reduction in heat due to ventilation





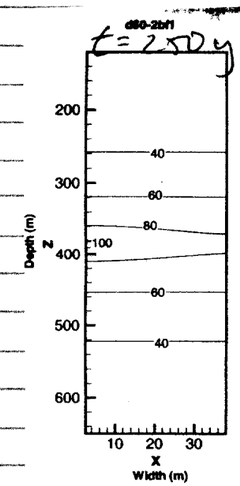


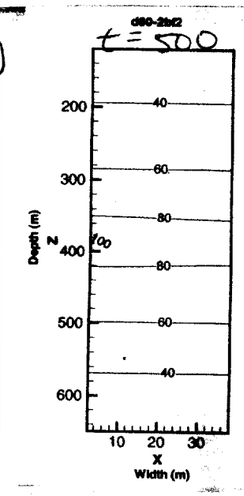
M Hill 7/30/99

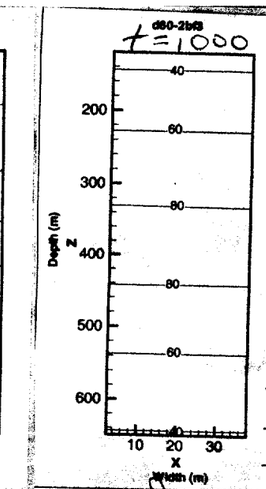
M Hill 7/30/99

results of drift60-1b.dat

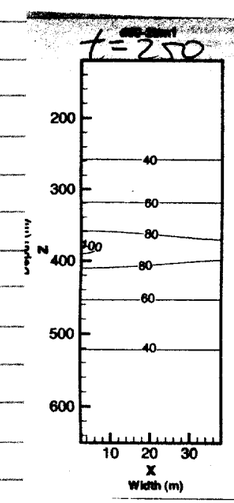
8/2/99 Results of d60-2b.dat 50% red. in heat

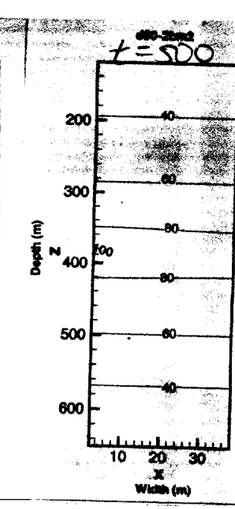


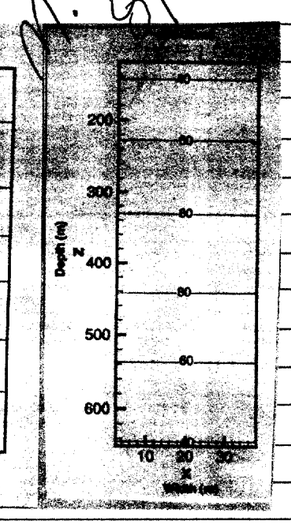




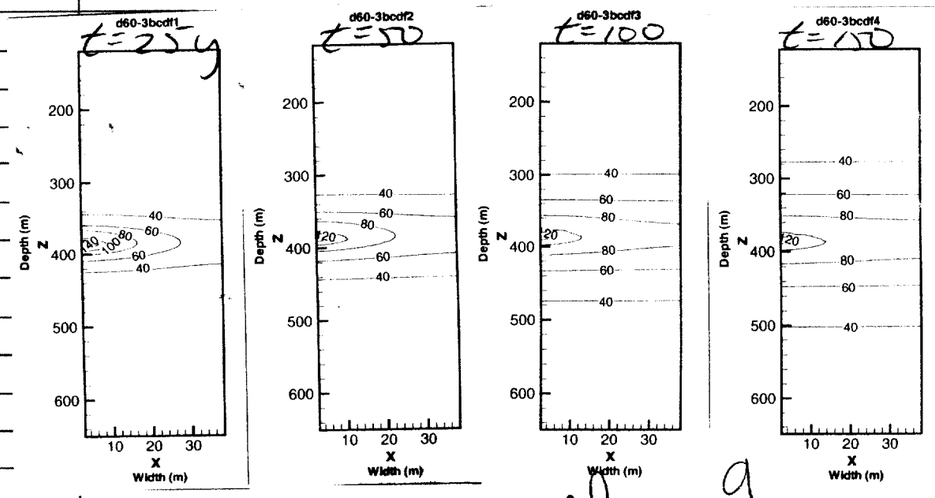
M Hill 8/2/99



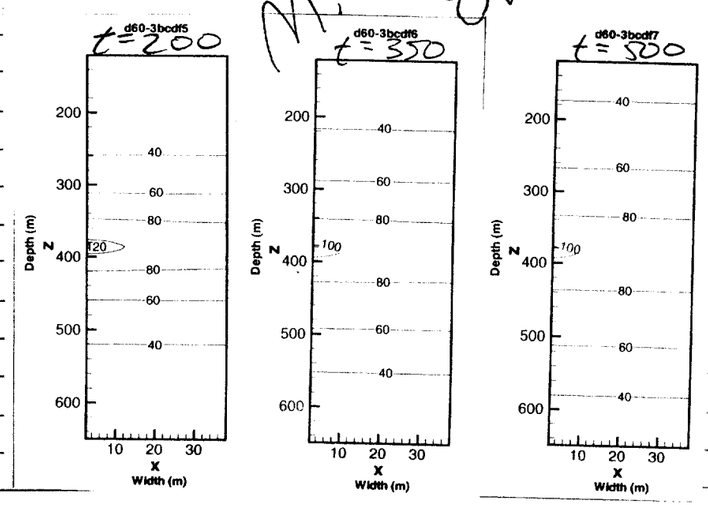


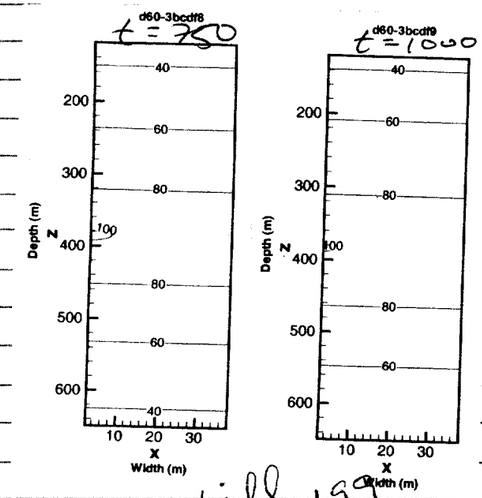


Results of d60-3bcd.dat 20% red.
in heat due to ventilation during 1st 50yrs

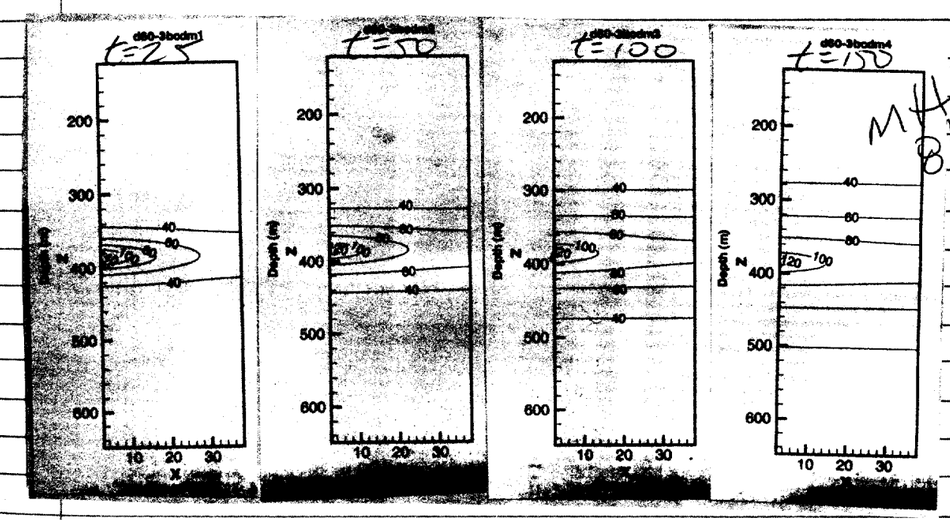


M. Hill 8/21/99

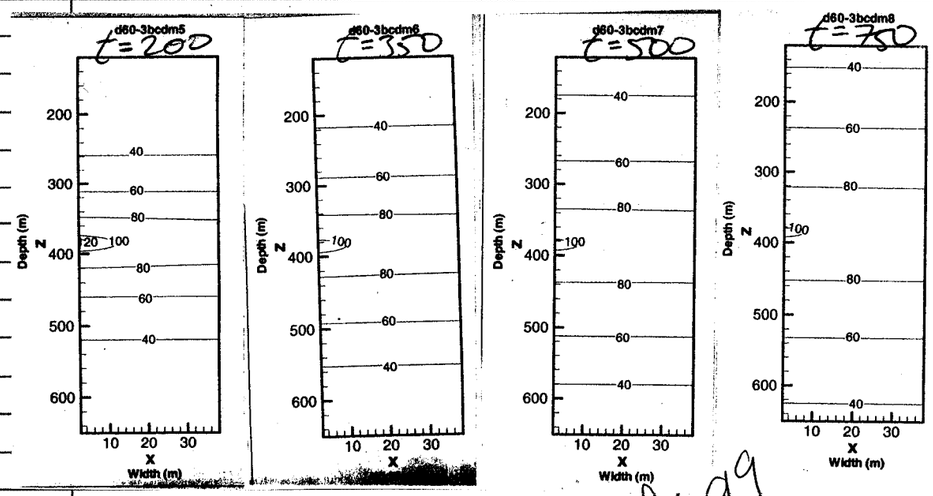




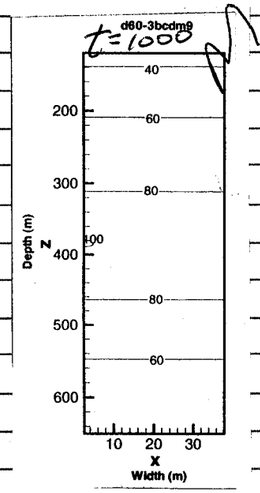
M Hill 8/21/99



M Hill 8/21/99



MNill 8/2/99



MNill 8/2/99

8/6/99 Amended file drift60-1b.dat as follows:

Output in recument data changed to:

C = 10
Q = 10
T = 1
G = 1
P = 1

in an effort to reduce vector output data files.

Also time steps changed as follows:

(years)

T = 45
T = 85
T = 100
T = 200
T = 500
T = 750
T = 1000
T = 1250
T = 1500
T = 1850
T = 2000

file name remained drift60-1b.dat

because of confusion with earlier version of drift60-1b.dat file (p 86 of this notebook), the file was renamed drift60-1bb.dat MNill 8/6/99

8/11/99 Amended file drift60-1bb.dat as follows:

(years)

T = 5
= 10
15
20
25
30
35
45
50
51
53
55
58
60
70
80
90
110
125
250
500
800
1000
5000
7500
10,000

Renamed updated version of file: drift60-1bba.dat.

MNiel 8/11/99

8/12/99 Amended file ~~drift~~ d60-3bcd.dat as follows:

(years)

T = 5
10
15
20
25
30
35
45
50
51
53
55
58
60
70
80
90
110
125
250
500
800
1000
5000
7500
10,000

Renamed updated version of file: d60-3bcda.dat

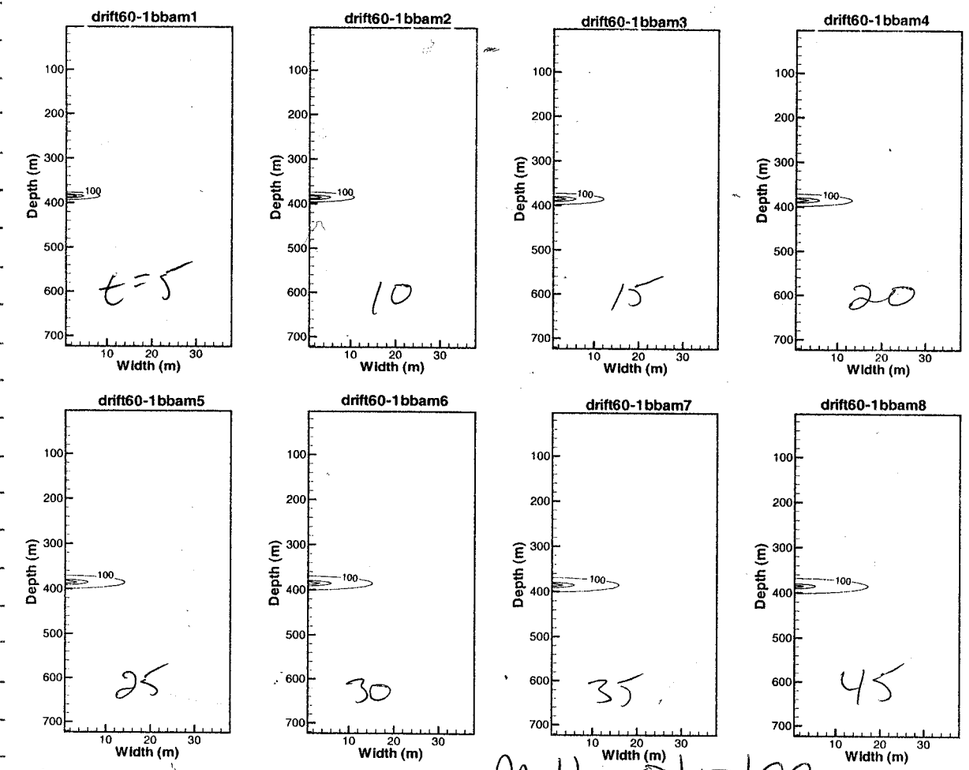
MNiel 8/12/99

8/17/99 Amended file d60-2b.dat as follows:

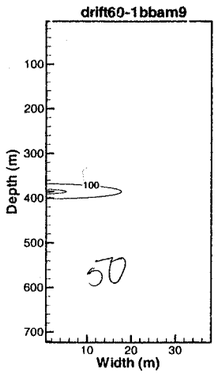
		(years)
1	time step T =	5
2		10
3		15
4		20
5		25
6		30
7		35
8		45
9		50
10		51
11		53
12		55
13		58
14		60
15		70
16		80
17		90
18		110
19		125
20		250
21		500
22		800
23		1000
24		5000
25		7500
26		10,000

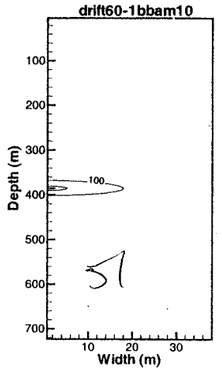
Renamed updated version of file: d60-2ba

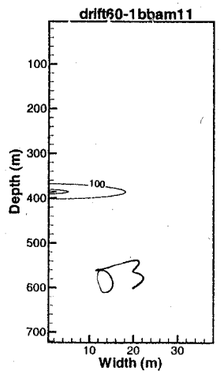
Results of drift60-1bba.dat (p 98 of this notebook) No ventilation 60 MTU/Acre

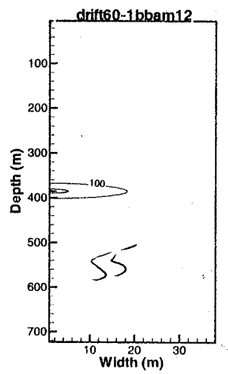


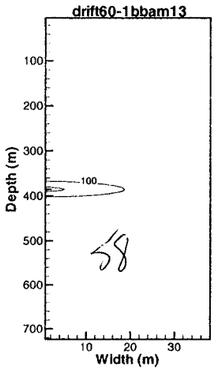
MH 8/17/99

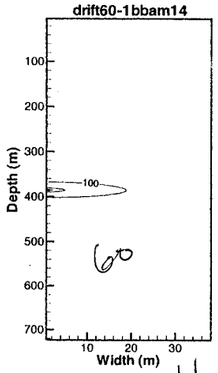


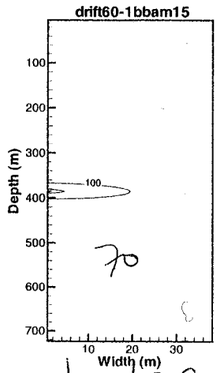


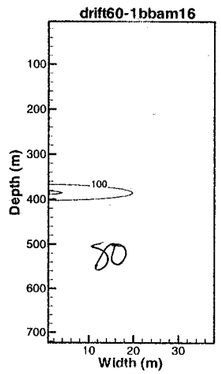




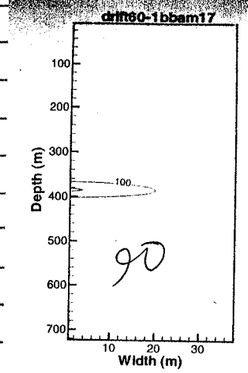


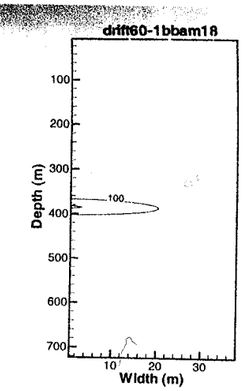


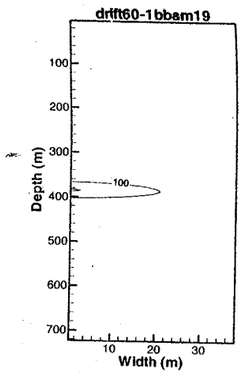


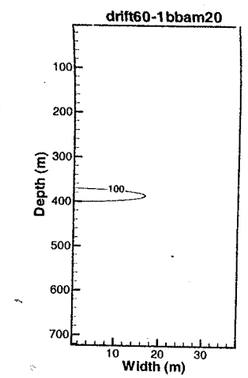


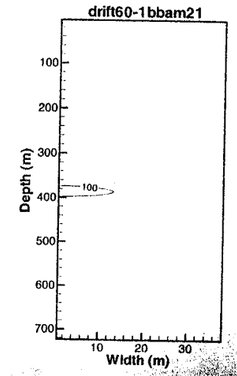
MH 8/17/99

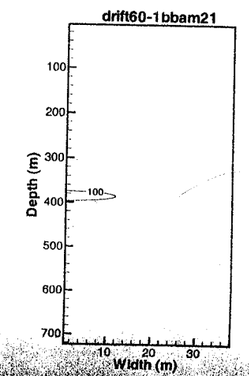


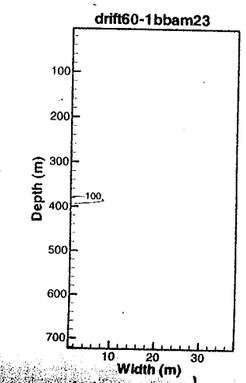


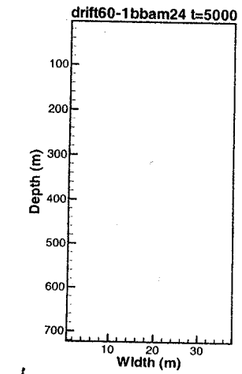






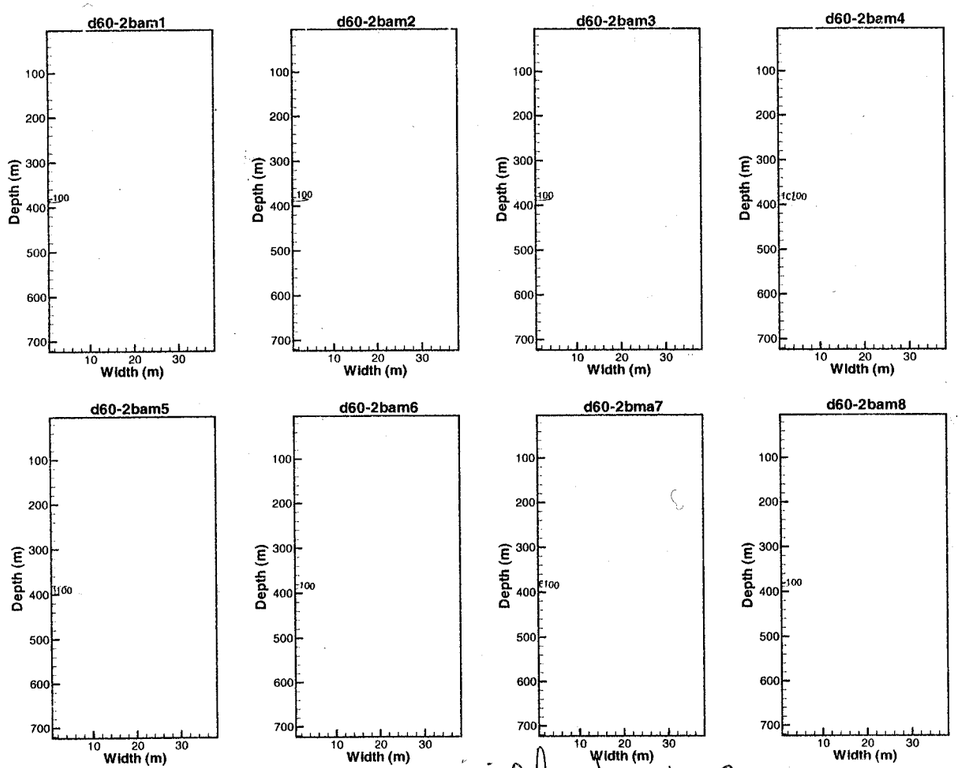




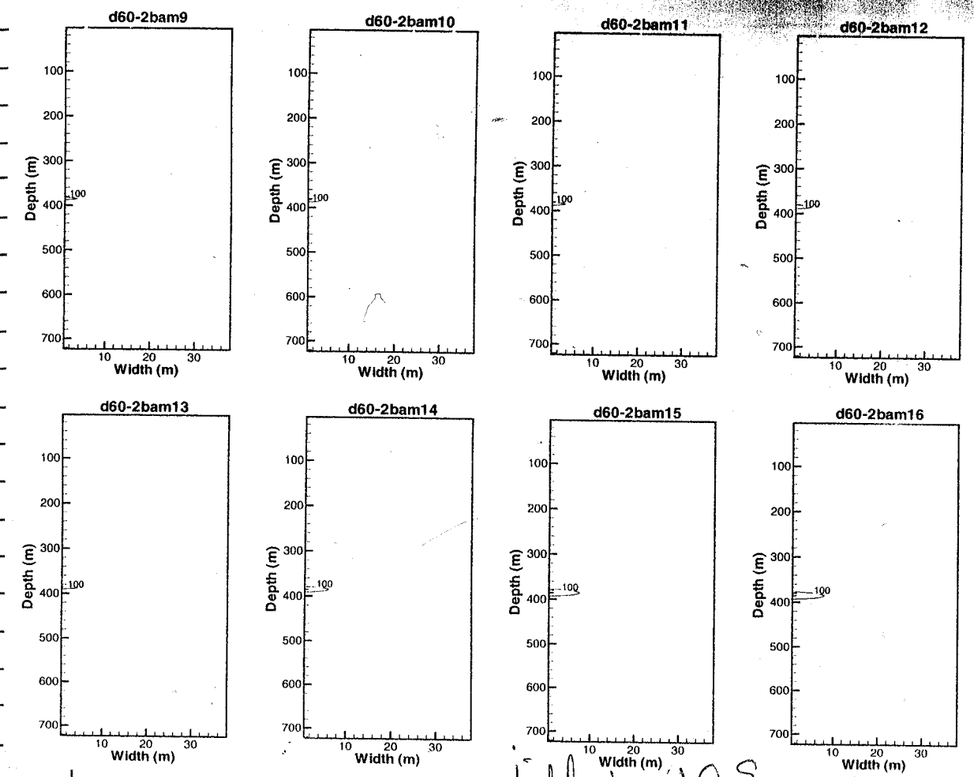


MH 8/17/99

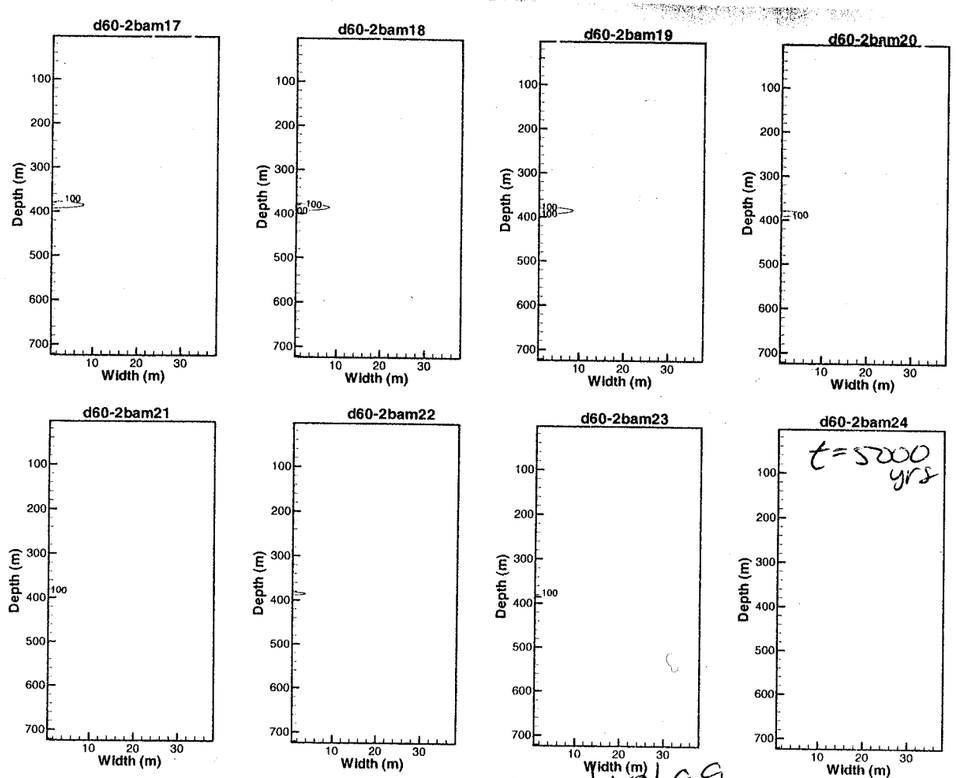
8/18/99 Results of d60-2ba.dat (p 100 of this notebook) 50% reduction in heat load due to ventilation



M Hill 8/18/99

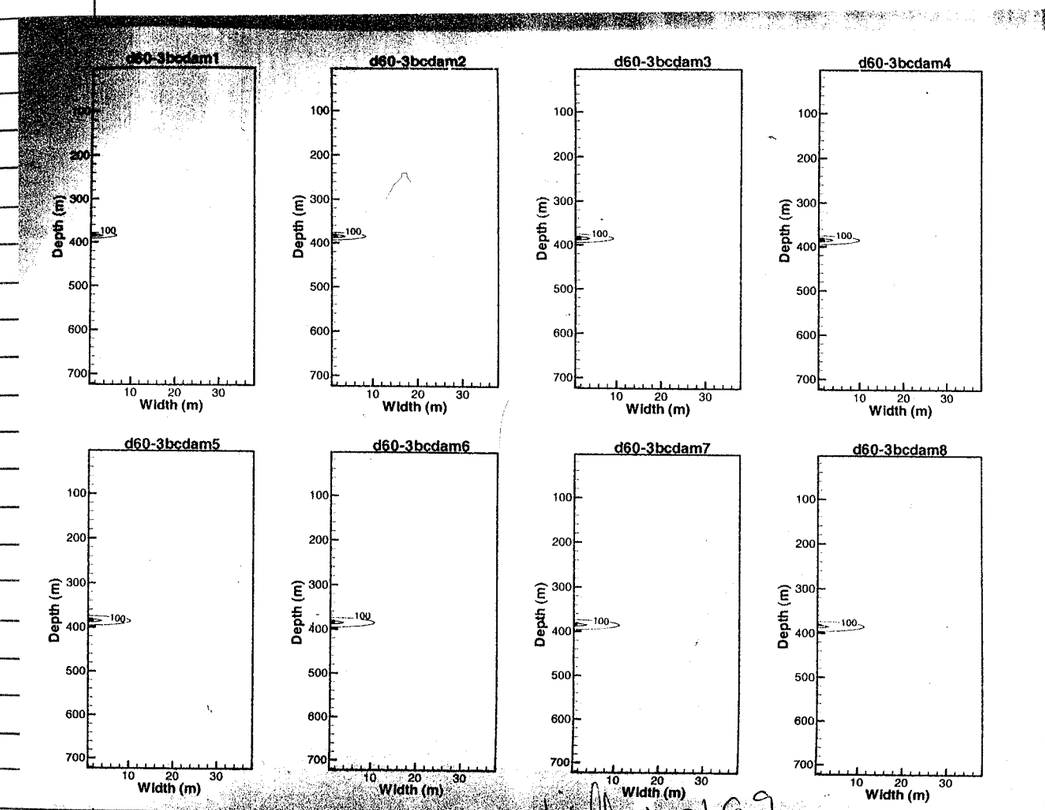


M Hill 8/18/99

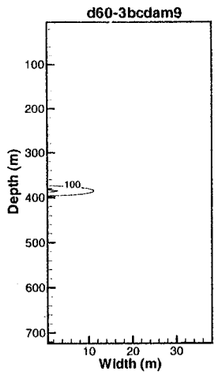


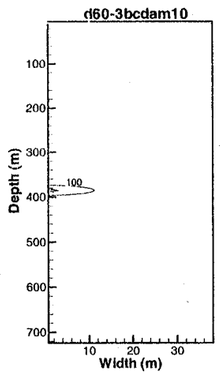
MHill 8/18/99

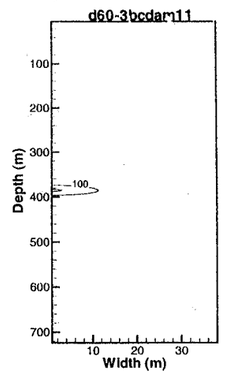
Results of d60-3bcda.dat (p 99 of this notebook) 20% reduction in heat due to ventilation

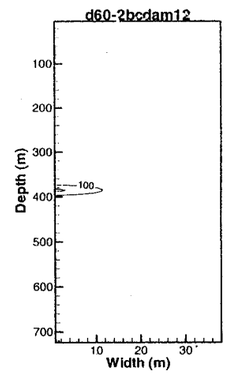


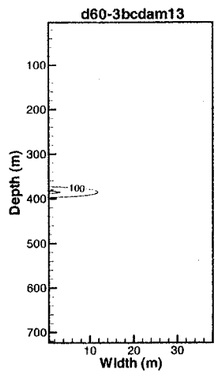
MHill 8/18/99

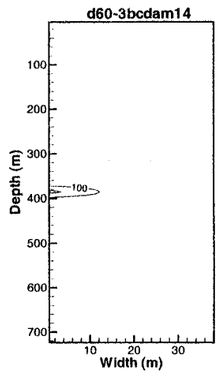


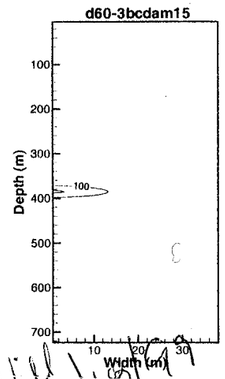


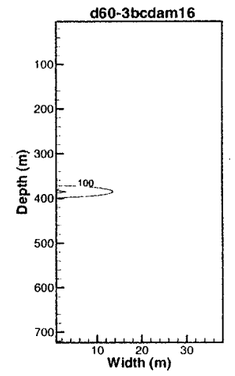




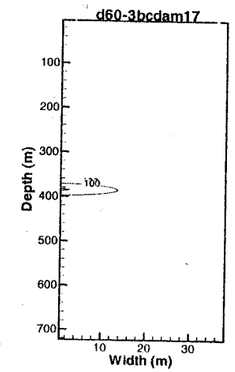


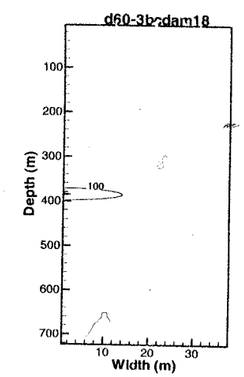


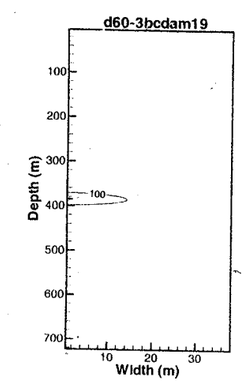


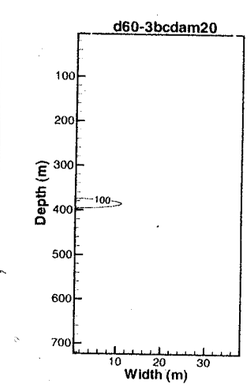


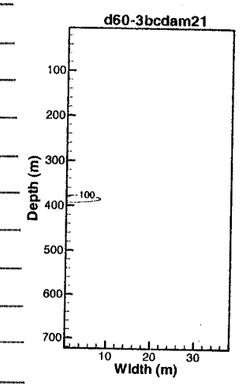
MWW 8/18/99

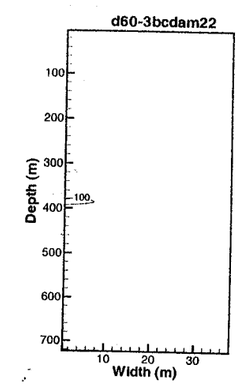


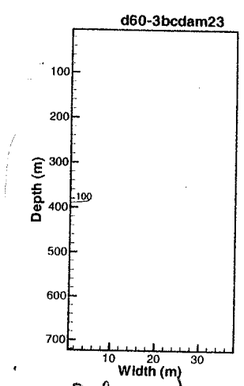


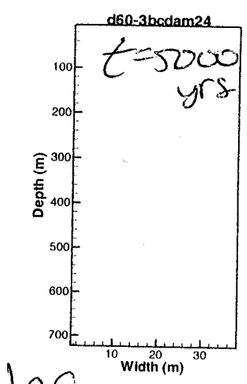












MWW 8/18/99

MH 8/18/99

8/20/99 Amended file d60-3bcda.dat as follows:

Time = (years)	time step
1	1
2	2
3	3
4	4
5	5
15	6
30	7
45	8
50	9
51	10
53	11
55	12
58	13
65	14
80	15
90	16
110	17
125	18
200	19
350	20
500	21
800	22
1000	23
1500	24
2000	25
2500	26
3000	27
3500	28
4000	29
4500	30
5000	31

Renamed file as: d60-3bcda1.dat
MH 8/20/99

8/22/99 Amended file d60-2bda.dat as follows:

Time = (years)
1
2
3
4
5
15
30
45
50
51
53
55
58
65
80
90
110
125
200
350
500
800
1000
1500
2000
2500
3000
3500
4000
4500
5000

Renamed file as: d60-2bd1.dat

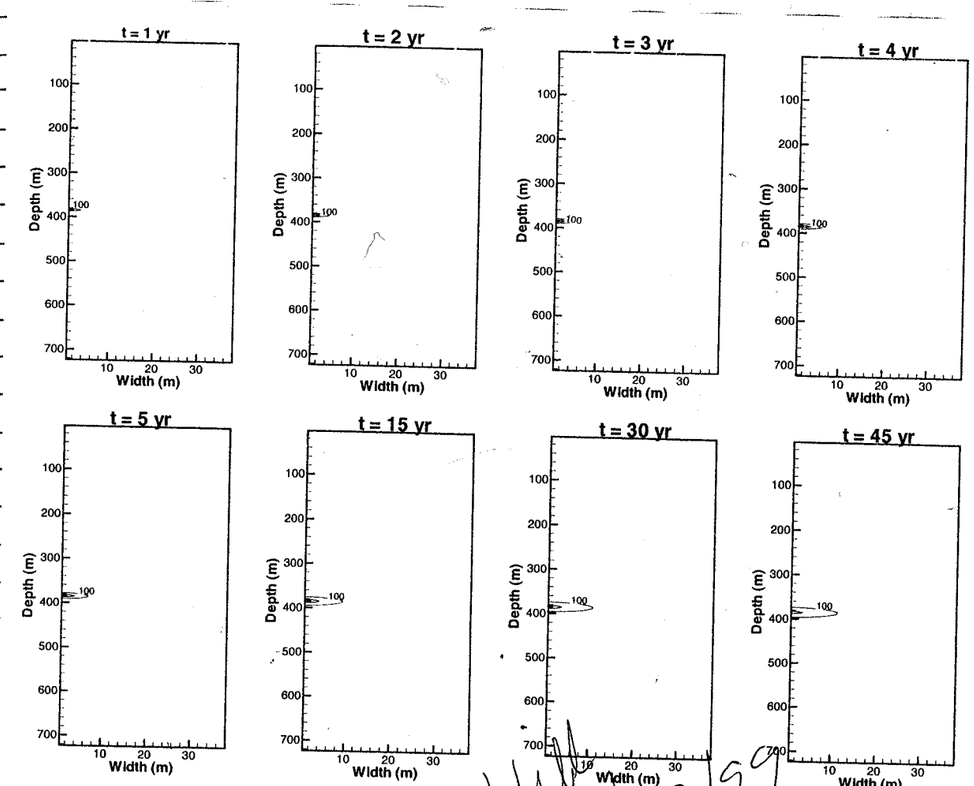
Amended file drift60-1bba.dat as follows:

Time = (years)

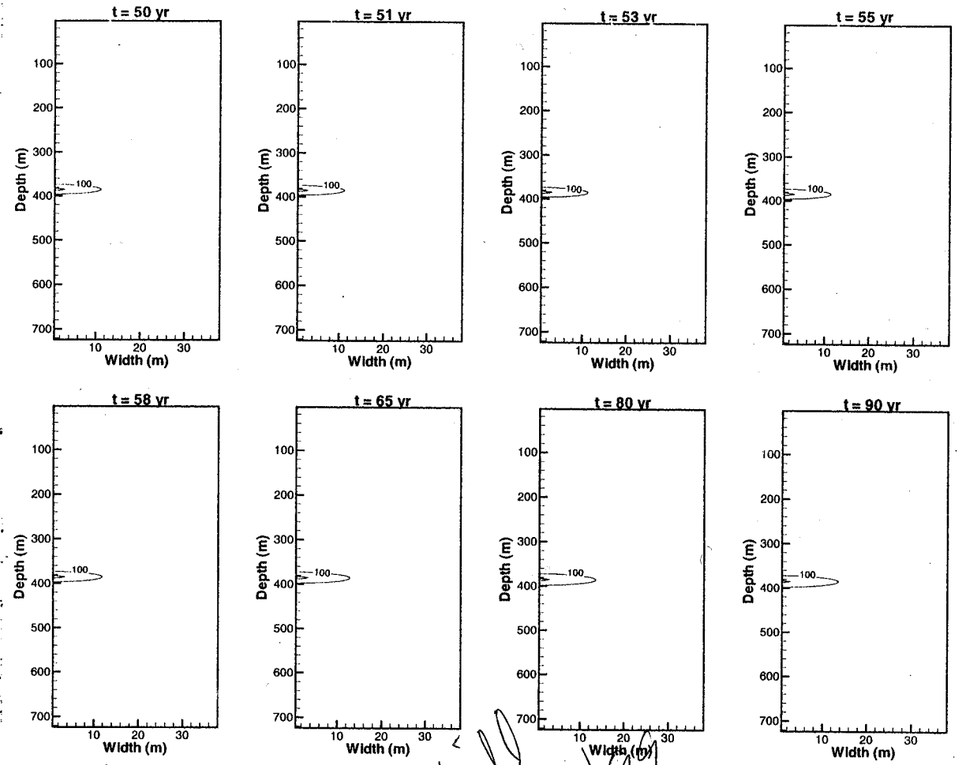
1
2
3
4
5
15
30
45
50
51
53
55
58
65
80
90
110
125
200
350
500
800
1000
1500
2000
2500
3000
3500
4000
4500
5000

Renamed as file: drift60-1bba2L.dat

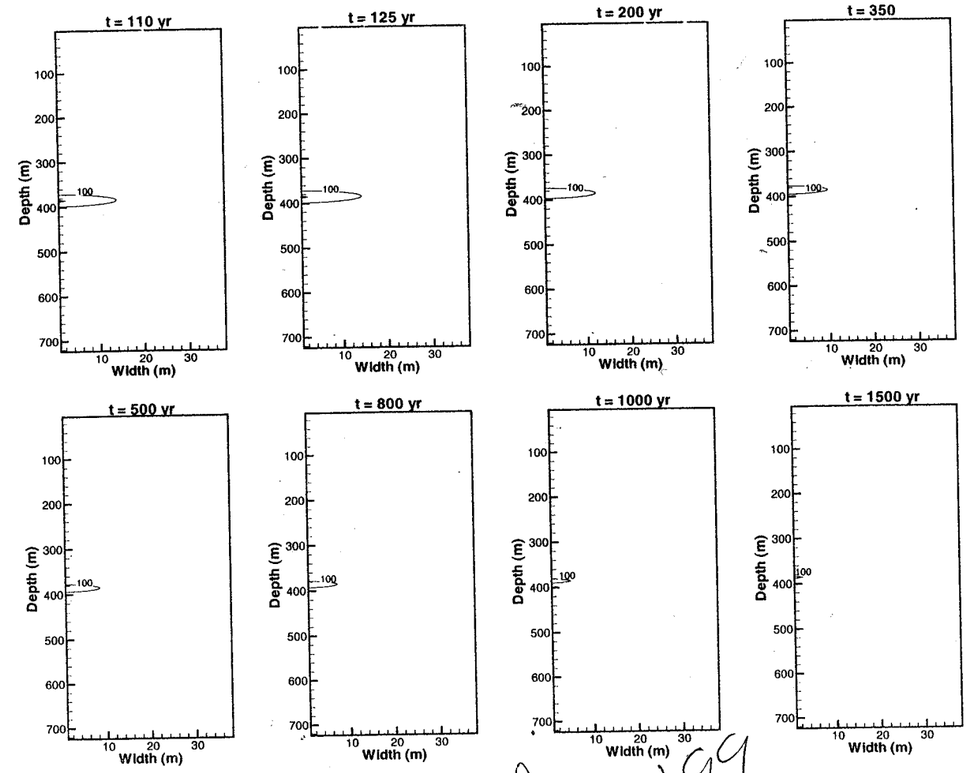
Results of d60-3bcda2L.dat



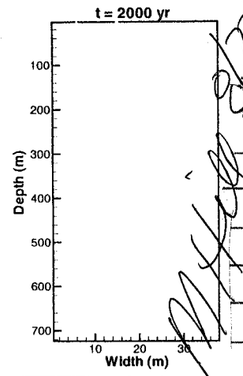
M Hill 8/22/99



M Hill 8/22/99



M Hill 8/22/99



MNW 8/22/99

Amended files: drift60-1bbal.dat, d60-3bcdal.dat & file d60-2bal.dat as follows:

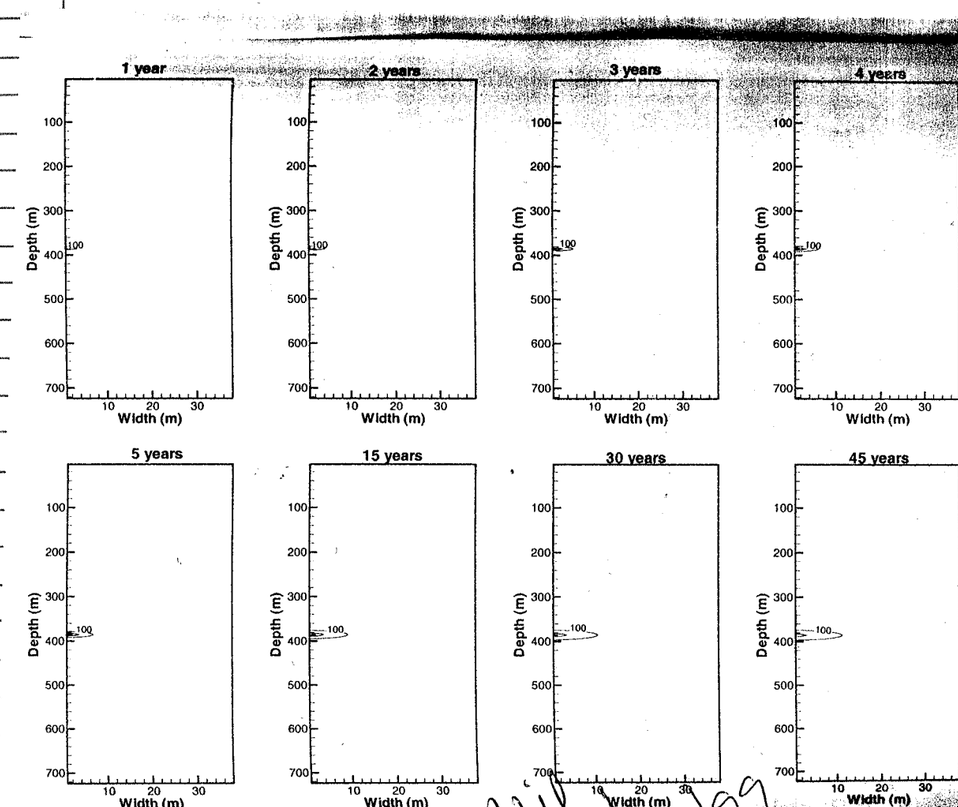
Zoomed in on time steps from 1500-2000 yrs: Renamed as files: drift60-1bball.dat, d60-3bcdall.dat & d60-2ball.dat, respectively MNW 8/22/99

8/23/99 Time steps for files drift60-1bball.dat d60-3bcdall.dat & d60-2ball.dat were amended on 8/22/99 (p116 of this notebook) as follows

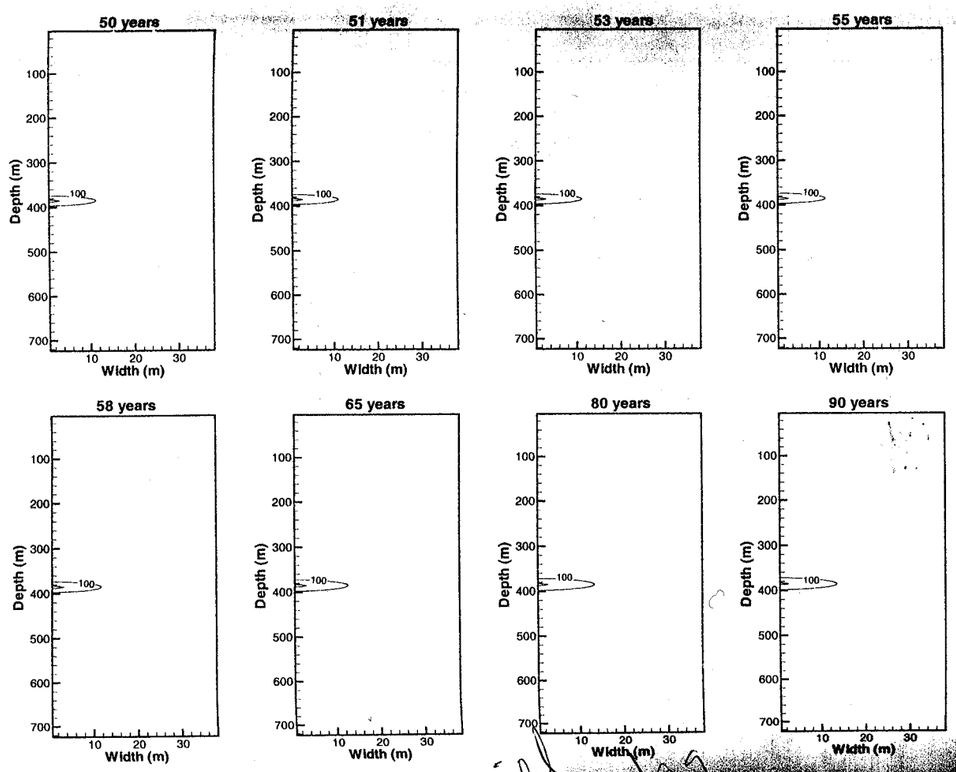
	(years)
T =	1500
=	1550
	1600
	1650
	1700
	1750
	1800

1850
1900
1950
2000 MNW 8/23/99

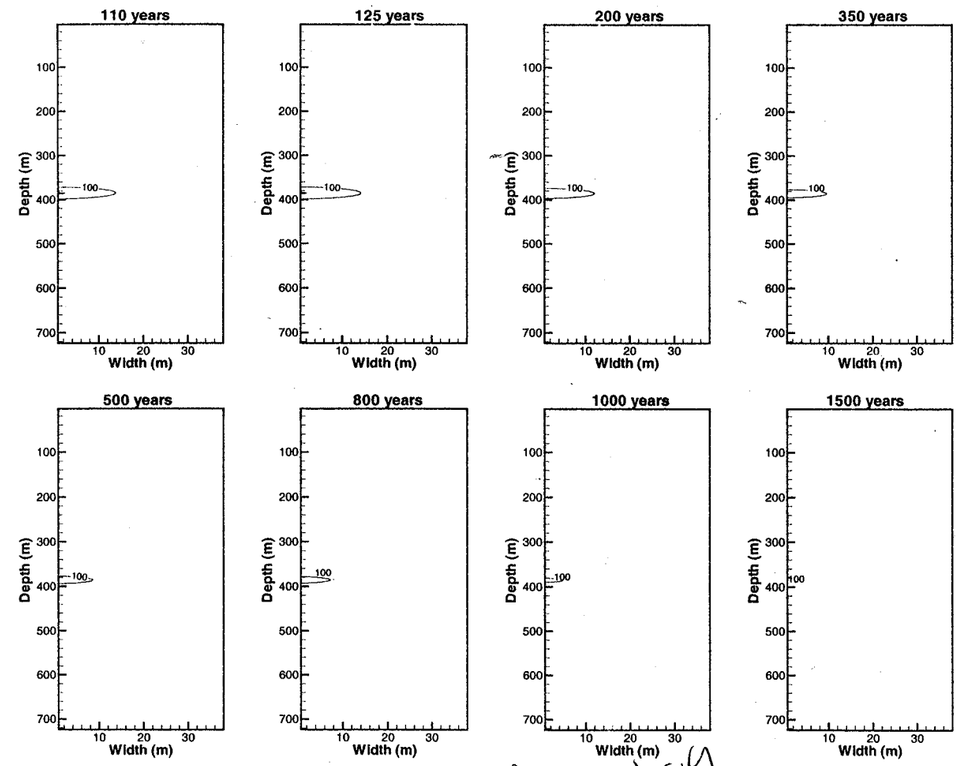
Results of d60-3bcdall.dat p 116 of this notebook



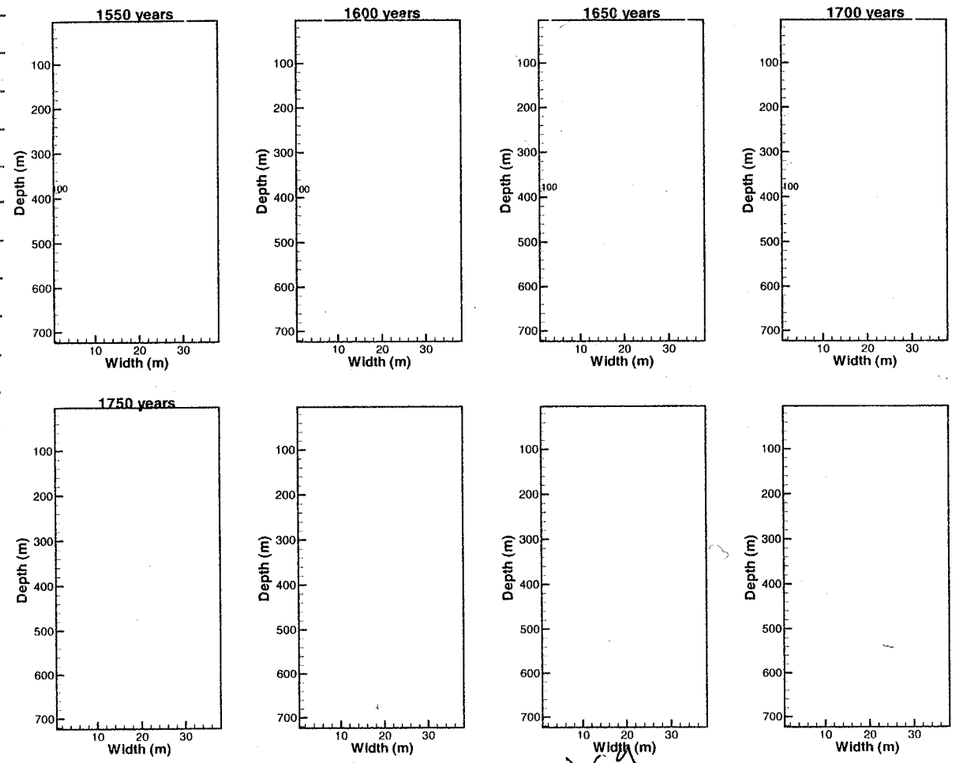
MNW 8/23/99



M. Hill 8/23/99



M. Hill 8/23/99



MHill 8/23/99

MH 8/23/99

8/25/99

Date: 8/13/99
Sender: Debra Hughson
To: Melissa Hill
Priority: Normal
Subject: Re:infiltration reference

Good morning,

Initial conditions I obtained by setting the boundary conditions to prescribed flux and state at the surface and prescribed state for water table at the bottom then running the model until it arrived at a steady state flow condition. I cut and pasted from the multi_out file into the INITial keyword in the input file. For infiltration at the top boundary I simply selected, somewhat arbitrarily, a value I thought reasonable. I recall being confused then about how velocities for the fracture continuum are calculated and wound up with a very small infiltration rate. This part of multiflo is not actually in the documentation. You divide the fracture bulk permeability by the fracture bulk porosity to get the fracture permeability for the input file. You put in 1.0 for the fracture porosity and the bulk fracture porosity goes in as the sigmaf or volf number in the DCMPARameters. Then to get the actual velocities calculated you multiple the results in the output file multivz?.xyp by the fracture bulk porosity. Then vlfz is in m/yr and flxlfz is in kg/m^2/s.

Hope this helps. Call if you have questions.

Reply Separator

Subject: infiltration reference
Author: Melissa Hill
Date: 8/12/99 6:03 PM

Hi Debra

Did you get the initial conditions for saturation, infiltration and temperature for the input file that you gave to me from the Near-Field Altered Zone Report?

Thanks,
Melissa

MHill 8/23/99

On 8/24/99 Amended file drift60-1 bball.dat as follows:

(years)
T = 2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100

Renamed as file: drift60-1bball2.dat

MH 8/25/99

8/25/99 Amended file d60-2.dat as follows:

1) changed heat multiplier to 0.6

2) changed source parameter KS2 from ~~j=32 to j=31~~ mtt 8/25/99 32 to 31.

Renamed as file d60-2R2.dat

Also increased # of time steps as follows:

	(years)
T =	20
	45
	75
	90
	110
	125
	200
	500
	800
	1000
	1500
	2000

Amended file d60-3.dat as follows:

1) changed heat multiplier to 0.6

2) changed source parameter KS2 to 31

	(years)
T =	20
	45
	75
	90
	110
	125
	200
	500
	800
	1000
	1500
	2000

Renamed as file d60-3R2.dat

MTT 8/25/99

8/26/99 Amended file d60-1.dat provided from Dr. R. Green located in rgreen/multi/60mtu on sneezy as follows:

	(years)
T =	120
	135
	150
	165

190
205
220
250
265
300
325
350
375
400
450
500

Renamed file: d60-1Z.dat located in vulcan/home/mhill/vent/

Amended file d60-2R2.dat as follows:

(years)
T = 120
135
150
165
190
205
220
250
265
300
325
350
375
400
450
500

Renamed file: d60-2R2Z.dat located in vulcan/home/mhill/multi

Amended file d60-3R2.dat as follows:

1) Added the following time steps

(years)
T = 120
135
150
165
190
205
220
250
265
300
325
350
375
400
450
500

Renamed file: d60-3R2Z.dat located in vulcan/home/mhill/multi

Amended file d60-1Z.dat as follows:

(yrs)
T = 120
135
140
145
150

155
160
165
170
175
180
185

Renamed file: d60-172.dat located in vulcan/home/mhill/vent/

Date: 8/12/99
Sender: Debra Hughson
To: Melissa Hill
Priority: Normal
Subject: Re[2]:hydro properties

Melissa,

Always a good idea to double check me. I dug up the URL for these tables. Go to

http://domino.ymp.gov/va/support/tspa-vatbr/chap3.nsf

and look at tables 3.18, 3.30, and 3.31. We might have made a typo on the numbers or something.

debra

Reply Separator

Subject: Re:hydro properties
Author: Melissa Hill
Date: 8/12/99 12:56 PM

Thanks Debra!

Reply Separator

Subject: hydro properties
Author: Debra Hughson
Date: 8/12/99 12:18 PM

Melissa,

Here is the reference for the thermal/hydro properties we used. The original source is the Near Field/Altered Zone Models report, Tables 3-10, 3-11, and 3-5. The DTN numbers are from Chapter 3 of the TBD for the TSPA-VA

Copy and paste from Hughson and Green TEF report.

Matrix and fracture hydrological properties for these units of the Topopah Springs tuff, which were calibrated against the SHT (Hardin, 1998), are summarized in tables 2-1 and 2-2 and thermal properties are presented in table 2-3. These data sets are identified as the TH property sets and are identified as: DTN: LL980209004242.026 for the matrix and fracture property sets and DTN:STN05071897001.002 for the thermophysical property set.

Hardin, E.L. 1998. *Near-Field/Altered-Zone Models Report*. SP3100M3. Livermore, CA: Lawrence Livermore National Laboratory.

8/12/99

Total System Performance Assessment
Viability Assessment Technical Basis Report
Chapter 3 - Thermal Hydrology

Jump to the Previous, or Next Section.

Table 3-18. Thermophysical Properties Used in TH Simulations for TSPA-VA
DTN: SNT05071897001.002

Unit	Wet Thermal Conductivity (W/m-K)	Dry Thermal Conductivity (W/m-K)	Rock Grain Density (kg/m^3)	Rock Grain Specific Heat (J/kg-K)	Tortuosity Coefficient
TSw11* (Tpcpll)	1.76	1.02	2510	847	0.7
TCw12 (Tpcpln)	1.88	1.28	2510	837	0.7
TCw13 (Tpcpv)	0.98	0.54	2470	857	0.7
PTn21 (Tpbt4)	0.5	0.35	2340	1080	0.7
PTn22 (Tpy)	0.97	0.44	2400	849	0.7
PTn23 (Tpbt3)	1.02	0.46	2370	1020	0.7
PTn24 (Tpp)	0.82	0.35	2260	1330	0.7
PTn25 (Tpbt2)	0.67	0.23	2370	1220	0.7
TSw31 (Tptrv)	1.00	0.37	2510	834	0.7
TSw32 (Tptrn)	1.62	1.06	2550	866	0.7
TSw33* (Tptpul)	1.80	0.71	2510	883	0.7
TSw34 (Tptpmn)	2.33	1.56	2530	948	0.7
TSw35* (Tptpll)	2.02	1.2	2540	900	0.7
TSw36 (Tptpln)	1.84	1.42	2560	865	0.7
TSw37 (Tptpv)	2.08	1.69	2360	984	0.7
CH1zc (Tpbt1)	1.31	0.7	2310	1060	0.7
CH2zc (Tac(z))	1.2	0.61	2350	1150	0.7
CH3zc (Tac(z))	1.2	0.61	2350	1150	0.7
CH4zc (Tacbt)	1.35	0.73	2440	1170	0.7
CH1vc (Tpbt1)	1.31	0.7	2310	1060	0.7
CH2vc	1.17	0.58	2240	1200	0.7

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(Tac(v))					
CH3vc (Tac(v))	1.17	0.58	2240	1200	0.7
CH4vc (Tac(v))	1.17	0.58	2240	1200	0.7
PP3vp (Tcp3)	1.26	0.66	2580	841	0.7
BF3vb (Tcp3)	1.26	0.66	2580	841	0.7
TM3vt (Tcp3)	1.26	0.66	2580	841	0.7
PP2zp (Tcp2)	1.35	0.74	2510	644	0.7
BF2zb (Tcp2)	1.35	0.74	2510	644	0.7

*Used lithophysal thermal conductivities

Jump to the Previous, or Next Section

Table 3-30. Matrix Property Values for the TH Hydrologic Parameter Set Calibrated Against the SHT

DTN: LL980209004242.026

Geologic Unit	Model Unit	Porosity	Permeability (m^2)	S_r [a]	α [b] (Pa^{-1})	m [b]
Tpcpll	TCw11	0.066	5.40E-18	0.13	1.15E-06	0.2310
Tpcpln	TCw12	0.066	5.40E-18	0.13	2.01E-06	0.2447
Tpcpv	TCw13	0.140	5.69E-17	0.33	3.74E-06	0.4548
Tpbt4	PTn21	0.369	1.61E-14	0.10	3.98E-05	0.2531
Tpy	PTn22	0.234	3.30E-15	0.14	7.94E-06	0.4925
Tpbt3	PTn23	0.353	5.40E-14	0.17	5.44E-05	0.3002
Tpp	PTn24	0.469	8.80E-14	0.10	3.43E-05	0.3859
Tpbt2	PTn25	0.464	3.18E-13	0.10	1.81E-04	0.3195
Tptrv	TSw31	0.042	7.76E-17	0.11	5.84E-05	0.2304
Tptrn	TSw32	0.146	1.82E-16	0.04	2.00E-05	0.2861
Tptpul	TSw33	0.135	2.04E-17	0.06	6.21E-06	0.2479
Tptpmn	TSw34	0.089	4.08E-18	0.18	1.19E-06	0.3212
Tptpll	TSw35	0.115	2.22E-17	0.08	4.01E-06	0.1983
Tptpln	TSw36	0.092	8.70E-18	0.18	8.08E-07	0.5138
Tptpv	TSw37	0.020	8.39E-18	0.50	5.30E-07	0.3709
Tpbt1	CH1zc	0.193	1.36E-17	0.36	4.29E-06	0.3489
Tac(z)	CH2zc	0.240	2.50E-18	0.20	2.16E-05	0.2119
Tac(z)	CH3zc	0.240	2.50E-18	0.20	2.16E-05	0.2119
Tacbt	CH4zc	0.169	5.49E-18	0.33	1.03E-06	0.4322
Tpbt1	CH1vc	0.265	1.60E-12	0.04	7.60E-05	0.1592
Tac(v)	CH2vc	0.321	5.50E-14	0.06	4.12E-05	0.2291
Tac(v)	CH3vc	0.321	5.50E-14	0.06	4.12E-05	0.2291
Tabt1	CH4vc	0.321	5.50E-14	0.06	4.12E-05	0.2291
Tcp(3)	PP3vp	0.274	1.91E-15	0.07	1.66E-05	0.3142
Tcb(w)	BF3vb	0.274	1.91E-15	0.07	1.66E-05	0.3142
Tcb(w)	TM3vt	0.274	1.91E-15	0.07	1.66E-05	0.3142
Tcp(2)	PP2zp	0.197	1.75E-17	0.18	8.39E-06	0.3568
Tcb(n)	BF2zb	0.197	1.75E-17	0.18	8.39E-06	0.3568

[a] S_r is the residual liquid-phase saturation (not in situ saturation).

[b] α and m are fitting parameters for capillary pressure and relative permeability curves, respectively.

Total System Performance Assessment
Viability Assessment Technical Basis Report
Chapter 3 - Thermal Hydrology

Jump to the Previous, or Next Section.

Table 3-31. Fracture Property Values for the TH Property Set that was Calibrated Against the SHT

DTN: LL980209004242.026

Geologic Unit	Model Unit	Porosity	Permeability (m^2)		S_r [a]	α [b] (Pa-1)	m [b]	FMX
			Vertical	Horizontal				
Tpcpll	TCw11	2.33E-04	2.29E-11	6.03E-12	0.01	2.37E-03	0.667	5.00E-04
Tpcpln	TCw12	2.99E-04	1.38E-11	6.03E-12	0.01	2.37E-03	0.669	5.00E-04
Tpcpv	TCw13	7.05E-05	2.82E-12	2.40E-13	0.01	9.12E-04	0.669	5.00E-04
Tpbt4	PTn21	4.84E-05	5.25E-13	5.25E-13	0.01	1.10E-03	0.669	5.02E-01
Tpy	PTn22	4.83E-05	1.95E-13	1.95E-13	0.01	1.85E-03	0.669	5.00E-01
Tpbt3	PTn23	1.30E-04	2.57E-13	2.57E-13	0.01	3.45E-03	0.667	5.00E-01
Tpp	PTn24	6.94E-05	6.17E-14	6.17E-14	0.01	9.13E-04	0.667	5.00E-01
Tpbt2	PTn25	3.86E-05	7.76E-14	7.76E-14	0.10	1.81E-04	0.320	5.00E-01
Tptrv	TSw31	8.92E-05	1.07E-11	1.00E-12	0.01	1.44E-04	0.566	4.68E-01
Tptrn	TSw32	1.29E-04	1.51E-11	7.08E-13	0.01	1.42E-03	0.667	5.00E-04
Tptpul	TSw33	1.05E-04	2.63E-11	8.91E-13	0.01	1.73E-03	0.667	5.00E-04
Tptpmn	TSw34	1.24E-04	6.76E-12	4.27E-13	0.01	9.34E-04	0.643	1.23E-03
Tptpll	TSw35	3.29E-04	3.80E-12	9.12E-13	0.01	1.26E-03	0.667	5.00E-04
Tptpln	TSw36	3.99E-04	1.20E-12	1.20E-12	0.01	1.32E-03	0.667	5.00E-04
Tptpv	TSw37	4.92E-04	1.20E-12	1.20E-12	0.01	1.19E-03	0.659	5.00E-04
Tpbt1	CH1zc	1.10E-05	2.51E-14	2.40E-14	0.01	1.14E-03	0.667	5.00E-01
Tac(z)	CH2zc	1.10E-05	2.51E-14	1.17E-14	0.01	1.12E-03	0.654	9.22E-01
Tac(z)	CH3zc	1.10E-05	2.51E-14	1.17E-14	0.01	1.12E-03	0.654	9.22E-01
Tacbt	CH4zc	1.10E-05	2.51E-14	1.55E-14	0.01	1.14E-03	0.667	5.00E-01
Tpbt1	CH1vc	7.14E-05	1.74E-13	1.74E-13	0.01	1.18E-03	0.669	5.00E-01
Tac(v)	CH2vc	7.14E-05	2.88E-13	2.88E-13	0.01	1.18E-03	0.667	5.00E-01
Tac(v)	CH3vc	7.14E-05	2.88E-13	2.88E-13	0.01	1.18E-03	0.667	5.00E-01
Tabt1	CH4vc	7.14E-05	2.88E-13	2.88E-13	0.01	1.18E-03	0.667	5.00E-01
Tcp(3)	PP3vp	7.14E-05	7.08E-13	6.92E-13	0.01	1.42E-03	0.667	5.00E-04
Tcb(w)	BF3vb	7.14E-05	7.08E-13	6.92E-13	0.01	1.42E-03	0.667	5.00E-04
Tcb(w)	TM3vt	7.14E-05	7.08E-13	6.92E-13	0.01	1.42E-03	0.667	5.00E-04
Tcp(2)	PP2zp	1.10E-05	2.51E-14	6.46E-14	0.01	1.14E-03	0.667	5.00E-01
Tcb(n)	BF2zb	1.10E-05	2.51E-14	6.46E-14	0.01	1.14E-03	0.667	5.00E-01

[a] Sr is the residual liquid-phase saturation (not in situ saturation).
[b] α and m are fitting parameters for capillary pressure and relative permeability curves, respectively.

Jump to the Previous, or Next Section.

Date: 8/26/99
Sender: Debra Hughson
To: Melissa Hill, Ronald Green
Priority: Normal
Subject: alphas

Melissa,

Here's the URL for α TSw 36 & 37 (matrix)

http://domino.ymp.gov/va/support/tspa-vatbr/chap3.nsf

Go to Table 3-32

debra

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Total System Performance Assessment
Viability Assessment Technical Basis Report
Chapter 3 - Thermal Hydrology

Jump to the Previous, or Next Section.

Table 3-32. Matrix Property Values of the Thermal-Hydrologic Property Set for Only the Property Values that Differ from the Matrix Values in the Previous Table

DTN: LL980209004242.026

Geologic Unit	Model Unit	Porosity	Permeability (m^2)	S_r [a]	α [b] (Pa^{-1})	m [b]
Tptpln	TSw36	0.092	8.70E-18	0.18	2.272E-6	0.5138
Tptpv	TSw37	0.02	4.080E-18	0.5	7.3856E-6	0.3709

[a] Sr is the residual liquid-phase saturation (not in situ saturation).
[b] α and m are fitting parameters for capillary pressure and relative permeability curves, respectively.

Jump to the Previous, or Next Section.

8/26/99

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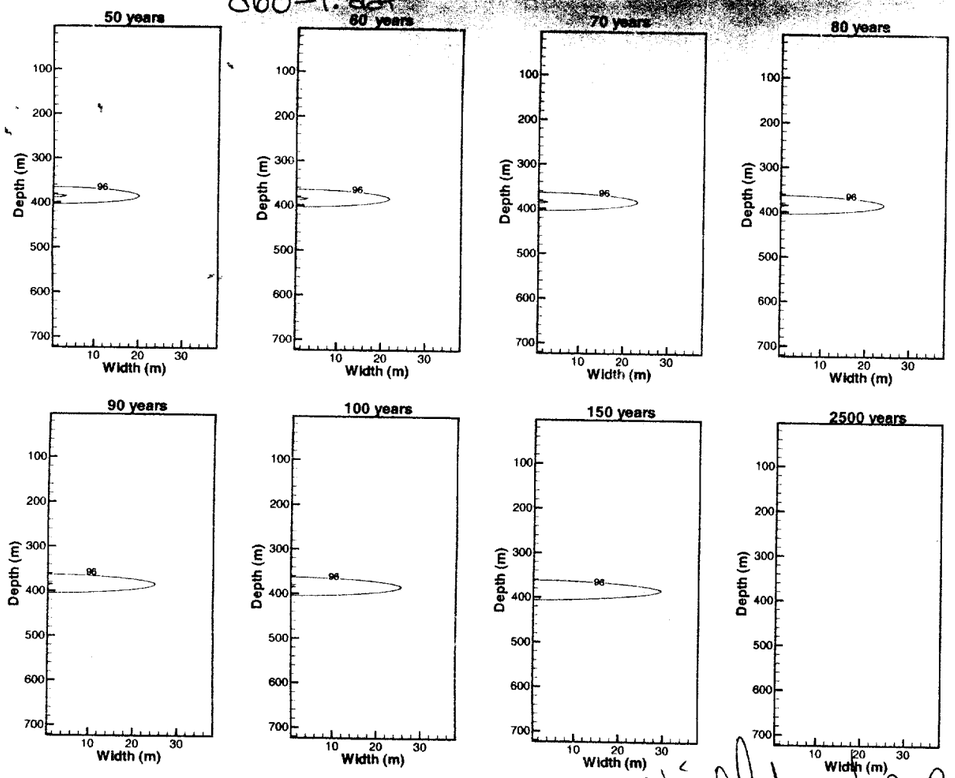
Results of d60-1.dat (p123 of this notebook).

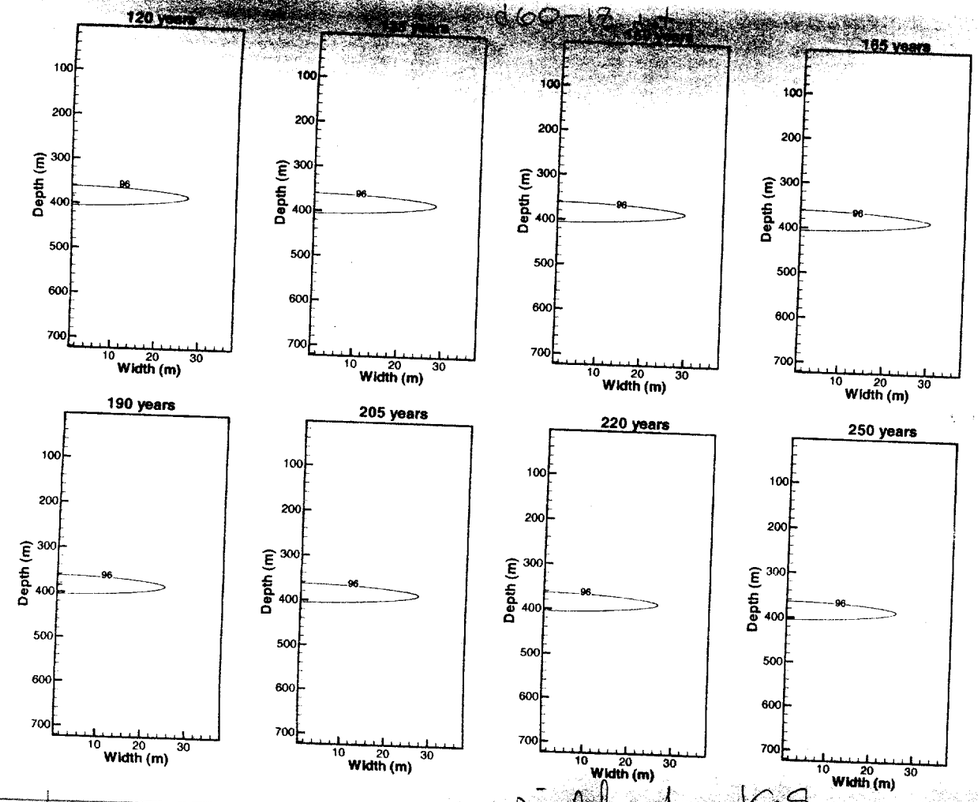
d60-1.dat



MHull 8/26/99

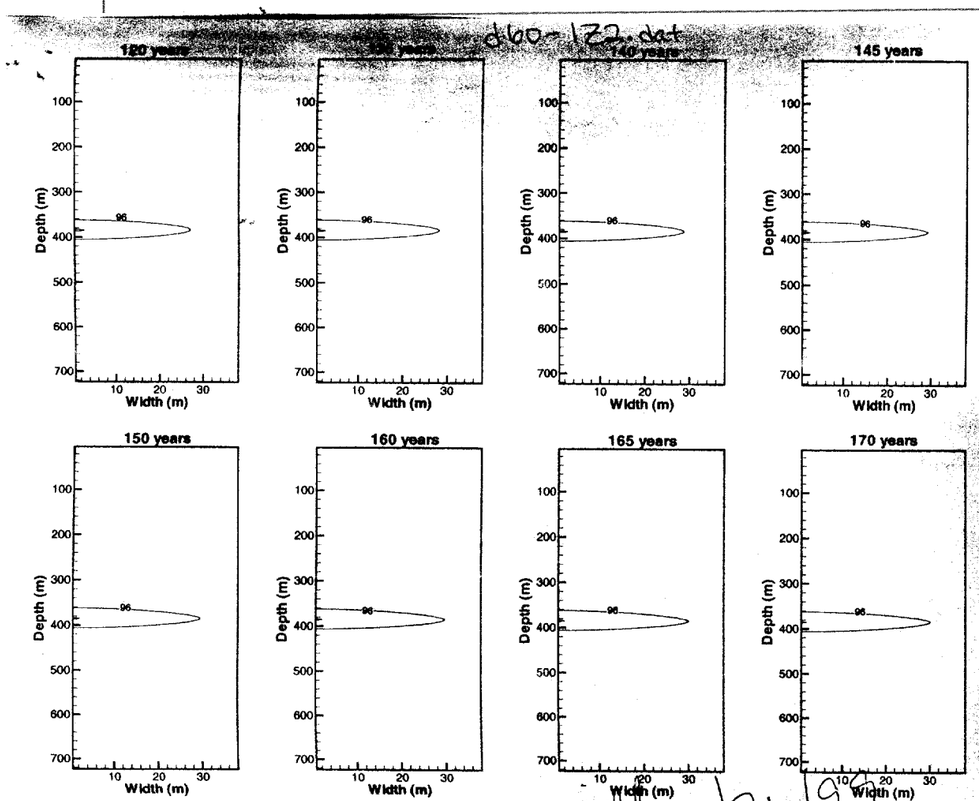
Results of d60-17.dat (p 124 of this notebook).

d60-17.dat



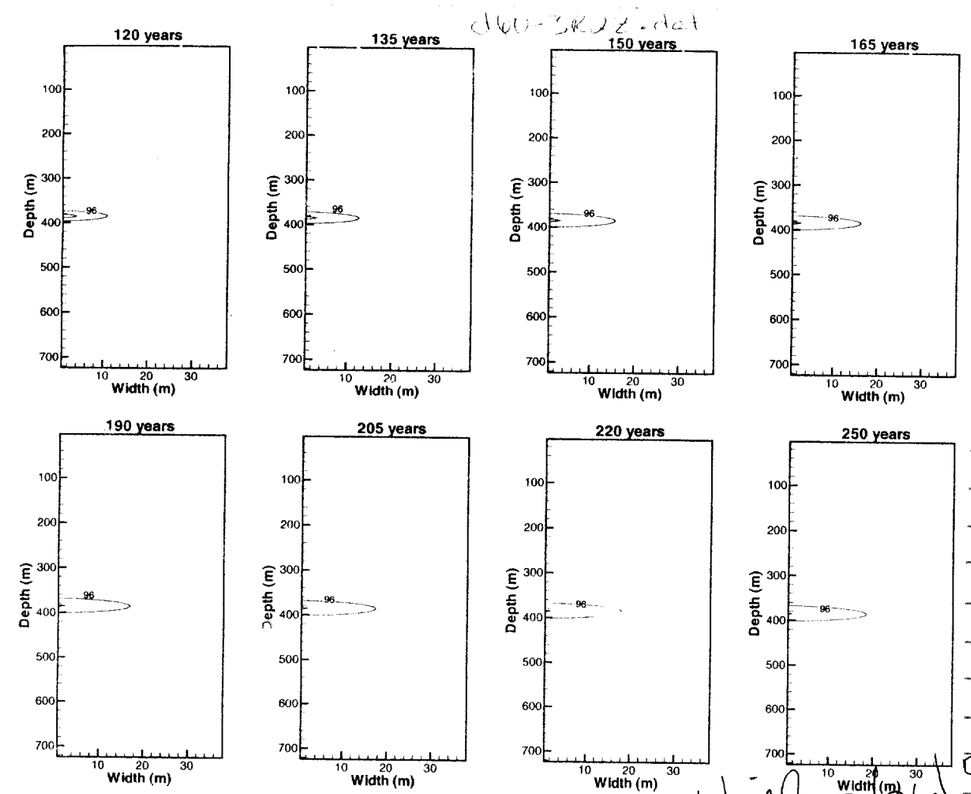
MHull 8/26/99

Results of d60-1Z2.dat
(p 126 of this notebook).



M Hill 8/26/99

Results of d60-3R2Z.dat
(p 125 of this notebook).



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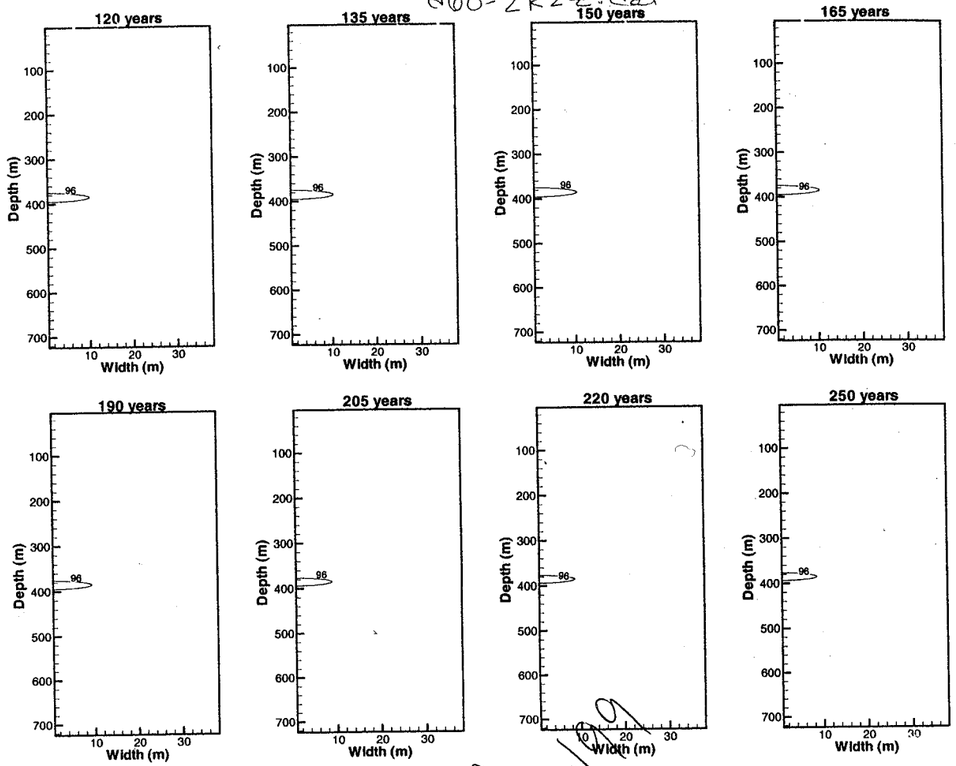
d60-2RZZ.dat



M Hill 8/26/99

Amended file d60-1Z2 as follows:

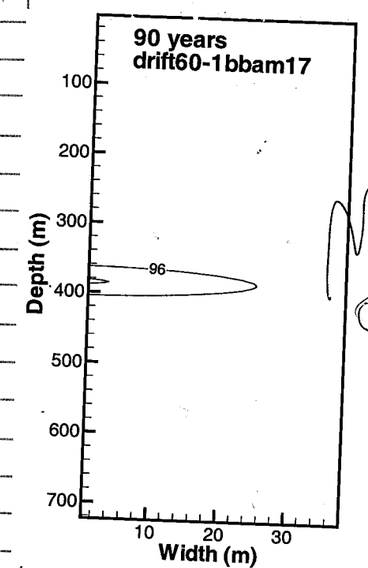
1) Changed α parameters for

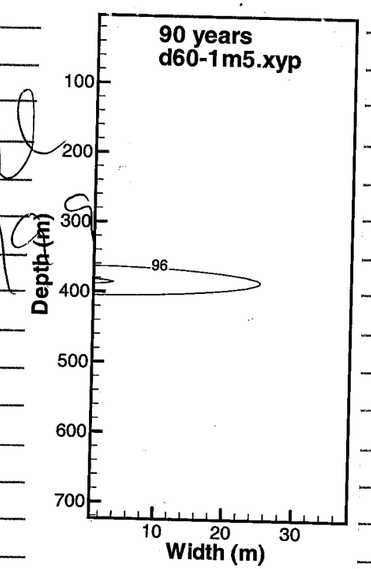
TSw36 (matrix) 8.08e-7

TSw37 (matrix) 5.30e-7

Renamed file d60-1Z2a.dat

In an effort to verify the heat multiplier value used in earlier runs the following plots were performed.





M Hill 8/26/99

multiplier = 0.27990
Source parameter = 32
(Ks2)

multiplier = 0.6
Source parameter = 31
(Ks2)

M Hill 8/26/99

8/27/99 Amended file d60-1.dat as follows:

After speaking with D. Hughson who calculated the following:

qbc For BCON 10 mm/y infiltration

MH 8/27/99

$$\frac{10\,mm}{y}\,\frac{y\,m}{1000\,mm}\,\frac{min}{60\,s}\,\frac{h}{60\,min}\,\frac{day}{24\,h}\,\frac{yr}{365\,d}\,\frac{9983\,kg}{m^3}$$

$$\frac{3.166\times10^{-6}}{2.33e-4} = 1.36e-3$$

MH 8/27/99

MH 8/27/99

MH 8/27/99

mistake should be to

MH 2/22/00

VOLP TCH

File name d60-1ST.dat

ran to steady state. Used cut & ~~pase~~ paste for Initial conditions & re-ran. New file d60-110.dat which is located in vulcan/home/mhill/~~rent~~

qbc For BCON 1 mm/y infiltration

$$\frac{1\,mm}{y}\left(\frac{m}{1000\,mm}\right)\left(\frac{min}{60\,s}\right)\left(\frac{h}{60\,min}\right)\left(\frac{day}{24\,h}\right)\left(\frac{yr}{365\,d}\right)\left(\frac{9983\,kg}{m^3}\right)$$

MH 8/27/99

$$\cancel{3.25\times10^{-7}}\quad \frac{3.17\times10^{-7}}{2.33e-4}$$

$$= 1.36\times10^{-3}$$

Set qbc for BCON 10 mm/y infiltration to 1.36e-2 file d0/d60-1ST.dat located in vulcan/mhill/final/ ran to steady state.

omit hyphen

set qbc for BCON 1 mm/y infiltration to 1.36e-3 or 1.4e-3 file d60-1ST1.dat located in vulcan/mhill/final/

cut & paste section of d60-1ST.dat output file d60-1ST-out

MH 8/27/99

renamed st10.dat

inserted st10.dat as INIT on d60-1ST.dat.

Renamed file ~~to mmy.dat~~ MH 8/27/99

d60-10mmy.dat

cut & paste section of d60-1571.dat
output file d60-1571_cut.
renamed stl.dat
inserted stl.dat as INIT in
d60-1571.dat file
Renamed d60-1mmy.dat
in vulcan/home/mhill/fixel/

MHill 8/27/99

8/29/99 Amended file d60-1ommy.dat as
follows:

T = (years)
1
4
8
25
40
50
60
70
80
90
100
150
165
175
185
200

500
800
1000
1500
1600
1700
1800
1900
2000
2100
2300
2400
2500
2600
7500
10000

Renamed file: d60-1ommy2.dat located in
vulcan/home/mhill/infil/
heater location = 385.28

fld mH 8/29/99
d60-1ommy2 ~~fdl~~ ml.xyp

z	x	temp	time
385.28	0.7450	224.4	1
	2.265	154.7	
	3.840	99.92	
	5.440	70.13	

mH 8/29/99
d60-1ommy2 ~~fld~~ fldm2.xyp

z	x	temp	time
385.28	0.7450	286.8	4
	2.265	209.3	
	3.840	151.7	
	5.440	120.7	

	7.090	99.73	
	8.790	83.69	

d00-lommy2fldm3.xyp

385.28	0.7450	318.3	8
	2.265	232.8	
	3.840	167.2	
	5.440	138.1	
	7.090	118.5	
	8.790	103.9	
	10.49	92.32	

d60-lommy2fldm4.xyp

385.28	0.7450	282.8	25
	2.265	220.0	
	3.840	166.8	
	5.440	142.3	
	7.090	126.4	
	8.790	115.3	
	10.49	107.2	
	12.24.	100.7	
	14.04	94.92	

d60-lommy2fldm5.xyp

385.28	0.7450	248.3	40
	2.265	198.5	
	3.840	156.2	
	5.440	136.4	
	7.090	123.6	
	8.790	114.7	
	10.49	108.4	
	12.24	103.5	
	14.04	99.39	
	16.54	94.45	

d60-lommy2fldm6.xyp

385.28	0.7450	226.5	50
	2.265	183.5	
	3.840	148.2	
	5.440	131.4	
	7.090	120.4	
	8.790	113.0	
	10.49	107.6	
	12.24	103.5	
	14.04	100.2	
	16.54	96.25	
	19.89	91.43	

d60-lommy2fldm7.xyp 60

385.28	0.7450	208.9	60
	2.265	171.3	
	3.840	141.2	
	5.440	126.6	
	7.090	117.4	
	8.790	111.0	
	10.49	106.5	
	12.24	103.1	
	14.04	100.3	
	16.54	97.07	
	19.89	93.18	
	23.64	89.13	

d60-lommy2fldm8.xyp

385.28	0.7450	194.7	70
	2.265	161.4	
	3.840	135.1	
	5.440	122.6	
	7.090	114.7	
	8.790	109.3	
	10.49	105.4	

	12.24	102.5	
	14.04	100.1	
	16.54	97.39	
	19.89	94.11	

d60-lommy2fldm9.xyp

385.28	0.7450	181.7	80
	2.265	152.6	
	3.840	129.7	
	5.440	119.0	
	7.090	112.2	
	8.790	107.6	
	10.49	104.3	
	12.24	101.8	
	14.04	99.78	
	16.54	97.41	
	19.89	94.54	

d60-lommy2fldm10.xyp

385.28	0.7450	170.9	90
	2.265	145.5	
	3.840	125.3	
	5.440	116.1	
	7.090	110.3	
	8.790	106.2	
	10.49	103.4	
	12.24	101.2	
	14.04	99.38	
	16.54	97.26	
	19.89	94.66	

d60-lommy2fldm11.xyp

385.28	0.7450	165.3	100
	2.265	141.7	
	3.840	123.2	
	5.440	114.7	
	7.090	109.3	

8.790	105.5	
10.49	102.9	
12.24	100.8	
14.04	99.17	
16.54	97.18	
19.89	94.75	

d60-lommy2fldm12.xyp

385.28	0.7450	143.6	150
	2.265	128.5	
	3.840	116.4	
	5.440	110.1	
	7.090	106.1	
	8.790	103.4	
	10.49	101.5	
	12.24	99.98	
	14.04	98.74	
	16.54	97.24	
	19.89	95.38	

d60-lommy2fldm13.xyp

385.28	0.7450	138.8	165
	2.265	125.2	
	3.840	114.2	
	5.440	108.6	
	7.090	105.1	
	8.790	102.7	
	10.49	100.9	
	12.24	99.56	
	14.04	98.41	
	16.54	97.00	
	19.89	95.22	

d60-lommy2fldm14.xyp

385.28	0.7450	135.6	175
	2.265	123.0	

3.840	112.9	
5.440	107.7	
7.090	104.4	
8.790	102.1	
10.49	100.5	
12.24	98.23	
14.04	98.12	
16.54	96.74	
19.89	95.00	

d60-lommy2fldm15.xyp

385.28	0.7450	132.6	185
	2.265	120.9	
	3.840	111.6	
	5.440	106.8	
	7.090	103.7	
	8.790	101.6	
	10.49	100.1	
	12.24	98.85	
	~~14.04~~	~~97.71~~	
	16.54	96.38	
	19.89	94.69	

MH 8/28/99

~~385.28~~	d60-lommy2fldm16.xyp		
385.28	0.7450	130.0	200
	2.265	119.2	
	3.840	110.5	
	5.440	106.0	
	7.090	103.1	
	8.790	101.1	
	10.49	99.59	
	12.24	98.37	
	14.04	97.27	
	16.54	95.86	

d60-lommy2fldm17.xyp

385.28	0.7450	114.3	500
	2.265	108.5	
	3.840	103.6	
	5.440	100.9	
	7.090	98.99	
	8.790	97.56	
	10.49	96.38	
	12.24	95.34	

d60-lommy2fldm18.xyp

5.440	98.63	800
7.090	97.12	
8.790	95.93	

d60-lommy2fldm19.xyp

385.28	2.265	100.5	1000
MH 8/28/99	~~3.840~~		
	3.840	97.60	
	5.440	95.84	

d60-lommy2fldm20.xyp

385.28	0.7450	98.12	1500
	2.265	95.57	

d60-lommy2fldm21.xyp

385.28	0.7450	96.89	1600
	2.265	94.49	

d60-lommy2fldm22.xyp

385.28	0.7450	95.56	1700

rerun files located in

vulcan/home/mhill/vent50-1mm2/
vulcan/home/mhill/vent50-10mm2/

Vulcan/mhill/vent 20-1mm2/
Vulcan/mhill/vent 20-10mm2/

File names are:

d60-20r-1mm.dat
d60-20r-10mm.dat
d60-50r-1mm.dat
d60-50r-10mm.dat

Provided by R. Green.
MH 8/29/99

8/30/99

d60-20r-10mmfldm1.xyp

T(yrs)	Z (m)	X (m)	Temp. (C)	Intrp. X
10	385.28	8.790	96.36	8.85
		10.49	86.54	

d60-20r-10mmfldm2.xyp

50	385.28	10.49	100.7	
		12.24	96.22	12.34
		14.04	92.31	

d60-20r-10mmfldm3.xyp

60	385.28	12.24	98.55	
		14.04	94.72	13.44

d60-20r-10mmfldm4.xyp

70	385.28	12.24	100.7	
		14.04	97.15	14.71
		16.54	92.86	

d60-20r-10mmfldm5.xyp

	Z (m)	X (m)	Temp. (C)	
80	385.28	14.04	97.89	15.28
		16.54	94.07	

d60-20r-10mmfldm6.xyp

90	385.28	14.04	~~98.16~~ 97.97	15.48
		16.54	~~94.97~~ 94.55	

d60-20r-10mmfldm7.xyp

100	385.28	14.04	98.16	15.73
		16.54	94.97	

d60-20r-10mmfldm8.xyp

125		14.04	98.80	
		16.54	96.04	16.58
		19.89	93.06	

d60-20r-10mmfldm9.xyp

150	385.28	14.04	98.78	
		16.54	96.40	17.06
		19.89	93.82	

d60-20r-10mmfldm10.xyp

175	385.28	14.04	98.01	16.49
		16.54	95.96	

d60-20r-10mmfldm11.xyp

200	385.28	14.04	96.76	15.08
		16.54	94.94	

d60-20r-10mmfldm12.xyp

Time (yrs)	Z (m)	X (m)	Temp (c)	Int. x
250	385.28	10.49	98.94	
		12.24	97.36	
		14.04	96.00	14.04
		16.54	94.35	
500	d60-20r-10mmfldm13.xyp			
	385.28	10.49	96.89	11.95
		12.24	95.82	
1000	d60-20r-10mmfldm14.xyp			
	385.28	7.090	96.55	8.05
		8.790	95.58	
1500	d60-20r-10mmfldm15.xyp			
	385.28	3.840	96.62	4.56
		5.440	95.24	
2500	d60-20r-10mmfldm16.xyp			
	385.28	0.7450	92.09	0

d60-20r-1mmfldm1.xyp

T (yrs)	Z (m)	X (m)	Temp (c)	Int. x
10	385.28	8.790	96.92	8.95
		10.49	87.01	
d60-20r-1mmfldm2.xyp				
20	385.28	12.24	96.95	12.67
		14.04	92.95	
d60-20r-1mmfldm3.xyp				
60	385.28	12.24	99.39	13.78
		14.04	95.42	
d60-20r-1mmfldm4.xyp				
	385.28	14.04	97.94	15.13
		16.54	93.51	
d60-20r-1mmfldm5.xyp				
80	385.28	14.04	98.72	15.74
		16.54	94.73	
d60-20r-1mmfldm8.xyp				
125	385.28	16.54	96.89	17.50
		19.89	93.78	
d60-20r-1mmfldm9.xyp				
150	385.28	16.54	97.35	18.20
		19.89	94.63	
d60-20r-1mmfldm10.xyp				
175	385.28	16.54	96.86	
		19.89	94.52	17.77

d60-20r-1mmfldm11.xyp

200	385.28	14.04	97.73	
		16.54	95.77	16.25

d60-20r-1mmfldm12.xyp

250	~~385.28~~	~~10.49~~	~~97.88~~	mk 9/3/99
	12.24 98.34	~~12.24~~ mk 9/3/99	~~96.70~~	~~13.50~~
	14.04 96.83	~~14.04~~	~~95.70~~	15.23
	16.54 95.08			

500 d60-20r-1mm fldm13.xyp

	385.28	~~10.49~~ mk 9/3/99	~~97.88~~ mk 9/3/99	mk 9/3/99
commented	10.49 97.88	~~12.24~~	~~96.70~~ 98.34	~~18.03~~
	12.24 96.70	~~14.04~~	~~95.70~~ 96.83	13.5
	14.04 95.70			

d60-20r-1mm fldm14.xyp

1000	385.28	5.440	98.77	
		7.090	97.41	
		8.790	96.37	9.56
		10.49	95.55	

d60-20r-1mmfldm15.xyp

1500	385.28	5.440	96.08	5.57
		7.090	95.05	

2500 d60-20r-1mmfldm16.xyp

	385.28	0.7450	93.00

d60-50r-10mmfldm1.xyp

T(yrs)	Z(m)	X (m)	Temp(c)	Int x
10	385.28	3.840	103.9	4.73
		5.440	89.62	

50 d60-50r-10mmfldm2.xyp

	385.28	2.265	108.1	3.74
		3.840	95.15	

60 d60-50r-10mmfldm3.xyp

				mk 8/31/99
	385.28	5.440	102.6	~~6.6~~ 6.70
		7.090	93.25	

d60-50r-10mmfldm5.xyp

80	385.28	8.790	96.00	8.79
		10.49	91.42	

d60-50r-10mmfldm8.xyp

125	385.28	8.790	97.94	9.76
		10.49	94.54	

~~125~~ mk 8/31/99

d60-50r-10mmfldm9.xyp

150	385.28	8.790	98.09	9.99
		10.49	95.12	

8/31/99

d60-50r-10mmfldm10.xyp

~~150~~	385.28	7.090	99.95	
		8.790	96.79	
175		10.49	94.25	9.32

8/31/99

d60-50r-10mmfldm11.xyp

	Z(m)	X(m)	Temp (C)	Int. x
175	385.28	7.090	97.96	8.29
		8.790	95.19	

d60-50r-10mmfldm12.xyp

250	385.28	7.090	97.03	7.80
		8.790	94.55	~~7.7~~ 8/31/99

d60-50r-10mmfldm13.xyp

350	385.28	5.440	97.31	
		7.090	95.17	6.45

d60-50r-10mmfldm14.xyp

450	385.28	2.265	99.11	
		3.840	96.08	
		5.440	94.27	3.91

d60-50r-10mmfldm15.xyp

550	385.28	0.7450	98.46	
		2.265	95.85	2.18

d60-50r-10mmfldm16.xyp

650	385.28	0.7450	89.73

d60-50r-1mmfldm1.xyp

	Z(m)	X(m)	Temp(c)	Int x
10	385.28	3.840	104.5	4.79
		5.440	90.12	

d60-50r-1mmfldm2.xyp

50	385.28	2.265	108.9	3.81
		3.840	95.74	

d60-50r-1mmfldm3.xyp

	385.28	5.440	103.3	6.82
		7.090	94.55	

d60-50r-1mmfldm5.xyp

	385.28	8.790	96.64	9.02
		10.49	91.96	

d60-50r-1mmfldm8.xyp

	385.28	8.790	98.82	10.14
		10.49	95.27	

d60-50r-1mmfldm9.xyp

	385.28	8.790	99.02	10.42
		10.49	95.87	

d60-50r-1mmfldm10.xyp

	385.28	7.090	101.4	
		8.790	97.93	9.996
		10.49	95.21	~10.00

d60-50r-1mmfldm11.xyp

Z (m)	X (m)	Temp (c)	Int X
385.28	5.440	102.8	
	7.090	98.89	8.77
	8.790	95.96	

d60-50r-1mmfldm12.xyp

385.28	7.090	98.10	8.44
	8.790	95.46	

d60-50r-1mmfldm13.xyp

385.28	~~2.265~~	~~99.90~~	5.440	98.13
	~~3.840~~	~~96.79~~	7.090	95.87
	~~5.440~~ MH 8/30/99	~~94.94~~		7.00

d60-50r-1mmfldm14.xyp

385.28	2.265	99.90	
	3.840	96.79	4.52
	5.440	94.94	

d60-50r-1mmfldm15.xyp

385.28	0.7450	99.29	
	2.265	96.68	2.72
	3.840	94.31	

d60-50r-1mmfldm16.xyp

385.28	0.7450	90.55	MH 8/30/99

vertical

8/31/99 MH ~~8/31/99 horizontal~~ d60-20r-10mmfldm1.xyp 8/31/99 MH

Z (m)	Temp (c)	Int Z
385.28	190.9	
MH 8/31/99 ~~3.7650~~		
376.5	97.34	
371.5	76.29	376.18

d60-20r-10mmfldm2.xyp

376.5	105.4	372.18
371.5	94.51	

d60-20r-10mmfldm3.xyp

376.5	107.4	
371.5	96.40	371.26
366.5	88.06	

d60-20r-10mmfldm4.xyp

371.5	98.24	369.95
366.5	91.01	

d60-20r-10mmfldm5.xyp

~~317.~~ MH 8/31/99		
371.5	98.67	369.42
366.5	92.24	

d60-20r-10mmfldm8.xyp

371.5	99.25	368.05
366.5	94.54	

d60-20r-10mmfldm9.xyp

371.5	99.21	
366.5	95.09	367.60

d60-20r-10mmfldm10.xyp

Z(m)	Temp(C)	Int. Z
371.5	98.49	
366.5	94.78	368.14

d60-20r-10mmfldm11.xyp

371.5	97.41	
366.5	93.81	369.54

d60-20r-10mmfldm12.xyp

371.5	96.75	
366.5	93.28	370.42

d60-20r-10mm fldm13.xyp

376.5	98.35	372.53
371.5	95.39	

d60-20r+0mmfldm14.xyp

380.7	98.52	376.93
376.5	95.71	

d60-20r-10mmfldm15.xyp

383.5	98.90	380.91
380.7	95.77	

d60-20r-10mmfldm16.xyp

mH 8/31/99 ~~horizontal~~ vertical

d60-20r-1mmfldm1.xyp

Z(m)	Temp(C)	Int Z
376.5	99.48	375.71
371.5	77.32	

d60-20r-1mmfldm2.xyp

376.5	106.0	372.15
371.5	94.51	

d60-20r-1mmfldm3.xyp

371.5	96.49	371.22
366.5	87.73	

mH 8/31/99

d60-20r-1mmfldm~~15~~.xyp

371.5	98.99	369.36
366.5	92.01	

d60-20r-1mmfldm8.xyp

371.5	99.65	368.06
366.5	94.34	

d60-20r-1mmfldm9.xyp

371.5	99.71	
366.5	94.97	367.59

d60-20r-1mmfldm10.xyp

371.5	98.96	
366.5	94.69	368.03

d60-20r-1mmfldm11.xyp

Z (m)	Temp (C)	Int Z
371.5	97.62	369.49
366.5	93.59	

d60-20r-1mmfldm12.xyp

371.5	96.79	370.45
366.5	93.04	

d60-20r-1mmfldm13.xyp

376.5	98.98	372.08
371.5	95.61	

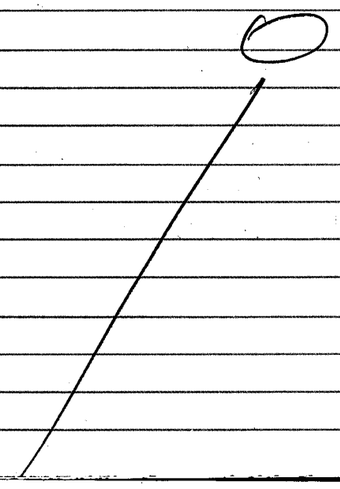
d60-20r-1mmfldm14.xyp

376.5	96.24	
371.5	94.07	375.95

d60-20r-1mmfldm15.xyp

380.7	96.56	379.72
376.5	94.15	

d60-20r-1mmfldm16.xyp



MH 8/31/99

d60-50r-10mmfldm1.xyp

~~horizontal~~ vertical Z (m)	Temp (c)	Int Z
380.7	96.57	380.60
376.5	72.74	

d60-50r-10mmfldm2.xyp

383.5	108.4	381.47
380.7	91.28	

d60-50r-10mmfldm3.xyp

380.7	107.8	378.06
376.5	89.04	

d60-50r-10mmfldm~~4~~5.xyp MH 8/31/99

376.5	97.23	375.93
371.5	86.42	

d60-50r-10mmfldm8.xyp

376.5	98.65	374.81
371.5	90.79	

d60-50r-10mmfldm9.xyp

376.5	98.72	374.53
371.5	91.82	

d60-50r-10mmfldm10.xyp

MH 8/31/99

376.5	97.~~98~~48	
371.5	91.27	375.31

d60-50r-10mmfldm11.xyp

z(m)	Temp(c)	Int z
380.7	103.7	376.54
376.5	95.93	

d60-50r-10mmfldm12.xyp

380.7	102.2	376.95
376.5	95.26	

d60-50r-10mmfldm13.xyp

380.7	98.60	378.45
376.5	93.75	

d60-50r-10mmfldm14.xyp

383.5	99.07	381.40
380.7	94.97	

d60-50r-10mmfldm15.xyp

~~385.3 98.76~~ MH 8/31/99

385.28	98.46	383.63
383.5	95.81	

d60-50r-10mmfldm16.xyp

0

d60-50r-1mmfldm17.xyp

z(m)	Temp(c)	Int z
380.7	96.99	380.53
376.5	72.92	

d60-50R-1mmfldm2.xyp

383.5	109.0	381.40
380.7	91.67	

d60-50R-1mmfldm3.xyp

380.7	108.4	377.99
376.5	89.17	

d60-50r-1mmfldm5.xyp

376.5	97.49	375.83
371.5	86.29	

d60-50r-1mmfldm~~6~~8.xyp MH 8/31/99

376.5	99.08	374.67
371.5	90.68	

d60-50r-1mmfldm9.xyp

376.5	99.~~12~~ 16 MH 8/31/99	374.38
371.5	91.70	

d60-50r-1mmfldm10.xyp

376.5	98.08	
371.5	91.42	374.94

d60-50r-1mmfldm11.xyp

Z(m)	Temp(c)	Int Z
376.5	96.14	376.38
371.5	90.08	

d60-50r-1mmfldm12.xyp

380.7	103.3	376.71
376.5	95.62	

d60-50r-1mmfldm13.xyp

380.7	99.20	378.08
376.5	94.07	

d60-50r-1mmfldm14.xyp

383.5	99.82	380.96
380.7	95.61	

d60-50r-1mmfldm15.xyp

383.5	96.62	382.96
380.7	93.39	

d60-50r-1mmfldm16.xyp

~~vertical~~ horizontal

d60-10mmfldm1.xyp

Z(m)	X(m)	Temp(c)	Int X
385.28	~~0.7450~~ 10.49	100.8	11.31
	12.24	90.55	

d60-10mmfldm2.xyp

385.28	14.04	106.8	
	16.54	101.1	19.59
	19.89	95.49	

d60-10mmfldm3.xyp

385.28	~~366.5~~	~~28.14~~	16.54	102.1
		~~92.22~~	19.89	97.28
			23.64	92.98
				21.01

d60-10mmfldm5.xyp

385.28	19.89	98.64	23.00
	23.64	95.46	

d60-10mmfldm8.xyp

385.28	19.89	99.14	25.58
	23.64	96.90	
	28.07	94.15	

d60-10mmfldm9.xyp

385.28	19.89	99.23	
	23.64	97.30	26.88
	28.07	95.52	

d60-10mmfldm10.xyp

Z(m)	X(m)	Temp(c)	
385.28	12.24	104.9	
	14.04	102.9	
	16.54	100.6	26.69
	19.89	98.68	
	23.64	97.04	
	28.07	95.53	

d60-10mmfldm11.xyp

385.28	16.54	99.35	
	19.89	97.69	24.37
	23.64	96.22	
	28.07	94.88	

d60-10mmfldm12.xyp

385.28	14.04	99.86	
	16.54	98.37	
	19.89	96.85	22.22
	23.64	95.48	

d60-10mmfldm13.xyp

385.28	12.24	98.72	
	14.04	97.88	
	16.54	96.87	19.21
	19.89	95.78	

d60-10mmfldm14.xyp

385.28	5.440	99.89	
	7.090	98.70	
	8.790	97.79	
	10.49	97.07	13.71
	12.24	96.45	

385.28	14.04	95.90	

d60-10mmfldm15.xyp ~~13~~ m14 8/21/99

Z(m)	X(m)	Temp(c)	Int X
385.28	3.840	98.56	
	5.440	97.22	
	7.090	96.25	7.66
	8.790	95.50	

d60-10mmfldm16.xyp

0

Vertical d60-10mmfldm1.xyp

376.5	112.3	373.11
371.5	88.24	

m2.xyp

366.5	97.28	365.58
361.5	90.34	

m3.xyp

366.5	98.14	364.69
361.5	92.22	

mt 8/21/99

m~~4~~5.xyp

366.5	98.68	
361.5	94.05	363.61

M8

366.5	98.88	
361.5	95.55	362.18

361.5	96.01	M9	361.49
356.5	92.26		

M10

366.5	98.51	
361.5	95.90	361.69

M11

366.5	97.79	362.99
361.5	95.24	

M12

366.5	97.22	
361.5	94.66	364.12

M13

366.5	96.25	365.94
361.5	94.01	

M14

371.5	96.15	
366.5	94.49	371.05

M15

380.7	97.77	
376.5	95.53	377.38

M16

0

horizontal d60-1mmfld ml.xyp

Z(m)	X(m)	Temp (c)	Int x
385.28	10.49	101.4	
	12.24	91.04	11.40

M2.xyp

19.89	96.12	
23.64	90.88	19.98

M3.xyp

19.89	98.04	
23.64	93.58	21.61

M4.xyp

19.89	99.11	
23.64	95.23	22.90

M5.xyp

19.89	99.57	
23.64	96.16	
28.07	93.10	23.87

M6.xyp

19.89	99.68	24.64
23.64	96.61	
28.07	93.90	

M8.xyp

23.64	97.90	27.19
28.07	95.53	

m9 xyp

28.07	96.21	
33.00	94.84	28.83

m10 . xyp

23.64	97.88	
28.07	96.24	
33.00	95.05	m# 8/31/99 29.06
		m# ~~29.06~~

m11. xyp

19.89	98.76	
23.64	97.08	
28.07	95.65	26.99

m12. xyp

19.89	97.77	
23.64	96.27	24.57
28.07	94.98	

m13

16.54	97.77	
19.89	96.57	
23.64	95.54	21.97

m14

14.04	96.80	
16.54	96.10	17.01
19.89	95.38	

m15

7.090	97.18	
8.790	96.37	
10.49	95.73	9.77

m16

Vertical 060-1mm flat1 . xyp

376.5	112.8	
371.5	88.50	373.04

m# 8/31/99

m2

~~366.5~~		
366.5	97.54	365.45
361.5	90.18	

m# 8/31/99

m3

366.5	98.45	364.58
361.5	92.08	

m# 8/31/99

m4

366.5	99.01	363.55
361.5	93.90	

m8

366.5	99.24	362.35
361.5	95.34	

m9

366.5	99.25	
361.5	95.78	361.82

M10

366.5 98.80 362.10
361.5 95.62

M11

366.5 97:91 363.39
361.5 94.84

M12

366.5 97.20 364.47
361.5 94.25

M13

366.5 96.13 366.21
361.5 93.87

M14

371.5 96.56 369.73
366.5 94.98

M15

376.5 96.24 375.78
371.5 94.57

M16

0

MH 8/31/99

Data pulled from notebook 148-172 of this notebook.

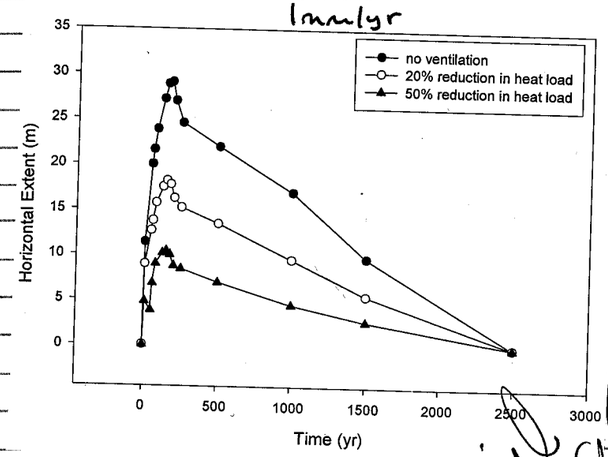
time (y)	no ventil. 10mm/y horizontal 10-H	no ventil. 10mm/y vertical 10-VC	no vetil. 1mm/y vertical 1-VC	no ventil. 1mm/y horizontal 1-H	20% red. 10mm/y horizontal 20-10H	20% red. 10mm/y vertical 20-10VC	20% red. 1mm/y horizontal 20-1H	20% red. 1mm/y vertical 20-1VC
0	0	0	0	0	0	0	0	0
10	11.31	12.17	12.24	11.4	8.85	9.1	8.95	9.57
50	19.59	19.7	19.83	19.98	12.34	13.1	12.67	13.13
60	21.01	20.59	20.7	21.61	13.44	14.02	13.78	14.06
80	23	21.67	21.73	23.87	15.28	15.86	15.74	15.92
125	25.58	23.1	22.93	27.19	16.58	17.23	17.5	17.22
150	26.88	23.79	23.46	28.83	17.06	17.68	18.2	17.69
175	26.69	23.59	23.18	29.06	16.49	17.14	17.77	17.25
200	24.37	22.29	21.89	26.99	15.08	15.74	16.25	15.79
250	22.22	21.16	20.81	24.57	14.04	14.86	15.23	14.83
500	19.21	19.34	19.07	21.97	11.95	12.75	13.5	13.2
1000	13.71	14.23	15.55	17.01	8.05	8.35	9.56	9.33
1500	7.66	7.9	9.5	9.77	4.56	4.37	5.57	5.56
2500	0	0	0	0	0	0	0	0

MH 9/3/99 MH 9/3/99 MH 9/3/99 MH 9/3/99

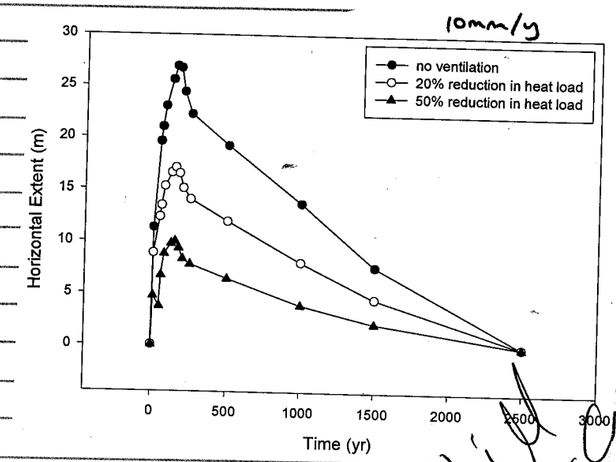
time (y)	50% red. 10mm/y horizontal 50-10H	50% red. 10mm/y vertical 50-10VC	50% red. 1mm/y horizontal 50-1H	50% red. 1mm/y vertical 50-1VC
0	0	0	0	0
10	4.73	4.68	4.79	4.75
50	3.74	3.81	3.81	3.88
60	6.7	7.22	6.82	7.29
80	8.79	9.35	9.02	9.45
125	9.76	10.47	10.14	10.61
150	9.99	10.75	10.42	10.9
175	9.32	9.97	10	10.34
200	8.29	8.74	8.77	8.9
250	7.8	8.33	8.44	8.57
500	6.45	6.83	7	7.2
1000	3.91	3.88	4.52	4.32
1500	2.18	1.65	2.72	2.32
2500	0	0	0	0

MH 9/3/99 MH 9/3/99 MH 9/3/99 MH 9/3/99

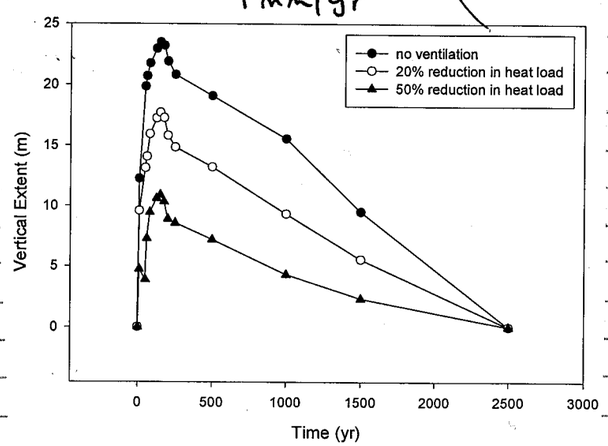
1mm/yr



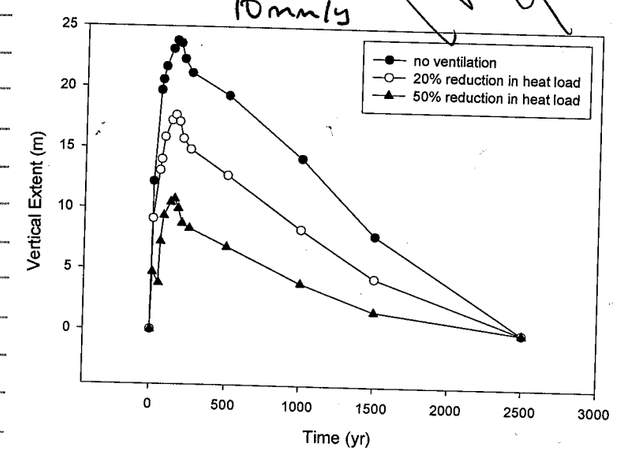
10mm/y



1mm/yr



10mm/y



M Lidel 9/3/89

10/21/99 vulcan/mhill/vent 20-1mm2/ MH 10/21/99

Filnames: d60-20r-1mmfldml.xyp

Time (yrs)	Z(m)	Temp (°C)
10	385.28	253.4
MH 10/21/99 ~~20~~ 50	385.28	198.2
60	"	207.8
70	"	200.7
80	"	190.7
90	"	182.2
100	"	178.5

vulcan/mhill/vent 20-10mm2/

Time (yrs)	Z(m)	Temp (°C)
10	385.28	250.5
50	"	196.6
60	"	205.6
70	"	198.9

Filenames: d60-20r-10mmfldml-4.xyp

vulcan/mhill/vent 50-1mm2/

Time (yr)	Z(m)	Temp (°C)
10	385.28	158.2
50	"	124.1
60	"	165.1
70	"	168.0
80	"	162.9

Filenames: d60-50r-1mmfldml-5.xyp

vulcan/mhill/vent 50-10mm2/

Time (yr)	Z(m)	Temp (°C)
10	385.28	157.2
50	"	123.2
60	"	163.5
70	"	166.4
80	"	161.0

Ammended file: d60-50r-1mm.dat
located in vulcan/mhill/vent50-1mm2/
to reproduce "no ventilation model"
as follows:

1020.00
949.00
813.00
780.00
709.00
649.00
550.00
471.00
408.00

renamed file: EDAII60.dat located
in vulcan/mhill/EDAII/

Ammended file: d60-50r-10mm.dat
located in vulcan/mhill/vent50-10mm2/
to reproduce "no ventilation model"
as follows:

1020.00
949.00
813.00
780.00
709.00
649.00
550.00
471.00
408.00

renamed file: EDAII10mm.dat
located in vulcan/mhill/EDAII10mm/

M Hill 10/26/99

10/26/99 vulcan/mhill/EDAII 1mm/y

File names: EDAII60fldm1-7.xyp

Time (yrs)	Z (m)	Temp (°C)
10	385.28	327.9
50	"	249.8
60	"	233.3
70	"	219.2
80	"	206.5
90	"	195.7
100	"	190.5

vulcan/mhill/EDAII 10mm/

Filenames: EDAII10mmfldm1-7.xyp

Time (yrs)	Z (m)	Temp (°C)
10	385.28	325.7
50	385.28	246.7
60	"	230.8
70	"	216.1
80	"	203.2
90	"	193.2
100	"	187.8

M Hill 10/26/99

12/15/99 This is my attempt to reproduce results obtained by D. Hughson input file on p. 185-187 of this notebook From Near Field/Altered Zone Models Rpt UCRL-ID-129179, Ch 3

Book No. 284 TITLE Unsaturated Zone Thermohydrology

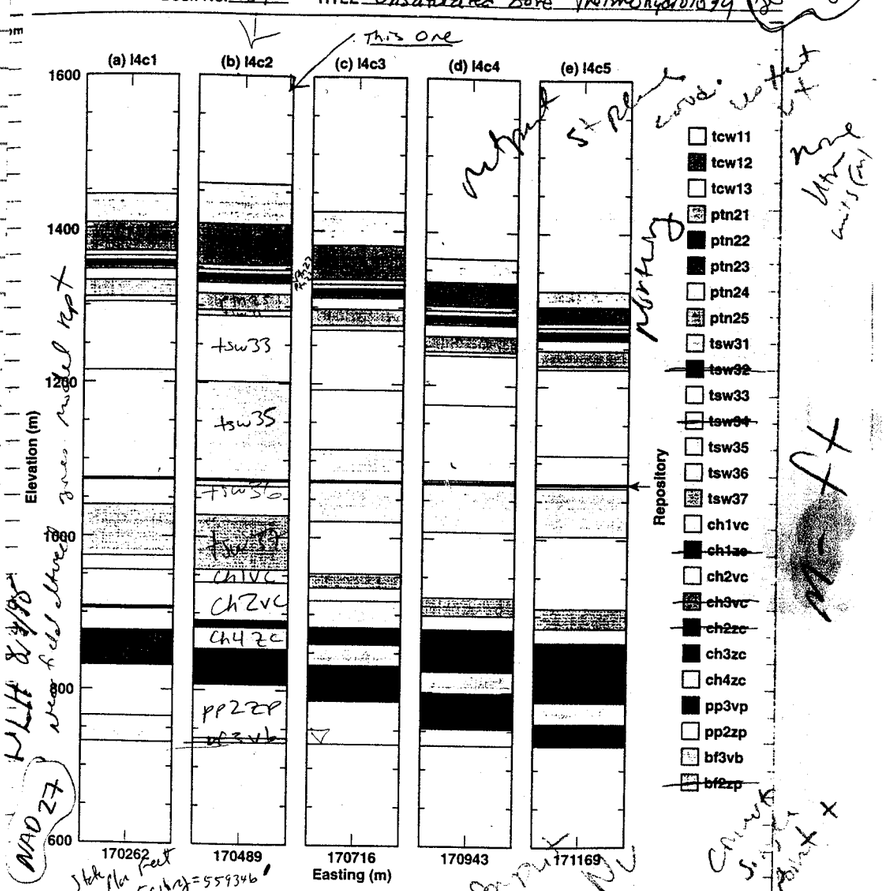


Figure 3-13. Vertical distribution of hydrostratigraphic model units shown for drift-scale model locations (in Nevada-State coordinates), including (a) l4c1 at Northing = 233760 m, (b) l4c2 at Northing = 233748 m, (c) l4c3 at Northing = 233736 m, (d) l4c4 at Northing = 233724 m, and (e) l4c5 at Northing = 233712 m

M Hill 12/15/99

Corpscon for Windows Version 5.1

Convert Input Format Output Format Send Data Utilities Help

Input Format

Output Window

Point 1 of 1

Input	Output
Datum(s): NAD27	Datum(s): NAD27
Zone: Nevada Central - 2702	UTM Zone: 11
Horiz. Units: Meters	Horiz. Units: Meters
Northing: 233748.00000	Northing: 4078915.60236
Easting: 170489.00000	Easting: 547798.40078
Convergence: 0 07 18.02887	Convergence: 0 19 17.82975
Scale Factor: 0.999904030	Scale Factor: 0.999628145

Done

cc.gif

M Hill 12/15/99

Date: 10/8/99
Sender: Randall Fedors
To: Melissa Hill
cc: Debra Hughson
Priority: Normal
Subject: Re:coordinates again

Missy,

The point you gave me is on Dead Yucca Ridge near the crest of Yucca Mtn, approximately 150 m northeast of borehole H-5. Let me know if this is not approximately where you thought the point was located.

The watertable elevation for this point is 768.7 meters msl.
Given the accuracy of the watertable interpolation, I would suggest that you just use 770 m elev.

--Randy

Reply Separator

Subject: coordinates again
Author: Melissa Hill
Date: 10/9/1999 12:21 AM

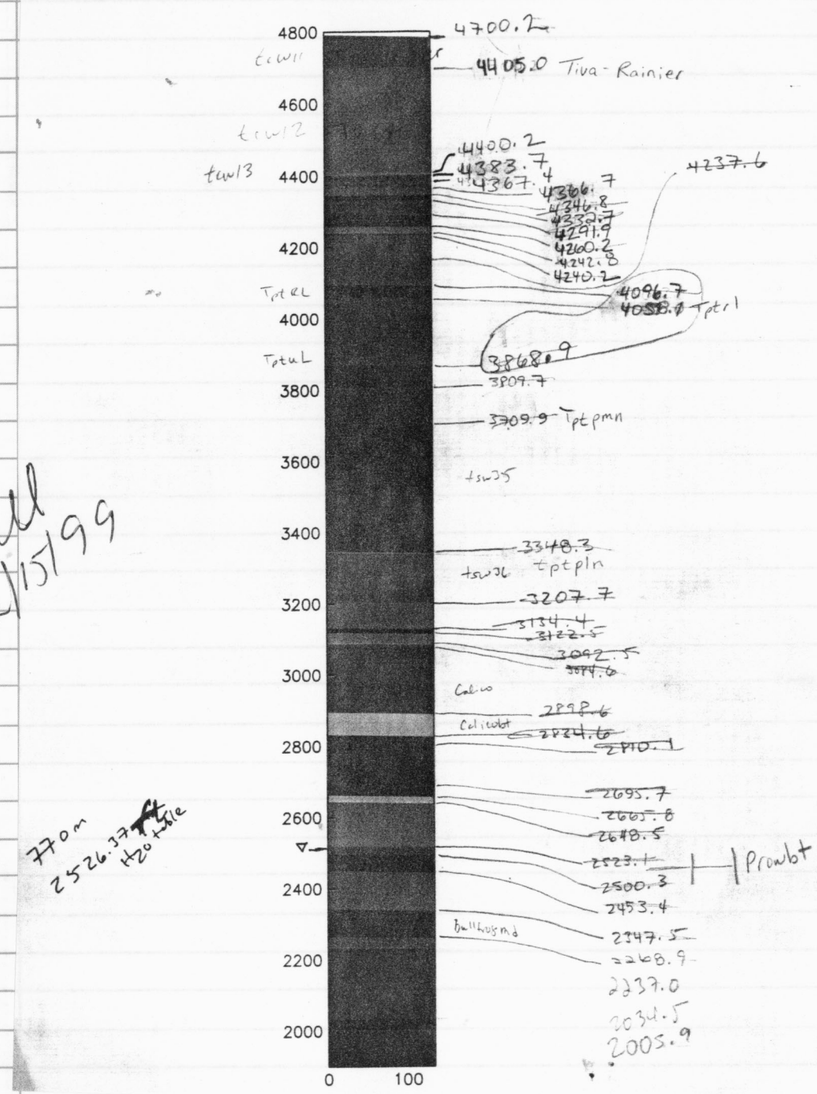
Hi Randy

Here are the corrected coordinates

cc.gif

Thanks!
Missy

Stratigraphy (Fig 3-13 case b p180 of this notebook)



M Hill 12/15/99

770m
2526.37 ft
H2O table

Downloaded by D. Hughson using Earth Vision.

input files modified from multi.dat
Vulcan/home/mhill/reyna

Filename: mm1.dat => ran to steady state

mm2.dat => steady st. cond.
back fill
air space
50 yr decayed
spent fuel

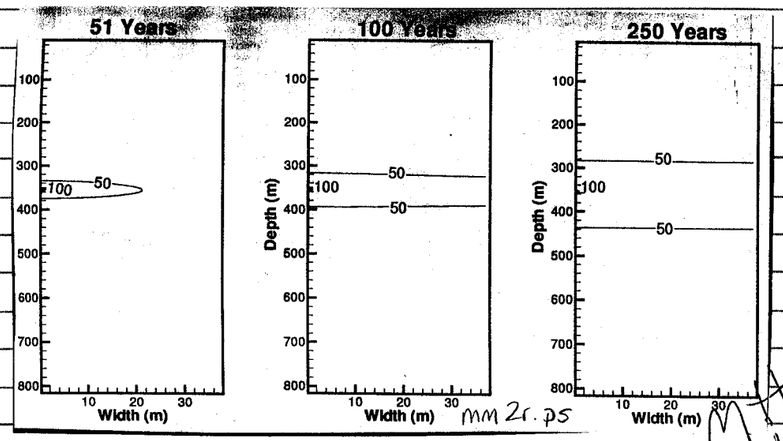
mm3.dat => steady st. cond
back fill
50 yr decayed
spent fuel

mm4.dat => 125 yr decayed
spent fuel
steady st. cond.
back fill
air gap

mm4-2.dat => Δed time steps

t_1 = 130 y
t_2 = 150 y
t_3 = 200 y
t_4 = 250 y
t_5 = 500 y
t_6 = 1,000 y
t_7 = 5,000 y
t_8 = 10,000 y

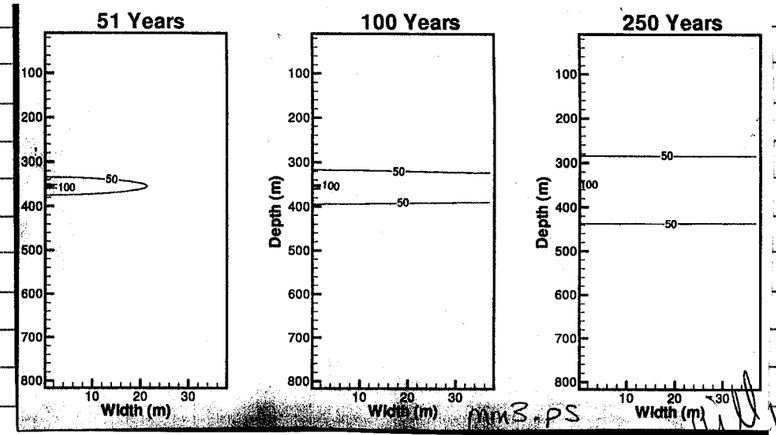
output from mm2.dat



mm2r.ps

M Hill 12/15/99

output from mm3.dat

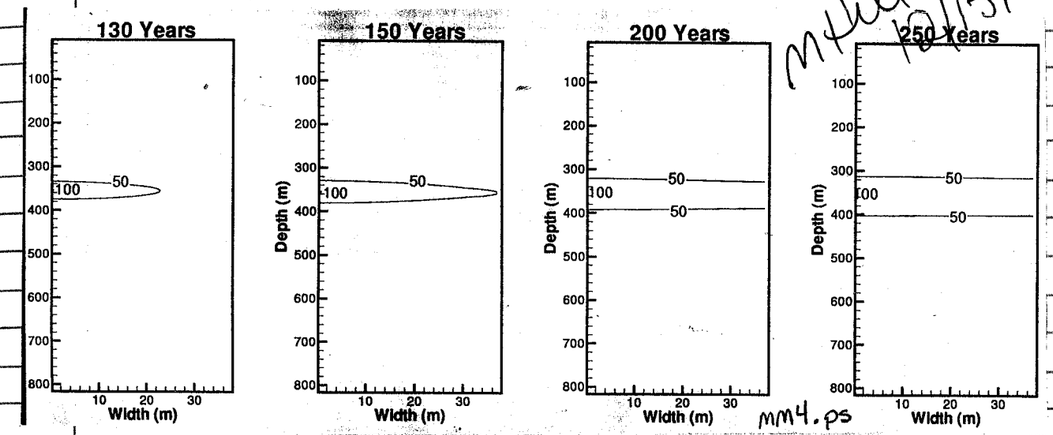


mm3.ps

M Hill 12/15/99

output from mm4-2.dat

M Hill 12/15/99



mm4.ps

M Hill 12/15/99

D. Hughson's input file: vulcan/home/mhill/reyna File name: multi.dat

M Hill 12/15/99

```
METRA-DCM INPUT FILE
 Sept. 24, 1999
:
: This input file was created to provide information on system state
: RH, T, P, S to ENFE KTI in detail around a backfilled drift.
:
: Location
: UTM 4077816.2 m N 547847.27 mE
: State Plane 763279.74 ft N 559493.78 ft E
: This is the point common to subareas 1, 2, 3, and 4 in TPA 3.2
:
: Stratigraphy from the Geologic Framework Model
: Hydrostratigraphic correlations based on pg 3.7 - 3.9 in
: Bodvarsson et al 1997 Site Scale UZ Model of YM for VA
:
:
RSTART  0
:
:grid  geometry  nx ny   nz ivplwr ipvcal  iout  gravity  pref tref  href
Grid   DCMXYZ     16 1   115  1      1      1     0        0    0     0
:
: ***********************************************************************
: i = sequential number of material types
: type = the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm = irreducible liquid saturation for the matrix
: rpmm = Van Genuchten parameter for matrix
: alpham = Van Genuchten parameter for matrix
: swext = liquid saturation below which the capillary pressure is calculated
based
:          on the slope dPcw/dSw evaluated at SWEXT.
: sgc = residual (immobile) gas saturation, fraction
: iecm = Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1
invoke, 2 ECM with tables)
: swirf = residual liquid saturation for fracture, fraction
: alphaf = parameter in Van-Genuchten equation for fracture (1/Pa)
: phim = matrix porosity (fraction)
: phif = fracture porosity (fraction)
: permm = intinsic matrix permeability (m^2)
: permf = intrinsic fracture permeability
:
Pckr                                  :relative perm and pc keyword
:   i  type-curv     swirm   rpmm(lamda) alpham      swext   sgc     iecm
:
: (TCw11 - matrix)
    1  Van-Gen      0.13   0.231        1.15e-6    -1.0e+8  0.0     0
:
: (TCw11 - fracture)
    2  Van-Gen      0.01    0.667       2.37e-3    -0.0e+8  0.0     0
:
: (TCw12 - matrix)
    3  Van-Gen      0.13   0.2447       2.01e-6    -1.0e+8  0.0     0
:
: (TCw12 - fracture)
    4  Van-Gen      0.01    0.669       2.37e-3    -0.0e+8  0.0     0
:
: (TCw13 - matrix)
    5  Van-Gen      0.33   0.4548       3.74e-6    -0.0e+8  0.0     0
```

M Hill 12/15/99

```
:
: (TCw13 - fracture)
  6 Van-Gen      0.01    0.669       9.12e-4    -0.0e+8   0.0      0
:
: (PTn21 - matrix)
  7 Van-Gen      0.10    0.2531      3.98e-5    -1.0e+8   0.0      0
:
: (PTn21 - fracture)
  8 Van-Gen      0.01    0.669       1.10e-3    -0.0e+8   0.0      0
:
: (PTn22 - matrix)
  9 Van-Gen      0.14    0.4925      7.94e-6    -0.0e+8   0.0      0
:
: (PTn22 - fracture)
  10 Van-Gen     0.01    0.669       1.85e-3    -0.0e+8   0.0      0
:
: (PTn23 - matrix)
  11 Van-Gen     0.17    0.3002      5.44e-5    -0.0e+8   0.0      0
:
: (PTn23 - fracture)
  12 Van-Gen     0.01    0.667       3.45e-3    -0.0e+8   0.0      0
:
: (PTn24 - matrix)
  13 Van-Gen     0.10    0.3859      3.43e-5    -0.0e+8   0.0      0
:
: (PTn24 - fracture)
  14 Van-Gen     0.01    0.667       9.13e-4    -0.0e+8   0.0      0
:
: (PTn25 - matrix)
  15 Van-Gen     0.10    0.3195      1.81e-4    -0.0e+8   0.0      0
:
: (PTn25 - fracture)
  16 Van-Gen     0.10    0.320       1.81e-4    -0.0e+8   0.0      0
:
: (TSw31 - matrix)
  17 Van-Gen     0.11    0.2304      5.84e-5    -1.0e+8   0.0      0
:
: (TSw31 - fracture)
  18 Van-Gen     0.01    0.566       1.44e-4    -0.0e+8   0.0      0
:
: (TSw32 - matrix)
  19 Van-Gen     0.04    0.2861      2.00e-5    -1.0e+8   0.0      0
:
: (TSw32 - fracture)
  20 Van-Gen     0.01    0.667       1.42e-3    -0.0e+8   0.0      0
:
: (TSw33 - matrix)
  21 Van-Gen     0.06    0.2479      6.21e-6    -1.0e+8   0.0      0
:
: (TSw33 - fracture)
  22 Van-Gen     0.01    0.667       1.73e-3    -0.0e+8   0.0      0
:
: (TSw34 - matrix)
  23 Van-Gen     0.18    0.3212      1.19e-6    -1.0e+8   0.0      0
:
: (TSw34 - fracture)
  24 Van-Gen     0.01    0.643       9.34e-4    -0.0e+8   0.0      0
:
:
: (BF3vb - matrix)
  43 Van-Gen     0.07    0.3142      1.66e-5    -0.0e+8   0.0      0
:
: (BF3vb - fracture)
  44 Van-Gen     0.01    0.667       1.42e-3    -0.0e+8   0.0      0
:
: ******************
: Backfill moisture retention properties go here
: ******************
  45 Van-Gen     0.04    0.3719      1.41e-3    -0.0e+8   0.0      0
:
0
: ***************
Debug  1
0
:
: ********************
:  Thermal properties
: ********************
: no = sequential number of data set
: rho = rock density (kg/m^3)
: cpr = rock specific heat (J/kg-K)
: ckdry = thermal conductivity of dry rock (J/s/m-K)
: cksat = thermal conductivity of liquid saturated rock (J/s/m-K)
: crp = pore compressibility with pressure at constant T (1/Pa)
: crt = absolute value of pore compressibility with pressure at constant T
(1/Pa)
: tau = tortuosity for binary diffusion
: cdiff = vapor-dir diffusion coefficient, (m^2/s)
: cexp = exponent for binary diffusion
: enbd = enhanced binary diffusion coefficient
:
Thermal-prop
: no rho      cpr    ckdry  cksat   crp   crt   tau  cdiff    cexp   enbd
: (TCw11 - matrix)
  1  2.510e+03 847.    1.02   1.76    0     0    .5  2.13e-5  1.8   0.
: (TCw12 - matrix)
  2  2.510e+03 837.    1.28   1.88    0     0    .5  2.13e-5  1.8   0.
: (TCw13 - matrix)
  3  2.470e+03 857.    0.54   0.98    0     0    .5  2.13e-5  1.8   0.
: (PTn21 - matrix)
  4  2.340e+03 1080.   0.35   0.50    0     0    .5  2.13e-5  1.8   0.
: (PTn22 - matrix)
  5  2.400e+03 849.    0.44   0.97    0     0    .5  2.13e-5  1.8   0.
: (PTn23 - matrix)
  6  2.370e+03 1020    0.46   1.02    0     0    .5  2.13e-5  1.8   0.
: (PTn24 - matrix)
  7  2.260e+03 1330    0.35   0.82    0     0    .5  2.13e-5  1.8   0.
: (PTn25 - matrix)
  8  2.370e+03 1220    0.23   0.67    0     0    .5  2.13e-5  1.8   0.
: (TSw31 - matrix)
  9  2.510e+03 834     0.37   1.00    0     0    .5  2.13e-5  1.8   0.
: (TSw32 - matrix)
  10 2.550e+03 866     1.06   1.62    0     0    .5  2.13e-5  1.8   0.
: (TSw33 - matrix)
  11 2.510e+03 883     0.71   1.80    0     0    .5  2.13e-5  1.8   0.
: (TSw34 - matrix)
:
: (TSw35 - matrix: Repository horizon)
  25 Van-Gen     0.08    0.1983      4.01e-6    -1.0e+8   0.0      0
:
: (TSw35 - fracture: Repository horizon)
  26 Van-Gen     0.01    0.667       1.26e-3    -0.0e+8   0.0      0
:
: (TSw36 - matrix)
  27 Van-Gen     0.18    0.5138      8.08e-7    -0.0e+8   0.0      0
  27 Van-Gen     0.18    0.5138      2.272e-6   -0.0e+8   0.0      0
:
: (TSw36 - fracture)
  28 Van-Gen     0.01    0.667       1.32e-3    -0.0e+8   0.0      0
:
: (TSw37 - matrix)
  29 Van-Gen     0.50    0.3709      5.30e-7    -0.0e+8   0.0      0
  29 Van-Gen     0.50    0.3709      7.3856e-6  -0.0e+8   0.0      0
:
: (TSw37 - fracture)
  30 Van-Gen     0.01    0.659       1.19e-3    -0.0e+8   0.0      0
:
: (CH1vc - matrix)
  31 Van-Gen     0.04    0.1592      7.60e-5    -1.0e+8   0.0      0
:
: (CH1vc - fracture)
  32 Van-Gen     0.01    0.669       1.18e-3    -0.0e+8   0.0      0
:
: (CH2vc - matrix)
  33 Van-Gen     0.06    0.2291      4.12e-5    -1.0e+8   0.0      0
:
: (CH2vc - fracture)
  34 Van-Gen     0.01    0.667       1.18e-3    -0.0e+8   0.0      0
:
: (CH3zc - matrix)
  35 Van-Gen     0.20    0.2119      2.16e-5    -1.0e+8   0.0      0
:
: (CH3zc - fracture)
  36 Van-Gen     0.01    0.654       1.12e-3    -0.0e+8   0.0      0
:
: (CH4zc - matrix)
  37 Van-Gen     0.33    0.4322      1.03e-6    -0.0e+8   0.0      0
:
: (CH4zc - fracture)
  38 Van-Gen     0.01    0.667       1.14e-3    -0.0e+8   0.0      0
:
: (PP3vp - matrix)
  39 Van-Gen     0.07    0.3142      1.66e-5    -0.0e+8   0.0      0
:
: (PP3vp - fracture)
  40 Van-Gen     0.01    0.667       1.42e-3    -0.0e+8   0.0      0
:
: (PP2zp - matrix)
  41 Van-Gen     0.18    0.3568      8.39e-6    -0.0e+8   0.0      0
:
: (PP2zp - fracture)
  42 Van-Gen     0.01    0.667       1.14e-3    -0.0e+8   0.0      0
:
  12 2.530e+03 948     1.56   2.33    0     0    .5  2.13e-5  1.8   0.
: (TSw35 - matrix)
  13 2.540e+03 900     1.20   2.02    0     0    .5  2.13e-5  1.8   0.
: (TSw36 - matrix)
  14 2.560e+03 865     1.42   1.84    0     0    .5  2.13e-5  1.8   0.
: (TSw37 - matrix)
  15 2.360e+03 984     1.69   2.08    0     0    .5  2.13e-5  1.8   0.
: (CH1vc - matrix)
  16 2.310e+03 1060    0.70   1.31    0     0    .5  2.13e-5  1.8   0.
: (CH2vc - matrix)
  17 2.240e+03 1200    0.58   1.17    0     0    .5  2.13e-5  1.8   0.
: (CH3zc - matrix)
  18 2.350e+03 1150    0.61   1.20    0     0    .5  2.13e-5  1.8   0.
: (CH4zc - matrix)
  19 2.440e+03 1170    0.73   1.35    0     0    .5  2.13e-5  1.8   0.
: (PP3vp - matrix)
  20 2.580e+03 841     0.66   1.26    0     0    .5  2.13e-5  1.8   0.
: (PP2zp - matrix)
  21 2.510e+03 644     0.74   1.35    0     0    .5  2.13e-5  1.8   0.
: (BF3vb - matrix)
  22 2.580e+03 841     0.66   1.26    0     0    .5  2.13e-5  1.8   0.
:
: ******************
: Backfill Thermal Properties go here
: ******************
:
  23 1.415e+03 305.0   .25    .50     0     0    .5  2.13e-5  1.8   0.
:
0
: ****************************
:  grid-blocks are specified max 10 to a row
: ****************************
:
DXYZ   0
: (dx(i),i=1,nx)
0.5 0.5 0.5 0.5 0.5 0.7 0.8 1.0 1.5 2.0
3.0 4.0 5.0 6.0 7.0 7.0
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
 3.6  3.6  4.0  6.0  8.0 10.0 10.0 10.0 10.0 10.0
10.0  7.0  6.0  4.3  3.7  3.6  3.2  5.0  4.3  4.1
 3.8  3.8  3.0  2.3  3.0  3.4  4.0  6.0  8.0 10.0
10.0 10.0 10.0 10.0 10.0  8.0  7.9  7.0  8.9 10.0
10.0 10.0 10.0  9.0  8.0  7.0  6.0  5.0  4.0  3.0
 2.2  1.5  1.0  1.0  1.0  1.0  1.0  1.0  1.0  1.0
 1.0  1.0  1.0  0.8  0.5  0.5  0.5  0.5  0.5  0.5
 0.5  0.7  0.8  1.0  1.5  2.0  3.0  4.0  5.0  7.0
 8.0  9.0 10.0 10.0  8.0  6.3  6.7  6.8  7.0  7.0
 7.5  8.0  8.0  8.0  8.0  8.3 10.0 12.9 10.8 10.0
10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0  9.0  8.8
 8.2 10.0 10.0 10.0 10.0
:
: fracture permeabilities modified from Buscheck by dividing by fracture.
porosity
PHIK
```



```
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf   pormm permm
istm ithrmm
:
  1  16  1  1  1  2    2    1  0. 1.0000 2.59e-08 2.59e-08 9.83e-08 0.066 5.40e-
18  1  1 :  TCw11
  1  16  1  1  3  14   4    2  0. 1.0000 2.02e-08 2.02e-08 4.62e-08 0.066 5.40e-
18  3  2 :  TCw12
  1  16  1  1  15 16   6    3  0. 1.0000 3.40e-09 3.40e-09 4.00e-08 0.140 5.69e-
17  5  3 :  TCw13
  1  16  1  1  17 17   8    4  0. 1.0000 1.08e-08 1.08e-08 1.08e-08 0.369 1.61e-
14  7  4 :  PTn21
  1  16  1  1  18 18  10    5  0. 1.0000 4.04e-09 4.04e-09 4.04e-09 0.234 3.30e-
15  9  5 :  PTn22
  1  16  1  1  19 19  12    6  0. 1.0000 1.98e-09 1.98e-09 1.98e-09 0.353 5.40e-
14  11 6 :  PTn23
  1  16  1  1  20 20  14    7  0. 1.0000 8.89e-10 8.89e-10 8.89e-10 0.469 8.80e-
14  13 7 :  PTn24
  1  16  1  1  21 23  16    8  0. 1.0000 2.01e-09 2.01e-09 2.01e-09 0.464 3.18e-
13  15 8 :  PTn25
  1  16  1  1  24 24  18    9  0. 1.0000 1.12e-08 1.12e-08 1.20e-07 0.042 7.76e-
17  17 9 :  TSw31
  1  16  1  1  25 30  20   10  0. 1.0000 5.49e-09 5.49e-09 1.17e-07 0.146 1.82e-
16  19 10 : TSw32
  1  16  1  1  31 38  22   11  0. 1.0000 8.49e-09 8.49e-09 2.50e-07 0.135 2.04e-
17  21 11 : TSw33
  1  16  1  1  39 42  24   12  0. 1.0000 3.44e-09 3.44e-09 5.45e-08 0.089 4.08e-
18  23 12 : TSw34
  1  16  1  1  43 64  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  4  16  1  1  65 65  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  5  16  1  1  66 66  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  6  16  1  1  67 71  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  5  16  1  1  72 72  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  4  16  1  1  73 73  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  1  16  1  1  74 80  26   13  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17  25 13 : TSw35
  1  16  1  1  81 86  28   14  0. 1.0000 3.01e-09 3.01e-09 3.01e-09 0.092 8.70e-
18  27 14 : TSw36
  1  16  1  1  87 88  30   15  0. 1.0000 3.01e-09 3.01e-09 3.01e-09 0.020 4.08e-
18  29 15 : TSw37
: layer rows 89 to 91 is either CH1 or CH2
  1  16  1  1  89 91  32   16  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.265 1.60e-
12  31 16 : CH1vc
:  1  16  1  1  89 91  34   17  0. 1.0000 4.03e-09 4.03e-09 4.03e-09 0.321
5.50e-14  33 17 : CH2vc
  1  16  1  1  92 96  36   18  0. 1.0000 1.06e-09 1.06e-09 2.28e-09 0.240 2.50e-
18  35 18 : CH3zc
  1  16  1  1  97 98  38   19  0. 1.0000 1.41e-09 1.41e-09 2.28e-09 0.169 5.49e-
18  37 19 : CH4zc
  1  16  1  1  99 103 40   20  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-
15  39 20 : PP3vp

  1  16  1  1 104 110 1.10e-5  5.00e-1  0.5  0.5  0.5  : PP2zp
  1  16  1  1 111 115 7.14e-5  5.00e-4  0.5  0.5  0.5  : BF3vb
: Properties of backfill material defining drift
  1   3  1  1  65 65  0.42  1.0  0.5  0.5  0.5  : backfill
  1   4  1  1  66 66  0.42  1.0  0.5  0.5  0.5  : backfill
  1   5  1  1  67 71  0.42  1.0  0.5  0.5  0.5  : backfill
  1   4  1  1  72 72  0.42  1.0  0.5  0.5  0.5  : backfill
  1   3  1  1  73 73  0.42  1.0  0.5  0.5  0.5  : backfill
:
0
:
:
Recurrent
:
BCON 2
:
:itype  iface  i1  i2  j1  j2
   5  TOP  1  16  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  1.e-9    93361.  20. 0.3  .0  0.0
0.0  1.3586e-3  93361.  20.  0.95  .0  0.0
:
/
:itype  iface  i1  i2  j1  j2
 1  BOTTOM  1  16  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  0.0    101325.  30.  0.0  0.0  0.0
0.0  0.0    101325.  30.  0.0  0.0  0.0
:
/
:
:skip
Source   1   .196   .196
:  isl is2 jsl js2 ksl ks2  istyp
:
   1 3   1 1   70 70    31
:
: This decay data is from "Characteristics of Spent Fuel, High-Level Waste, and
: Other Radioactive Wastes Which May Require Long-Term Isolation" DoE OCRWM
: DOE/RW-0184, Dec., 1997 Vol 2 of 6 Table 1C.7
: left column is time in seconds starting at 0.0 = 10 years
: right column is Watts per Metric Ton Uranium
: fuel is PWR 3000 MWd/MTU
: multiplier above converts this to Watts for each block in region (31)
:
0.0000E+00 1020.00
1.8935E+08 949.00
2.5246E+08 813.00
3.1558E+08 780.00
4.7336E+08 709.00
6.3115E+08 649.00
9.4673E+08 550.00
1.2623E+09 471.00
1.5779E+09 408.00
1.8935E+09 358.00
2.2090E+09 317.00
2.5246E+09 283.00
```

```
  1  16  1  1 104 110 42   21  0. 1.0000 5.87e-09 5.87e-09 2.28e-09 0.197 1.75e-
17  41 21 : PP2zp
  1  16  1  1 111 115 44   22  0. 1.0000 9.69e-09 9.69e-09 9.92e-09 0.274 1.91e-
15  43 22 : BF3vb
:
: Properties of backfill material defining drift
  1   3  1  1  65 65  45   23  0.  1.0000 1.00e-09 1.00e-09 1.00e-09 0.420
1.00e-09  45 23 : backfill
  1   4  1  1  66 66  45   23  0.  1.0000 1.00e-09 1.00e-09 1.00e-09 0.420
1.00e-09  45 23 : backfill
  1   5  1  1  67 71  45   23  0.  1.0000 1.00e-09 1.00e-09 1.00e-09 0.420
1.00e-09  45 23 : backfill
  1   4  1  1  72 72  45   23  0.  1.0000 1.00e-09 1.00e-09 1.00e-09 0.420
1.00e-09  45 23 : backfill
  1   3  1  1  73 73  45   23  0.  1.0000 1.00e-09 1.00e-09 1.00e-09 0.420
1.00e-09  45 23 : backfill
:
0
:
Init
:
: i1  i2  j1  j2  k1  k2        p         t         sg        xg2       pm
tm          sgm       xgm
:
   1   16   1   1   1   115   100000   25   .9  0.0000E+00 100000  25  0.1
0.0000E+00
   0   0
:
DCMPARA
: i1 i2 j1 j2 k1 k2   volf  areamodf  xlm ylm zlm
:
  1  16  1  1  1  2   2.33e-4  5.00e-4  0.5  0.5  0.5  : TCw11
  1  16  1  1  3  14  2.99e-4  5.00e-4  0.5  0.5  0.5  : TCw12
  1  16  1  1  15 16  7.05e-5  5.00e-4  0.5  0.5  0.5  : TCw13
  1  16  1  1  17 17  4.84e-5  5.02e-1  0.5  0.5  0.5  : PTn21
  1  16  1  1  18 18  4.83e-5  5.00e-1  0.5  0.5  0.5  : PTn22
  1  16  1  1  19 19  1.30e-4  5.00e-1  0.5  0.5  0.5  : PTn23
  1  16  1  1  20 20  6.94e-5  5.00e-1  0.5  0.5  0.5  : PTn24
  1  16  1  1  21 23  3.86e-5  5.00e-1  0.5  0.5  0.5  : PTn25
  1  16  1  1  24 24  8.92e-5  4.68e-1  0.5  0.5  0.5  : TSw31
  1  16  1  1  25 30  1.29e-4  5.00e-4  0.5  0.5  0.5  : TSw32
  1  16  1  1  31 38  1.05e-4  5.00e-4  0.5  0.5  0.5  : TSw33
  1  16  1  1  39 42  1.24e-4  1.23e-3  0.5  0.5  0.5  : TSw34
  1  16  1  1  43 64  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  4  16  1  1  65 65  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  5  16  1  1  66 66  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  6  16  1  1  67 71  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  5  16  1  1  72 72  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  4  16  1  1  73 73  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  1  16  1  1  74 80  3.29e-4  5.00e-4  0.5  0.5  0.5  : TSw35
  1  16  1  1  81 86  3.99e-4  5.00e-4  0.5  0.5  0.5  : TSw36
  1  16  1  1  87 88  4.92e-4  5.00e-4  0.5  0.5  0.5  : TSw37
  1  16  1  1  89 91  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH1vc
:  1  16  1  1  89 91  7.14e-5  5.00e-1  0.5  0.5  0.5  : CH2vc
  1  16  1  1  92 96  1.10e-5  9.22e-1  0.5  0.5  0.5  : CH3zc
  1  16  1  1  97 98  1.10e-5  5.00e-1  0.5  0.5  0.5  : CH4zc
  1  16  1  1  99 103 7.14e-5  5.00e-4  0.5  0.5  0.5  : PP3vp


 2.8402E+09 256.00
 5.9959E+09 144.00
 9.1517E+09 114.00
 1.2207E+10 97.80
 1.6063E+10 85.60
 3.1542E+10 50.40
 6.2800E+10 27.30
 9.4357E+10 21.50
 1.5747E+11 17.80
 3.1526E+11 12.90
 0
 :noskip
 :
 Output   A=1
 :
 :  isolv  newtnmn  newtnmx  north  nitmax  level
 Solve 4      1        12      2     100      1
 :
 :AUTO-step  DPMXE    DSMXE  DTMPMXE  DP2MXe TACCEL   IAUTODT   FAC1
 AUTO-step   1.0E+2   03     3.       1.e4  1.0e-3     0       0
 :
 :TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
 Tolr   1.0  1.e-5 1.e-3  1.0   1.e-5 1.e-5 1.e-3 1.e-12 1.e-12 1.e-12
 :
 :Limit dpmx    dsmx dtmpmx dpanx    dtmn    dtmx   dtfac
 LIMIT  3.e+2    08     6.  1.e+5    1.e-8  1.e5    .334
 :
 RSTArt 1
 :
 Plots 1 1 6
 1009 1011 1025 1027 1061 1062
 :
 Time[y] 1.0
 Time[y] 10.0
 Time[y] 25.0
 Time[y] 50.0
 Time[y] 100.0
 Time[y] 250.0
 Time[y] 500.0
 Time[y] 1000.0
 Time[y] 5000.0
 Time[y] 10000.0
 :STEADY[y] 1.0E-7 1.0E-07 1.0E-7
 :
 Ends
```

M Hill 2/15/99

12/17/99 On 12/10/99 & 12/13/99 performed the following:

- incorporated steady state conditions from dst3d2_out into dst3d2.dat

dst3d2.dat is located in vulcan/home/mhill/dst/

because of the large size of the cut & paste in dst3d2_out the incorporation was performed as follows:

wrote to file

Filename:	lines
steady1.dat	646,042 - 700,000
dst3d2_out5	700,001 - 700,842
dst3d2_out6	700,843 - 701,000
dst3d2_out7	* 700,000 - 702,000
dst3d2_out8	702,001 - 705,000
dst3d2_out9	705,001 - 706,000
dst3d2_out10	706,001 - 708,000
dst3d2_out11	708,001 - 710,000
steady2.dat	710,001 - 714,679

replaced the above files under INIT in dst3d2.dat file.

* deleted line 700,000 since repeated.

corrected file name: dst3d2.dat

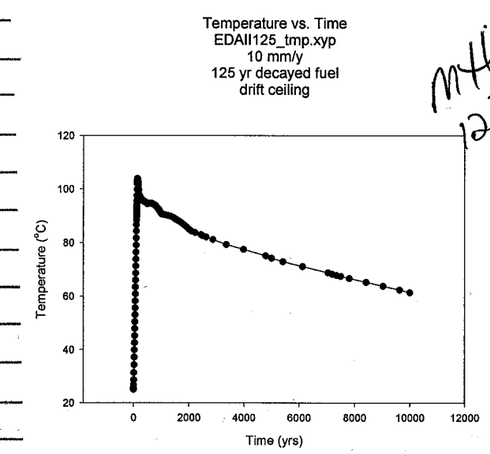
Modified input file: d60-50r-10mm2 located in vulcan/home/mhill/vent50-10mm2/ as follows:

- inserted 125 yr decayed spent fuel
- Δed iout in initialization data to 0
- Δed time steps

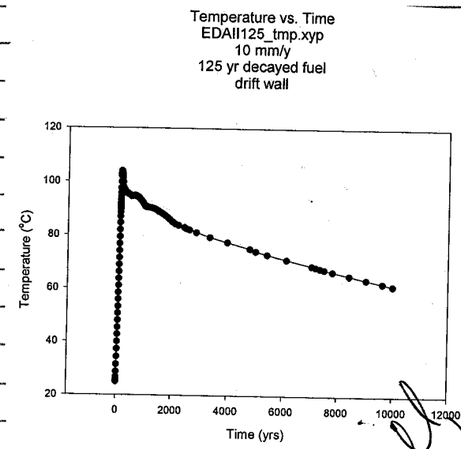
(yrs)

$t_1 = 129$
$t_2 = 150$
$t_3 = 175$
$t_4 = 200$
$t_5 = 250$
$t_6 = 500$
$t_7 = 1,000$
$t_8 = 1,500$
$t_9 = 2,500$
$t_{10} = 5,000$
$t_{11} = 7,500$
$t_{12} = 10,000$

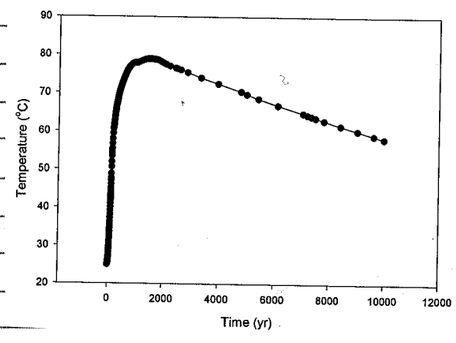
renamed file: EDAII125.dat



MHill 12/17/99



MHill 12/17/99



MHill 12/17/99

12/21/99 Modified input file: mm4-2.dat (p 183 of this notebook) as follows:

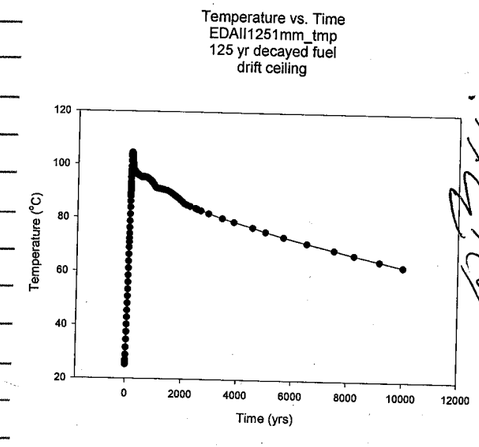
- changed location of heat source (different element)

Renamed file: mm4-3.dat located in vulcan/home/mhill/reyna/

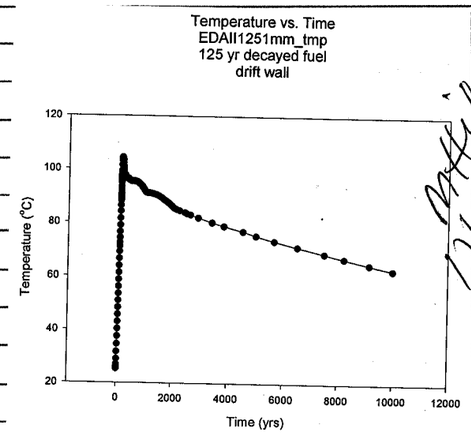
Modified input file: d60-50r-1mm.dat (p 148 of this notebook) as follows:

- 125 yr decayed fuel
- iout = 0
- Δed time steps

(yrs)
t_1 = 129
t_2 = 150
t_3 = 175
t_4 = 200
t_5 = 250
t_6 = 500
t_7 = 1,000
t_8 = 1,500
t_9 = 2,500
t_{10} = 5,000
t_{11} = 7,500
t_{12} = 10,000



MHill 12/21/99



MHill 12/21/99

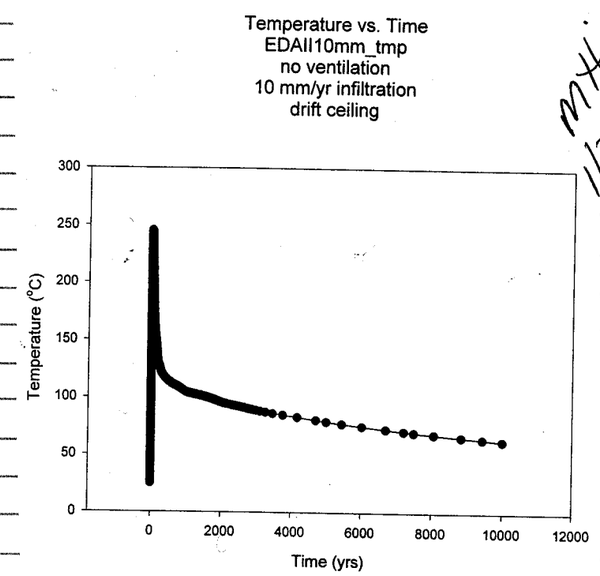
MHill 12/21/99

12/22/99 Note: problem with input files mm1.dat - mm4-2.dat (p 183 of this notebook) & file mm4-3.dat (p 190 of this notebook). The problem is that unit Tsw 34 is included in the input files, but has stratigraphically pinched out according to fig 3-13 Case b p 180 of this notebook. Moreover, the stratigraphic column (p 182 of this notebook) downloaded from Earth Vision has unit Tsw34 included.

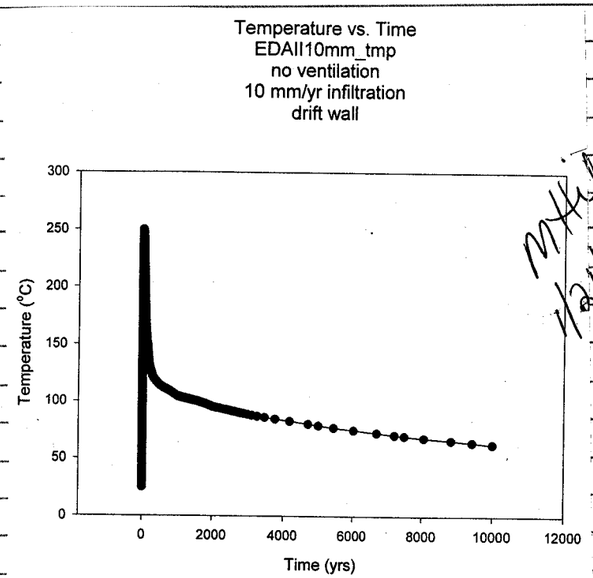
M Hill 12/22/99

1/21/00 Goodluck Ofoegbu's Project TEF

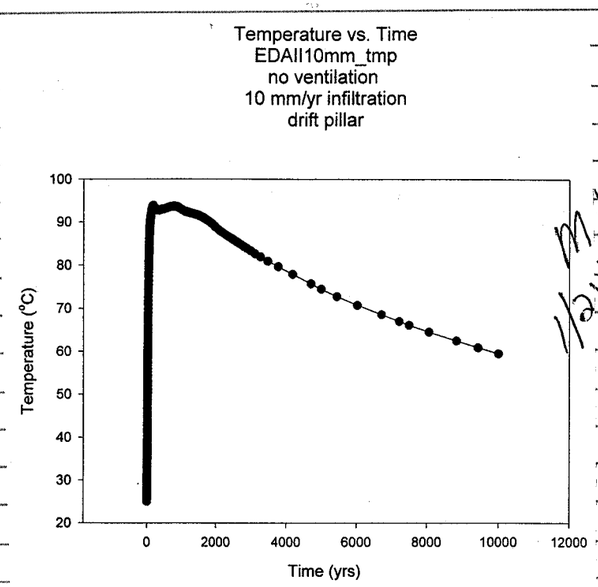
Goodluck requested temperature histories for 60 MTU/acre (no ventilation, 20% reduction in heat due to ventilation 1st 50 yrs, 50% reduction in heat due to ventilation 1st 50 yrs) at infiltration rates of both 1mm/y & 10mm/yr. File names are d60-20r-1mm.dat, d60-20r-10mm.dat, d60-50r-1mm.dat, d60-50r-10mm.dat (p 148 of this notebook) & files EDAII60.dat & EDAII 10mm.dat (p 178 of this notebook).



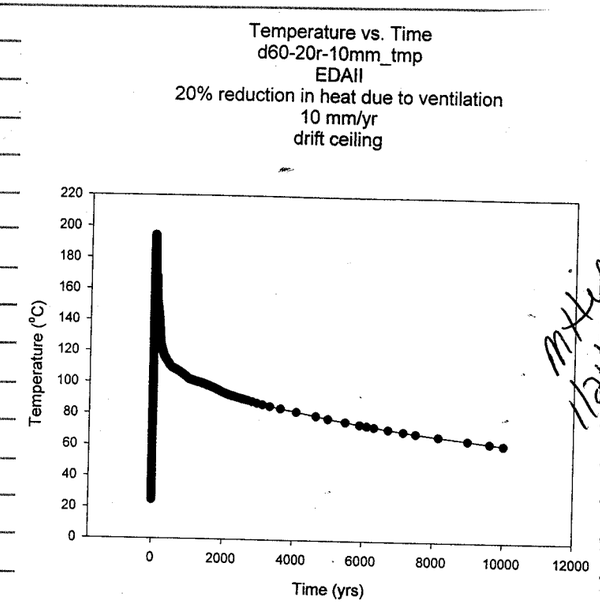
MHill 1/21/00



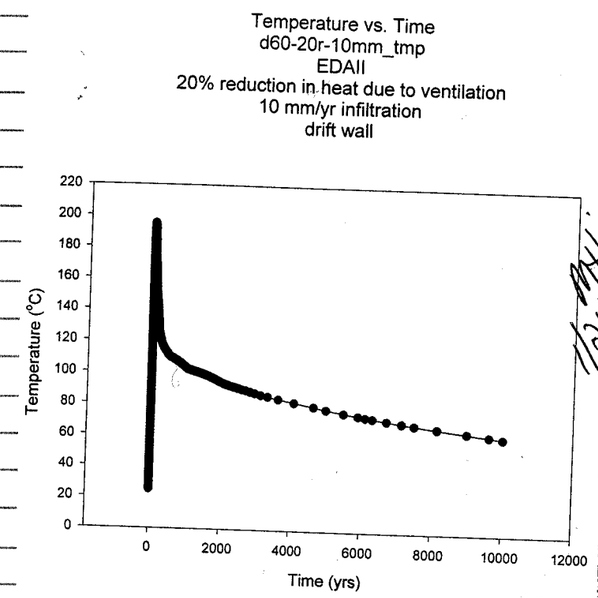
MHill 1/21/00



MHill 1/21/00

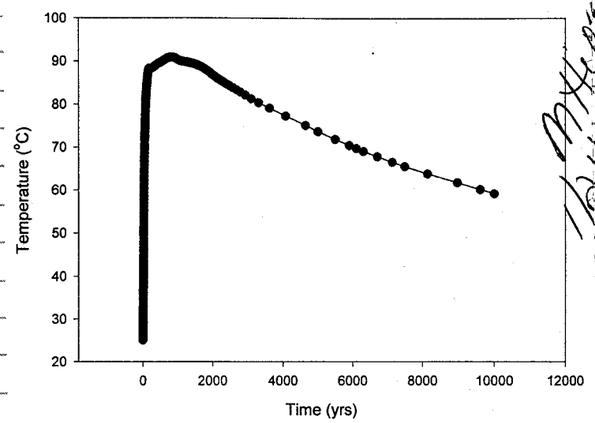


MHill 1/21/00



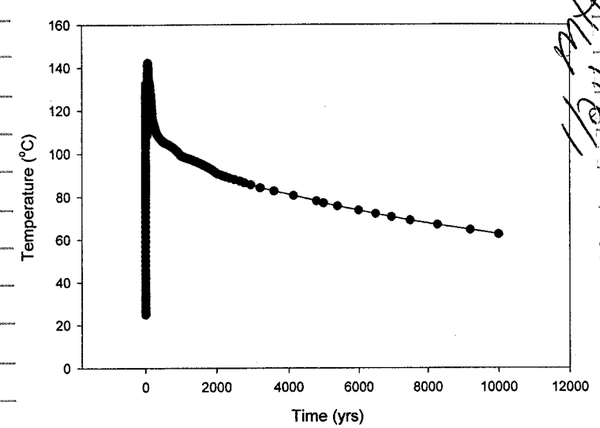
MHill 1/21/00

Temperature vs. Time
d60-20r-10mm_tmp
EDAII
20% reduction in heat due to ventilation
10 mm/yr
drift pillar



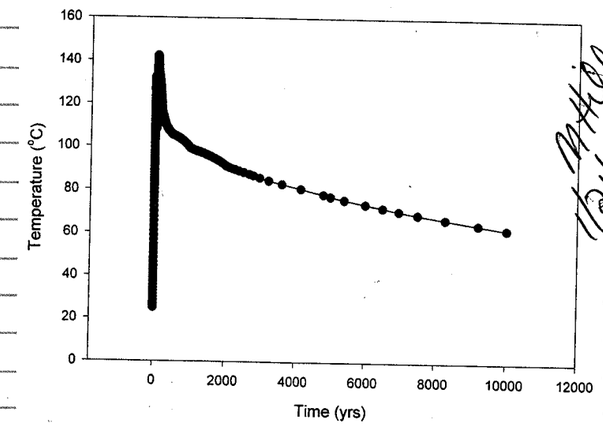
MHW 1/21/00

Temperature vs. Time
d60-50r-10mm_tmp
EDAII
50% reduction in heat due to ventilation
10 mm/yr infiltration
drift ceiling



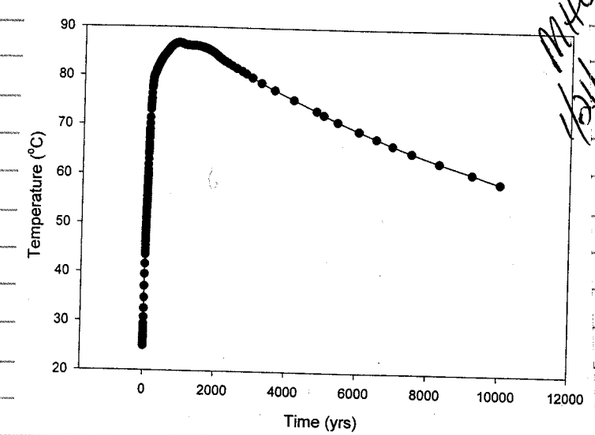
MHW 1/21/00

Temperature vs. Time
d60-50r-10mm_tmp
EDAII
50% reduction in heat due to ventilation
10 mm/yr infiltration
drift wall



MHW 1/21/00

Temperature vs. Time
d60-50r-10mm_tmp
EDAII
50% reduction in heat due to ventilation
10 mm/yr infiltration
drift pillar



MHW 1/21/00

Goodluck was concerned because maximum temperatures reached up to ~250°C, whereas his results reached maximum temperatures ~200°C. Difference between Goodluck's model & the results listed on p193-197 of this notebook was the heat source.

Heat source used in model for which results are posted on p193-197 of this notebook are listed below.

Taken from DOE/RW-0184 Dec '87 "Characteristics of spent fuel, high-level waste, & other radioactive wastes which may require long term isolation Table 1C.7 p47 (provided by D. Hughson). MH 1/21/00

MWd/MTU typical PWR ≈ 0.46 MTU BWR ~ 0.19 MTU

WATTS/MTU VS COOLING PWR

years

PWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	2.590E+03	1.000E+03	5.420E+02	3.430E+02	2.530E+02	2.090E+02	1.860E+02	1.730E+02	1.640E+02	1.580E+02	1.320E+02	1.260E+02	1.200E+02	1.070E+02	9.650E+01	7.610E+01	6.390E+01	5.770E+01	4.330E+01
10000	4.420E+03	1.890E+03	1.060E+03	6.850E+02	5.120E+02	4.260E+02	3.790E+02	3.520E+02	3.330E+02	3.190E+02	2.690E+02	2.570E+02	2.460E+02	2.220E+02	2.010E+02	1.670E+02	1.400E+02	1.160E+02	1.010E+02
15000	5.190E+03	2.440E+03	1.430E+03	9.710E+02	7.490E+02	6.340E+02	5.700E+02	5.300E+02	5.020E+02	4.810E+02	4.070E+02	3.890E+02	3.730E+02	3.390E+02	3.090E+02	2.590E+02	2.190E+02	1.880E+02	1.620E+02
20000	6.820E+03	3.280E+03	1.950E+03	1.330E+03	1.030E+03	8.710E+02	7.800E+02	7.220E+02	6.820E+02	6.530E+02	5.500E+02	5.260E+02	5.050E+02	4.590E+02	4.200E+02	3.550E+02	3.030E+02	2.610E+02	2.270E+02
25000	7.090E+03	3.630E+03	2.250E+03	1.600E+03	1.270E+03	1.090E+03	9.820E+02	9.120E+02	8.620E+02	8.250E+02	6.940E+02	6.650E+02	6.390E+02	5.810E+02	5.320E+02	4.510E+02	3.870E+02	3.320E+02	2.930E+02
30000	8.820E+03	4.530E+03	2.850E+03	2.010E+03	1.590E+03	1.360E+03	1.220E+03	1.130E+03	1.070E+03	1.020E+03	8.500E+02	8.130E+02	7.800E+02	7.090E+02	6.490E+02	5.500E+02	4.710E+02	4.080E+02	3.580E+02
33000	9.740E+03	5.050E+03	3.170E+03	2.270E+03	1.800E+03	1.530E+03	1.370E+03	1.270E+03	1.200E+03	1.140E+03	9.490E+02	9.080E+02	8.710E+02	7.910E+02	7.250E+02	6.120E+02	5.250E+02	4.550E+02	3.980E+02
35000	8.890E+03	4.710E+03	3.040E+03	2.230E+03	1.800E+03	1.560E+03	1.410E+03	1.310E+03	1.740E+03	1.180E+03	9.930E+02	9.530E+02	9.160E+02	8.340E+02	7.640E+02	6.490E+02	5.570E+02	4.830E+02	4.230E+02
40000	1.050E+04	5.610E+03	3.630E+03	2.660E+03	2.150E+03	1.850E+03	1.670E+03	1.550E+03	1.460E+03	1.390E+03	1.160E+03	1.110E+03	1.070E+03	9.720E+02	8.900E+02	7.540E+02	6.460E+02	5.630E+02	4.910E+02
45000	1.070E+04	5.930E+03	3.950E+03	2.970E+03	2.440E+03	2.120E+03	1.920E+03	1.780E+03	1.680E+03	1.610E+03	1.340E+03	1.280E+03	1.230E+03	1.110E+03	1.020E+03	8.610E+02	7.370E+02	6.380E+02	5.590E+02
50000	1.250E+04	6.920E+03	4.620E+03	3.470E+03	2.840E+03	2.470E+03	2.230E+03	2.070E+03	1.950E+03	1.860E+03	1.540E+03	1.470E+03	1.410E+03	1.270E+03	1.160E+03	9.750E+02	8.310E+02	7.180E+02	6.270E+02
55000	1.260E+04	7.240E+03	4.970E+03	3.820E+03	3.170E+03	2.780E+03	2.520E+03	2.340E+03	2.210E+03	2.110E+03	1.740E+03	1.660E+03	1.590E+03	1.430E+03	1.300E+03	1.090E+03	9.280E+02	7.990E+02	6.960E+02
60000	1.440E+04	8.310E+03	5.720E+03	4.390E+03	3.640E+03	3.190E+03	2.890E+03	2.680E+03	2.530E+03	2.410E+03	1.980E+03	1.880E+03	1.800E+03	1.620E+03	1.470E+03	1.220E+03	1.030E+03	8.860E+02	7.690E+02

years

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	3.670E+01	3.110E+01	2.670E+01	1.090E+01	8.870E+00	8.220E+00	7.780E+00	6.430E+00	5.400E+00	3.010E+00	4.560E+00	3.730E+00	1.980E+00	1.520E+00	1.190E+00	5.070E-01	3.260E-01	2.350E-01	1.490E-01
10000	8.670E+01	7.570E+01	6.680E+01	3.360E+01	2.750E+01	2.450E+01	2.230E+01	1.540E+01	1.070E+01	9.300E+00	8.180E+00	6.430E+00	3.080E+00	2.300E+00	1.770E+00	6.490E-01	3.510E-01	2.640E-01	1.800E-01
15000	1.420E+02	1.260E+02	1.120E+02	6.080E+01	4.960E+01	4.360E+01	3.900E+01	2.580E+01	1.550E+01	1.290E+01	1.110E+01	8.500E+00	3.800E+00	2.800E+00	2.130E+00	7.510E-01	3.890E-01	3.080E-01	2.220E-01
20000	2.000E+02	1.780E+02	1.600E+02	8.950E+01	7.260E+01	6.310E+01	5.590E+01	3.440E+01	1.990E+01	1.620E+01	1.370E+01	1.020E+01	4.320E+00	3.150E+00	2.380E+00	8.370E-01	4.400E-01	3.620E-01	2.610E-01
25000	2.590E+02	2.320E+02	2.090E+02	1.180E+02	9.510E+01	8.190E+01	7.210E+01	4.300E+01	2.380E+01	1.890E+01	1.580E+01	1.160E+01	4.700E+00	3.390E+00	2.560E+00	9.160E-01	5.020E-01	4.230E-01	3.180E-01
30000	3.170E+02	2.830E+02	2.560E+02	1.440E+02	1.140E+02	9.780E+01	8.560E+01	5.040E+01	2.730E+01	2.150E+01	1.780E+01	1.290E+01	5.020E+00	3.600E+00	2.720E+00	9.960E-01	5.710E-01	4.840E-01	3.630E-01
33000	3.530E+02	3.160E+02	2.860E+02	1.600E+02	1.280E+02	1.080E+02	9.380E+01	5.470E+01	2.920E+01	2.280E+01	1.880E+01	1.350E+01	5.190E+00	3.710E+00	2.800E+00	1.050E+00	6.180E-01	5.250E-01	3.920E-01
35000	3.750E+02	3.360E+02	3.040E+02	1.700E+02	1.350E+02	1.140E+02	9.960E+01	5.700E+01	2.930E+01	2.260E+01	1.860E+01	1.340E+01	5.530E+00	4.010E+00	3.050E+00	1.150E+00	6.870E-01	5.770E-01	4.260E-01
40000	4.350E+02	3.890E+02	3.520E+02	1.960E+02	1.530E+02	1.290E+02	1.120E+02	6.330E+01	3.210E+01	2.450E+01	2.010E+01	1.460E+01	5.820E+00	4.210E+00	3.200E+00	1.240E+00	7.670E-01	6.440E-01	4.690E-01
45000	4.940E+02	4.420E+02	4.000E+02	2.200E+02	1.690E+02	1.420E+02	1.220E+02	6.870E+01	3.460E+01	2.630E+01	2.150E+01	1.560E+01	6.090E+00	4.390E+00	3.350E+00	1.340E+00	8.560E-01	7.130E-01	5.120E-01
50000	5.530E+02	4.940E+02	4.460E+02	2.410E+02	1.830E+02	1.520E+02	1.310E+02	7.330E+01	3.700E+01	2.810E+01	2.300E+01	1.650E+01	6.370E+00	4.590E+00	3.500E+00	1.430E+00	9.450E-01	7.790E-01	5.500E-01
55000	6.130E+02	5.470E+02	4.920E+02	2.620E+02	1.970E+02	1.630E+02	1.390E+02	7.760E+01	3.910E+01	2.970E+01	2.420E+01	1.730E+01	6.610E+00	4.760E+00	3.640E+00	1.530E+00	1.040E+00	8.480E-01	5.870E-01
60000	6.750E+02	6.000E+02	5.390E+02	2.830E+02	2.100E+02	1.720E+02	1.470E+02	8.150E+01	4.110E+01	3.120E+01	2.540E+01	1.810E+01	6.840E+00	4.920E+00	3.770E+00	1.630E+00	1.140E+00	9.150E-01	6.230E-01

BWR

years

BWR	1	2	3	4	5	6	7	8	9	10	16	18	20	25	30	40	50	60	70
5000	2.380E+03	9.580E+02	5.200E+02	3.310E+02	2.450E+02	2.040E+02	1.820E+02	1.690E+02	1.610E+02	1.550E+02	1.320E+02	1.260E+02	1.200E+02	1.080E+02	9.750E+01	7.970E+01	6.570E+01	5.470E+01	4.580E+01
10000	3.470E+03	1.590E+03	9.190E+02	6.180E+02	4.760E+02	4.040E+02	3.640E+02	3.400E+02	3.230E+02	3.110E+02	2.660E+02	2.550E+02	2.450E+02	2.220E+02	2.020E+02	1.690E+02	1.420E+02	1.210E+02	1.040E+02
15000	4.080E+03	2.030E+03	1.250E+03	8.820E+02	7.000E+02	6.040E+02	5.480E+02	5.130E+02	4.890E+02	4.710E+02	4.040E+02	3.880E+02	3.730E+02	3.410E+02	3.120E+02	2.640E+02	2.260E+02	1.950E+02	1.710E+02
20000	5.690E+03	2.850E+03	1.750E+03	1.230E+03	9.750E+02	8.360E+02	7.550E+02	7.040E+02	6.680E+02	6.410E+02	5.470E+02	5.250E+02	5.060E+02	4.620E+02	4.250E+02	3.620E+02	3.110E+02	2.700E+02	2.370E+02
25000	6.320E+03	3.290E+03	2.090E+03	1.520E+03	1.220E+03	1.060E+03	9.610E+02	8.960E+02	8.500E+02	8.150E+02	6.930E+02	6.660E+02	6.410E+02	5.860E+02	5.380E+02	4.590E+02	3.960E+02	3.450E+02	3.030E+02
27500	7.070E+03	3.700E+03	2.360E+03	1.710E+03	1.380E+03	1.190E+03	1.080E+03	1.000E+03	9.510E+02	9.110E+02	7.730E+02	7.420E+02	7.130E+02	6.520E+02	5.990E+02	5.110E+02	4.400E+02	3.830E+02	3.380E+02
30000	6.490E+03	3.500E+03	2.310E+03	1.720E+03	1.420E+03	1.240E+03	1.140E+03	1.060E+03	1.010E+03	9.710E+02	8.250E+02	7.910E+02	7.600E+02	6.920E+02	6.340E+02	5.360E+02	4.590E+02	3.960E+02	3.460E+02
35000	6.880E+03	3.880E+03	2.630E+03	2.010E+03	1.680E+03	1.480E+03	1.360E+03	1.270E+03	1.210E+03	1.160E+03	9.840E+02	9.440E+02	9.070E+02	8.260E+02	7.570E+02	6.410E+02	5.490E+02	4.760E+02	4.160E+02
40000	8.630E+03	4.810E+03	3.240E+03	2.440E+03	2.040E+03	1.790E+03	1.630E+03	1.520E+03	1.440E+03	1.380E+03	1.160E+03	1.120E+03	1.070E+03	9.740E+02	8.910E+02	7.540E+02	6.450E+02	5.590E+02	4.890E+02

years

	80	90	100	200	300	400	500	1000	2000	3000	5000	10000	30000	40000	50000	100000	200000	500000	1000000
5000	3.800E+01	3.330E+01	2.880E+01	1.290E+01	1.070E+01	9.810E+00	9.210E+00	7.330E+00	5.940E+00	5.460E+00	4.940E+00	4.010E+00	2.080E+00	1.500E+00	1.230E+00	4.850E-01	2.860E-01	2.130E-01	1.440E-01
10000	9.050E+01	7.950E+01	7.070E+01	3.750E+01	3.090E+01	2.750E+01	2.500E+01	1.710E+01	1.160E+01	1.000E+01	8.770E+00	6.820E+00	3.190E+00	2.360E+00	1.800E+00	6.280E-01	3.130E-01	2.460E-01	1.780E-01
15000	1.500E+02	1.340E+02	1.210E+02	6.890E+01	5.660E+01	4.960E+01	4.420E+01	2.780E+01	1.670E+01	1.380E+01	1.180E+01	8.890E+00	3.890E+00	2.840E+00	2.150E+00	7.330E-01	3.630E-01	2.990E-01	2.270E-01
20000	2.110E+02	1.890E+02	1.710E+02	9.920E+01	8.070E+01	7.000E+01	6.190E+01	3.750E+01	2.120E+01	1.700E+01	1.430E+01	1.060E+01	4.360E+00	3.150E+00	2.380E+00	8.190E-01	4.210E-01	3.590E-01	2.770E-01
25000	2.700E+02	2.430E+02	2.200E+02	1.280E+02	1.030E+02	8.830E+01	7.750E+01	4.590E+01	2.500E+01	1.980E+01	1.640E+01	1.190E+01	4.720E+00	3.380E+00	2.550E+00	9.020E-01	4.910E-01	4.230E-01	3.260E-01
27500	3.000E+02	2.700E+02	2.450E+02	1.420E+02	1.140E+02	9.720E+01	8.500E+01	4.990E+01	2.680E+01	2.100E+01	1.740E+01	1.260E+01	4.880E+00	3.490E+00	2.630E+00	9.450E-01	5.300E-01	4.580E-01	3.510E-01
30000	3.050E+02	2.720E+02	2.450E+02	1.350E+02	1.070E+02	9.130E+01	7.990E+01	4.730E+01	2.590E+01	2.040E+01	1.700E+01	1.230E+01	4.820E+00	3.460E+00	2.620E+00	9.760E-01	5.700E-01	4.790E-01	3.530E-01
35000	3.680E+02	3.290E+02	2.970E+02	1.640E+02	1.280E+02	1.090E+02	9.440E+01	5.470E+01	2.890E+01	2.240E+01	1.850E+01	1.330E+01	5.080E+00	3.640E+00	2.750E+00	1.070E+00	6.570E-01	5.530E-01	4.060E-01
40000	4.330E+02	3.870E+02	3.500E+02	1.920E+02	1.480E+02	1.240E+02	1.070E+02	6.090E+01	3.140E+01	2.410E+01	1.970E+01	1.410E+01	5.310E+00	3.800E+00	2.880E+00	1.180E+00	7.540E-01	6.310E-01	4.560E-01

TABLE 1C.7

47

TITLE TEF

From Page No.

Book No. 284

Witnessed & Understood by me, Date

Invented by

Recorded by

Date 9/2/98

M Hill 1/21/00

2/2/00 Heat source provided by G. Ofoegbu:

The ref is

CRWMS M&O. Repository Thermal Loading Management Analysis, Document Identifier Number B00000000-01717-0200-00135, Revision 00, Las Vegas, NV, Civilian Radioactive Waste Management System Management and Operating Contractor, 1997.

But note that the heat decay information in that table is now outdated. It is still the only one we have but I know they have changed it and I am trying to get the updated info.

thanks.

gio

-----Original Message-----
From: Melissa Hill [mailto:mhill@swri.edu]
Sent: Wednesday, February 02, 2000 11:30 PM
To: ofoegbu@swri.edu
Subject: reference

Hi Goodluck

Could I please have the complete reference for the heat decay table that you gave to me?

Thanks I appreciate it,
Melissa

M Hill 2/2/00

taken from

Title: Repository Thermal Loading Management Analysis
ID: B00000000-01717-0200-00135 REV 00

Attachment V
Page: V-1 of V-5

Table V-1. Average Thermal Decay for All WPs

(A) Year	(B) (Sec. 4.3.23) Total Heat from 2,859 44-BWR Pkgs (MW)	(C) (Sec. 4.3.23) Total Heat from 4,137 21-PWR Pkgs (MW)	(D) (Sec. 4.3.23) Total Heat from 3,259 DHLW Pkgs (MW)	(E) (Sec. 4.3.23) Total Heat from 683 12-PWR Pkgs (MW)	(F) (B)+(C)+(D)+(E) Total Heat from All (10,938) Waste Pkgs (MW)	(G) (F)/ 71.499486 x100% Percent of Total Initial Heat
0	21.423086	37.436260	4.875464	7.764676	(Total Initial Heat) 71.499486	100.00%
5	19.017122	33.491405	4.399650	6.610624	63.518801	88.84%
10	17.301296	30.536741	3.923836	5.890347	57.652220	80.63%
20	14.643423	25.862371	3.252482	4.839801	48.598077	67.97%
30	12.580315	22.215593	2.581128	4.051793	41.428829	57.94%
40	10.962790	19.329458	2.260442	3.448308	36.000998	50.35%
50	9.651849	16.991320	1.939757	2.961375	31.544301	44.12%
60	8.602695	15.112725	1.619071	2.577586	27.912077	39.04%
70	7.755189	13.588046	1.298386	2.268359	24.909980	34.84%
80	7.055883	12.335578	0.977700	2.017372	22.386533	31.31%
90	6.494939	11.315100	0.902091	1.818288	20.530418	28.71%
100	6.012681	10.456422	0.826482	1.646766	18.942351	26.49%
150	4.567073	7.878865	0.448438	1.145978	14.040354	19.64%
200	3.824607	6.569736	0.196061	0.909198	11.499602	16.08%
300	3.038994	5.220269	0.083430	0.682267	9.024960	12.62%
400	2.560390	4.412083	0.052579	0.560346	7.585398	10.61%
500	2.219442	3.838502	0.034363	0.482585	6.574892	9.20%
600	1.943922	3.378038	0.030191	0.422659	5.774810	8.08%
700	1.728933	3.016950	0.026020	0.377363	5.149266	7.20%
800	1.542874	2.706392	0.021848	0.339467	4.610581	6.45%
900	1.394818	2.458149	0.017677	0.309170	4.179814	5.85%
1,000	1.270218	2.248570	0.014340	0.284115	3.817243	5.34%
2,000	0.659264	1.219725	0.009370	0.160481	2.048840	2.87%
3,000	0.505804	0.954557	0.008588	0.127461	1.596410	2.23%
4,000	0.449766	0.853526	0.007806	0.114076	1.425174	1.99%
5,000	0.418991	0.795874	0.007034	0.106206	1.328105	1.86%
6,000	0.387847	0.736906	0.006747	0.097886	1.229386	1.72%
7,000	0.363303	0.690293	0.006460	0.091349	1.151405	1.61%
8,000	0.340257	0.646400	0.006173	0.085211	1.078041	1.51%
9,000	0.321149	0.609974	0.005887	0.080141	1.017151	1.42%
10,000	0.304807	0.578761	0.005602	0.075839	0.965009	1.35%

File:\123r4w\1997-tyVAttach-5.wk4 by1/

M Hill 2/2/00

Attachment III. Mass of Waste

The average mass content for various types of waste packages were calculated using the CDA assumption (Ref. 5.1, Key 0 and Key 004). The data, sources of information and calculations are summarized in the following table.

Table III-1 WP Average Mass Content

YEAR	LG-WP 44 BWR			LG-WP 21 PWR			SM-WP 12 PWR			HLW 4-CAN-PK			TOTAL MTU
	Number of pks	Average MTU/pk	Subtotal MTU	Number of pks	Average MTU/pk	Subtotal MTU	Number of pks	Average MTU/pk	Subtotal MTU	Number of pks	Average MTU/pk	Subtotal MTU	
(A)	(B) Ref. 5.1	(C) Ref. 5.1	(D) (B) x (C)	(E) Ref. 5.1	(F) Ref. 5.1	(G) (E) x (F)	(H) Ref. 5.1	(I) Ref. 5.1	(J) (H) x (I)	(K) Ref. 5.1	(L) see Note 1	(M) (K) x (L)	(N) (D)+(G)+(J)+(M)
2010	13	7.82	101.66	21	9.28	194.88	1	1.84	1.84				298.38
2011	30	7.85	235.50	40	9.03	361.20	2	4.60	9.20				605.90
2012	65	7.74	503.10	74	8.94	661.56	5	6.08	30.40				1,195.06
2013	89	7.80	694.20	134	9.00	1,206.00	18	5.60	100.80				2,001.00
2014	118	7.79	919.22	211	8.96	1,890.56	38	5.31	201.78				3,011.56
2015	142	7.74	1,099.08	186	8.98	1,670.28	37	5.56	205.72	199	2.15	427.45	3,402.53
2016	110	7.89	867.90	203	9.05	1,837.15	53	5.53	293.09	202	2.15	433.90	3,432.04
2017	129	7.86	1,013.94	190	8.91	1,692.90	56	5.50	308.00	200	2.15	429.60	3,444.44
2018	131	7.91	1,036.21	189	8.94	1,689.66	51	5.36	273.36	200	2.15	429.60	3,428.83
2019	126	7.94	1,000.44	179	9.04	1,618.16	70	5.52	386.40	199	2.15	427.45	3,432.45
2020	130	8.01	1,041.30	186	9.02	1,677.72	53	5.42	287.26	200	2.15	429.60	3,435.88
2021	116	7.81	905.96	193	9.05	1,746.65	65	5.29	343.85	200	2.15	429.60	3,426.06
2022	154	7.85	1,208.90	167	9.06	1,513.02	53	5.35	283.55	200	2.15	429.60	3,435.07
2023	114	7.88	898.32	197	8.95	1,763.15	66	5.40	356.40	202	2.15	433.90	3,451.77
2024	173	7.79	1,347.67	155	9.03	1,399.65	46	5.39	247.94	200	2.15	429.60	3,424.86
2025	136	7.72	1,049.92	177	8.94	1,582.38	69	5.36	369.84	200	2.15	429.60	3,431.74
2026	189	7.57	1,430.73	185	8.42	1,557.70				199	2.15	427.45	3,415.88
2027	158	7.61	1,202.38	205	8.68	1,779.40				200	2.15	429.60	3,411.38
2028	150	7.91	1,186.50	204	8.92	1,819.68				200	2.15	429.60	3,435.78
2029	138	7.95	1,097.10	208	9.09	1,890.72				200	2.15	429.60	3,417.42
2030	146	7.75	1,131.50	214	8.82	1,887.48				47	2.15	100.96	3,119.94
2031	115	7.77	893.55	234	8.97	2,098.98				109	2.15	234.13	3,226.66
2032	129	7.72	995.88	224	9.00	2,016.00				102	2.15	219.10	3,230.98
2033	58	7.69	446.02	161	9.00	1,449.00							1,895.02
Total Pks	2,859			4,137			683			3,259			
Total MTU			22,307			37,004			3,699			7,000	70,011

Commercial SNF = Total - HLW = 70,011 - 7,000 = 63,011 MTU

$$\frac{\text{Mass of 12 PWR}}{\text{Mass of SNF}} = \frac{3{,}699 \text{ MTU}}{63{,}011 \text{ MTU}} \times 100\% = 5.87\% \approx 6\%$$

$$\frac{(\text{Mass of 21 PWR}) + (\text{Mass of 44BWR})}{\text{Mass of SNF}} = \frac{22{,}307 + 37004}{63{,}011} \times 100\% = 94.13\% \approx 94\%$$

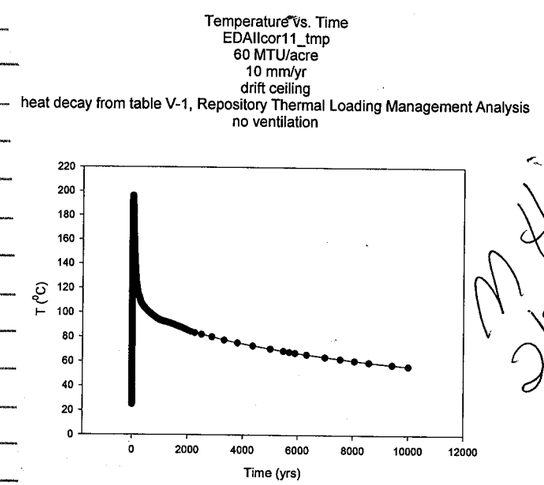
Averge MTU/pk	44-BWR	21-PWR	12-PWR	HLW
	7.80	8.94	5.42	2.15
	(22,307MTU/2,859pk = 7.80)	(37,004MTU/4,137pk = 8.94)	(3,699MTU/683pk = 5.42)	(7,000MTU/3,259pk = 2.15)

Note 1: The average mass content of HLW packages was estimated from the total of 7,000 MTU equivalent of HLW and the total number of 3,259 HLW packages (Ref. 5.1, CDA, Key 003).

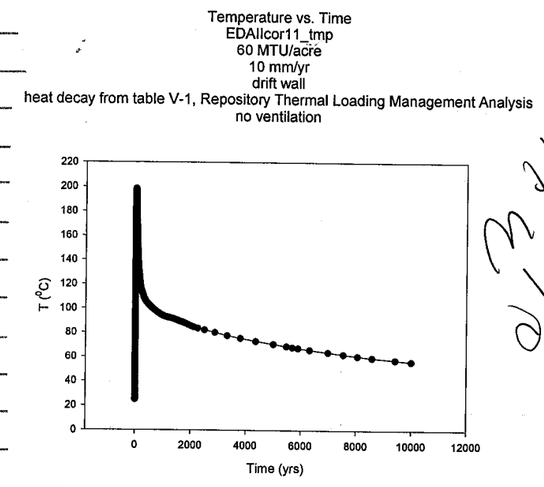
File:\123r+ex\1967-fy\Attach-3.wk4 Jy1/9

M Hill 2/2/00

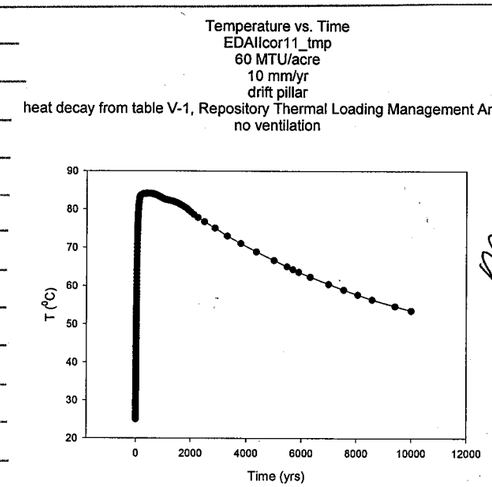
Input file located in vulcan/home/mhill/
EDAIIcor10mm Filename: EDAIIcor11_tmp



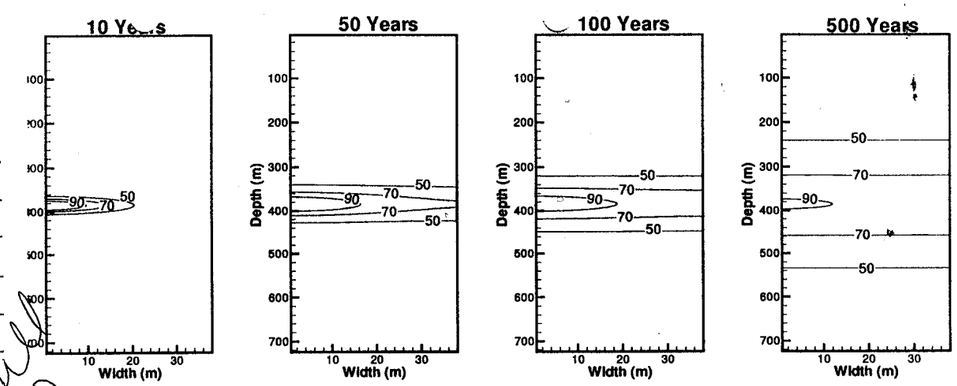
M Hill 2/2/00

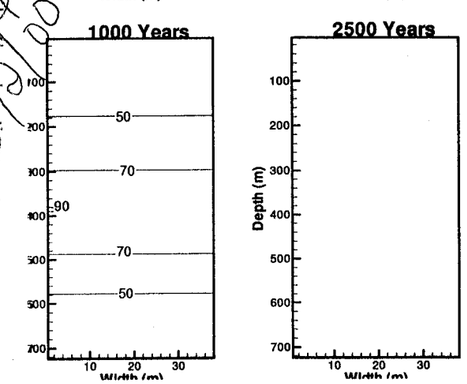


M Hill 2/2/00



M Hill 2/2/00





M Hill 2/2/00

Temperature contours EDA II 60 MTU/acre, no ventilation, 10 mm/yr infiltration used heat decay table V-1 from, "Repository Thermal Loading Management Analysis" (for complete reference see p 199 of this notebook)
M Hill 2/2/00

Final plots for March 2000 deliverable saved on zip disk located ~~in fire-proof cabinet bldg 51~~. filenames are 13.jnb & 13rh.jnb
M H 8/15/00

2/8/00 TEF March 2000 Deliverable

One component of the March 2000 Deliverable is an evaluation of rh & temp. vs. time in the near-field environment using EDA II. The effects of backfill will be evaluated implicitly & the effects of an air gap will be evaluated explicitly.

plots on p 299-301 of this notebook 8/28/00

vulcan/home/mhill/novent60

can be found in ~~this directory~~

File: EDAIIcor13-2.dat ran to steady state. Steady conditions saved under file name: steady.int
- no ventilation 60 MTU/acre
- 10 mm/yr Infiltration
- backfill (implicit)

MH 2/8/00

File: ~~EDAII cor13~~ EDAII 13air-2a.dat in directory vulcan/home/mhill/novent60/ ran to steady state. Saved steady state conditions under filename: steair.int
- air gap
- 10 mm/yr infiltration rate

File: EDAIIcor14-2a.dat located in directory vulcan/home/mhill/20-50vent60/ ran to steady state & saved steady state conditions under filename: stea14.int

- 20% reduction in heat load during 1st 50 yrs
- 10 mm/yr infiltration rate
- backfill (implicit)

File: EDAII14air-2a.dat located in directory vulcan/home/mhill/20-50vent60/ ran to steady state & saved steady state conditions under filename: stir14.int

- 20% reduction in heat load during 1st 50yrs
- 10mm/yr infiltration rate
- air gap

File: EDAII cor15-2a.dat located in directory vulcan/home/mhill/20-125vent60/ ran to steady state & saved steady state conditions under filename: stea15.int

- 20% reduction in heat load during 1st 125 yrs
- 10mm/yr infiltration rate
- backfill (implicit)

File: EDAII15air-2a.dat located in directory vulcan/home/mhill/20-125vent60/ ran to steady state & saved steady state conditions under filename: sair15.int

- 20% reduction in heat load during 1st 125 yrs /10mm/yr
- air gap

File: EDAII cor16-2a.dat located in directory vulcan/home/mhill/50-50vent60/ ran to steady state & saved steady state conditions under filename: stea16.int

- 50% reduction in heat during 1st 50 yrs
- 10 mm/yr infiltration rate
- back fill (implicit)

File: EDAII16air-2a.dat located in directory vulcan/home/mhill/50-50vent60/ ran to steady state & saved steady state conditions under filename: sair16.int

- 50% reduction in heat during 1st 50yrs
- 10mm/y
- air gap

File: EDAII cor17-2a.dat located in directory vulcan/home/mhill/50-125vent60/ ran to steady state & saved steady ~~stear~~ state conditions under filename: stea17.int.

MH 2/8/00

- 50% reduction in heat during 1st 125 yrs
- 10 mm/yr infiltration rate
- backfill (implicit)

File: EDAII17air-2a.dat located in directory vulcan/home/mhill/50-125vent60/ ran to steady state & saved steady state conditions under filename: sair17.int

- 50% reduction in heat during 1st 125 yrs

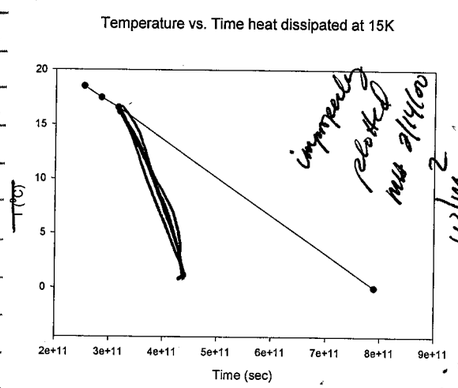
• 10 mm/yr infiltration rate
• air gap

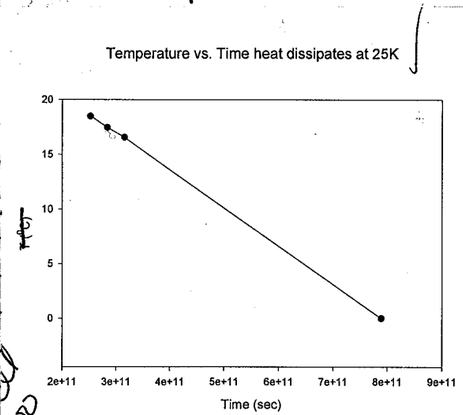
M Hill 2/8/00

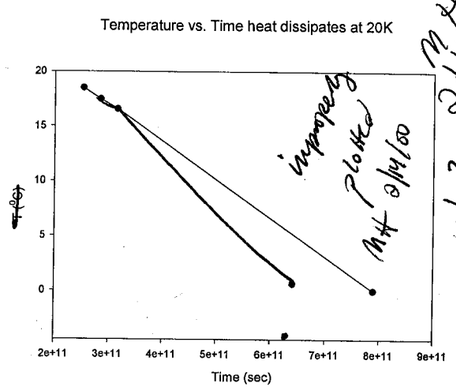
2/14/00 Picked a point for all heat to equal zero (from waste pkges at 4m). Used three data points from table V-1 p199 of this notebook & picked 4th point @ t = 15 K, 20 K, 25 K & 30 K, respectively.

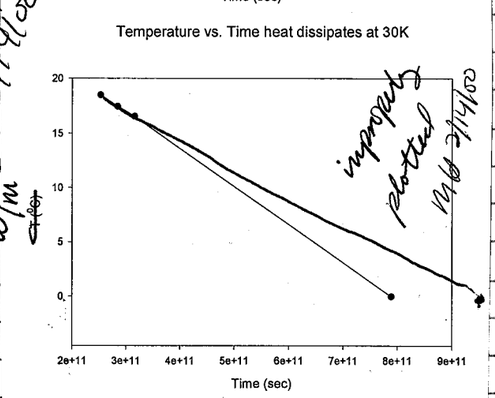
15K	20 K	25 K	30000	W/m^2
2.53E+11	2.53E+11	2.53E+11	2.53E+11	18.49
2.84E+11	2.84E+11	2.84E+11	2.84E+11	17.45
3.16E+11	3.16E+11	3.16E+11	3.16E+11	16.58
4.73E+11	6.31E+11	7.89E+11	9.47E+11	

M Hill 2/14/00









M Hill 2/14/00

Modified files listed on p 203-206 of this notebook as follows:

• heat source equal to zero @ 25 K yrs
• increased time steps up to yr 45 K
• reran to steady state

new file names are:

Filename	location
EDAII3e.dat	vulcan/home/mhill/novent60
EDAII4e.dat	vulcan/home/mhill/20-50vent60
EDAII5e.dat	vulcan/home/mhill/20-125vent60
EDAII6e.dat	vulcan/home/mhill/50-50vent60
EDAII7e.dat	vulcan/home/mhill/50-125vent60

M Hill 2/14/00

2/15/00 On 2/15/00 a power outage occurred 3 of the 5 runs started on 2/14/00 crashed p 207 of this notebook crashed (EDAII4e.dat, EDAII5e.dat & EDAII6e.dat). Left files with same name & reran.

Modified files listed on p 207 of this notebook to allow for airgap in drift. Modified files ran to steady state conditions. MH 2/15/00

MH 2/15/00

ssfn:	Filenames:	location:
ss13ac.int	EDA13aire.dat	vulcan/home/mhill/novent60
ss14ac.int	EDA14aire.dat	vulcan/home/mhill/20-50vent60
ss15ac.int	EDA15aire.dat	vulcan/home/mhill/20-125vent60
ss16ac.int	EDA16aire.dat	vulcan/home/mhill/50-50vent60

MH 2/15/00

ss17ec.int EDA17aire.dat vulcan/home/mhill/50-125vent60

MHill 2/15/00

2/21/00 Reran & renamed files EDAII13-17e.dat
This was done due to changes in
METRA concerning the areamodf in
the DCM parameters as specified by
S. Painter (see attached email)

Date: 1/21/00
Sender: scott painter <spainter@swri.edu>
To: "Debra Hughson (dhughson)" <dhughson@swri.edu>, "Ronald Green (rgreen)" <rgreen@swri.edu>, Goodluck Ofoegbu <ofoegbu@swri.edu>, "Lauren Browning (lbrowning)" <lbrowning@swri.edu>, Melissa Hill <mehill@swri.edu>
cc: "English Pearcy (epearcy)" <epearcy@swri.edu>
bcc: Melissa Hill
Priority: Normal
Subject: MULTIFLO issues

MULTIFLO users:

We are planning to finalize the "official" version 1.2 soon. I want to make you aware of two undocumented features. These are not in the User's Manual because they will be replaced by more flexible implementations in Version 2.0, but they may be of use to you now.

If you are using a version that has been modified since June 1998, you can cite the new User's Manual (Lichtner, Seth and Painter) in reports and journal articles. Please see me if you can't find the full reference.
The grid generation helper application, AMESH2MFLO or its predecessor MFLOMESH, is a beta Version 2.0 capability and there is no way to cite it now except by acknowledging my help with grid generation in the Acknowledgment sections.

We now have the option to apply the fracture-matrix area reduction factor (areamodf) to the liquid flow from fracture to matrix only, instead of to all fluxes. Your old input files are "backward compatible" and will not cause this option to be activated unless you modify them. To activate the new option modify the DCMParam input block as follows: replace the "areamodf" value with "1.0" and move your old areamodf value to the end of the line. For example,

```
: i1 i2 j1 j2 k1 k2   volf   areamodf  xlm  ylm  zlm
   1 43  1 42  1  7  1.05e-4  5.00e-4  0.5  0.5  0.5  :
TSw33
```

becomes

```
: i1 i2 j1 j2 k1 k2   volf    areamodf  xlm  ylm  zlm
   1 43  1 42  1  7  1.05e-4  1           0.5  0.5  0.5   5.00e-4:
TSw33
```

This new treatment is more realistic physically, and also avoids numerical difficulties caused by excessive matrix pressures during heated runs.

We also have an undocumented option for the way boundaries are treated in the GEM operator splitting algorithm. This is probably unnecessary for most application, but may give better results in diffusion dominated systems. If you are interested in trying it, I can show you how to activate it.

Scott

RFC822.TXT FileItem.txt

MHill 2/21/00

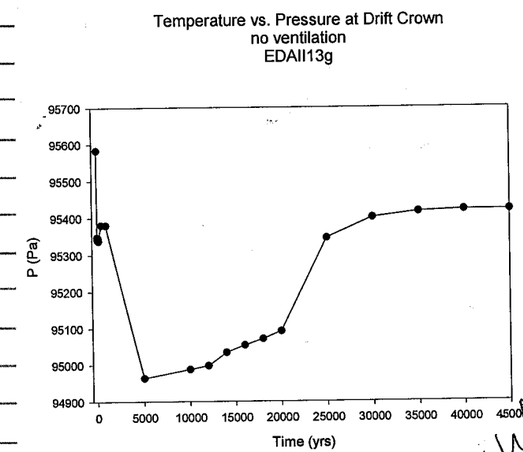
2/22/00

Files renamed as follows:

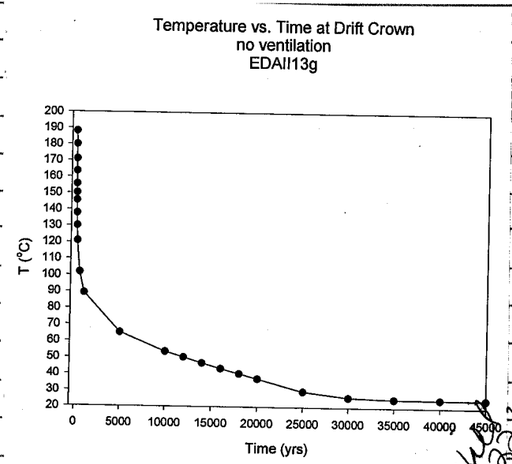
steady state	Input file
ss13f.int	EDAII13g.dat
ss14f.int	EDAII13g MH 2/21/00 14g.dat
ss15f.int	EDAII15g.dat
ss16f.int	EDAII16g.dat
ss17f.int	EDAII17g.dat

	location
EDAII13g.dat	vulcan/home/mhill/novent60/
EDAII14g.dat	vulcan/home/mhill/20-50vent60/
EDAII15g.dat	vulcan/home/mhill/20-125vent60/
EDA16g.dat	vulcan/home/mhill/50-50vent60/
EDA17g.dat	vulcan/home/mhill/50-125vent60/

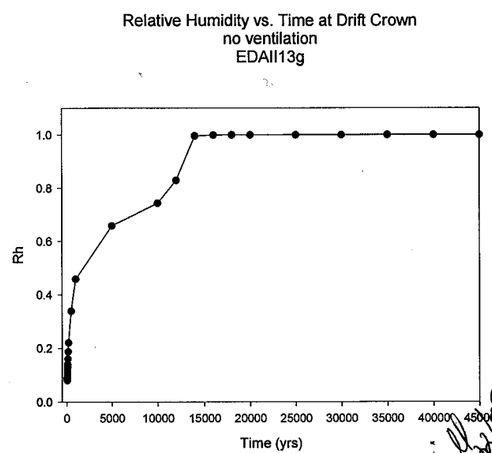
MHill 2/21/00



MHill 2/22/00



M Hill 2/22/00



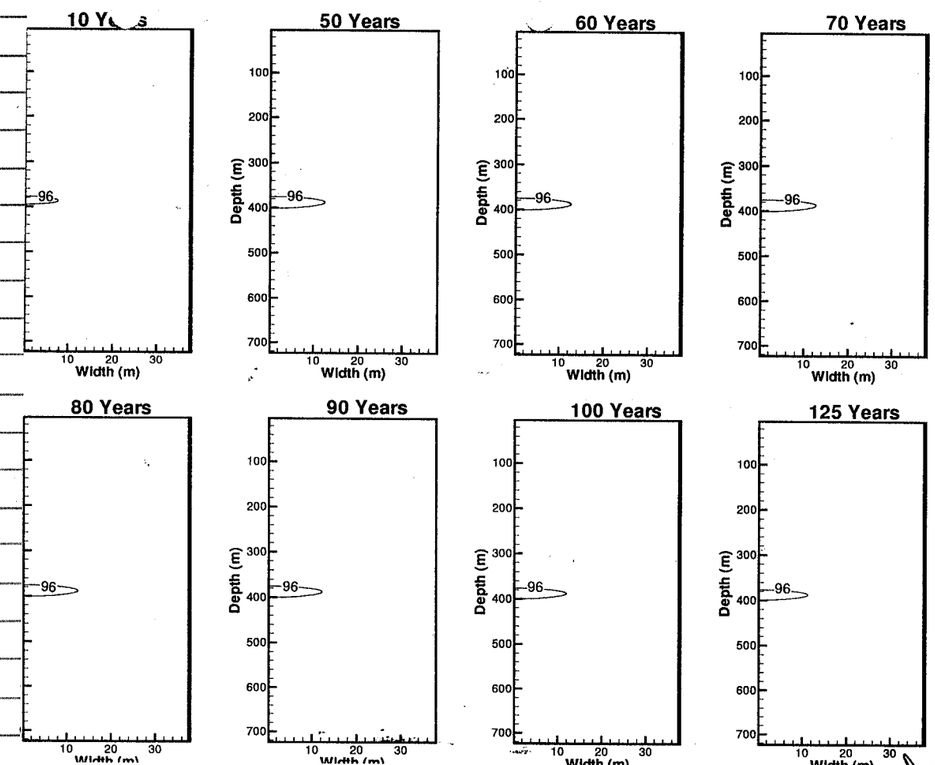
M Hill 2/22/00

M Hill 2/22/00

2/23/00 Temperature Plots for files ~~EDAII3gmt~~ MH 2/23/00

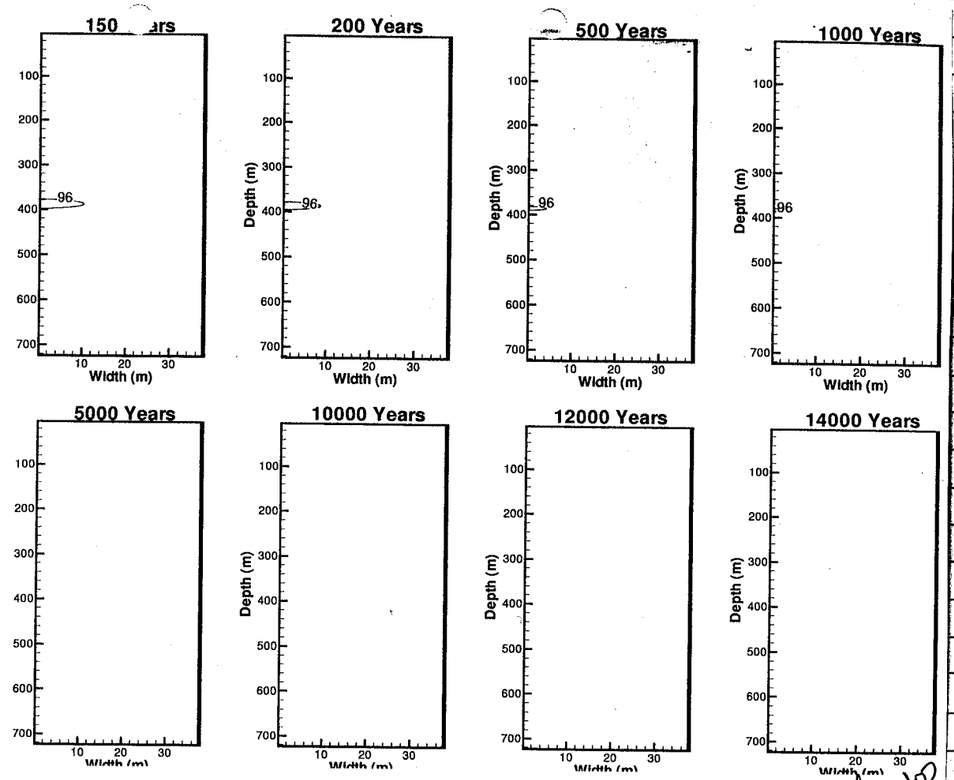
EDAIIfldml-16.xyp files located in vulcan/home/mhill/novent60/

no ventilation



M Hill 2/23/00

no ventilation



M Hill 2/23/00

M Hill 2/28/00

20 MH 3/20/00

3/14/00 Final runs for March 2000 TEF deliverable are listed below (errors were found in earlier runs p 203-212 of this notebook)

```
/home/mhill/novent60-2/ filename 13.dat
/home/mhill/20-50vent60-2/ filename 14.dat
/home/mhill/20-125vent60-2/ filename 15.dat
/home/mhill/50-50vent60-2/ filename 16.dat
/home/mhill/50-125vent60-2/ filename 17.dat
```

MHill 3/14/00

Output from files listed above are presented below:

13. dat

m1

	Z	X	Temp	Rh	VZ
	377.75	.25	93.81	.9989	4.41e1
	380	'	111.7	.9989	
Interpolated value	378.03		96		

m2

	371	.25	85.21	.9985	2.1136e1
	375	'	96.95	.9983	
MH 3/20/00	~~344.68~~ 374.68		96		

m3

	371	.25	85.93	.9984
	375	'	96.66	.9981
	374.75			

14. dat

m1

380	.25	94.86	.9986
381.75	'	110.90	.9983
380.12		96	

m2
377.75 .25 90.99 .9980
380 100.3 .9971
378.96 96

m3
377.75 .25 93.70 .9979
380 ' 103.5 .9970
378.28 96

m4
377.75 .25 95.64 .9978 6.2139e0
380 ' 104.5 .9967
377.84 96

m5
377.75 95.24 .9977
380 103.7 .9964
377.95 96

15.dat m1
380. 94.86
381.75 110.9
380.12 96

m2
377.75 90.99 1.5583e1
380 100.3
378.96 96

m3
377.75 89.70
380 97.97
379.46 96

m4
380 95.89
381.75 103.8
380.02 96

m5
380 .25 93.85
381.75 101
380.53 96

m6
381.75 .25 98.91
383 ' 105.6
381.21 96

m8
381.75 .25 93.54
383 ' 98.93
382.32 96

m9
381.75 .25 95.23
383 100.9
381.92 96

16.dat
m1
384 91.58
385 102.4
384.41 96

m3
381.75 94.43
383 104.6
381.94 96

m4

380	91.13	
381.75	100.6	
380.90	96	

m5

380	91.88	1.4447e1
381.75	100.7	
380.82	96	

17.dat

m1

383	90.09	2.6674e1
384	102	
383.50	96	

m2

384	91.57	
385	102.4	
384.41	96	

m3

384	87.85	
385	97.34	
384.86	96	

m4

385	92.62	
385.75	105	
385.20	96	

M Hill 3/20/00

3/22/00 Modified input file 13.dat p 213 of this notebook as follows:

printed results for element # 865 (element which serves as heat source). This was

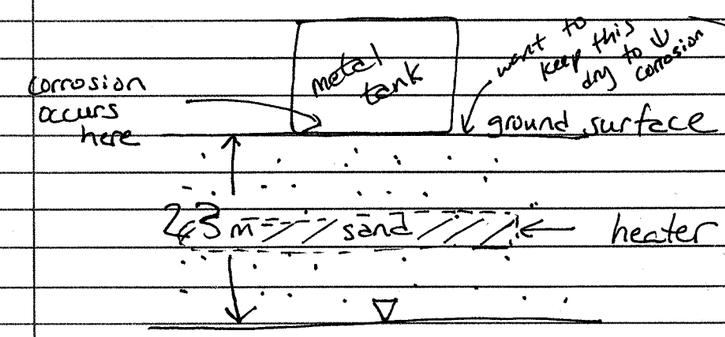
done so that the temp. could be given to PA for the TPA code. Modified file named: 13-2.dat & is located in the same directory as the original file p 213 of this notebook.

M Hill 3/22/00

4/19/00 O. Moghissi's project

Ron provided me with an input file located at /home/rgreen/oliver on vulcan. Input file named oliver1.dat would crash. Isolated that problem "floating point error at address 8710c" was in recurrent data. Commented out SOLVE & input file ran. Named file that would run Oliver2.dat. Oliver2.dat located on vulcan at /home/mhill/olive/.

Ron said that Solve is needed for metra (otherwise not solving anything) so changed parameters under solve & input file ran. Created new directory on vulcan at home/mhill/oli/.



sketch of what is going to be modeled in these analyses

(omitting the tank) M Hill 4/14/00

4/24/00 D. Hughson

Updated heat decay for file 13.dat p 213 of this notebook. Heat decay taken from "Waste packages & source terms for the Commercial 1999 Design Basis Waste Streams" provided by D Hughson & Chad Glen. Document Identifier CAL-MGR-MD-00000 MOL.20000214.0479 Rev # 00.
Taken from table 11. Case A p 25/35
83,800 MTU (case A)

Total MTU = 83,791.49

from table → V-1 p199 of this notebook

$$\frac{71\times10^6\ W}{83{,}791\ MTU}\left(\frac{83.8\ MTU/acre}{4047\ m^2}\right)(81\ m) = 1421\ W/m \text{ of drift}$$

The above calculation was used for the attached spreadsheet p 219 of this notebook.

Revised Heat Decay from "Waste pkges & source terms for the Commercial '99 Design basis waste Streams" (see p 218 of this notebook).

⇓

sec	yr	(MW)	MW/MTU			W/m^2	20% red	50% red
0	0	71.49949	0.000853	0.020707	1.76692E-05	81 1431.203	286.2407	715.6017
157800000	5	63.5188	0.000758	0.020707	1.5697E-05	81 1271.454	254.2909	635.7271
315600000	10	57.65222	0.000688	0.020707	1.42472E-05	81 1154.023	230.8046	577.0115
631200000	20	48.59808	0.00058	0.020707	1.20097E-05	81 972.7865	194.5573	486.3933
946800000	30	41.42883	0.000494	0.020707	1.0238E-05	81 829.2799	165.856	414.6399
1.262E+09	40	36.001	0.00043	0.020707	8.89668E-06	81 720.6311	144.1262	360.3155
1.578E+09	50	31.5443	0.000376	0.020707	7.79533E-06	81 631.4215	126.2843	315.7108
1.894E+09	60	27.91208	0.000333	0.020707	6.89772E-06	81 558.7154	111.7431	279.3577
2.209E+09	70	24.90998	0.000297	0.020707	6.15583E-06	81 498.6225	99.72449	249.3112
2.525E+09	80	22.38653	0.000267	0.020707	5.53223E-06	81 448.1107	89.62214	224.0553
2.84E+09	90	20.53042	0.000245	0.020707	5.07354E-06	81 410.9569	82.19138	205.4784
3.156E+09	100	18.94235	0.000226	0.020707	4.68109E-06	81 379.1686	75.83372	189.5843
4.734E+09	150	14.04035	0.000168	0.020707	3.4697E-06	81 281.0454	56.20908	140.5227
6.312E+09	200	11.4996	0.000137	0.020707	2.84182E-06	81 230.1873	46.03745	115.0936
9.468E+09	300	9.02496	0.000108	0.020707	2.23028E-06	81 180.6524	36.13048	90.3262
1.262E+10	400	7.585398	9.05E-05	0.020707	1.87453E-06	81 151.8367	30.36735	75.91836
1.578E+10	500	6.574892	7.85E-05	0.020707	1.62481E-06	81 131.6095	26.32189	65.80473
1.894E+10	600	5.77481	6.89E-05	0.020707	1.42709E-06	81 115.5942	23.11885	57.79712
2.209E+10	700	5.149266	6.15E-05	0.020707	1.2725E-06	81 103.0727	20.61455	51.53637
2.525E+10	800	4.610581	5.5E-05	0.020707	1.13936E-06	81 92.28989	18.45798	46.14494
2.84E+10	900	4.179814	4.99E-05	0.020707	1.03293E-06	81 83.66723	16.73345	41.83362
3.156E+10	1000	3.817243	4.56E-05	0.020707	9.43329E-07	81 76.40966	15.28193	38.20483
6.312E+10	2000	2.04884	2.45E-05	0.020707	5.06316E-07	81 41.01158	8.202316	20.50579
9.468E+10	3000	1.59641	1.91E-05	0.020707	3.9451E-07	81 31.9553	6.39106	15.97765
1.262E+11	4000	1.425174	1.7E-05	0.020707	3.52193E-07	81 28.52767	5.705535	14.26384
1.578E+11	5000	1.328105	1.59E-05	0.020707	3.28205E-07	81 26.58465	5.316929	13.29232
1.894E+11	6000	1.229386	1.47E-05	0.020707	3.0381E-07	81 24.60859	4.921718	12.30429
2.209E+11	7000	1.151405	1.37E-05	0.020707	2.84539E-07	81 23.04765	4.609529	11.52382
2.525E+11	8000	1.078041	1.29E-05	0.020707	2.66409E-07	81 21.57912	4.315824	10.78956
2.84E+11	9000	1.017151	1.21E-05	0.020707	2.51362E-07	81 20.36029	4.072057	10.18014
3.156E+11	10000	0.965009	1.15E-05	0.020707	2.38476E-07	81 19.31656	3.863312	9.658281
			0.97	1.16E-05	0.020707	2.39709E-07	81 19.41647	3.883293
			0.93	1.11E-05	0.020707	2.29825E-07	81 18.61579	3.723157
			0.8	9.55E-06	0.020707	1.97699E-07	81 16.01358	3.202716
			0.7	8.35E-06	0.020707	1.72986E-07	81 14.01188	2.802377
			0.6	7.16E-06	0.020707	1.48274E-07	81 12.01019	2.402037
			0.5	5.97E-06	0.020707	1.23562E-07	81 10.00849	2.001698
			0.4	4.77E-06	0.020707	9.88493E-08	81 8.00679	1.601358
			0.6	7.16E-06	0.020707	1.48274E-07	81 12.01019	2.402037
			0.2	2.39E-06	0.020707	4.94246E-08	81 4.003395	0.800679
			0		0	0	0	0

M Hall 4/24/00

M Hall 4/24/00

4/25/00 Matrix Saturations for T&W

Input file: 13c.dat Modified area modf & xlm parameter. Matrix saturations now = .92 for repository horizon. File located on vulcan/mhill/novent60-2 Used heat decay discussed on p 218-219 of this notebook.

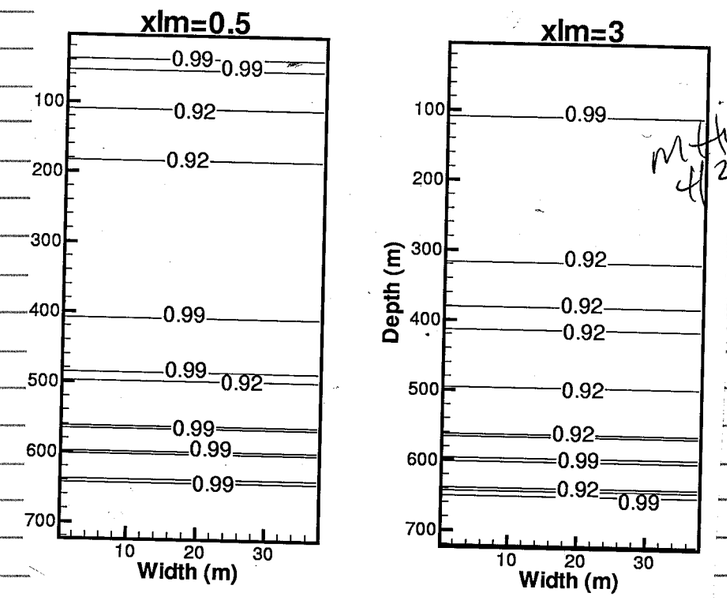
Used xlm ylm zym of 3 which is acceptable according to Liu, HH, Doughty, C. & Bodvarsson G.S. 1998 An active fracture model for unsaturated flow & transport in fractured rocks. Water Resources Research vol 34 no. 10 pgs 2633-2646.

Ran file 13c.dat to steady state. Cut & pasted initial conditions under INIT & wrote as another file 13cs.dat. Added heat source. 13cs.dat located on vulcan under mhill/novent60-2.

M Hill 4/25/00

4/26/00 Did comparison of sensitivity of xlm factor on matrix saturation & plotted up results (see p 221 of this notebook).

Sensitivity of xlm parameter on matrix saturation



M Hill 4/26/00

Differences between input files
13b.dat vs. 13c.dat

```
4c4
< : 13b.dat
---
> : 13c.dat
7c7
< : updated heat load see citation after source
---
> : updated heat load see citation under Source
13c13
< : XLM=0.5
---
> : XLM=3
311,330c311,330
<   1  18   1   1   1   6   2.33e-4 1.0 .5  .5  .5  5.00e-4          :TCw11
<   1  18   1   1   1   7  12  2.99e-4  1.0 .5  .5  .5  5.00e-4       :TCw12
<   1  18   1   1  13  13  7.05e-5  1.0 .5  .5  .5  5.00e-4           :TCw13
<   1  18   1   1  14  14  4.84e-5  1.0 .5  .5  .5  5.02e-1           :PTn21
<   1  18   1   1  15  15  4.83e-5  1.0 .5  .5  .5  5.00e-1           :PTn22
<   1  18   1   1  16  16  1.30e-4  1.0 .5  .5  .5  5.00e-1           :PTn23
<   1  18   1   1  17  18  6.94e-5  1.0 .5  .5  .5  5.00e-1           :PTn24
<   1  18   1   1  19  21  3.86e-5  1.0 .5  .5  .5  5.00e-1           :PTn25
<   1  18   1   1  22  22  8.92e-5  1.0 .5  .5  .5  4.68e-1           :TSw31
<   1  18   1   1  23  29  1.05e-4  1.0 .5  .5  .5  5.00e-4           :TSw33
<   1  18   1   1  30  53  3.29e-4  1.0 .5  .5  .5  5.00e-4           :TSw35
<   1  18   1   1  54  58  3.99e-4  1.0 .5  .5  .5  5.00e-4           :TSw36
<   1  18   1   1  59  63  4.92e-4  1.0 .5  .5  .5  5.00e-4           :TSw37
<   1  18   1   1  64  64  7.14e-5  1.0 .5  .5  .5  5.00e-1           :CH1vc
<   1  18   1   1  65  68  7.14e-5  1.0 .5  .5  .5  5.00e-1           :Ch2vc
<   1  18   1   1  69  69  1.10e-5  1.0 .5  .5  .5  9.22e-1           :CH3vc
<   1  18   1   1  70  71  1.10e-5  1.0 .5  .5  .5  5.00e-1           :CH4vc
<   1  18   1   1  72  74  7.14e-5  1.0 .5  .5  .5  5.00e-4           :PP3vp
<   1  18   1   1  75  79  1.10e-5  1.0 .5  .5  .5  5.00e-1           :PP2zp
<   1  18   1   1  80  80  7.14e-5  1.0 .5  .5  .5  5.00e-4           :BF3vb
---
>   1  18   1   1   1   6   2.33e-4 1.0 3.0 3.0 3.0 5.00e-4          :TCw11
>   1  18   1   1   1   7  12  2.99e-4  1.0 3.0 3.0 3.0 5.00e-4       :TCw12
>   1  18   1   1  13  13  7.05e-5  1.0 3.0 3.0 3.0 5.00e-4           :TCw13
>   1  18   1   1  14  14  4.84e-5  1.0 3.0 3.0 3.0 5.02e-1           :PTn21
>   1  18   1   1  15  15  4.83e-5  1.0 3.0 3.0 3.0 5.00e-1           :PTn22
>   1  18   1   1  16  16  1.30e-4  1.0 3.0 3.0 3.0 5.00e-1           :PTn23
>   1  18   1   1  17  18  6.94e-5  1.0 3.0 3.0 3.0 5.00e-1           :PTn24
>   1  18   1   1  19  21  3.86e-5  1.0 3.0 3.0 3.0 5.00e-1           :PTn25
>   1  18   1   1  22  22  8.92e-5  1.0 3.0 3.0 3.0 4.68e-1           :TSw31
>   1  18   1   1  23  29  1.05e-4  1.0 3.0 3.0 3.0 5.00e-4           :TSw33
>   1  18   1   1  30  53  3.29e-4  1.0 3.0 3.0 3.0 5.00e-4           :TSw35
>   1  18   1   1  54  58  3.99e-4  1.0 3.0 3.0 3.0 5.00e-4           :TSw36
>   1  18   1   1  59  63  4.92e-4  1.0 3.0 3.0 3.0 5.00e-4           :TSw37
>   1  18   1   1  64  64  7.14e-5  1.0 3.0 3.0 3.0 5.00e-1           :CH1vc
>   1  18   1   1  65  68  7.14e-5  1.0 3.0 3.0 3.0 5.00e-1           :Ch2vc
>   1  18   1   1  69  69  1.10e-5  1.0 3.0 3.0 3.0 9.22e-1           :CH3vc
>   1  18   1   1  70  71  1.10e-5  1.0 3.0 3.0 3.0 5.00e-1           :CH4vc
>   1  18   1   1  72  74  7.14e-5  1.0 3.0 3.0 3.0 5.00e-4           :PP3vp
>   1  18   1   1  75  79  1.10e-5  1.0 3.0 3.0 3.0 5.00e-1           :PP2zp
>   1  18   1   1  80  80  7.14e-5  1.0 3.0 3.0 3.0 5.00e-4           :BF3vb
```

MHill 4/26/00

MHill 4/26/00

5/1/00 Calculation for SCALH parameter under SOURCE for files: 13cs.dat & nest1.dat

MH 5/1/00 → p 220 of this notebook

old heat decay table III-1 (p 200 of this notebook)

Goodluck:

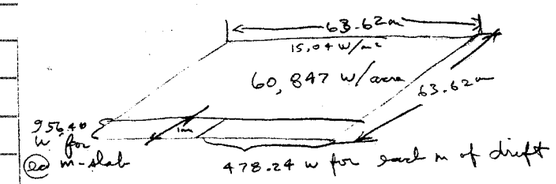
$$\frac{MW}{MTU}\left(\frac{\frac{MTU}{acre}}{m^2}\right)(81\,m) = \frac{MTU}{m \text{ of drift}}$$

$$\frac{71\times10^6\,W}{70{,}011\,MTU}\left(\frac{60\,MTU}{4047\,m^2}\right)(81\,m) = \frac{\text{Watts}}{\text{meter of drift}}$$

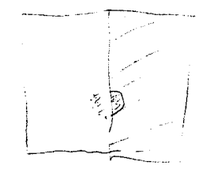
≈ 1000

$= 1014\ \frac{W}{MTU}$

$\approx 1220\ \frac{W}{m}$



60 MTU ≈ 60,000 W



$\frac{1226.47}{478.24} = 2.56$

$\frac{478.24}{1226.47} = 0.39$

MHill 5/1/00

New heat load (p218 of this notebook)

Waste Package Operations **Calculation**

Title: Waste Packages and Source Terms for the Commercial 1999 Design Basis Waste Streams
Document Identifier: CAL-MGR-MD-000001 REV 00 Page 25 of 35

Table 11. Case A - 83,800 MTU Waste Package Characteristics[a]

WP Design	Average WP Heat Generation Rate Based on Assembly Heat at Repository Arrival (kW)[b]	Number of Assemblies	Number of WPs	Average Initial Burnup (GWd / MTU)	Average Initial U-235 Enrichment	Average MTU / Assembly	Average Assembly Age (years)	Total MTU
21 PWR Absorber Plate	11.33	119480	5690	41.976	3.75	0.431	25.20	51529.19
21 PWR Control Rod	3.26	2207	106	19.862	3.61	0.376	35.63	829.07
12 PWR Absorber Plate-Long	8.97	3513	293	43.337	3.77	0.540	21.59	1897.56
44 BWR Absorber Plate	7.00	164165	3732	33.981	3.02	0.178	25.08	29140.39
24 BWR Thick Absorber Plate	0.54	2338	98	8.480	2.68	0.169	41.82	395.28
Totals		291703	9919					

NOTES:

[a] Information in table based on summary.dat file for waste arrival Case A, 83,800 MTU.

[b] Average WP Heat Generation Rate, kW: 9.43
Average PWR WP Heat Generation Rate, kW: 11.07
Average BWR WP Heat Generation Rate, kW: 6.83

MHell 5/1/00

83791.49 MHell 5/1/00

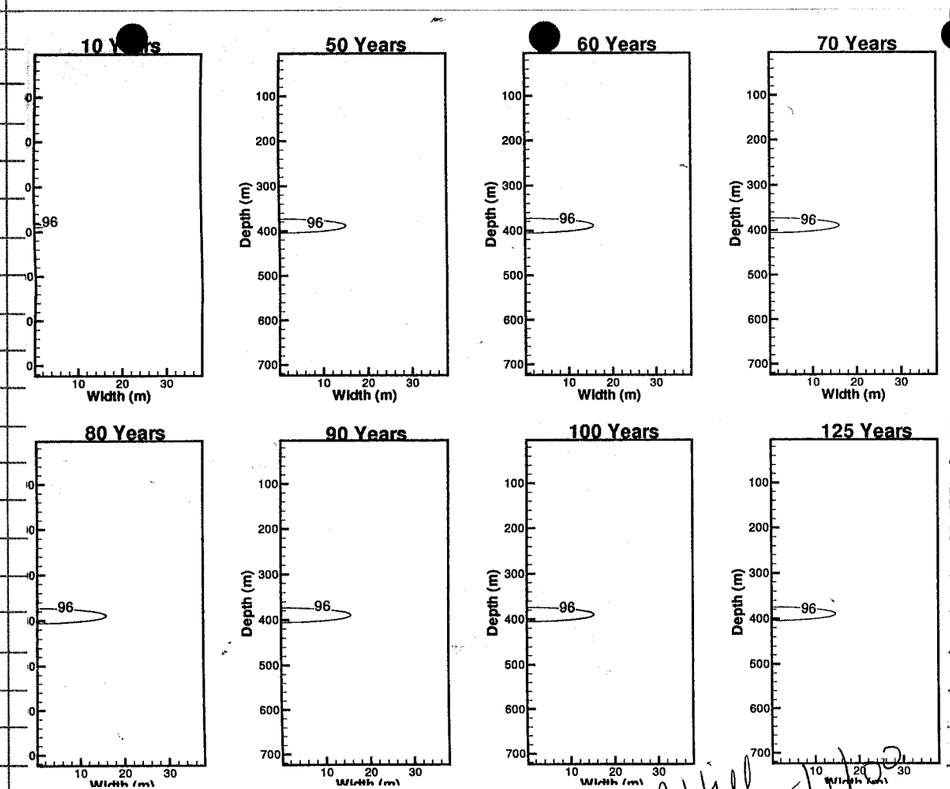
Calculation of SCALH parameter:

$$\frac{478.24}{1431.20}$$ (see p 223 of this notebook) (see p 219 of this notebook)

$= 0.33$

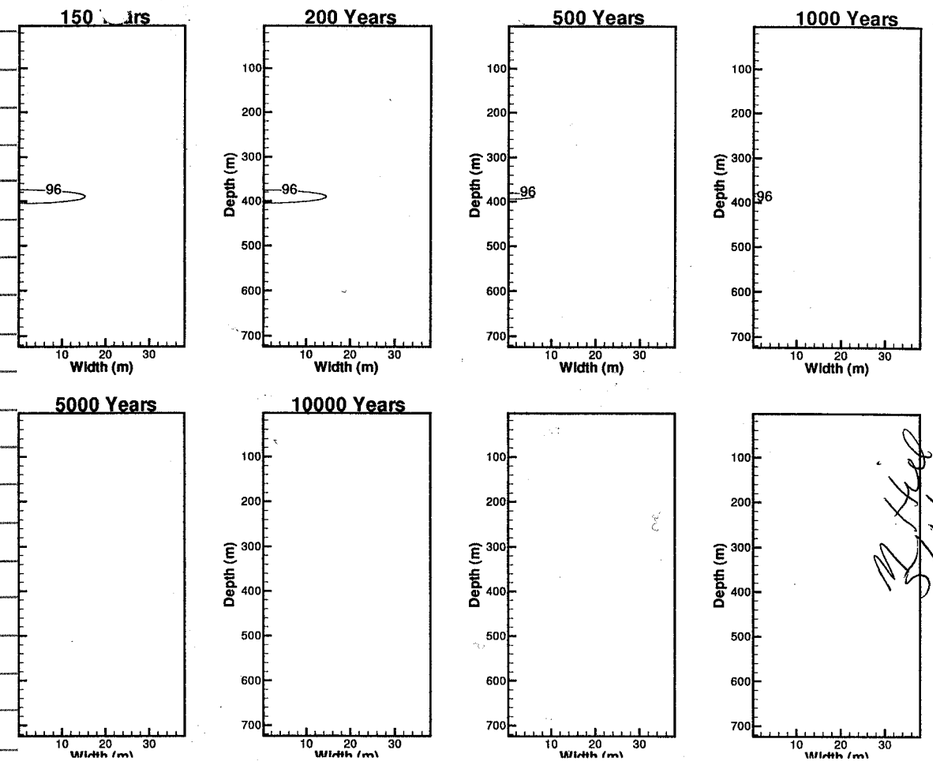
Results of 13cs.dat (p 220 of this notebook) simulation:

Contour variable = Temperature (°C)



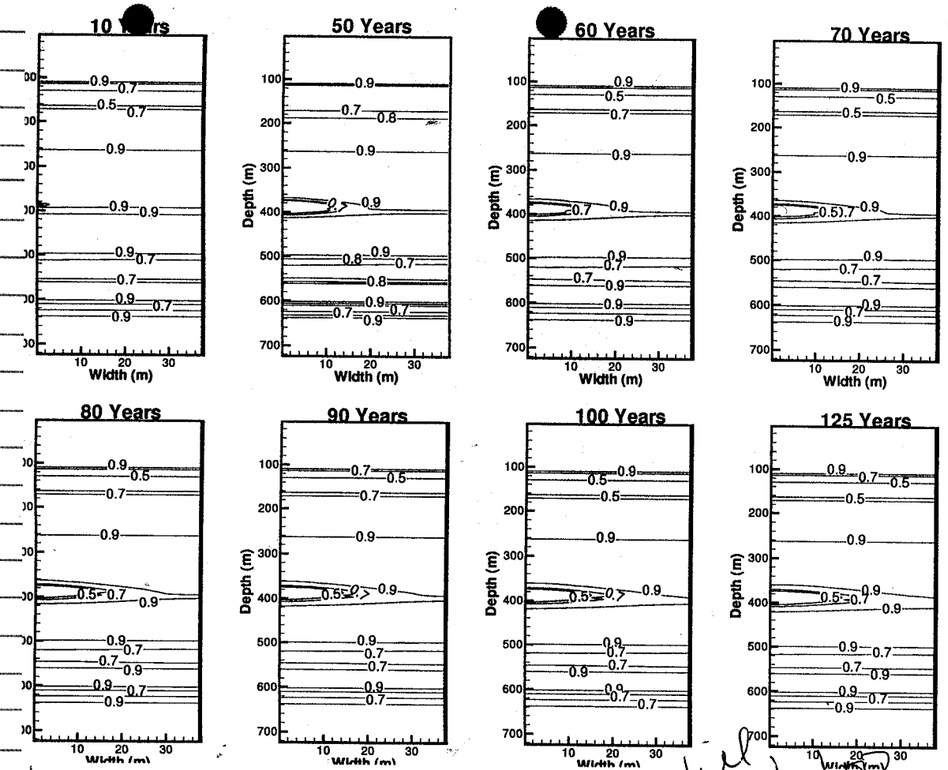
MHell 5/1/00

Results of 13cs.dat (p 220 of this notebook)
Contour variable = Temperature (°C)



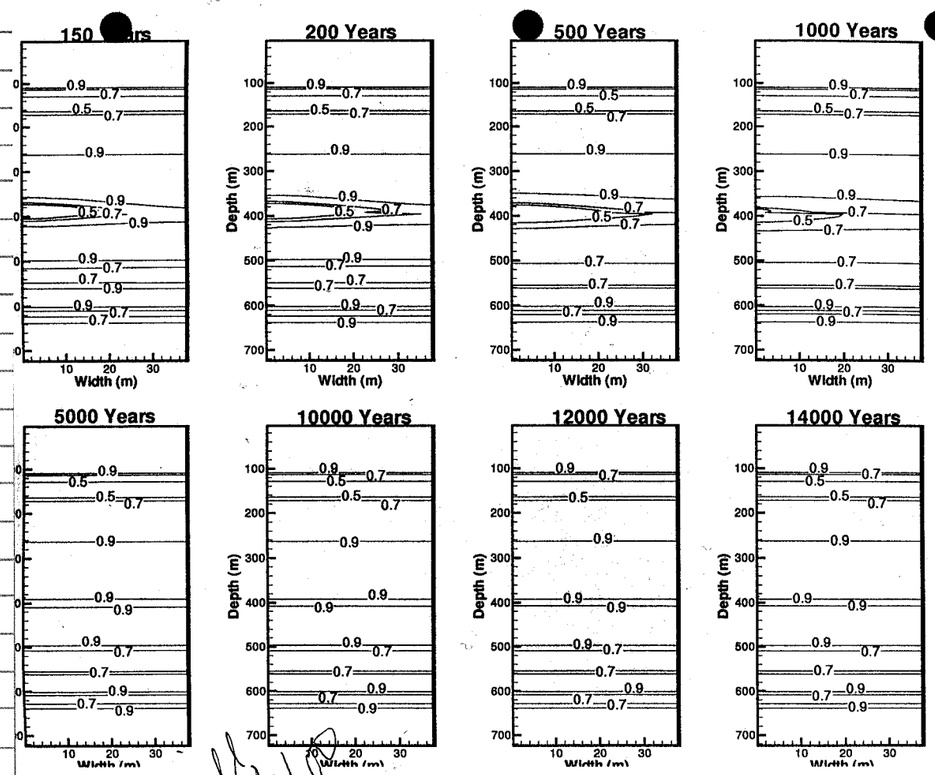
M Hall 5/1/00

Results of 13cs.dat (p 220 of this notebook)
Temperature Contour = Matrix liquid saturations



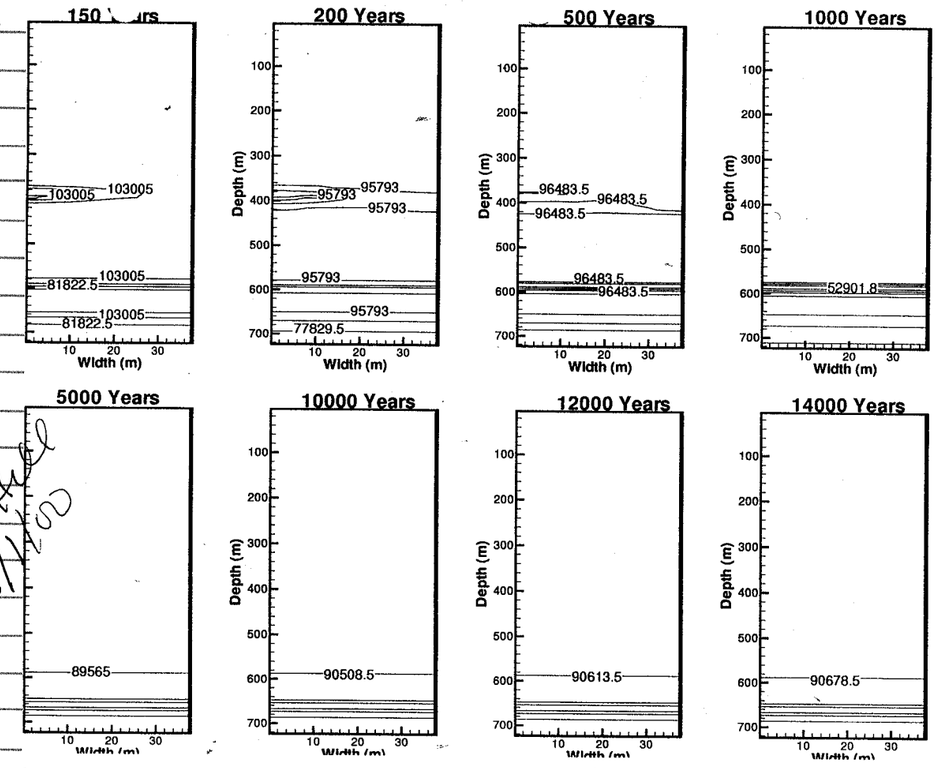
M Hall 5/1/00

Results of 13cs.dat (p 220 of this notebook)
Contour variable = Matrix liquid saturation



mtell 3/1/10

Results of 13cs.dat (p220 of this notebook)
Contour variable = Pressure (Pa)



mtell 3/1/10

13csfldm1.xyp

Z (m)	Temp (°C)	
381.75	85.21	
383	99.46	
382.70	96	(Interpolated value)

13csfldm2.xyp

371	88.68
375	102
373.20	

13csfldm3.xyp
371 89.62
375 102.2
373.03

maximum vertical extent of boiling isotherm occurs @ ~60yrs

13csfldm4.xyp
371 89.97
375 101.7
373.06

13csfldm5.xyp
371 89.85
375 100.7
373.27

13csfldm6.xyp
371 89.42
375 99.49
373.61

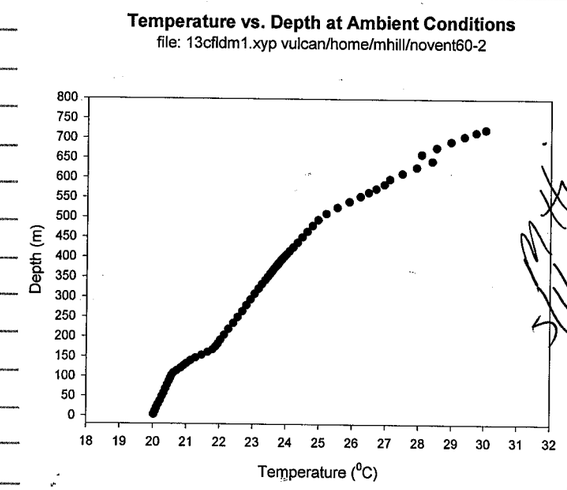
13csfldm7.xyp
371 88.81
375 98.16
374.08

13csfldm8.xyp
371 88.21
375 96.78
374.64

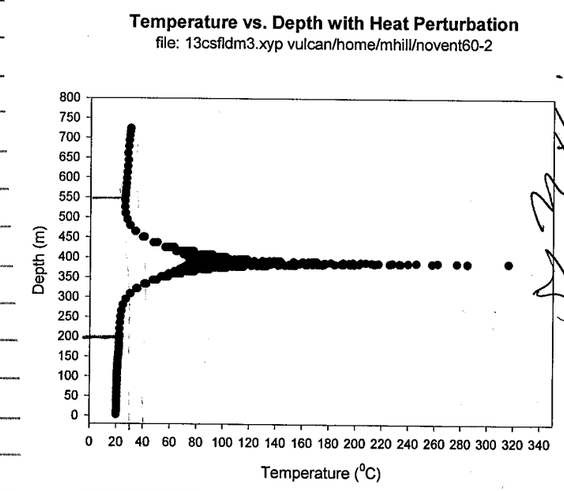
13csfldm9.xyp
371 88.98
375 97.37
374.35

13csfldm10.xyp
375 95.49
377.75 102.2
375.21

13csfldm11.xyp
380 93.73
381.75 97.78
380.98



M Hill 5/1/00

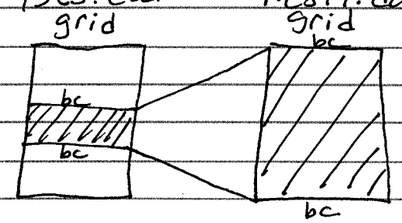


M Hill 5/1/00

M Hill 5/1/00

5/2/00 File: 13csfldm3.xyp & File: 13csfldf3.xyp both located on vulcan under /home/mhill/novemtbr2 were used for the collection of boundary conditions for a nested model.

13cs.dat grid nest1.dat grid vulcan/home/mhill/nest



Boundary conditions collected from 13csfldm3.xyp & 13csfldf3.xyp:

	Z	Press	Temp	sgm	sgf	
TSw33	205	9.3886e+4	22.15	0.1775	0.96	TSw33
CH_2vc	554.25	9.5017e+4	26.24	0.2770	1.00	CH2vc

ran nest1.dat to stead state. File located on vulcan under /home/mhill/nest

X=.25 for which boundary conditions were collected. However, boundary conditions along the 40.5m distance in the x-direction remained fairly constant (at least 1 decimal place).

M Hill 5/2/00

5/5/00 The following information was taken from "In-Drift Thermal Hydrological-Chemical Model" Document Identifier ANL-EBS-MD-000026 Rev 00 p 13 & 14

p 13
Thermal properties of simulated drift air at 300°K (Incropera & DeWitt 196 pg 839) (TBV)

Mass density 1.1614 kg/m³ (see attached copy)

4.1.2 Thermal Properties of Simulated Drift Air at 300° K (Incropera and DeWitt 1996, pg 839) (TBV)

Mass Density 1.1614 kg/m³
Thermal Conductivity 0.0263 watt/(m-°K)
Specific Heat Capacity 1.007 kJ/kg

4.1.3 Thermal Properties of the Invert Material (DTN: SN9908T0872799.004 – indriftgeom_rev01.doc, pages 1 and 2) (TBV)

Thermal Conductivity 0.66 watt/(m-°K) Dry
Grain Density 2530 kg/m³
Specific Heat Capacity 948 J/(kg-°K)

4.1.4 Thermal Properties of Drip Shield (DTN: SN9908T0872799.004) (TBV)

Thermal Conductivity 20.55 W/(m-°K)
Specific Heat Capacity 551.32 J/(kg-°K)
Mass Density 7900 Kg/m³ **(Incropera and DeWitt 1996, pg 829) (TBV)**

4.1.5 Thermal Properties of Waste Package (DTN: SN9908T0872799.004) (TBV)

Mass Density 8189.2 kg/m³
Thermal Conductivity 14.42 W/(m-°K)
Specific Heat capacity 488.86 J/(kg-°K)

4.1.6 Fluid and Thermodynamic Properties of Water and Air

Properties such as molecular weight, density, viscosity, diffusivity, enthalpy versus temperature/pressure, and specific volume as a function of temperature/pressure, are incorporated into the NUFT code (Attachment III, Software Qualification).

4.1.7 Universal Constants

The Ideal Gas Constant R (1.987 cal/(g.mol-°K)) and Gravitational Constant g (9.807 m/s²) are accepted data incorporated into the NUFT code.

4.2 CRITERIA

Not Applicable

4.3 CODES AND STANDARDS

Not Applicable

M Hill 5/2/00

5. ASSUMPTIONS (used in Section 6)

5.1 HYDROLOGIC PROPERTIES OF WASTE PACKAGE

The following properties are assumed from (MO9812MWD1NUFT.000 – MOL.19990408.0013)
Porosity = 0.010
Permeability = 0.0
Tortuosity Factor = 0.0

5.2 DRIP SHIELD AND OTHER EBS COMPONENTS

For ease of modeling, the top of the drip shield is assumed to be flat rather than curved. This assumption is discussed under "Results" in Section 6.5. The modeled thickness of the drip shield is 2 cm and the dimensions of the drift, invert material, and drip shield are shown on the simulation grid, corresponding to the EDA II design (Wilkins and Heath, 1999; CRWMS M&O 1999b).

5.3 HYDROLOGIC PROPERTIES OF DRIP SHIELD

As the drip shield is made of titanium, its hydrologic properties are assumed to be the same as those of the waste package (Section 5.1)
Porosity = 0.010
Permeability = 0.0
Tortuosity Factor = 0.0

5.4 THERMAL AND HYDROLOGIC PROPERTIES OF ATMOSPHERIC AIR

A heat capacity of 1,007 J/(kg-K) is assigned to the atmosphere above the ground surface (MO9812MWD1NUFT.000). The thermal conductivity of the atmosphere is 0.0263 W/(m-K), same as that used for air in the emplacement drift (Incropera and DeWitt, 1996). A porosity of 0.990 and a bulk intrinsic permeability of 1E-8 m^2 are used for the atmosphere, according to MO9812MWD1NUFT.000.

5.5 APPROXIMATION OF DRIFT AIR

To simulate the air space underneath the drip shield, a fictitious material with a porosity of 0.990 and a saturated porous medium-equivalent permeability of 10,000 darcys is assumed to occupy the simulated drift air space underneath the drip shield. A porosity close to 1.0 is chosen because using 1.0 would lead to a singularity in the flow equations. An adjustment of thermal conductivity is addressed in Attachment IV. The selection of a single value of intrinsic permeability (1E-8 m^2) and a single value of thermal conductivity (0.0263 W/(m-K)) for the air gap will approximate the average heat transfer between the waste package and the drip shield. To account for spatial variation of heat transfer in the air gap, thermal conductivity and permeability of the pseudo-porous material would have to be selected to produce air convection pattern similar to that in the

M Hall 5/5/00

5/10/00 The following information was taken from "In-drift Thermal Hydrological-Chemical Model" Document Identifier ANL-EBS-MD-000026 Rev 00 p 15 & 16

air gap. Furthermore, the values of these parameters would change with the temperature difference between the waste package and the drip shield as the thermal loading varies. Improved parameter calibration will be implemented in a later revision of this AMR.

5.6 THERMAL LOADING OF WASTE PACKAGE

The thermal loading for the waste package is based on data from the Design Input transmittal (CRWMS M&O 1999a) and is presented in Attachment V. As the main purpose of this report is to predict flow into various EBS components of the drift during the cooling phase of the repository, the first 50 years or 100 years of thermal loading will be ignored in the analyses described in Section 6. This is done to decrease the turnaround time of the production runs. The impact of this modification will be discussed in Section 6.

Ignoring the first 100 years of thermal loading will not impact the results for revision 00A of this AMR because chemical reactions are not considered in this model.

Thermal-mechanical induced alterations in material properties are addressed in another AMR.

The simulated waste package support is not considered in this analysis and the lower surface of the waste package is assumed to be in direct contact with the invert material. This assumption ignores the convective heat transfer in the air space between the waste package and the invert material although given the geometry of the support, air movement around the support may be somewhat restricted. This air space trapped in the support system would tend to reduce the convective heat transfer to the invert material. The impact of ignoring this air gap and heat conduction by the support will be evaluated in a later revision of this AMR when the final design of the waste package support system is complete.

5.7 WATER INFLUX INTO DRIFT

This report evaluates the impact of water influx into the drift that could affect the performance of the drip shield in minimizing water contact with the waste package. The first approach involves uniformly applying an infiltration rate of 35 mm/yr on the ground surface and percolation at this rate will, at a steady or quasi-steady state, continue through the profile. This rate is based on the total percolation flux from fractures (25 mm/yr) and matrix (10 mm/yr) (MO9901RIB00044.000) at the repository level. For the sensitivity analysis, the infiltration rate will be increased to 68 mm/yr to represent the maximum expected for a long-term projection of weather changes in the repository area.

5.8 HYDROLOGIC PROPERTIES OF THE INVERT MATERIAL (SN9908T0872799.004 – MOL.19990901.0312)

Porosity = 0.545
Intrinsic Permeability (m^2) = 6.16 E-10

M Hall 5/10/00

Van Genuchten α_v (1/Pa) = 1.2232E-3
n = 2.7
Residual saturation = 0.092

Porosity and permeability are test measurements and the other parameters are derived from curvefitting to water retention data.

5.9 BACKFILL MATERIAL

The Overton sand backfill is assumed to completely fill the outer annulus between the drip shield and the drift wall rather than leaving a relatively small air gap on top of the backfill, as depicted in Figure 3. The air gap above the backfill will facilitate natural convection that would tend to dry the crown area so less moisture would accumulate above the drip shield. The air space would also facilitate moisture runoff on the surface of the backfill away from the crown area. Thus omission of the air gap is conservative. This assumption allows any influx into the crown of the drift to be in direct contact with the backfill and, thus, would facilitate flow to the invert of the drift. Whereas in the presence of the air space above the backfill, liquid from crown of the drift could come into contact with the backfill by free fall. Additionally, as this modification only occurs in the outer rather than the inner annulus of the drip shield, this assumption will not impact the condensation potential underneath the drip shield.

5.10 THERMAL AND HYDROLOGIC PROPERTIES OF BACKFILL MATERIAL (SN9908T0872799.004 – MOL.19990901.0312)

Porosity = 0.410
Intrinsic Permeability (m^2) = 1.43E-11
Van Genuchten α_v (1/Pa) = 2.75E-4
n = 2.0
residual saturation = 0.01

Porosity and permeability are determined from test measurements and the other parameters are derived from curvefitting to water retention data.

The backfill material is chosen such that it has a permeability about an order of magnitude higher than that of the surrounding rock. As a result, capillary barrier effect would minimize the infiltration of liquid from the host rock into the backfill under unsaturated conditions.

5.11 TORTUOSITY FACTORS

A factor of 1.0 is assigned to Simulated Drift Air and Atmosphere to simulate open air space with porosity values of 0.999 and 0.990, respectively.
A factor of 0.0 is assigned to Simulated Heaters and Drip Shield since they are assumed to be air and water tight and have zero permeability.

5/10/00 M Hill

M Hill 5/10/00

6/1/00 D. Hughson modified file: 13cs.dat p. 220 of this notebook. She changed the infiltration to 5.5 mm/y & changed the xlm, ylm & zym parameters to 1.5.

6/1/00 MH

Copied D. Hughson's version of 13cs.dat located on ~~vulcan/home/mhill/14tpa/~~ ~~to my own directory~~ dhughson/multiflo/mhill/fordpa to my own directory home/mhill/14tpa on vulcan. MH 6/1/00

Refined grid on D. Hughson's version of 13cs.dat & created nested model used boundary conditions from D. Hughson's 13cs.dat output files (specificially 13csfldm7.xyp & 13csfldf7.xyp)

Output from D. Hughson's 13cs.dat file:

13csfldm1.xyp

	z (m)	temp (°C)
	3.8e+2	81.01
	3.8175e+2	89.29
Interpolated value	381.44	96

13csfldm2.xyp

371	78.69
375	98.02
374.58	

13csfldm3.xyp

371	91.10
375	100.4
373.11	

13csfldm4.xyp

371	92.0
375	106.1
372.13	

13csfldm5.xyp

371	92.62
375	108.4
371.86	

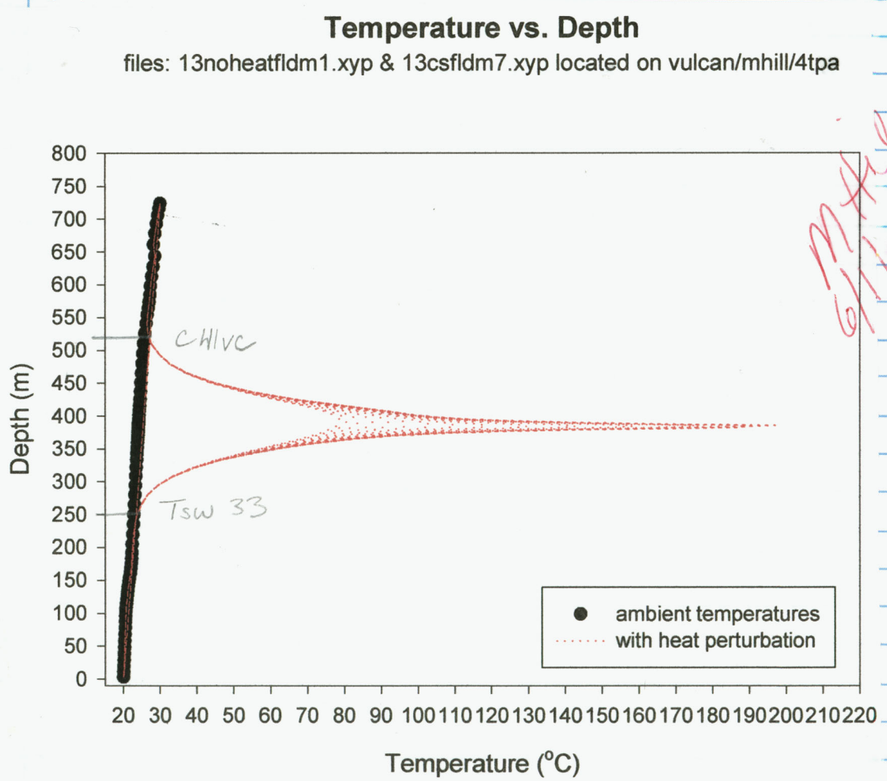
13csfldm6.xyp
371 93.45
375 108.7
371.67

13csfldm7.xyp
371 93.74
375 108.2
371.63

maximum vertical extent of boiling isotherm

13csfldm8.xyp
371 93.54
375 107.1
371.73

13csfldm9.xyp
371 93.11
375 105.7
371.92



MHill 6/1/00

MHill 6/1/00

6/7/00 Revised 13cs.dat file (see p. 237 of this notebook). Renamed file nestrev.dat located on vulcan under home/mhill/4tpa. Hardcopy of nestrev.dat is attached:

```
METRA-DCM, Patterned after T. Buscheck Case 3 of Drift Scale
Near-Field/Altered-Zone Models Report UCRL-ID-129179
: nestrev.dat
: 6/7/00
: no ventilation
: updated heat load see citation under source
: updated 13cs1 int ran to steady state
: by MH, DH, & RG
: This is my attempt to reproduce the results for Drift Scale Thermohydrologic
: nested model zoomed in on drift units Tsw33-Chl
: Infiltration rate = 5.5 mm/y
: refined grid
: 2-D
:
:
RSTART 0
:
:grid  geometry  nx ny  nz  ivplwr  ipvcal  iout  gravity  pref  tref  href
:grid  DCMXYZ    35 1   121  0       1       0     0        0     0     0
:
: ***********************************************************
: i = sequential number of material types
: type = the characteristic curves (Van-Gen, Linear, tabular, and corey)
: swirm = irreducible liquid saturation for the matrix
: rpmm = Van Genuchten parameter for matrix
: alpham = Van Genuchten parameter for matrix
: swext = liquid saturation below which the capillary pressure is calculated
based
:      on the slope dPcw/dSw evaluated at SWEXT.
: sgc = residual (immobile) gas saturation, fraction
: iecm = Equivalent Continuum Model (ECM) formulation (0 do not invoke, 1
invoke, 2 ECM with tables)
: swirf = residual liquid saturation for fracture, fraction
: alpharf = parameter in Van-Genuchten equation for fracture (1/Pa)
: phim = matrix porosity (fraction)
: phif = fracture porosity (fraction)
: permm = intrinsic matrix permeability (m^2)
: permf = intrinsic fracture permeability
:
Pckr
:  i  type-curv   swirm   rpmm(lamda) alpham    :relative perm and pc keyword   swext   sgc     iecm
:
: (Tsw33 - matrix)
:  1  Van-Gen     0.06    0.2479      6.21e-6   -1.0e+8   0.0     0
:
: (Tsw33 - fracture)
:  2  Van-Gen     0.01    0.667       1.73e-3   -0.0e+8   0.0     0
:
: (Tsw35 - matrix: Repository horizon)
:  3  Van-Gen     0.08    0.1983      4.01e-6   -1.0e+8   0.0     0
:
: (Tsw35 - fracture: Repository horizon)
:  4  Van-Gen     0.01    0.667       1.26e-3   -0.0e+8   0.0     0
:
: (Tsw36 - matrix)
:  5  Van-Gen     0.18    0.5138      2.272e-6  -0.0e+8   0.0     0
: (Tsw36 - fracture)
:  6  Van-Gen     0.01    0.667       1.32e-3   -0.0e+8   0.0     0
:
: (Tsw37 - matrix)
:  7  Van-Gen     0.50    0.3709      7.3856e-6 -0.0e+8   0.0     0
:
: (Tsw37 - fracture)
:  8  Van-Gen     0.01    0.659       1.19e-3   -0.0e+8   0.0     0
:
: (CHlvc - matrix)
:  9  Van-Gen     0.04    0.1592      7.60e-5   -1.0e+8   0.0     0
:
: (CHlvc - fracture)
:  10 Van-Gen     0.01    0.669       1.18e-3   -0.0e+8   0.0     0
:
:kip
: ********************
: Metal Waste Package
: ********************
:  11 Van-Gen     0.092   0.630       1.2232E-3 -0.0e+8   0.0     0
: ********************
: Invert material
: ********************
:  12 Van-Gen     0.092   0.630       1.2232E-3 -0.0e+8   0.0     0
: ********************
: Drip shield
: ********************
:  13 Van-Gen     0.092   0.630       1.2232E-3 -0.0e+8   0.0     0
: ********************
: Simulated drift-air at 300 K
: ********************
:  14 Van-Gen     0.05    0.700       1.41e-3   -0.0e+8   0.0     0 !no info
: ********************
: Air below drip shield
: ********************
:  15 Van-Gen     0.05    0.700       1.41e-3   -0.0e+8   0.0     0 !no info
:oskip
0
: ********************
: Debug options
: ********************
Debug 1
0
:
: ********************
: Thermal properties
: ********************
: no = sequential number of data set
: rho = rock density (kg/m^3)
: cpr = rock specific heat (J/kg-K)
: ckdry = thermal conductivity of dry rock (J/s/m-K)
: cksat = thermal conductivity of liquid saturated rock (J/s/m-K)
: cpw = pore compressibility with pressure at constant T (1/Pa)
: crt = absolute value of pore compressibility with pressure at constant T
(1/Pa)
: tau = tortuosity for binary diffusion
```

MHill 6/7/00

```
: cdiff = vapor-dir diffusion coefficient, (m^2/s)
: cexp = exponent for binary diffusion
: enbd = enhanced binary diffusion coefficient
:
Thermal-prop
: no rho      cpr     ckdry  ckseat  crp  crt  tau  cdiff    cexp  enbd
: (TSw33 - matrix)
  1 2.510e+03 883     0.71   1.80    0    0    .5  2.13e-5  1.8   0.
: (TSw35 - matrix)
  2 2.540e+03 900     1.20   2.02    0    0    .5  2.13e-5  1.8   0.
: (TSw36 - matrix)
  3 2.560e+03 865     1.42   1.84    0    0    .5  2.13e-5  1.8   0.
: (TSw37 - matrix)
  4 2.360e+03 984     1.69   2.08    0    0    .5  2.13e-5  1.8   0.
: (CHlvc - matrix)
  5 2.310e+03 1060    0.70   1.31    0    0    .5  2.13e-5  1.8   0.
:kip
: ********************
: Metal Waste Package
: ********************
  6 8.189e+03 489.0   14.42  14.42   0    0    .5  2.13e-5  1.8   0.
: ********************
: Invert material
: ********************
  7 2.530E+03 948.0   0.66   0.66    0    0    .5  2.13e-5  1.8   0.
: ********************
: Drip shield
: ********************
  8 7.900e+03 551     20.55  20.55   0    0    .5  2.13e-5  1.8   0.
: ********************
: Simulated drift air at 300 K
: ********************
  9 1.16      1007    20     20      0    0    .5 2.13e-5   1.8   0.
: ********************
: Air below drip shield
: ********************
 10 1.16      1007    20     20      0    0    .5 2.13e-5   1.8   0.
:oskip
0
: ****************************
:  Define size of grid-blocks
: ****************************
:
DXYZ   0
: (dx(i),i=1,nx)
0.30 0.10 0.05 0.10 0.05 0.05 0.03 0.02 0.02 0.03
0.05 0.05 0.10 0.20 0.30 0.25 0.30 0.50 0.25 0.30
0.48 0.50 1.00 1.00 1.00 1.00 2.00 2.00 2.00 3.00
3.40 4.00 4.77 5.30 6.00
: (dy(j),j=1,ny)
1.
: (dz(k),k=1,nz)
1.0 1.0 1.0 1.0 1.0 0.6 0.6 0.4 0.4 0.63
0.5 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 3.0
3.5 4.0 4.0 4.0 4.0 3.5 3.0 4.0 3.5 3.0
3.0 3.0 3.5 3.0 3.0 3.0 3.0 3.0 2.0 3.0
3.0 3.0 2.0 2.0 2.0 2.5 2.5 2.0 2.5 3.0
```

```
3.0 2.0 2.0 1.0 1.5 1.0 1.0 0.5 0.5 0.5
0.5 0.5 1.0 0.5 0.4 0.3 0.2 0.1 0.08 0.06
0.05 0.04 0.03 0.02 0.5 0.5 0.4 0.38 0.34 0.3
0.2 0.1  0.08 0.06 0.05 0.04 0.03 0.02 0.02 0.03
0.05 0.08 0.1 0.3 0.41 0.5 1.0 1.7 2.9 2.0
3.0 3.0 3.0 3.0 4.0 4.0 5.0 5.0 5.5 6.5
6.5 7.0 7.0 7.0 7.3 7.0 8.0 7.0 8.0 8.0
8.2
:
: fracture permeabilities modified from Buscheck by dividing by fracture
porosity
PHIK
: i1 i2 j1 j2 k1 k2 ist ithrm vb  porf permxf  permyf  permzf    pormm permm
istm ithrmm
:
  1  35  1  1 1   9    2    1  0. 1.0000 8.49e-09 8.49e-09 2.50e-07 0.135 2.04e-
17   1  1 : TSw33
  1  35  1  1 10  99   4    2  0. 1.0000 2.77e-09 2.77e-09 1.16e-08 0.115 2.22e-
17   3  2 : TSw35
:kip
  1   5  1  1 63  65  14    9  0. 1.0000 1.00e-08 1.00e-08 1.00e-08 0.990 1.00e-
08 14  9 :Air in drift
  1  10  1  1 66  67  14    9  0. 1.0000 1.00e-08 1.00e-08 1.00e-08 0.990 1.00e-
08 14  9 :Air in drift
  1  16  1  1 68  72  14    9  0. 1.0000 1.00e-08 1.00e-08 1.00e-08 0.990 1.00e-
08 14  9 :Air in drift
  1  19  1  1 73  80  14    9  0. 1.0000 1.00e-08 1.00e-08 1.00e-08 0.990 1.00e-
08 14  9 :Air in drift
  1   8  1  1 74  74  13    8  0. .0000 1.00E-10 1.00E-10 1.00E-10 0.010 1.00E-
10 13  8  : Drip shield
  8   8  1  1 75  80  13    8  0. .0000 1.00E-10 1.00E-10 1.00E-10 0.010 1.00E-
10 13  8  : Drip shield
  1   7  1  1 75  79  15   10  0. .0000 1.00e-08 1.00e-08 1.00e-08 0.990 1.00e-
08 15 10 : Air below drip shield
  1   1  1  1 80  80  11    6  0. .0000 1.00E-10 1.00e-10 1.00E-10 0.010 1.0E-10
11  6 : waste package
  1   1  1  1 81  82  12    7  0. .0000 6.16E-10 6.16E-10 6.16E-10 0.545 6.16E-
10 12 7  : Invert material
:oskip
  1  35  1  1 100 109  6    3  0. 1.0000 3.01e-09 3.01e-09 3.01e-09 0.092 8.70e-
18   5  3 : TSw36
  1  35  1  1 110 119  8    4  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.020 4.08e-
18   7  4 : TSw37
  1  35  1  1 120 121 10    5  0. 1.0000 2.44e-09 2.44e-09 2.44e-09 0.265 1.60e-
12   9  5 : CHlvc
0
:
Init steady
:
:EQUIL depth  pdepth  tdepth  tgrad  param  iequil
:
:EQUIL 926.9  101325  30.  .013757    0.0      40
DOMAIN
: i1 i2 j1 j2 k1 k2   volf  areamodf  xlm ylm zlm
:
  1  35  1  1 1   9   1.05e-4  1.0 1.5 1.5 1.5 5.00e-4          :TSw33
  1  35  1  1 10 99   3.29e-4  1.0 1.5 1.5 1.5 5.00e-4          :TSw35

  1  35  1  1 100 109 3.99e-4  1.0 1.5 1.5 1.5 5.00e-4          :TSw36
  1  35  1  1 110 119 4.92e-4  1.0 1.5 1.5 1.5 5.00e-4          :TSw37
  1  35  1  1 120 121 7.14e-5  1.0 1.5 1.5 1.5 5.00e-1          :CHlvc
0 ;
:
:
Recurrent
:
BCON 2
: .
:itype  iface  i1  i2  j1  j2
  5   TOP  1 35  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  1.e-9    94392.  24. 0.97   .0 0.0
0.0  7.47e-4   94414.   24.  0.97  .0  0.0
:
/
:itype  iface  i1  i2  j1  j2
  5  BOTTOM  1 35  1  1
:timbc  qbcf  pbcf  tbcf  sgbcf  xabcf  emsivtf
0.0  0.0     95358.  28.  0.96  0.0 0.0
0.0  0.0     95358.  28.  0.96 0.0  0.0
:
/
Skip
Source   1   .33 1.
:  is1 is2 js1 js2 ks1 ks2  istyp
:
   1 1   1 1  80 80    31
: .
: This decay data is from "Waste packages and source terms for the commercial
1999 design basis waste streams"
: Provided by Chad Glenn/Debra Hughson
: ID: B00000000-01717-0200-00135 Rev 00 Table V-1 column F p V-1
: left column is time in seconds
: ramped up heat over 12 yr
: right column is Watts per meter squared
0.0000E+00   44.73
6.3120E+07   89.45 ! 2 yr
1.2624E+08  178.90 ! 4 yr
1.8936E+08  357.80 ! 6 yr
2.5248E+08  715.60 ! 8 yr
3.1560E+08 1073.40 ! 10 yr
3.7872E+08 1431.20 ! 12 yr
5.3652E+08 1271.45 ! 17 yr
8.5212E+08 1154.02 ! 27 yr
1.1677E+09  972.79 ! 37 yr
1.4833E+09  829.28 ! 47 yr
1.7989E+09  720.63 ! 57 yr
2.1145E+09  631.42 ! 67 yr
2.4301E+09  558.72 ! 77 yr
2.7457E+09  498.62 ! 87 yr
3.0613E+09  448.11 ! 97 yr
3.3769E+09  410.96 ! 107 yr
4.9549E+09  379.17 ! 157 yr
6.5329E+09  281.05 ! 207 yr
9.6889E+09  230.19 ! 307 yr
1.2845E+10  180.65 ! 407 yr
1.6001E+10  151.84 ! 507 yr
1.9157E+10  131.61 ! 607 yr
2.2313E+10  115.59 ! 707 yr
2.5469E+10  103.07 ! 807 yr
2.8625E+10   92.29 ! 907 yr
3.1781E+10   83.67 ! 1007 yr
6.3341E+10   76.41 ! 2007 yr
9.4901E+10   41.01 ! 3007 yr
1.2646E+11   31.96 ! 4007 yr
1.5802E+11   28.53 ! 5007 yr
1.8958E+11   26.58 ! 6007 yr
2.2114E+11   24.61 ! 7007 yr
2.5270E+11   23.05 ! 8007 yr
2.8426E+11   21.58 ! 9007 yr
3.1582E+11   20.36 ! 10007 yr
7.8900E+11   00.00 ! 25000 yr
0
Noskip
Output C=10 Q=10  T=1  G=1  P=1
:
:  isolv  newtnmn  newtnmx  north  nitmax  level
Solve 4      1        12       2     100      1
:
:AUTO-step  DPMXE    DSMXE  DTMPMXE  DP2MXe TACCEL   IAUTODT  FAC1
AUTO-step   1.0E+4   0.03    3        1.e4  1.0e-3     0       0
:
:TOLR TOLP  TOLS  TOLT  TOLP2  TOLM  TOLA  TOLE rtwotol  rmxtol   smxtol
Tolr   1.0e1 1.e-4 1.e-3 1.0e1 1.e-3 1.e-5 1.e-3 1.e-8  1.e-8  1.e-8
:
:Limit dpmx    dsmx dtmpmx dpamx    dtmn    dtmx   dtfac
LIMIT  1.e+5    .08    6.  1.e+5    1.e-8  1.e5   .334
:
RSTArt 1
:
Plots 1 1 2
2486 2171
Skip
Time[y] 10.
Time[y] 50.
Time[y] 60.
Time[y] 70.
Time[y] 80.
Time[y] 90.
Time[y] 100.
Time[y] 125.
Time[y] 150.
Time[y] 200.
Time[y] 500.
Time[y] 1000.
Time[y] 5000.
Time[y] 10000.
Time[y] 12000.
Time[y] 14000.
Time[y] 16000.
Time[y] 18000.
Time[y] 20000.
Time[y] 25000.
Time[y] 30000.
Time[y] 35000.
Time[y] 40000.
Time[y] 45000.
Noskip
STEADY[y]   1.0E-7 1.0E-7 1.0E-7
:
Ends
```


Boundary conditions for nestrev.dat taken from 13csfldm7.xyp & 13csfldf7.xyp located on vulcan under home/dhughson/multiflo/mhill/fortpa

13csfldm7.xyp

z (m)	pressure (Pa)	Temp (°C)	xairg
250	94392	23.73	0.9689
510.4	95358	27.66	0.9612

13csfldf7.xyp

z (m)	Pressure (Pa)	Temp (°C)	xairg
250	94414	23.73	0.9689
570.4	95358	27.66	0.9612

MHill 6/7/00

6/8/00 Continuation of output from D. Hughson's 13cs.dat file (p 237-238 of this notebook).

13csfldm10.xyp

z (m)	temp (°C)
371	92.5
375 MHill 6/8/00	104.1
372.~~6~~921	96

Inter-polated

13csfldm12.xyp

371	92.22
375	100.8
372.76	96

13csfldm15.xyp

375	94.65
377.75	100.3
375.66	96

13csfldm17.xyp
377.75 94.15
380 98.94
378.62 96
13csfldm18.xyp
380 95.93
381.75 101
380.02
13csfldm19.xyp
380 93.49
381.75 97.72
381.04
13csfldm20.xyp
381.75 94.73
383 97.26
382.38

13csfldm21.xyp

96°C isotherm ↗°

85 MTU TPA 4.0		60 MTU 13csfldm*.xyp	
time (y)	dryt (m)	time (y)	dryt (m)
1	1	1	
10	4.9	10	4.81
20	8.2	20	11.67
30	12.1	30	13.14
40	16.7	40	14.12
50	21.5	50	14.39
60	23.7	60	14.58
70	24.9	70	14.62
80	25.9	80	14.52
100	27.6	100	14.04
200	33.6	200	13.49
400	49.5	400	10.59
600	70.7	600	7.63
800	78.7	800	5.21
1000	80.7	1000	
2000	7.3	2000	
4000	0	4000	

M. Hill 6/8/00

M Hill 6/8/00

7/14/00 Plotting up of Results provided by R. Green for DSHT model. (DSHT stands for drift-scale heater test). File names are listed below:

Filename	location*
• dst43efldf1.xyp	vulcan/home/mhill/green
• dst43efldm1.xyp	"
• dst43ffldf1.xyp	"
• dst43ffldm1.xyp	"

* also located on zip disk: dsht (which is in fire-proof cabinet bldg 51)

The elements for the horizontal distance are located in file: col160.dat

m H 7/14/00 Elements for the vertical distance are located in profile.~~dat~~ pts. But because

m H 7/14/00 the profile.~~dat~~ pts will be repeatedly updated the elements for the vertical distance will be permenantly located in file: col158.dat

Both files: col160.dat & col158.dat are located on vulcan/home/mhill/green & on the zip disk: dsht which is stored in the fire-proof cabinent in bldg 51.

The data located in files dst43efldf1.xyp through dst43ffldm1.xyp (see top of this page) must be processed before ~~it~~ they can be plotted. Details of this processing procedure will be discussed for the initial procedure. All subsequent processes which replicate processing procedures will be referenced to this initial description. m H 7/14/00

~~Processing Process (Detailed Description)~~

R. Green provided me with a file: plotf* which is an executable compiled program written in FORTRAN. It reads the eleme file (also provided by R. Green). m H 7/14/00 The plotf* program provides an output file named plotf.dat. The plotf.dat

file will be saved under a different file name so that a record is maintained for each output file. This will be done because the plotf.dat file will be repeatly written over during each processing of data.

A second file: vertprof* was provided by R. Green. Vertprof* is an executable compiled program written in FORTRAN. The vertprof* program provides an output file called vertprof.dat. The vertprof.dat file will be saved under a different filename so that a record is maintained for each output file. This will be done because the vertprof.dat file will be repeatly written over during each processing of data. It is important to note that vertprof* also reads the profile.pts file. The profile.pts file will periodaclly be updated by the user with contents located in files: col 158.dat (vertical elements) & col 160.dat (horizontal elements). All of the programs & files discussed above are located on vulcan/home/mhill/green & on the zip disk: dsht located in the fire-proof cabinent in bldg 51.

It is important to note that plotf* also reads the file: filename.xyp.

whatever the name of file that you want processed

Journal Processing of Data Procedure for DSHT model

DSHT model output data is located on file: dst43efldfl.xyp located on vulcan/home/mhill/green & on zip disk dsht (located in fire-proof cabinet bldg 51).

Step 1: plotf dst43efldfl.xyp
(this executes the program plotf* see p 243-244 of this notebook)

which yields the output file: plotf.dat

Step 2: Plotf.dat is written under a new file name: pd43efl.dat located on vulcan/home/mhill/green & zip disk dsht

Step 3: vertprof plotf.dat
(this executes the program vertprof* see p 244 of this notebook) located on vulcan/home/Mhill/green & on zip disk dsht (located in fire-proof cabinent bldg 51). Profile.pts currently contains contents of col 158.dat
which yields the output file: vertprof.dat

Step 4: vertprof.dat is written under a new filename: vd43efl.dat located on vulcan/home/mhill/green & zip disk dsht

Step 5: Copy vd43efl.dat to d:drive & open in Excel. Sort B column in ascending order. Also when importing data into Excel you must delineate data in last 3 rows manually where the colums are

offset. Saved as excel file named: vd43efl.xls, on hydra's d:drive.
Copied dsht measured values from file: 158-19y-26.jnb (provided by R. Green) located on vulcan/home/mhill/green & zip disk: dsht. Saved dsht measured values to file: dshtmeas.xls on hydra's d:drive. The 2.5 m have already been added to z-direction in the dshtmeas.xls file.

Opened dshtmeas.xls file & copied contents from file: vd43efl.xls to dshtmeas.xls. Renamed as file: 43efl.xls, located on hydra's d:drive & zip disk dsht located in fire-proof cabinet in bldg 51.

Repeat steps 1-4 p 245 of this notebook. Except now do this for file: dst43efldm1.xyp.

Step 1: plotf dst43efldm1.xyp

Step 2: plotf.dat saved as: pd43eml.dat on vulcan/home/mhill/green & zip disk: dsht

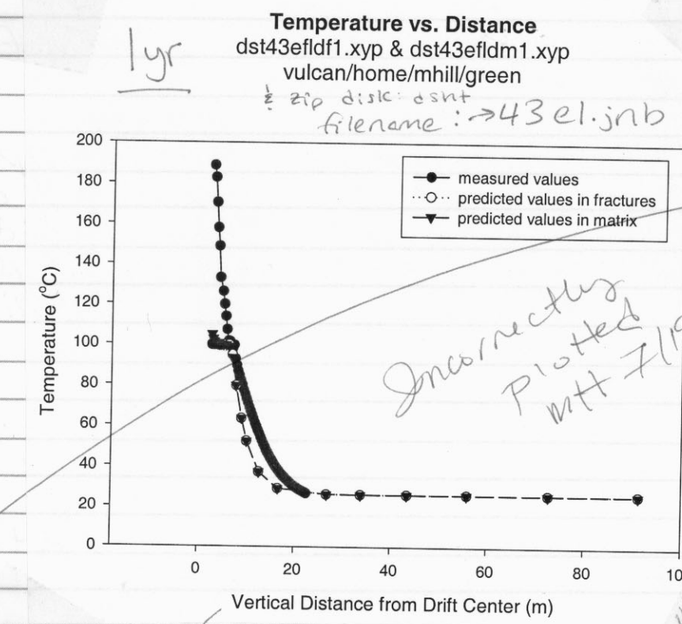
Step 3: vertprof plotf.dat
(profile.pts currently contains contents of col 158.dat)

Step 4: vertprof.dat written under new filename: vd43eml.dat on vulcan/home/mhill/green & zip disk: dsht

Step 5: sorted & renamed vd43eml.xls on hydra's d:drive. Copied contents of vd43eml.xls to file: 43efl.xls p246 of

this notebook.

1yr



→ col 158.dat

col 158.dat #'s 149 - ~~1589~~ 1589 MH 7/14/00
MH 7/14/00

Step 6: Now need to replace contents of file: profile.pts. Replaced with contents in file: col 160.dat p 243 of this notebook.

Repeat steps 1-4 p 245 of this notebook Except now do this for file: ~~pd~~ dst43efldfl.xyp
MH 7/14/00

Step 1: plotf dst43efldfl.xyp

Step 2: plotf.dat saved as: p43efl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat saved as: v43efl.dat
all of the above files located on: vulcan/home/mhill/

green & zip disk: dsht

Step 5: sorted & renamed v43ef1.xls on hydra's d:drive.

Opened dshtmeas.xls file & copied contents of v43ef1.xls to it. Renamed as file: ~~43ef1h.xls~~ on hydra's d:drive. MH 7/17/00

MH 7/17/00 ~~43ef1a.xls~~ ~~43ef1h.xls~~ 43e.xls MH 7/17/00 mH 7/17/00

Repeat steps 1-4 p 245 of this ~~notebook~~ notebook. Except now do this for file: dst43efldm1.xyp

Step 1: plotf dst43efldm1.xyp

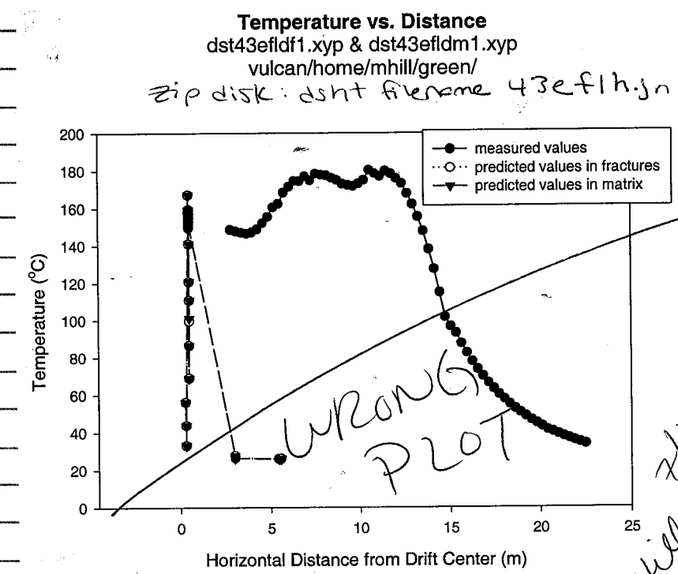
Step 2: plotf.dat saved as: p43em1.dat

Step 3: vertprof plotf.dat (profile currently contains contents of file col160.dat (p 247 of this notebook)

Step 4: vertprf.dat saved as: v43em1.dat all of the above files are located on vulcan/home/mhill/~~mts~~ green & mH 7/14/00

zip disk: dsht

Step 5: sorted & renamed v43em1.xls on hydra's d:drive. Copied contents of v43em1.xls to file: ~~43ef1h.xls~~ 43e.xls (p 248 of this notebook). MHill 7/17/00



Incorrect plot MH 7/14/00 Correct plot on p 250 of this notebook mH 7/17/00

MHill 7/14/00

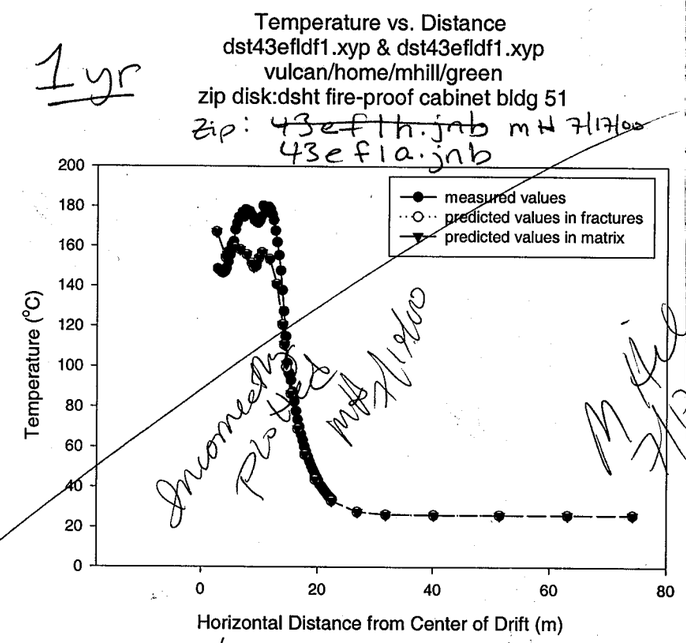
Prior to plotting R. Green sorted horizontal length values which were previously calculated

mH 7/14/00

MHill 7/14/00

7/17/00

1yr



↳ col 160.dat

Plotting of results for DJHT Model (for detailed discussion of procedures see p 243 - 248 of this notebook).

Replaced contents of profile.pts with of file col 158.dat

Step 1: plotf dst43ffldf1.xyp

Step 2: plotf.dat => p43ff1.dat

Step 3: vertprof plot f.dat

Step 4: vertprof.dat => [redacted]

Repeat steps 1-4 with file: dst43ffldm1.xyp

Step 1: plot f dst43ffldm1.xyp

Step 2: plotf.dat => p43fm1.dat

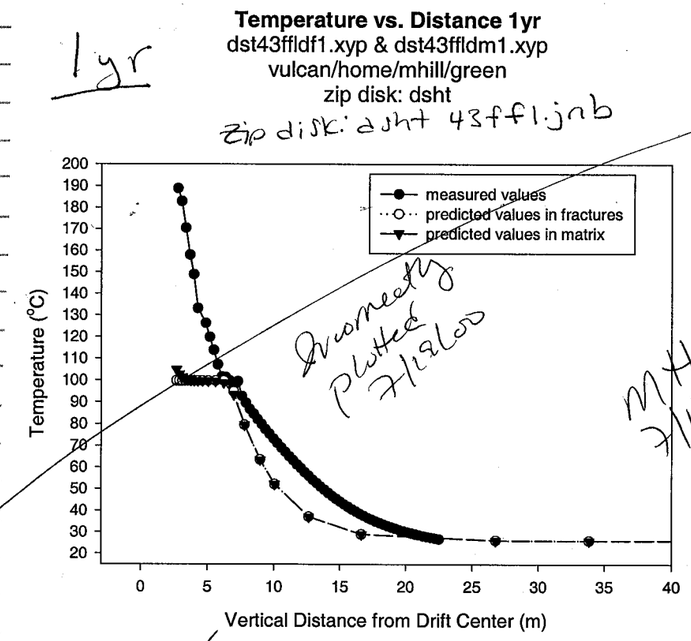
Step 3: vertprof plotf.dat

Step 4: vertprof.dat => [redacted]

Step 5: Sorted in Excel => 43ff1.xls

Plotted in ΣPlot saved on zip disk dsht file name: 43ff1.jnb

1yr



↳ col 158.dat

Replaced contents of profile.pts
with contents of col160.dat

Step 1: plot f dst43ffldfl.xyp

Step 2: plotf.dat => pd43ffl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => vd43ffl.dat

Repeat steps 1-4 with file dst43ffldml.xyp

Step 1: plot f dst43ffldml.xyp

Step 2: plotf.dat => pd43fml.dat

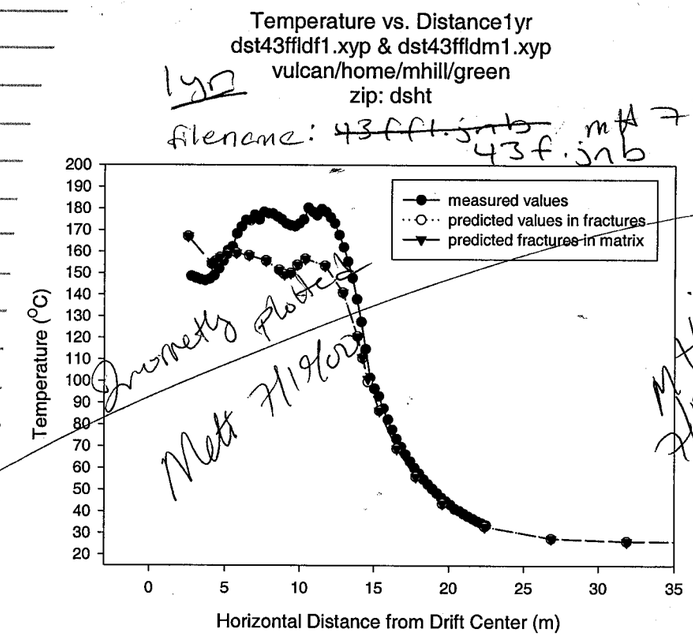
Step 3: vertprof plot f.dat

Step 4: vertprof.dat => vd43fml.dat

Step 5: sorted 43f.xls
vd43ffl.dat & vd43fml.dat

Plot in Eplot saved as: ~~43ffl.jnb~~ 43f.jnb on
zip disk: dsht

MH 7/17/00



1yr

filename: ~~43ffl.jnb~~ 43f.jnb MH 7/18/00

Incorrectly plotted
Matt 7/19/00

MHill 7/17/00

Step 1: plotf dst43efldf2.xyp

Step 2: plotf.dat => pd43ef2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => vd43ef2.dat

Repeat steps 1-4 using file: dst43efldm2.xyp

Step 1: plotf dst43efldm2.xyp

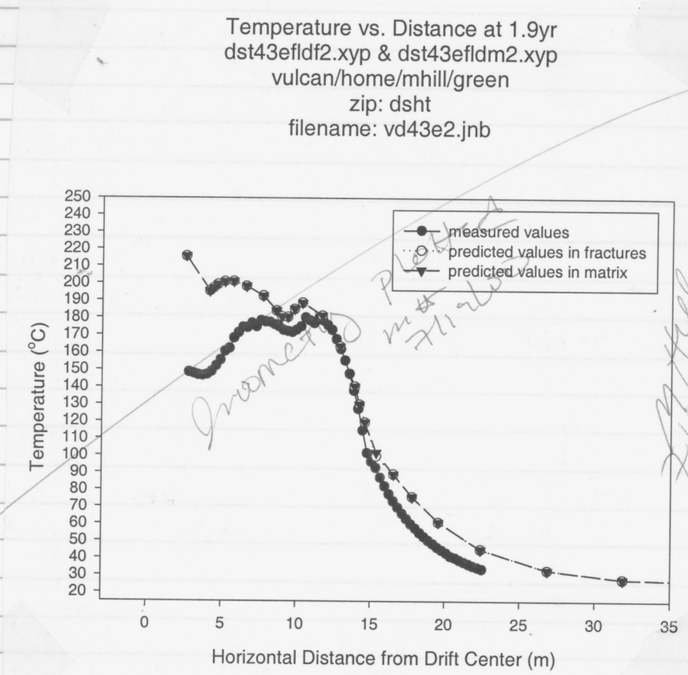
Step 2: plotf.dat => pd43em2.~~xyp~~ dat MH 7/17/00

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => vd43em2.dat

Step 5: Sorted => vd43e2.xls

Plotted using EPlot



Incorrectly plotted MH 7/19/02

MHill 7/17/02

Step 1. plotf dst43ffldf2.xyp

Step 2. plotf.dat => p43f2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => v43f2.dat

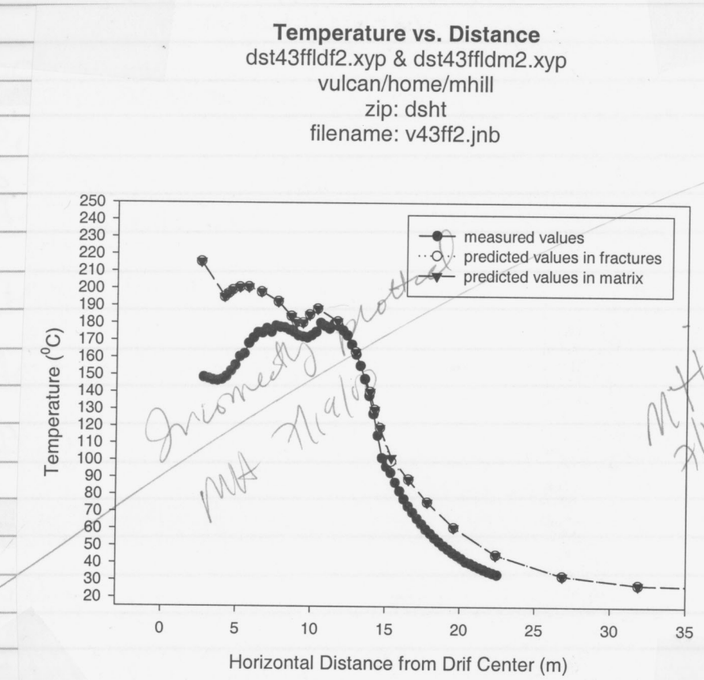
Step 1: plotf dst43ffldm2.xyp

Step 2: plotf.dat => p43m2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => v43fm2.dat

Step 5: Sort in Excel => v43ff2.xls



Incorrectly plotted MH 7/19/02

MHill 7/17/02

Replaced contents of profile.pts with that of file col158.dat.

Step 1: plotf dst43efldf2.xyp

Step 2: plotf.dat => 43ef2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => 43evf2.dat

Repeat steps 1-4 with new file

Step 1: Plotf ~~dstff~~ (MH 7/17/00) dst43ffldm2.xyp

Step 2: plotf.dat => ~~43ff~~ (MH 7/17/00) 43fm2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => 43fvm2.dat

Step 5: sort in Excel saved as:

MH 7/17/00 ~~43evf2.xls~~ ~~43ev2.xls~~

Step 1: plotf dst43efldm2.xyp

Step 2: plotf.dat => 43em2.dat

Step 3: vertprof.dat => plotf.dat

Step 4: ~~p~~ (MH 7/17/00) vertprof.dat => v43em2.dat

MNill 7/17/00

7/18/00 Step 1: Plotf dst43ffldf2.xyp

Step 2: plotf.dat => 43ff2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => v43ff2.dat

MNill 7/19/00

7/19/00 Provided 2 more files by R. Green:

- dst44h(fld) fl.xyp (MH 7/19/00)
- dst44h(fld) ml.xyp

copied to vulcan/home/mhill/green

Processing of data for Eplot plotting:

Step 1: Plotf dst44h(fld) fl.xyp (mh 7/19/00)

Step 2: plotf.dat => p44hfl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => v44hfl.dat

Repeat Steps 1-4 = new file

Step 1: Plotf dst44hfldml.xyp

Step 2: plotf.dat => pd44hml.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => vd44hml.~~xyp~~ dat (MH 7/19/00)

Replaced contents of profile.pts = contents of file col160.dat

Step 1. plotf dst44hfldfl.xyp

Step 2: plotf.dat => pd44hfl.dat

Step 3: vertprof plotf.dat

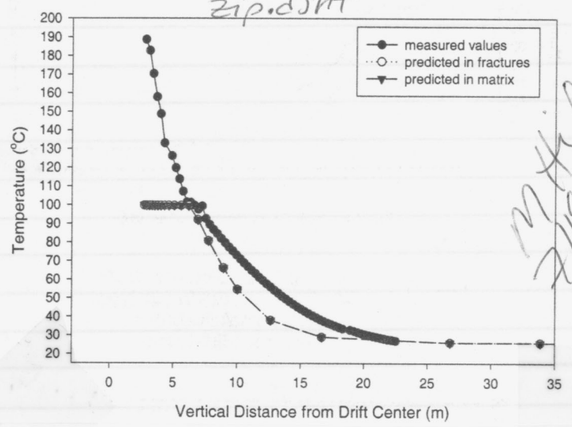
Step 4: vertprof.dat => vd44hfl.dat

Step 1: plotf dst44hfldml.xyp
Step 2: plotf.dat => p44hml.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => v44hml.~~xy~~dat

MH 7/19/00

Temperature vs. Distance Borehole 158
Simulation 44h 1year
dst44hfldf1.xyp & dst44hfldm1.xyp
vulcan/home/mhill/green

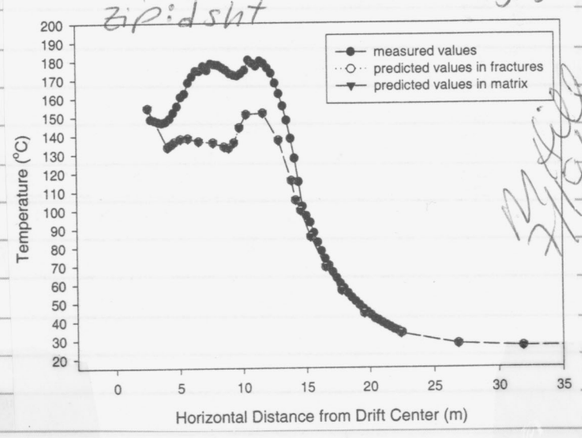
filename: 44h158ly.jnb
zip.dsht



MH 7/19/00

Temperature vs. Distance Borehole 160
Simulation 44h 1 yr
dst44hfldf1.xyp & dst44hfldm1.xyp
vulcan/home/mhill/green

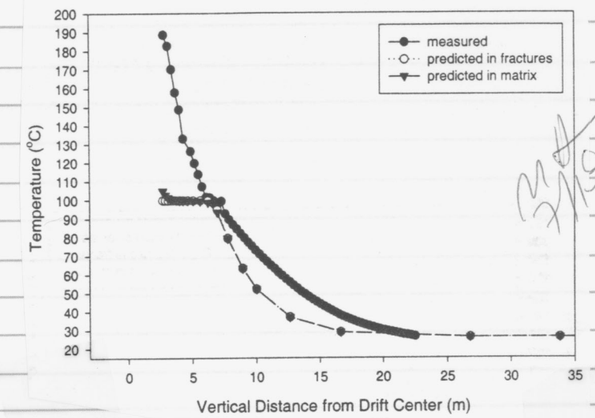
filename: 44h160ly.jnb
zip.dsht



MH 7/19/00

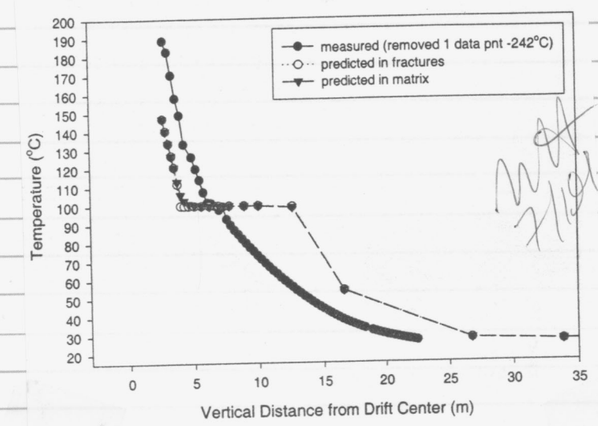
Corrected plots performed p 247 - 255 of this notebook.

Temperature vs. Distance @ 1yr
dst43efldf1.xyp & dst43efldm1.xyp
vulcan/home/mhill/green
43e1.jnb



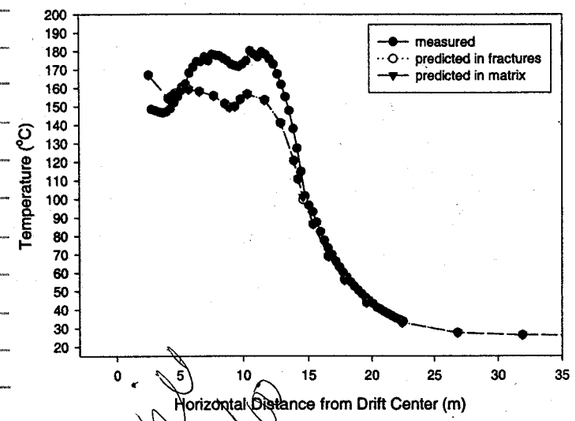
MH 7/19/00

Temperature vs. Distance @1.9y
dst43efldf2.xyp & dst43efldm2.xyp
vulcan/home/mhill/green
filename: 1581-9y.jnb

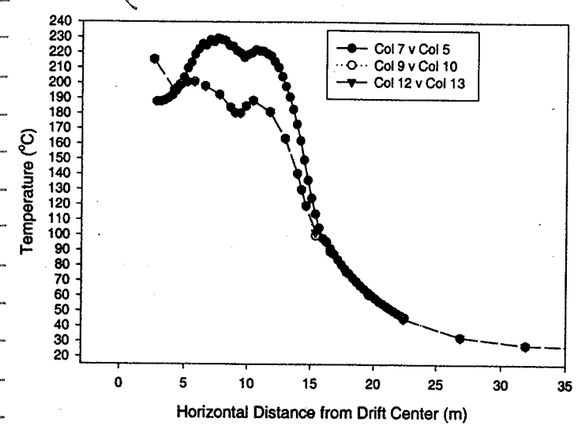


MH 7/19/00

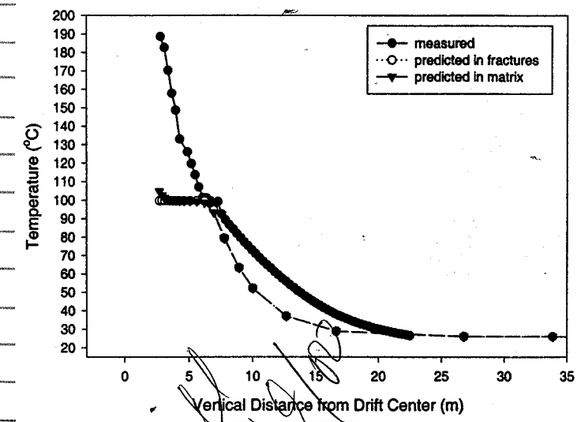
Temperature vs. Distance @ 1yr
43e.jnb



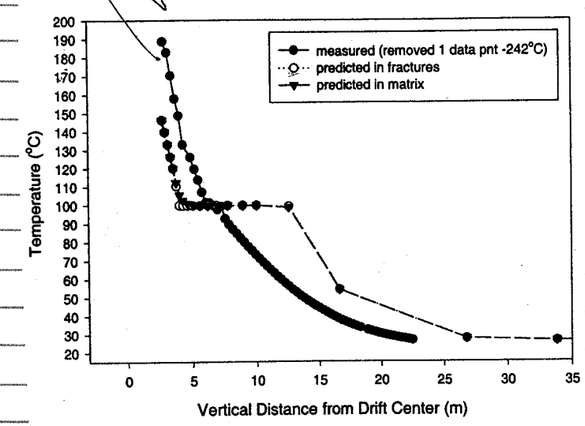
Temperature vs. Time @ 1.9y
dst43efldf2.xyp & dst43efldm2.xyp
vulcan/home/mhill/green
filename: vd43e2.jnb



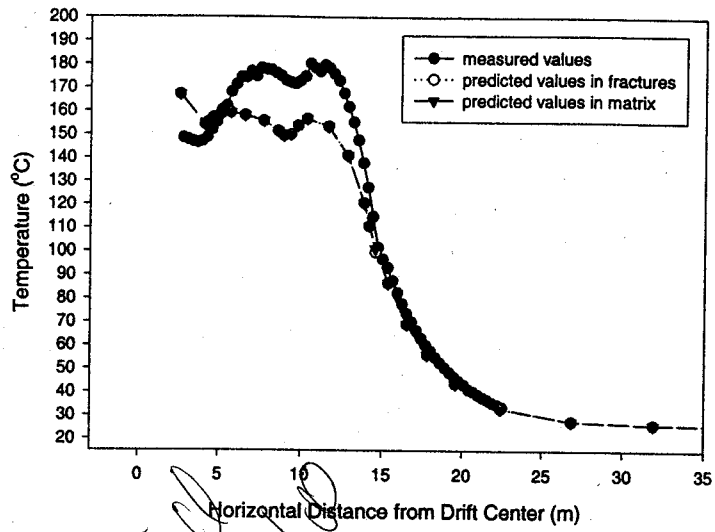
Temperature vs. Distance @ 1yr
dst43ffldf1.xyp & dst43ffldm1.xyp
vulcan/home/mhill/green
zip disk: dsht
43ff1.jnb



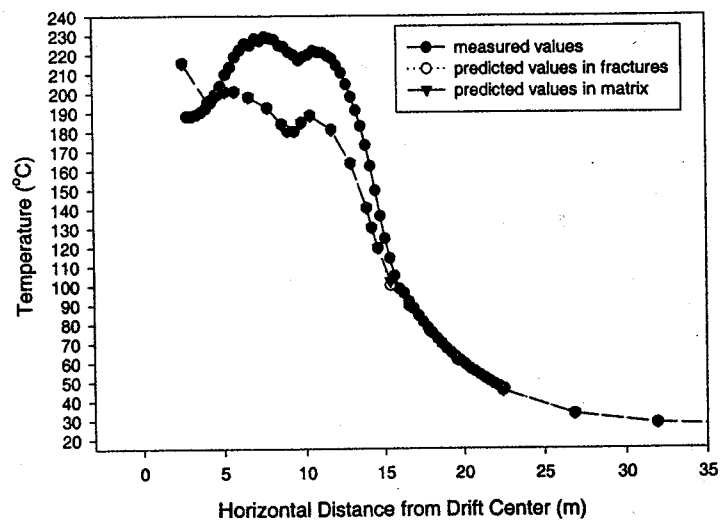
Temperature vs. Distance @ 1.9y
dst43ffldf2.xyp & dst43ffldm2.xyp
vulcan/home/mhill/green
filename: 158f1-9y.jnb



Temperature vs. Distance @ 1y
dst43ffldf1.xyp & dst43ffldm1.xyp
vulcan/home/mhill/green
filename: 43f.jnb



Temperature vs. Distance @ 1.9yr
dst43ffldf2.xyp & dst43ffldm2.xyp
vulcan/home/mhill/green
filename: 160f1-9y.jnb



Provided 2 more files by R. Green:

- dst44hfldf2.xyp
- dst44hfldm2.xyp

Copied to hulcon/home/mhill/green

Step 1: Plot f dst44hfldf2.xyp

Step 2: plotf.dat => a44hf2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => b44hf2.dat

Repeat steps 1-4 c̄ a new file

Step 1: plotf dst44hfldm2.xyp

Step 2: plotf.dat => a44hm2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => b44hm2.dat

Replaced contents of profile.pts file c̄ contents in file col158.dat

Step 1: plotf dst44hfldf2.xyp

Step 2: plotf.dat => 44hf2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => c44hf2.dat

Step 1: plotf dst44hfldm2.xyp

Step 2: plotf.dat => d44hm2.dat

MH 7/19/00

Step 3: ~~plot~~ vertprof plotf.dat

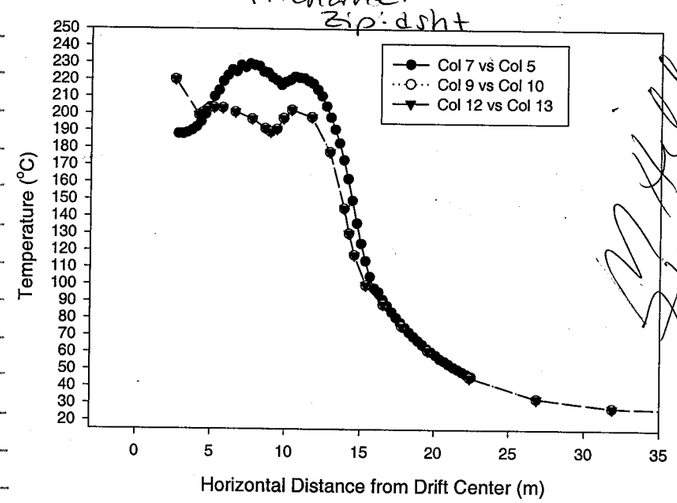
Step 4: vertprof.dat => [redacted]

M Hill 7/19/00

7/20/00

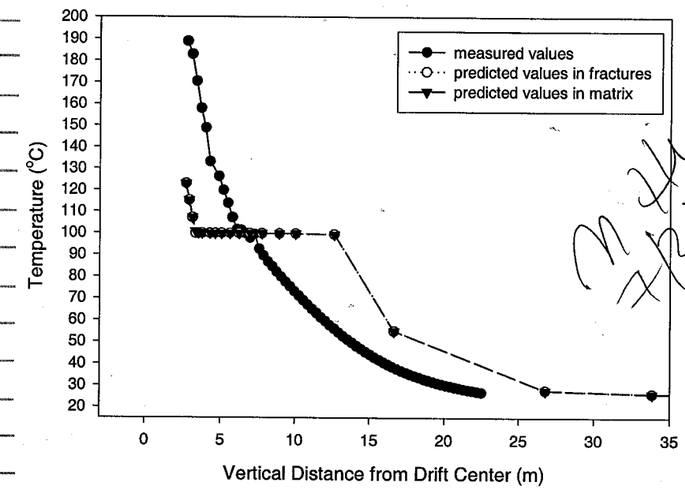
Temperature vs. Distance Borehole 160
Simulation 44h 1.9y
dst44hfldf2.xyp & dst44hfldm2.xyp
vulcan/home/mhill

filename:
zip:dsht



M Hill 7/20/00

Temperature vs. Distance Borehole 158
Simulation 44h 1.9yr
dst44hfldf2.xyp & dst44hfldm2.xyp
vulcan/home/mhill/green
filename: 44h1581-9.jnb



M Hill 7/20/00

M Hill 7/20/00

7/21/00 Provided 2 more files by R. Green:

MH 7/21/00

- ~~dst44imf~~ dst44ifldfl.xyp
- dst44ifldml.xyp

Step 1:
Plotf.dat dst44ifldfl.xyp

Step 2: plotf.dat => p44ifl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => [redacted]

Step 1: plot dst44ifldml.xyp
Step 2: plotf.dat => p44iml.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => v44iml.dat

Replaced contents of profile.pts ~~7~~ MH 7/21/00 with contents of file col160.dat
Step 1: MH 7/21/00
Plotf ~~dstf~~ dst44ifldfl.xyp

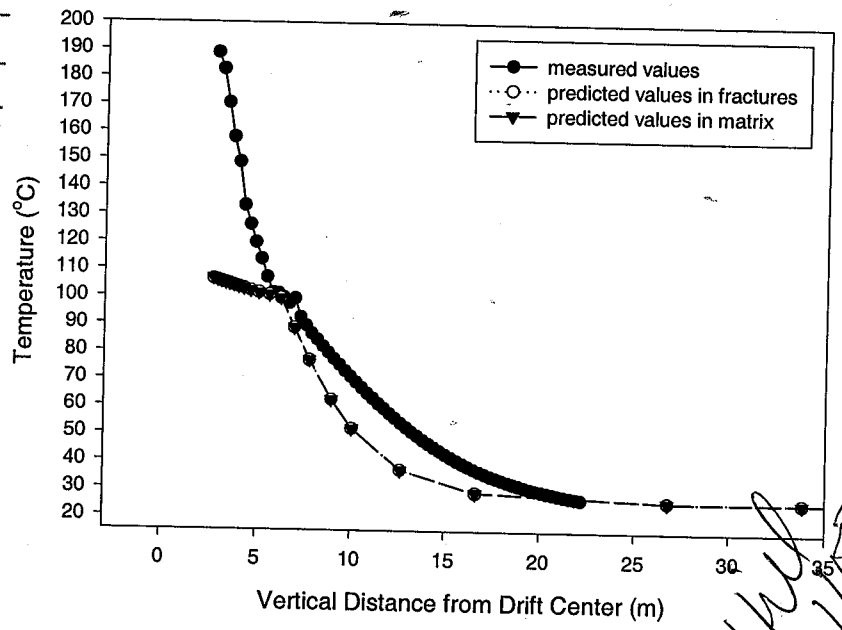
Step 2: plotf.dat => pd44ifl.dat

Step 3: vertprof =plotf.dat

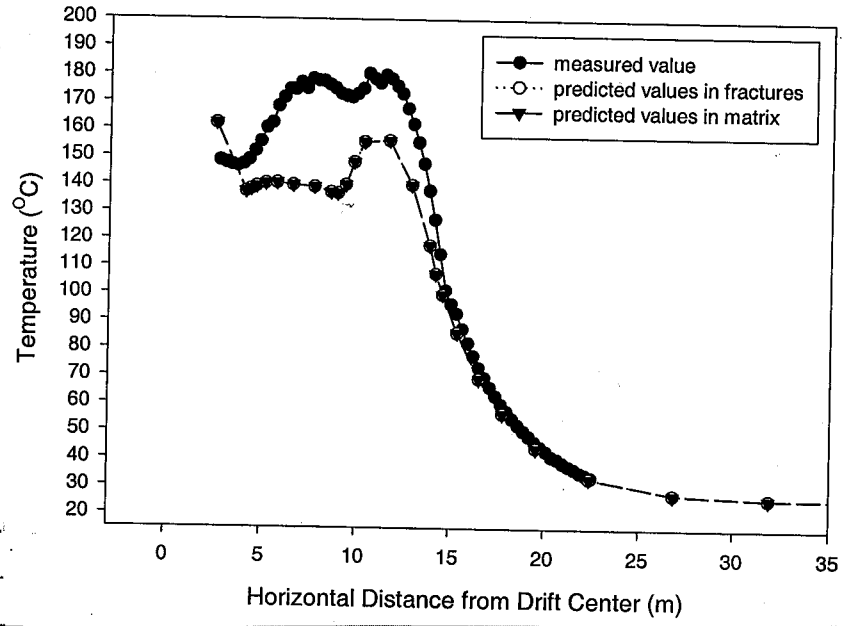
Step 4: vertprof.dat => vd44ifl.dat

Step 1: plotf dst44ifldml.xyp
Step 2: plotf.dat => pd44iml.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => vd44iml.dat

Temperature vs. Distance Borehole 158
simulation 44i 1yr
dst44ifldf1.xyp & dst44ifldm1.xyp
vulcan/home/mhill/green
filename: 44i1581y.jnb



Temperature vs. Distance Borehole 160
simulation 44i 1yr
dst44ifldf1.xyp & dst44ifldm1.xyp
vulcan/home/mhill/green
filename: 44i1601y.jnb



Provided 2 more files by R. Green:

- dst44ifldf2.xyp
- dst44ifldm2.xyp

Step 1: plotf dst 44ifldf2.xyp

Step 2: plotf.dat => p44if2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ~~v44if2.dat~~

Step 1: plotf dst44ifldm2.xyp

Step 2: plotf.dat => ~~pd44~~ p44im2.dat

MH 7/21/00

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ~~v44im2.dat~~

Replaced contents of file profile.pts with the contents of file col158.dat

Step 1: plotf dst44ifldf2.xyp

Step 2: plotf.dat => pd44if2.dat

Step 3: vertprof profile.dat

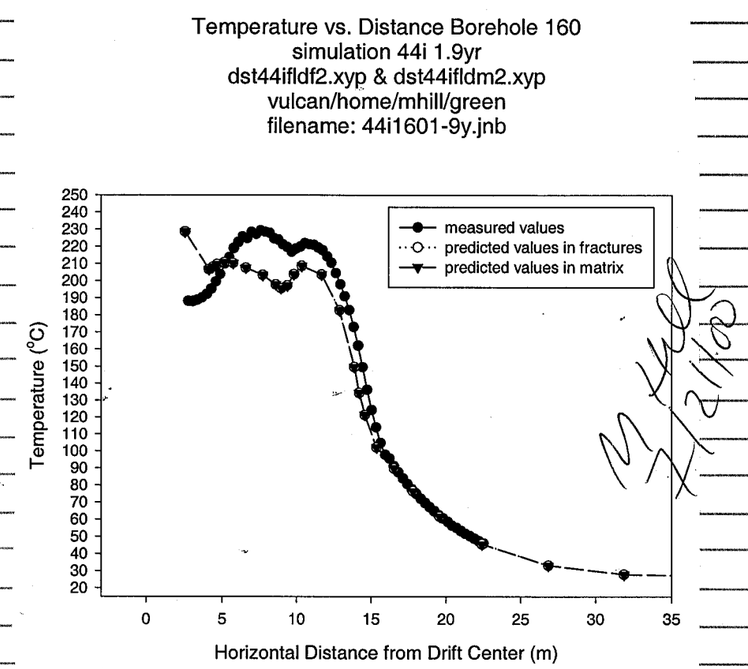
Step 4: vertprof.dat => ~~vd44if2.dat~~

Step 1: plotf dst44ifldm2.xyp

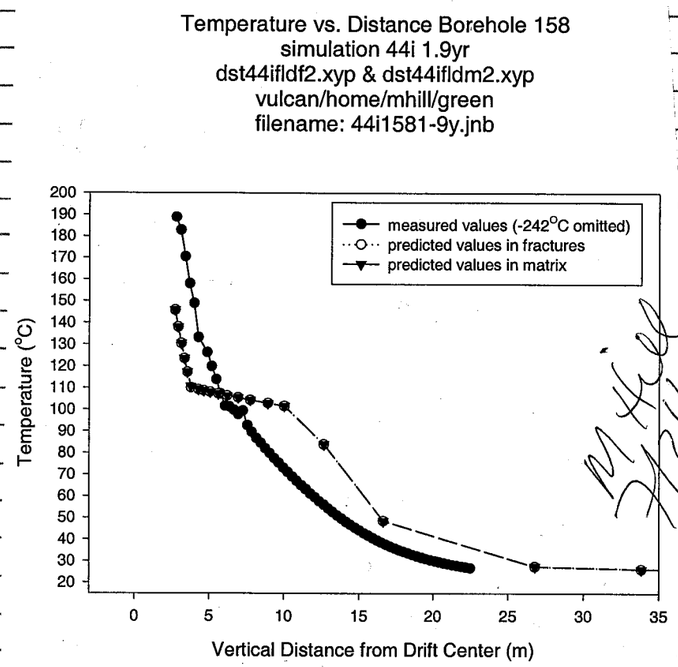
Step 2: plotf.dat => pd44im2.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ~~vd44im2.dat~~



MHill 7/21/00



M Hill 7/21/00

M Hill 7/21/00

7/24/00 Copied files:

- dst44i.dat
- muset2.phk
- multi.con
- mu44g.bc

to vulcan/home/mhill/green. Renamed file dst44i.dat => dst44is.dat & ran to steady state.

Amended file muset2.phk. Reduced fracture permeability in x, y & z directions by a factor of 10. Renamed as file: muset3.phk

Inserted muset3.phk into file dst44is.dat & renamed fp44is.dat
Cut & pasted initial conditions
Saved initial conditions as file: fp44.int
Turned on heat renamed as file: fp44i.dat

M Hill 7/24/00

7/26/00 File: fp44i.dat simulation ended with core dump ~~at~~ MH 7/26/00 after 1 yr.

Amended file dst44is.dat (p270 of this notebook) by changing area mod f to 1.00. Renamed or saved amended file as: am44is.dat. Ran to steady state cut & pasted initial conditions & saved in file: am44is.int.
Used contents of file am44is.int & turned on heat saved as new file: am44i.dat.

Processed files: fp44ifldf1.xyp & fp44ifldm1.xyp for plotting:

Step 1: plotf ~~at~~ MH 7/26/00 fp44ifldf1.xyp

Step 2: plotf.dat => ffp44i.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => vfp44i.dat

Step 1: Plotf ~~d~~ MA 7/26/00 fp44ifldfl.xyp m1 MA ~~7/27~~ MA 7/26/00

Step 2: plotf.dat => cp44ifl.dat

Step 3: ~~plotf~~ MA 7/26/00 vertprof plotf.dat

Step 4: vertprof.dat => vfp44im.dat

M Nill 7/26/00

7/27/00 Replaced contents of file profile.pts with contents of col160.dat 7/28/00

Step 1: Plotf fp44ifldfl.xyp

Step 2: Plotf.dat => Lfp44i.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ofp44i.dat

Step 1: plotf fp44ifldml.xyp

Step 2: plotf.dat => Sfp44i.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ofpim.dat

Step 1: plotf am44ifldfl.xyp

Step 2: plotf.dat => bam44i.dat

Step 3: Vertprof plotf.dat

Step 4: vertprof.dat => cam44i.dat

MA 7/27/00

Step 1: plotf ~~da~~ am44ifldml.xyp

Step 2: plotf.dat => bam44im.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => cam44im.dat

M Nill 7/27/00

Replaced contents of file profile.pts with contents of file col158.dat.

Step 1: plotf am44ifldfl.xyp

Step 2: plotf.dat => dam44i.dat

Step 3: Vertprof plotf.dat

Step 4: vertprof.dat => dam44if.dat

Step 1: plotf am44ifldml.xyp

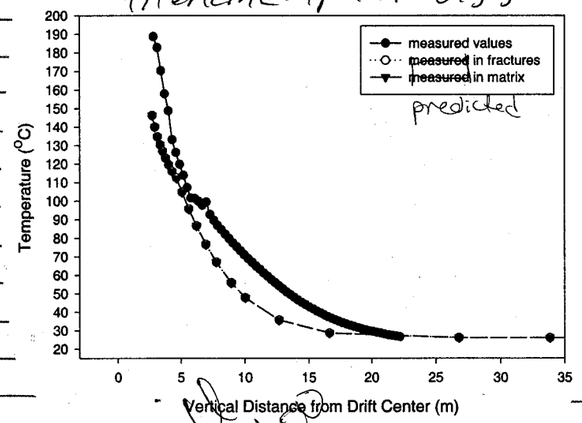
Step 2: plotf.dat => dam44im.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => dam44imm.dat

Temperature vs. Distance
simulation fp44i 1yr
fp44ifldf1.xyp & fp44ifldm1.xyp
vulcan/home/mhill/green

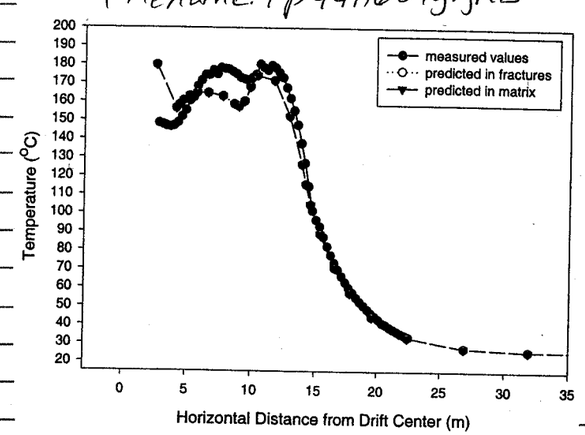
filename: fp44i1581y.jnb



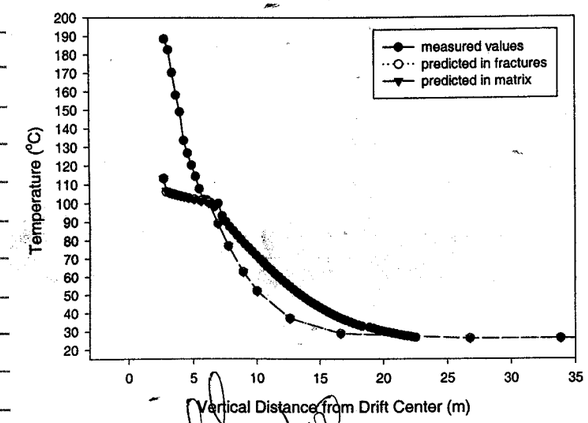
M Hill 7/28/00

Temperature vs. Distance
simulation fp44i 1yr
fp44ifldf1.xyp & fp44ifldm1.xyp
vulcan/home/mhill/green

filename: fp44i1601y.jnb



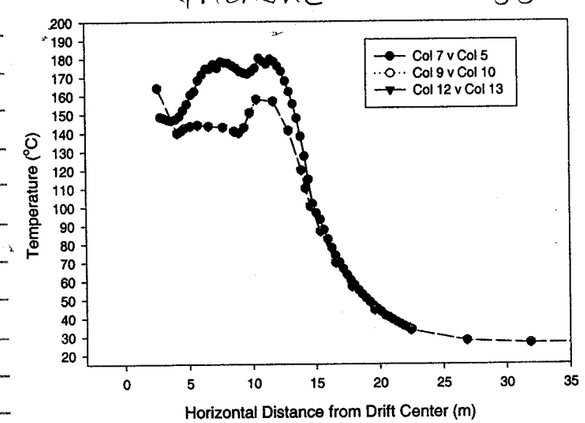
Temperature vs. Distance
simulation am44i 1yr
am44ifldf1.xyp & am44ifldm1.xyp
home/vulcan/mhill/green
filename: am44i1581y.jnb



M Hill 7/28/00

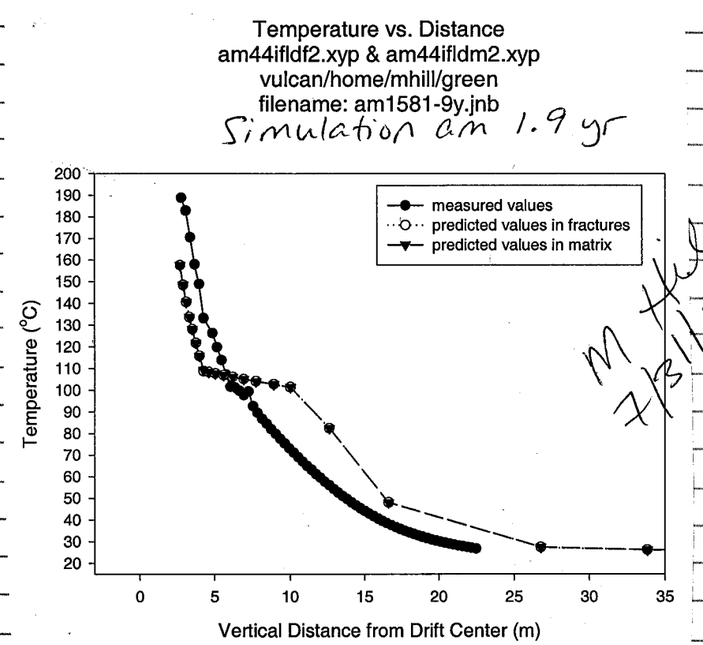
Temperature vs. Distance
simulation am44i 1yr
am44ifldf1.xyp & am44ifldm1.xyp
vulcan/home/mhill/green

filename: am44i1601y.jnb

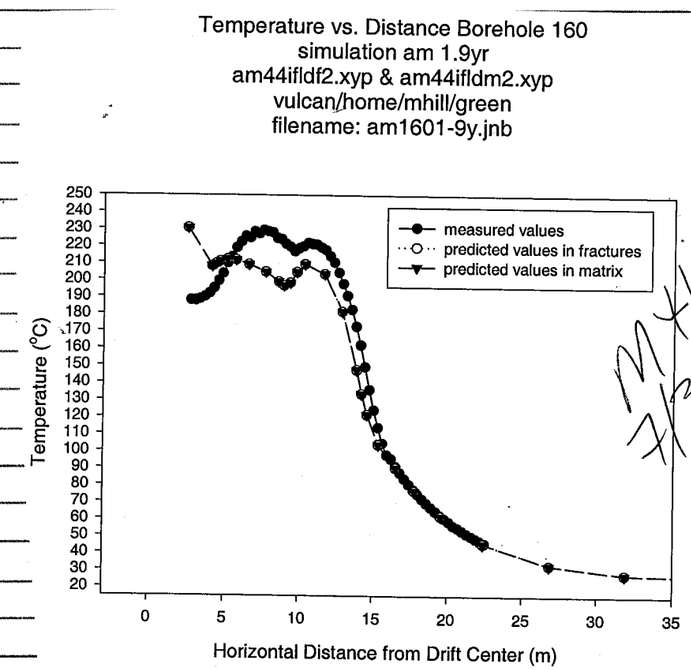


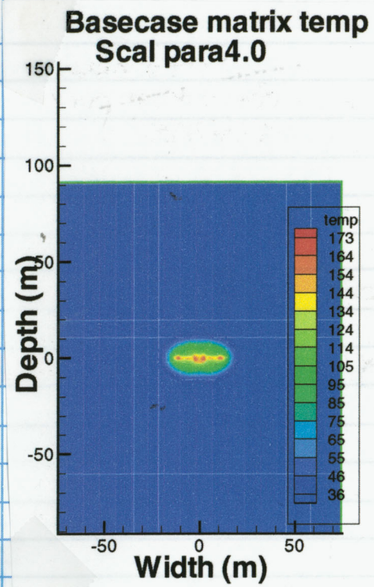
M Hill 7/28/00

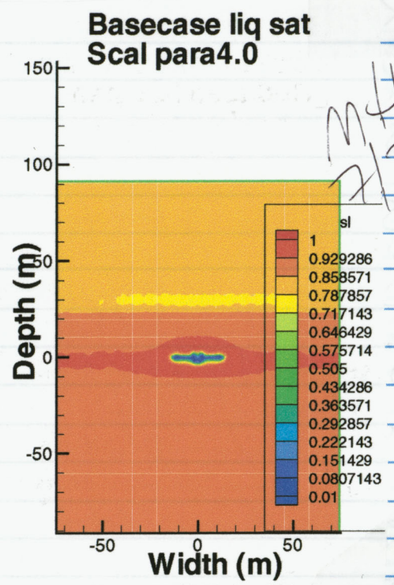
7/31/00 Step 1: Plotf am44ifldf2.xyp
Step 2: plotf.dat => amf2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => aamf2.dat
Step 1: plotf am44ifldm2.xyp
Step 2: plotf.dat => amm2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => aamm2.dat



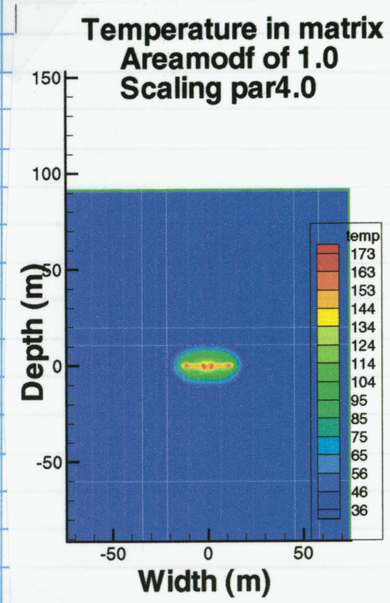
Replaced contents of profile.pts with contents of file col160.dat
Step 1: plot f am44ifldf2.xyp
Step 2: plotf.dat => damf2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => ~~aa~~amf2.dat
Step 1: plotf am44ifldm2.xyp
Step 2: plotf.dat => damm2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => ~~aa~~amm2.dat

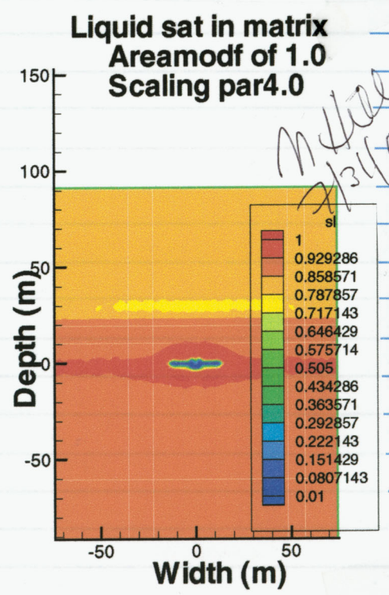




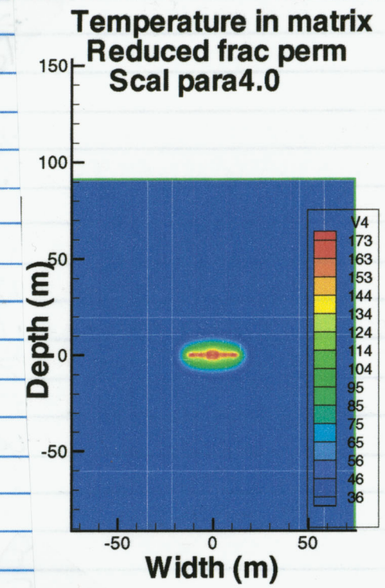


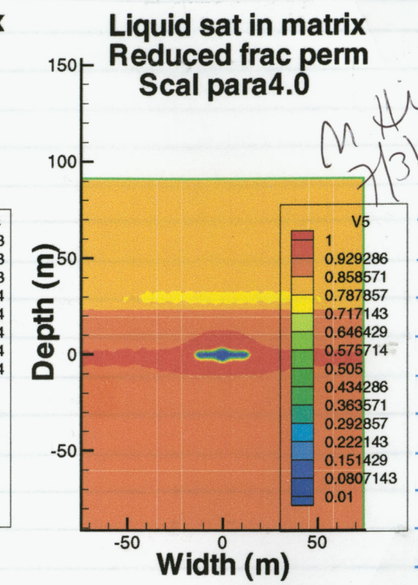
M Hill 7/31/00



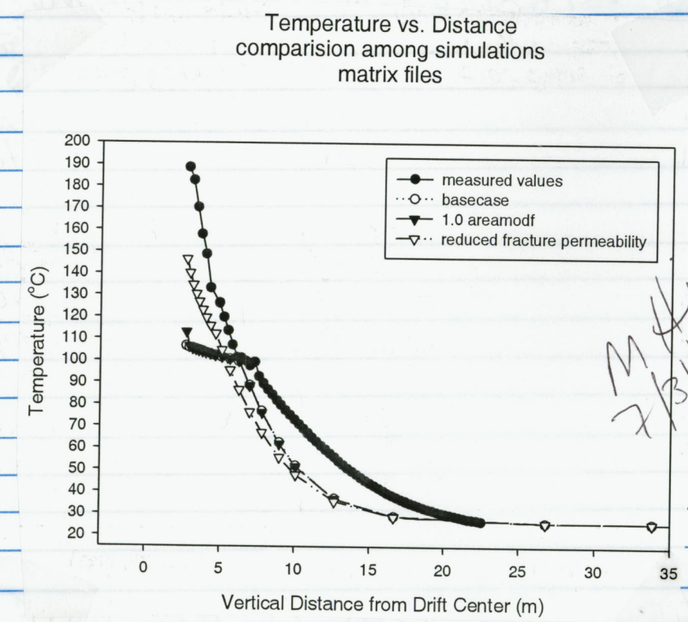


M Hill 7/31/00





M Hill 7/31/00



M Hill 7/31/00

M Hill 7/31/00

MH 8/1/00

8/1/00 Processing data ~~for profile~~ plots

~~Step 1.~~ plotf 44imodfldf1.xyp
On 7/31/00
Set up 7 separate files as follows: (modified file dst44i.dat provided by R. Green)

1st file Case 1:
- held area modf constant (5e-4)
- reduced fracture permeability
  -13 (x) -13 (y) -12 (z)
- no mass loss 0.0

filename: 44imod.dat on vulcan/home/mhill/ron
ran to steady state

2nd file Case 2:
- held area modf constant (5e-4)
- reduced fracture permeability
  -13 (x) -13 (y) -12 (z)
- mass loss of 4.0

filename: 44imod2.dat on vulcan/home/mhill/ron - ran to steady state

Turned on heat, cut & pasted steady state conditions
44imod.dat with heat => 44imods.dat
44imod2.dat " " 44imod2s.dat

On 8/1/00 observed that both files crashed with heat turned on so modified files by changing areamodf to 1.0

44imods.dat with 1.0 areamodf & ran to steady state conditions renamed as file 44imod s2.dat

44imod2s.dat with 1.0 areamodf & ran to steady state renamed as file: 44imod2s2.dat

Initial conditions saved as: a.int & b.int, respectfully.

Turned on heat, added initial conditions:

MH 8/1/00

44imod s2.dat with heat, ss conditions renamed 44iz.dat on vulcan/home/mhill/ron

R. Green identified that the frac. permeabilities were not properly assigned to the 3 stratigraphic units in the dst model. The effect of the improper assignments on simulation results is not known. Therefore, corrections were made & the simulations will be re-performed as discussed below:

Correct fracture permeabilities for the 3 stratigraphic units are located on multi.phk vulcan/home/mhill/ron.

Adjusted fracture permeabilities as follows:

X-dir	Y-dir	Z-dir
-12	-12	-11 / -10

renamed as file multi2.phk

File: 44iz2.dat

- inserted multi2.phk
- no mass loss
- ran to steady state

Steady state conditions saved as: az.int.

Turned on heat, inserted initial conditions saved as file 44iz2a.dat vulcan/home/mhill/ron

File: 44iz3.dat

- inserted multi2.phk
- mass loss set @ 4.0
- ran to steady state

Steady state conditions saved as file: bz.int

Turned on heat inserted initial conditions saved as file 44iz3b.dat vulcan/home/mhill/ron

M Hill 8/1/00

8/2/00 Provided 2 new files by R. Green

- fp44jfldfl.xyp
- fp44jfldml.xyp

Processed data for plots

Step 1: plotf fp44jfldfl.xyp

Step 2: plotf.dat => pfpfl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ~~rfpjfl.dat~~

Step 1: plotf fp44jfldml.xyp

Step 2: plotf.dat => pfpml.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => ~~rfpjml.dat~~

Replaced contents of profile.pts with the contents of coll58.dat

Step 1: plotf fp44jfldfl.xyp

Step 2: plotf.dat => mfpfl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => rfpfl.dat

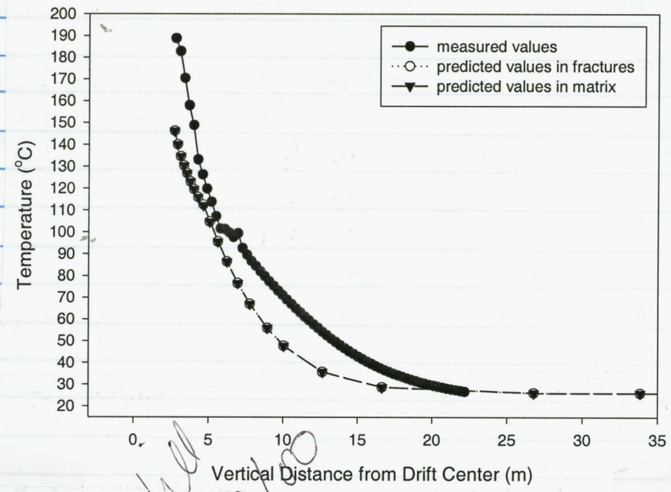
Step 1: plotf fp44jfldml.xyp

Step 2: plotf.dat => mfpml.dat

Step 3: vertprof plotf.dat

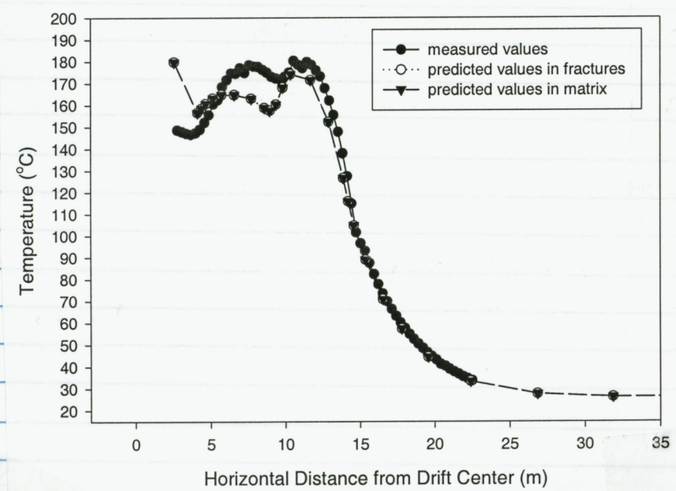
Step 4: vertprof.dat => rfpml.dat

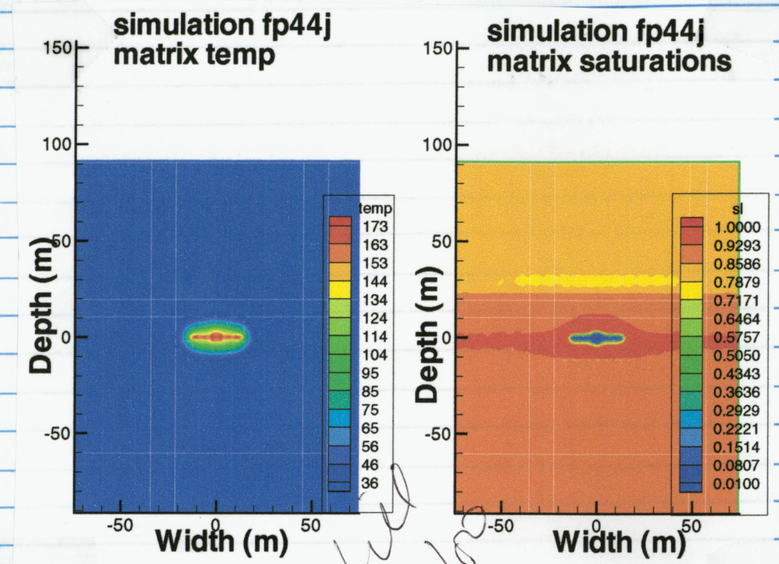
Temperature vs. Distance Borehole 158
simulation fp44j 1yr
fp44jfldf1.xyp & fp44jfldm1.xyp
vulcan/home/mhill/ron
filename: fp44j1581y.jnb



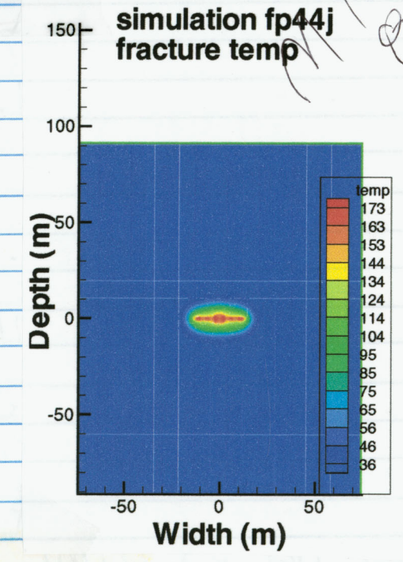
MHill 8/2/00

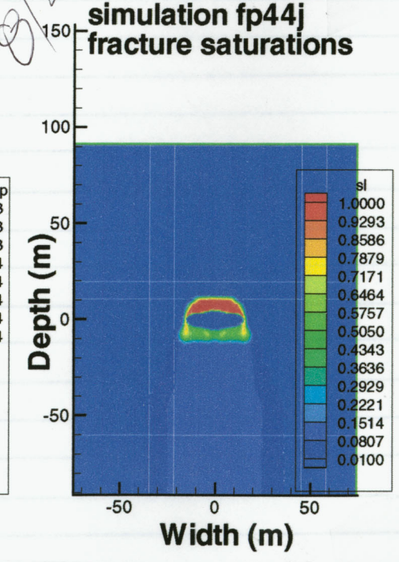
Temperature vs. Distance Borehole 160
simulation fp44j 1yr
fp44jfldf1.xyp& fp44jfldm1.xyp
vulcan/home/mhill/ron
filename: 44j1601y.jnb





MHill 8/2/00





MHill 8/2/00

8/3/00 Provided the following plots by R. Green:

- d1h44vfldfl.xyp
- d1h44vflaml.xyp
- d2h44vfldfl.xyp
- d2h44vfldml.xyp
- d6h44vfldfl.xyp
- d6h44vfldml.xyp
- d5h44vfldml.xyp
- d5h44vfldfl.xyp

copied to vulcan/home/mhill/ron

Processed files for plotting

Step 1: plot f d1h44vfldfl.xyp

Step 2: plotf.dat => pd1fl.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => d1fl.dat

Step 1: plotf d1h44vfldml.xyp

Step 2: plotf.dat => pd1ml.dat

Step 3: vertprof plotf.dat

Step 4: vertprof.dat => d1ml.dat

Replaced contents of profile.pts with contents in file col160.dat

Step 1: plotf d1h44vfldfl.xyp
Step 2: plotf.dat => nd1fl.dat
Step 3: vertprof. plotf. dat
Step 4: vertprof. dat => 2d1fl.dat
Step 1: plotf d1h44vfldml.xyp
Step 2: plotf.dat => nd1ml.dat
Step 3: vertprof plotf.dat
Step 4: vertprof. dat => 2d1ml.dat
Step 1: plotf d2h44vfldfl.xyp
Step 2: plotf. dat => rd2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => d2.dat
Step 1: plotf d2h44vfldml.xyp
Step 2: plotf.dat => rrd2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => d2h.dat
Replaced contents of profile.pts
with contents of file co1158.dat
Step 1: plotf d2h44vfldfl.xyp

Step 2: plotf.dat => qd2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => hd2.dat
Step 1: plotf d2h44vfldml.xyp
Step 2: plotf.dat => zd2.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => hhd2.dat
Step 1: plotf d6h44vfldfl.xyp
Step 2: plotf.dat => xd6.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => d6.dat
Step 1: plotf d6h44vfldml.xyp
Step 2: plotf.dat => yd6.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => 2d6.dat
Replaced contents of file profile.pts with contents of file col160.dat
Step 1: plotf d6h44vfldfl.xyp
Step 2: plotf.dat => MH 8/31/00 ~~zzd2~~ xxd6.dat

Step 3: vertprof plotf.dat
Step 4: vertprof.dat => 3d6.dat
Step 1: plotf d6h44vfldml.xyp
Step 2: plotf.dat => yyd6.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => 4d6.dat
Step 1: plotf d5h44vfldfl.xyp
Step 2: plotf.dat => p5fl.dat
Step 3: MH 8/31/00 ~~plotf.dat =>~~ vertprof plotf.dat
Step 4: vertprof.dat => d5fl.dat
Step 1: plotf d5h44vfldml.xyp
Step 2: plotf.dat => p5ml.dat
Step 3: vertprof plotf.dat
Step 4: vertprof.dat => d5ml.dat
Replaced contents of profile.pts with contents of file col158.dat
Step 1:
Plotf d5h44vfldfl.xyp
Step 2: plotf.dat => oxd5.dat
Step 3: vertprof plotf.dat

Step 4: vertprof.dat => xd5fl.dat
Step 1: plotf d5h44vfldml.xyp
Step 2: plotf.dat => nxd5.dat
Step 3: vertprof profile.dat
Step 4: vertprof.dat => xd5ml.dat
MNil 8/3/00

8/6/00 Plotf d5t45bfldfl.xyp
Plotf.dat => o45bfl.dat
vertprof plotf.dat
vertprof.dat => 45bfl.dat
Plotf d5t45bfldml.xyp
plotf.dat => o45bml.dat
Vertprof plotf.dat
Vertprof.dat => 45bml.dat
Replaced contents of profile.pts with contents of col160.dat
Plotf d5t45bfldfl.xyp
plotf.dat => m4bfl.dat
vertprof plotf.dat

vertprof.dat => mm45bfl.dat
plotf d5t45bfldml.xyp
m mt. 8/6/00
plotf.dat => r45bfl.dat
vertprof plotf.dat
vertprof.dat => rr45bml.dat
plotf d4h44vfldfl.xyp
plotf.dat => d4hfl.dat
vertprof plotf.dat
vertprof.dat => d4h44fl.dat
plotf d4h44vfldml.xyp
plotf.dat => d4hml.dat
vertprof plotf.dat
vertprof.dat => d4h44ml.dat
Replaced contents of profile.pts with contents of col158.dat
plotf d4h44vfldfl.xyp
plotf.dat => 4hfl.dat
vertprof plotf.dat
vertprof.dat => a4hfl.dat

plotf d4h44vfldml.xyp
plotf.dat => 4hml.dat
vertprof plotf.dat
vertprof.dat => a4hml.dat
plotf d13hfldfl.xyp
plotf.dat => ad13hfl.dat
vertprof plotf.dat
vertprof.dat => d13hfl.dat
plotf d13hfldml.xyp
MWill 8/18/00
plotf.dat => ~~a4~~ ad13hml.dat
vertprof plotf.dat
vertprof.dat => d13hml.dat
Replaced contents of profile.pts with contents of col160.dat
plotf d13hfldfl.xyp
plotf.dat => ad13hfl.dat
vertprof plotf.dat
vertprof.dat => ldd13hfl.dat

plotf d13hfldml.xyp
plotf.dat => ~~ad~~ d13hml.dat
vertprof plotf.dat
vertprof.dat => ldd13hml.dat
plotf d11hfldfl.xyp
plotf.dat => d11h.dat
vertprof plotf.dat
vertprof.dat => xd11h.dat
plotf d11hfldml.dat
plotf.dat => d11hml.dat
vertprof plotf.dat
vertprof.dat => xxd11h.dat
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plotf d11hfldfl.xyp
plotf.dat => p11h.dat
vertprof plotf.dat
vertprof.dat => d11hfl.dat
plotf d11hfldml.xyp

plotf.dat => pd11hml.dat
vertprof plotf.dat
vertprof.dat => dd11hml.dat
M Will 8/6/00

8/7/00 Plotf d14hfldfl.xyp
plotf.dat => pd14.dat
vertprof plotf.dat
vertprof.dat => d14hfl.dat
plotf d14hfldml.xyp
plotf.dat => pd14ml.dat
vertprof plotf.dat
vertprof.dat => d14hml.dat
Replaced contents of profile.pts
with contents of co160.dat
plotf d14hfldfl.xyp
plotf.dat => yd14h.dat
vertprof plotf.dat
vertprof.dat => td14hfl.dat
MH 8/7/00
plotf ~~d13~~ d14hfldml.xyp

plotf.dat => yd14hml.dat
Vertprof plotf.dat
vertprof.dat => td14hml.dat
plotf d17hfldfl.xyp
MH 8/7/00
plotf.dat => ~~pdf~~ pd17hfl.dat
vertprof plotf.dat
vertprof.dat => d17hfl.dat
plotf.dat => pd17hml.dat
vertprof plotf.dat
vertprof.dat => d17hml.dat
Replaced contents of profile.pts
with contents of file co158.dat
plotf d17hfldfl.xyp
plotf.dat => ppd17hfl.dat
vertprof plotf.dat
vertprof.dat => qd17hfl.dat
plotf d17hfldml.xyp
plotf.dat => ppd17hml.dat
vertprof plotf.dat

vertprof. dat => qd17hml. dat 8/16/00
Plotf d18hfldfl. xyp
plotf. dat => ad18hfl. xyp
vertprof plotf. dat
vertprof. dat => d18hfl. dat
Plotf d18hfldml. xyp
plotf. dat => ad18hml. dat
vertprof plotf. dat
vertprof. dat => d18hml. dat
replaced contents of profile. pts with contents of col160. dat
Plotf d18hfldfl. xyp
plotf. dat => p18hfl. dat
vertprof plotf. dat
vertprof. dat => 18hfl. dat
Plotf d18hfldml. xyp
plotf. dat => p18hml. dat
vertprof plotf. dat
vertprof. dat => 18hml. dat
MWill 8/16/00

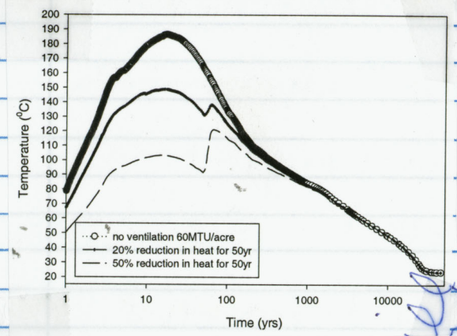
Plotf rdt2fldfl. xyp
plotf. dat => rt2a. dat
vertprof plotf. dat
vertprof. dat => rt2f. dat
plotf rdt2fldml. xyp
plotf. dat => rt2b. dat
vertprof plotf. dat
vertprof. dat => rt2m. dat
replaced contents of profile. pts with contents of col158. dat
plotf rdt2fldfl. xyp
plotf. dat => rt2c. dat
vertprof plotf. dat
vertprof. dat => ~~art2f. dat~~
plotf rdt2fldml. xyp
plotf. dat => rt2d. dat
vertprof plotf. dat
vertprof. dat => art2m. dat

plotf rd4fldfl.xyp
plotf.dat => rtd4a.dat
vertprof plotf.dat
vertprof.dat => rtd4f.dat
plotf rd4fldml.xyp
plotf.dat => rtd4b.dat
vertprof plotf.dat
vertprof.dat => rtd4m.dat
replaced contents of profile.pts with contents of col158.dat MJ 8/16/00
plotf rdt4fldfl.xyp
plotf.dat => rtd4c.dat
vertprof plotf.dat
vertprof.dat => 2rtd4f.dat
MJ 8/16/00
plotf rtd4fldml.xyp
plotf.dat => rtd4d.dat
vertprof plotf.dat
vertprof.dat => 2rtd4m.dat
plotf rdt6fldfl.xyp
plotf.dat => rdt6a.dat
vertprof plotf.dat

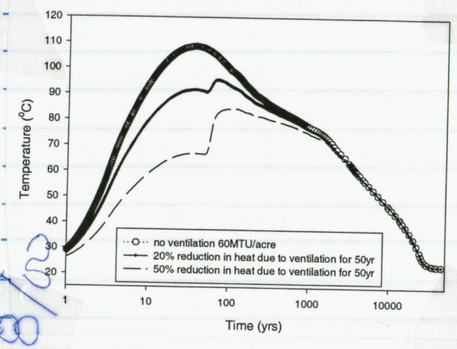
vertprof.dat => rdt6f.dat
plotf rdt6fldml.xyp
plotf.dat => rdt6b.dat
vertprof plotf.dat
vertprof.dat => rdt6m.dat
replaced contents of profile.pts with contents of col158.dat
plotf rdt6fldfl.xyp
plotf.dat => rdt6c.dat
vertprof plotf.dat
MJ 8/16/00 ~~plo~~ vertprof.dat => 2rdt6f.dat
plotf rdt6fldml.xyp
plotf.dat => rdt6d.dat
vertprof plotf.dat
vertprof.dat => 2rdt6m.dat
MJ 8/16/00

8/28/00 Results for TEF March 2000 deliverable (p 300 - 301) see p 203 of this notebook for more discussion
MJ 8/28/00

Temperature vs. Time 3m above heater element
50yr-fig a

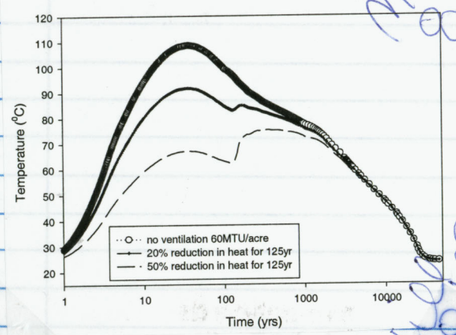


Temperature vs. Time in Matrix 8.25m Above heater element
50yr-figc

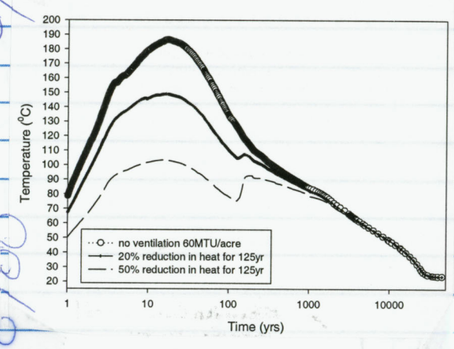


M Hill 8/28/00

Temperature vs. Time in Matrix 8.25m Above Heater Element
125 yr -fig d

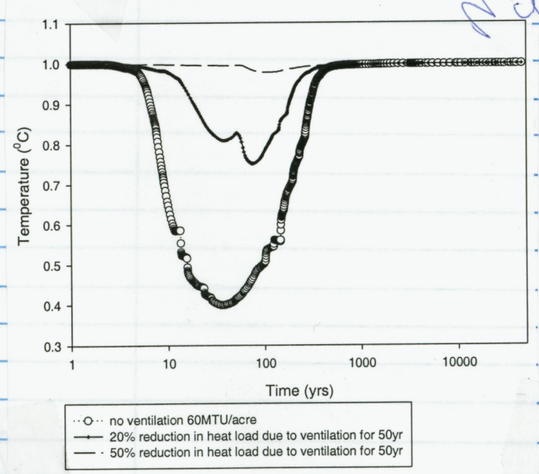


Temperature vs. Time 3m above heater element
125yr-fig b

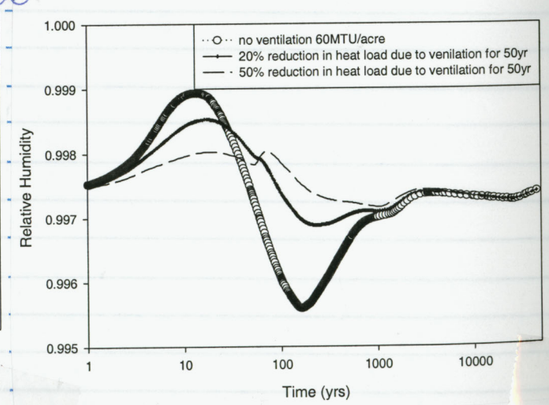


M Hill 8/28/00

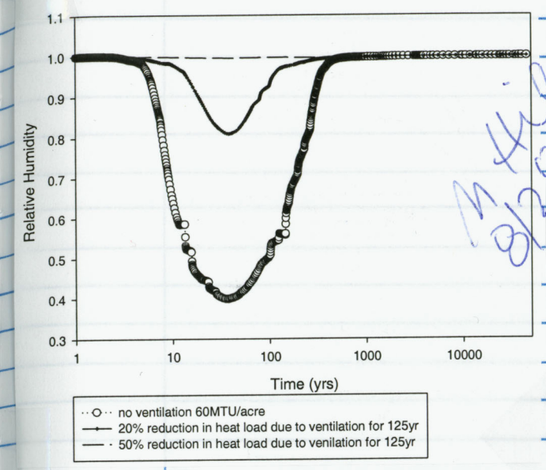
Relative Humidity vs. Time 3m Above Heater Element
50yr-fig e



Relative Humidity vs. Time in Matrix 8.25m Above Heater Element
50yr-fig g

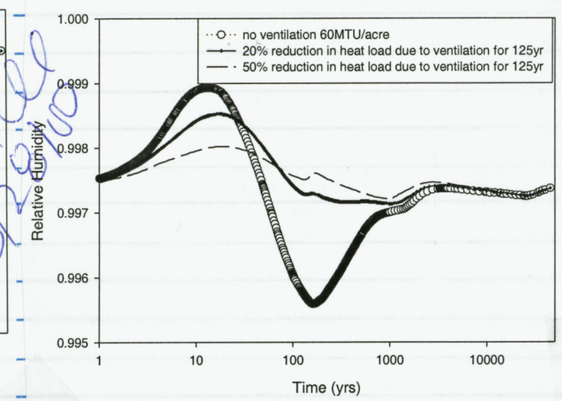


Relative Humidity vs. Time 3m above heater element
125 yr-fig f



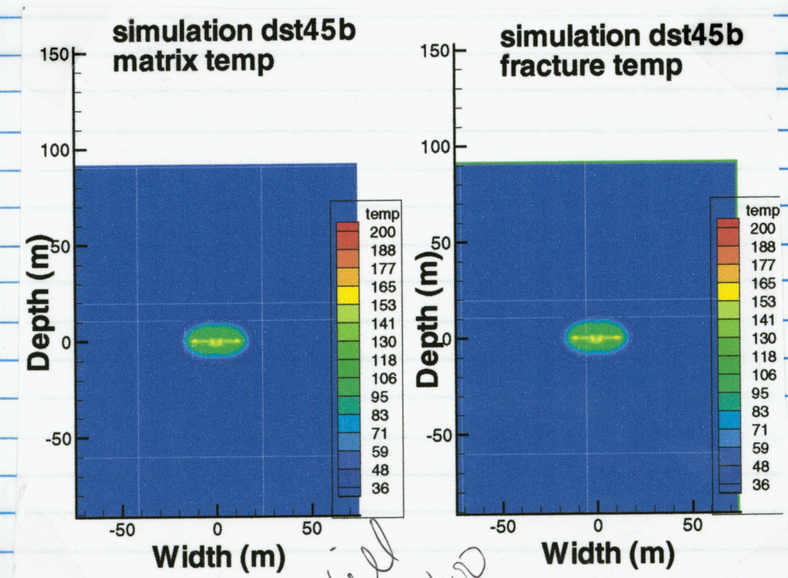
M Hill 8/28/00

Relative Humidity vs. Time in Matrix 8.25m Above Heater Element
125yr-fig h

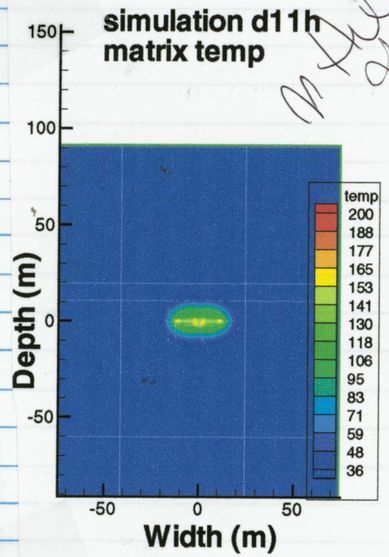


M Hill 8/28/00

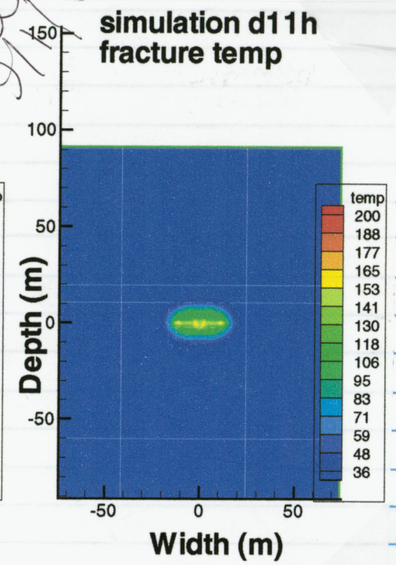
9/1/00 Plots for TEF August 2000 deliverable

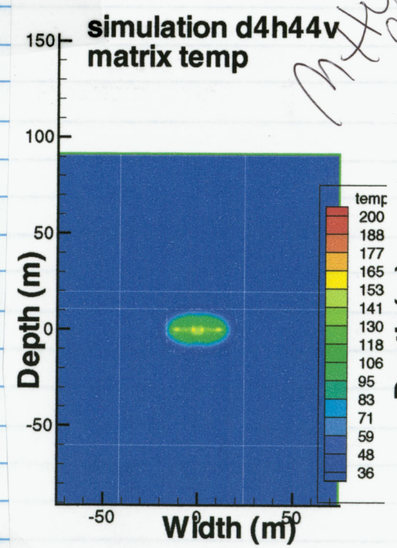


M Hill 9/1/00

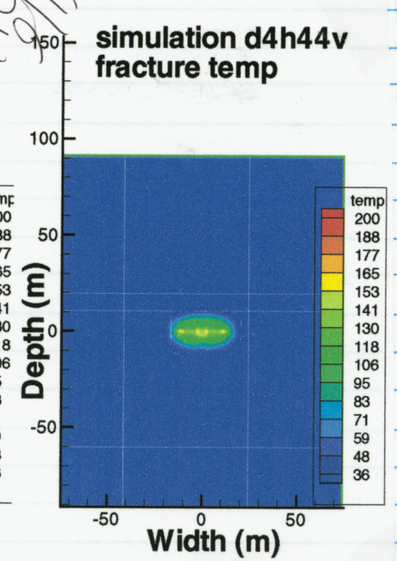


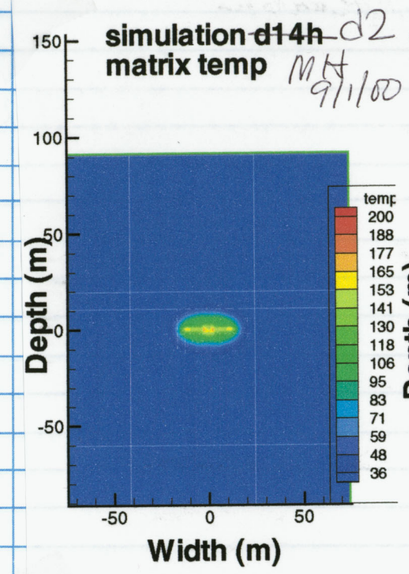
M Hull 9/1/00



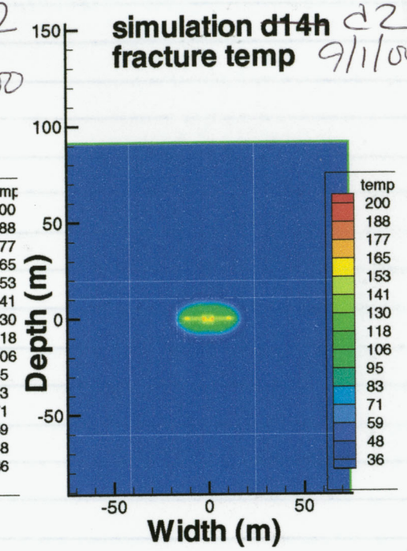


M Hull 9/1/00



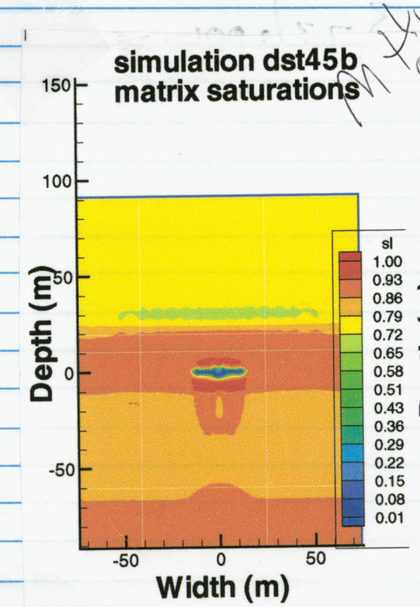


MH 9/1/00

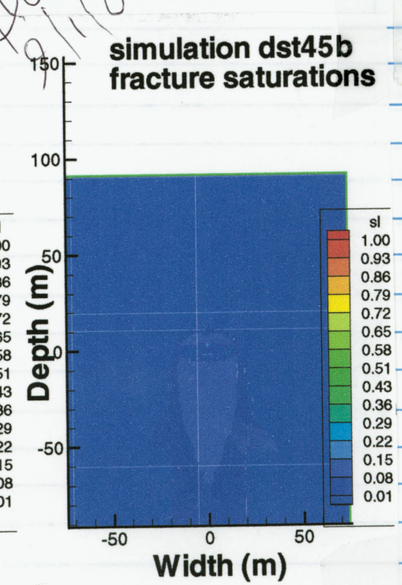


9/1/00

M Hull 9/1/00



M Hull 9/1/00



Entries for this notebook are continued in notebook # 425.

MH 9/1/00

"I have reviewed this scientific notebook and find it in agreement with QAP-001. There is sufficient information regarding methods used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity."
the EM)

E. C. Pearson

3/23/2001