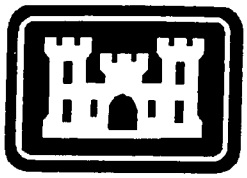

US Army Corps of Engineers
Buffalo District

TECHNICAL MEMORANDUM

CLEANUP GOALS FOR SOIL AT THE FINISHING AREA OF THE FORMER BLISS AND LAUGHLIN FACILITY

BUFFALO, NEW YORK

DECEMBER 1998

LBLS 21.00

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Prepared by:

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Dublin, Ohio 43017

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
ft	Foot (feet)
g	Gram(s)
hr	Hour(s)
m^2	Square meter(s)
m^3	Cubic meter(s)
mg	Milligram(s)
mrem	Millirem
NaI	Sodium iodide
NU	Naturally occurring uranium
NYSDEC	New York State Department of Environmental Conservation
pCi	Picocurie(s)
yr	Year(s)
U	Uranium

1. PURPOSE

The purpose of this Technical Memorandum is to present a range of potential cleanup concentration goals for soils at the Finishing Area of the former Bliss and Laughlin facility. Soils have been identified as potentially contaminated with naturally occurring uranium [uranium-238 (U-238), U-235 and U-234 in activity concentration (pCi/g) ratios of 1:0.05:1, respectively) under portions of the Finishing Area slab. The cleanup goals for this soil are based on achieving a maximum residual radiological dose 25 mrem/yr (from 10 CFR 20 Subpart E) with consideration of more stringent goals of 10 mrem/yr (from NYSDEC TAGM 4003) and 1 mrem/yr (for the purpose of comparison only). Cleanup concentration goals (in pCi/g) are also compared to the standard scanning sensitivity of field instruments as an indicator of the ease of locating contamination at or above the final cleanup goal.

2. METHOD

RESRAD Version 5.82 was used to model exposure to a future resident, an industrial worker, and a construction worker exposed to residual uranium under the Finishing Area slab to compare the exposures to each group. The industrial worker is presumed to be the average member of the critical group, per the ARAR determination of 10 CFR 20. The total contaminated area was assumed to be 100 m^2 although the area has been estimated to be much smaller. The residential exposure was assumed to be a worst case (highly unlikely) exposure scenario provided only for comparison purposes. The industrial worker was assumed to be the most likely future land use scenario. The construction worker was included as the most likely direct contact scenario.

The residential RESRAD calculations employed default exposure parameters only. This approach is considered conservative (likely overestimates actual dose) but reasonable with a soil ingestion rate of 36.5 g/yr, and inhalation rate of 8,400 m^3/yr, a 50 percent indoor on-site occupancy fraction, and a 25 percent outdoor on-site occupancy fraction. The industrial worker calculations likewise employ the same default parameters with the following exceptions:

- Soil ingestion rate was set to 18.25 g/yr,
- Indoor occupancy was set to 7 hrs/day for 250 days/yr (0.20 occupancy fraction), and
- Outdoor occupancy was set to 1 hr/day for 250 days/yr (0.029 occupancy fraction).

Likewise, the construction worker scenario employs mostly default exposure parameters with the following exceptions:

- Soil ingestion rate was set to 175.2 g/yr (480 mg/day),
- Inhalation rate was set to 13,140 m^3/yr (1.5 m^3/hr for moderate outdoor activities),
- Indoor occupancy was set 0.0 days/yr (all exposure assumed to be outdoors), and
- Outdoor occupancy was set to 8 hr/day for 10 days/yr (0.0091 occupancy fraction).

The non-default exposure parameters for the industrial and construction workers are consistent with standard EPA values as presented in the 1997 *Exposure Factors Handbook* (EPA 1997).

All scenarios include the soil ingestion, particulate inhalation, and external gamma pathways. The ingestion of contaminated foodstuff and water was not included because the potentially contaminated surface area is considered too small for farming or to impact ground water. The radon pathway was likewise excluded considering that radon standards are based on air concentrations. (Note that, per NCRP No. 93, natural levels of background radon contribute 200 mrem/yr on average to persons in the United States. Also, modeling radon migration into structures from soils is highly uncertain.)

3. RESULTS

Results indicate that the resident would receive 0.096 mrem/yr, the industrial worker would receive 0.026 mrem/yr, and the construction worker would receive 0.0017 mrem/yr if exposed to 2.05 pCi/g of uranium (1.0 pCi/g of U-238 plus 0.05 pCi/g of U-235 plus 1.0 pCi/g of U-234). It would, therefore, require approximately 530 pCi/g of uranium to produce a dose of 25 mrem/yr, 210 pCi/g to produce a dose of 10 mrem/yr, or 21 pCi/g to produce a dose of 1 mrem/yr to the resident. It would likewise require approximately 2,000 pCi/g of uranium to produce a dose of 25 mrem/yr, 780 pCi/g to produce a dose of 10 mrem/yr, and 78 pCi/g to produce a dose of 1 mrem/yr to the industrial worker. It would also require approximately 15,000 pCi/g of uranium to produce a dose of 25 mrem/yr, 5,900 pCi/g to produce a dose of 10 mrem/yr, and 590 pCi/g to produce a dose of 1 mrem/yr to the construction worker. Note that NUREG 1575 lists 80 pCi/g as the minimum detectable concentration of naturally occurring uranium that can be located with a 2-inch by 2-inch NaI detector. Concentrations at or above 80 pCi/g could, therefore, be detected in the field.

The following table lists concentrations for modeled dose endpoints and other relevant exposure model information.

Scenario	Exposure Pathways	Exposure Parameters	Dose (mrem/yr)	Residual Concentration[a] (pCi/g)			
				U-238	**U-235**	**U-234**	**NU[b]**
Residential	Soil ingestion, dust inhalation, external gamma radiation	RESRAD defaults	25	260	13	260	530
			10	100	5.0	100	210
			1	10	0.50	10	21
Industrial		18.25 g soil per year, 7 hours per day indoors, 1 hour per day outdoors	25	960	48	960	2000
			10	380	19	380	780
			1	38	1.9	38	78
Construction		175.2 g soil per year, 13,140 m^3 air per year, no indoor exposure, 80 hours outdoors	25	7,300	37	7,300	15,000
			10	2,900	140	2,900	5,900
			1	290	14	290	590

(a) All values rounded to two significant digits.

(b) NU= naturally occurring uranium, including U-238 + U-235 + U-234 at concentration ratios of 1:0.05:1 (based on activity – pCi/g)

4. CONCLUSION

According to the model described above, a cleanup goal of 530 pCi/g naturally occurring uranium (including 260 pCi/g of U-238) would satisfy the 25 mrem/yr NRC limit for the resident and the 10 mrem/yr NYSDEC guideline for both the industrial and construction workers. By selecting a cleanup goal of 210 pCi/g for naturally occurring uranium (including 100 pCi/g of U-238), the residential, industrial worker and construction worker doses would be below the 10 mrem/yr NYSDEC guideline. The use of the selected cleanup goal (100 pCi/g U-238) for soils will allow unrestricted use of the facility for all scenarios modeled (residential, industrial, and construction). Because naturally occurring uranium can be scanned in the field down to 80 pCi/g (in this model equating to approximately 1 mrem/yr to the industrial worker), the NRC and NYSDEC dose endpoints for all modeled exposure scenarios may be achieved using standard field instruments.

5. REFERENCES

DoD, DOE, EPA, NRC 1997 *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, EPA 402-R-97-016, December.

EPA 1997, Exposure Factors Handbook Volume 1 – General Factors, EPA/600/P-95/002F-a, August.

NCRP No. 93, National Council on Radiation and Protection and Measurements Report No. 93, "Ionizing Radiation Exposure of the Population of the United States," 1987.

NRC 1997, 10 CFR 20, *Standard for Protection Against Radiation – Subpart E – Radiological Criteria for License Termination.*

NYSDEC 1993, *Cleanup Guidance for Soils Contaminated with Radioactive Material*, Technical Administrative Guidance Memorandum (TAGM) 4003, September.

APPENDIX A - Future Resident RESRAD INPUTS

Residential Scenario Inputs
to RESRAD Model

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IHAFTIM = 0,
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&END
&INDATA
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VCV = .001,
DENSCZ = 1.5,
VCZ = .001,
TPCZ = .4,
EPCZ = .2,
HCCZ = 10,
BCZ = 5.3,
HUMID = 8,
EVAPTR = .5,
PRECIP = 1,
RI = .2,
IDITCH = 0,
RUNOFF = .2,
WAREA = 1000000,
EPS = .001,
NS = 1,
TI = 0,
DENSAQ = 1.5,
TPSZ = .4,
EPSZ = .2,
HCSZ = 100,
HGWT = .02,
BSZ = 5.3,
VWT = .001,
DWIBWT = 10,
MODEL = 0,
UW = 250,
AREA = 100,
THICK0 = 2,
LCZPAQ = 100,
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BRDL = 30,
T(1) = 0,
T(2) = 1,
T(3) = 3,
T(4) = 10,
T(5) = 30,
T(6) = 100,
T(7) = 300,
T(8) = 1000,
T(9) = 0,
T(10) = 0,
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MLINH = .0001,
ED = 30,
SHF1 = .7,
SHF3 = .4,
FIND = .5,
FOTD = 2.25,
FS = 1,
RAD_SHAPE(1) = 50,
RAD_SHAPE(2) = 70.71068,
RAD_SHAPE(3) = 0,
RAD_SHAPE(4) = 0,
RAD_SHAPE(5) = 0,
RAD_SHAPE(6) = 0,
RAD_SHAPE(7) = 0,
RAD_SHAPE(8) = 0,
RAD_SHAPE(9) = 0,
RAD_SHAPE(10) = 0,
RAD_SHAPE(11) = 0,
RAD_SHAPE(12) = 0,
FRACA(1) = 1,
FRACA(2) = .2732395,
FRACA(3) = 0,
FRACA(4) = 0,
FRACA(5) = 0,
FRACA(6) = 0,
FRACA(7) = 0,
FRACA(8) = 0,
FRACA(9) = 0,
FRACA(10) = 0,
FRACA(11) = 0,
FRACA(12) = 0,

DIET(1) = 160,
DIET(2) = 14,
DIET(3) = 92,
DIET(4) = 63,
DIET(5) = 5.4,
DIET(6) = .9,
SOIL = 36.5,
DWI = 510,
FDW = 1,
FHHW = 1,
FLW = 1,
FIRW = 1,
FR9 = .5,
FPLANT =-1,
FMEAT =-1,
FMILK =-1,
LFI5 = 68,
LFI6 = 55,
LWI5 = 50,
LWI6 = 160,
LSI = .5,
MLFD = .0001,
DM = .15,
DROOT = .9,
FGWDW = 1,
FGWHH = 1,
FGWLW = 1,
FGWIR = 1,
STOR_T(1) = 14,
STOR_T(2) = 1,
STOR_T(3) = 1,
STOR_T(4) = 20,
STOR_T(5) = 7,
STOR_T(6) = 7,
STOR_T(7) = 1,
STOR_T(8) = 1,
STOR_T(9) = 45,
FLOOR = .15,
DENSFL = 2.4,
TPCV = .4,
TPFL = .1,
PH2OCV = .05,
PH2OFL = .03,

DIFCV = .000002,
DIFFL = .0000003,
DIFCZ = .000002,
HMIX = 2,
WIND = 2,
REXG = .5,
HRM = 2.5,
FAI = 0,
DMFL =-1,
EMANA(1) = .25,
EMANA(2) = .15,
C12WTR = .00002,
C12CZ = .03,
CSOIL = .02,
CAIR = .98,
DMC = .3,
EVSN = .0000007,
REVSN = 1E-10,
AVFG4 = .8,
AVFG5 = .2,
H(1) = 4,
H(2) = 4,
H(3) = 4,
H(4) = 4,
H(5) = 4,
DENSUZ(1) = 1.5,
DENSUZ(2) = 1.5,
DENSUZ(3) = 1.5,
DENSUZ(4) = 1.5,
DENSUZ(5) = 1.5,
TPUZ(1) = .4,
TPUZ(2) = .4,
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EPUZ(3) = .2,
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EPUZ(5) = .2,
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BUZ(2) = 5.3,
BUZ(3) = 5.3,

BUZ(4) = 5.3,
BUZ(5) = 5.3,
HCUZ(1) = 10,
HCUZ(2) = 10,
HCUZ(3) = 10,
HCUZ(4) = 10,
HCUZ(5) = 10,
INDPOPFLAG = 0,
OFFDISTANCE(1) = 250,
NUMDISTANCES = 0,
AMBIENTTEMP = 10,
LIDHEIGHT = 1000,
SOURCEHEIGHT = 10,
AGVEG(1) = 0,
AGVEG(2) = .5,
AGVEG(3) = .5,
AGMILK(1) = 0,
AGMILK(2) = .5,
AGMILK(3) = .5,
AGMEAT(1) = 0,
AGMEAT(2) = .5,
AGMEAT(3) = .5,
BEEFDENSITY = .164,
MILKDENSITY = .0207,
VEGLANDFRACTION = .0185,
YV(1) = .7,
YV(2) = 1.5,
YV(3) = 1.1,
TE(1) = .17,
TE(2) = .25,
TE(3) = .08,
TIV(1) = .1,
TIV(2) = 1,
TIV(3) = 1,
WLAM = 20,
RWET(1) = .25,
RWET(2) = .25,
RWET(3) = .25,
RDRY(1) = .25,
RDRY(2) = .25,
RDRY(3) = .25,
NUCNAM = 'Ac-227', 'Pa-231', 'Pb-210', 'Ra-226', 'Th-230', 'U-234',
'U-235', 'U-238', 'LAST',

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S = 5*0, 1, .05, 1,
W = 8*0,
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DCACTU1 = 20, 50, 100, 70, 60000, 3*50,
DCACTS = 20, 50, 100, 70, 60000, 3*50,
RLEACH = 8*0,
SOLUBK0 = 8*0,
NSENA = 0,
NUM_SAMPS = 0, NUMVAR = 0,
SELPATH = 131,
&END
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APPENDIX B - Industrial Worker RESRAD Inputs

Industrial Scenario Inputs
to RESRAD Model

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&DB
IHAFTIM = 0,
DFFILE = 'DOSFAC.BIN',
&END
&INDATA
TITLE = 'RESRAD Default Parameters',
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VCV = .001,
DENSCZ = 1.5,
VCZ = .001,
TPCZ = .4,
EPCZ = .2,
HCCZ = 10,
BCZ = 5.3,
HUMID = 8,
EVAPTR = .5,
PRECIP = 1,
RI = .2,
IDITCH = 0,
RUNOFF = .2,
WAREA = 1000000,
EPS = .001,
NS = 1,
TI = 0,
DENSAQ = 1.5,
TPSZ = .4,
EPSZ = .2,
HCSZ = 100,
HGWT = .02,
BSZ = 5.3,
VWT = .001,
DWIBWT = 10,
MODEL = 0,
UW = 250,
AREA = 100,
THICK0 = 2,
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LCZPAQ = 100,
BRDL = 30,
T(1) = 0,
T(2) = 1,
T(3) = 3,
T(4) = 10,
T(5) = 30,
T(6) = 100,
T(7) = 300,
T(8) = 1000,
T(9) = 0,
T(10) = 0,
INHALR = 8400,
MLINH = .0001,
ED = 30,
SHF1 = .7,
SHF3 = .4,
FIND = .5,
FOTD = .25,
FS = 1,
RAD_SHAPE(1) = 50,
RAD_SHAPE(2) = 70.71068,
RAD_SHAPE(3) = 0,
RAD_SHAPE(4) = 0,
RAD_SHAPE(5) = 0,
RAD_SHAPE(6) = 0,
RAD_SHAPE(7) = 0,
RAD_SHAPE(8) = 0,
RAD_SHAPE(9) = 0,
RAD_SHAPE(10) = 0,
RAD_SHAPE(11) = 0,
RAD_SHAPE(12) = 0,
FRACA(1) = 1,
FRACA(2) = .2732395,
FRACA(3) = 0,
FRACA(4) = 0,
FRACA(5) = 0,
FRACA(6) = 0,
FRACA(7) = 0,
FRACA(8) = 0,
FRACA(9) = 0,
FRACA(10) = 0,
FRACA(11) = 0,

FRACA(12) = 0,
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DIET(2) = 14,
DIET(3) = 92,
DIET(4) = 63,
DIET(5) = 5.4,
DIET(6) = .9,
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DWI = 510,
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FLW = 1,
FIRW = 1,
FR9 = .5,
FPLANT =-1,
FMEAT =-1,
FMILK =-1,
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LFI6 = 55,
LWI5 = 50,
LWI6 = 160,
LSI = .5,
MLFD = .0001,
DM = .15,
DROOT = .9,
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FGWHH = 1,
FGWLW = 1,
FGWIR = 1,
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STOR_T(2) = 1,
STOR_T(3) = 1,
STOR_T(4) = 20,
STOR_T(5) = 7,
STOR_T(6) = 7,
STOR_T(7) = 1,
STOR_T(8) = 1,
STOR_T(9) = 45,
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PH2OFL = .03,
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DIFCZ = .000002,
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HRM = 2.5,
FAI = 0,
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EMANA(2) = .15,
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C12CZ = .03,
CSOIL = .02,
CAIR = .98,
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H(2) = 4,
H(3) = 4,
H(4) = 4,
H(5) = 4,
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BUZ(3) = 5.3,
BUZ(4) = 5.3,
BUZ(5) = 5.3,
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HCUZ(2) = 10,
HCUZ(3) = 10,
HCUZ(4) = 10,
HCUZ(5) = 10,
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NUMDISTANCES = 0,
AMBIENTTEMP = 10,
LIDHEIGHT = 1000,
SOURCEHEIGHT = 10,
AGVEG(1) = 0,
AGVEG(2) = .5,
AGVEG(3) = .5,
AGMILK(1) = 0,
AGMILK(2) = .5,
AGMILK(3) = .5,
AGMEAT(1) = 0,
AGMEAT(2) = .5,
AGMEAT(3) = .5,
BEEFDENSITY = .164,
MILKDENSITY = .0207,
VEGLANDFRACTION = .0185,
YV(1) = .7,
YV(2) = 1.5,
YV(3) = 1.1,
TE(1) = .17,
TE(2) = .25,
TE(3) = .08,
TIV(1) = .1,
TIV(2) = 1,
TIV(3) = 1,
WLAM = 20,
RWET(1) = .25,
RWET(2) = .25,
RWET(3) = .25,
RDRY(1) = .25,
RDRY(2) = .25,
RDRY(3) = .25,
NUCNAM = 'Ac-227', 'Pa-231', 'Pb-210', 'Ra-226', 'Th-230', 'U-234',

'U-235', 'U-238', 'LAST',
S = 5*0, 1, .05, 1,
W = 8*0,
DCACTC = 20, 50, 100, 70, 60000, 3*50,
DCACTU1 = 20, 50, 100, 70, 60000, 3*50,
DCACTS = 20, 50, 100, 70, 60000, 3*50,
RLEACH = 8*0,
SOLUBK0 = 8*0,
NSENA = 0,
NUM_SAMPS = 0, NUMVAR = 0,
SELPATH = 131,
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APPENDIX C - Construction Worker RESRAD Inputs

Construction Scenario Inputs
to RESRAD Model

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&END
&INDATA
TITLE = 'RESRAD Default Parameters',
NPTS = 32 ,
TDISK = '', VERS = '5.82',
XSPACE = 'LOG',
COVER0 = 0,
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VCV = .001,
DENSCZ = 1.5,
VCZ = .001,
TPCZ = .4,
EPCZ = .2,
HCCZ = 10,
BCZ = 5.3,
HUMID = 8,
EVAPTR = .5,
PRECIP = 1,
RI = .2,
IDITCH = 0,
RUNOFF = .2,
WAREA = 1000000,
EPS = .001,
NS = 1,
TI = 0,
DENSAQ = 1.5,
TPSZ = .4,
EPSZ = .2,
HCSZ = 100,
HGWT = .02,
BSZ = 5.3,
VWT = .001,
DWIBWT = 10,
MODEL = 0,
UW = 250,
AREA = 100,
THICK0 = 2,
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LCZPAQ = 100,
BRDL = 30,
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T(2) = 1,
T(3) = 3,
T(4) = 10,
T(5) = 30,
T(6) = 100,
T(7) = 300,
T(8) = 1000,
T(9) = 0,
T(10) = 0,
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MLINH = .0001,
ED = 30,
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SHF3 = .4,
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FOTD = .0091,
FS = 1,
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RAD_SHAPE(2) = 70.71068,
RAD_SHAPE(3) = 0,
RAD_SHAPE(4) = 0,
RAD_SHAPE(5) = 0,
RAD_SHAPE(6) = 0,
RAD_SHAPE(7) = 0,
RAD_SHAPE(8) = 0,
RAD_SHAPE(9) = 0,
RAD_SHAPE(10) = 0,
RAD_SHAPE(11) = 0,
RAD_SHAPE(12) = 0,
FRACA(1) = 1,
FRACA(2) = .2732395,
FRACA(3) = 0,
FRACA(4) = 0,
FRACA(5) = 0,
FRACA(6) = 0,
FRACA(7) = 0,
FRACA(8) = 0,
FRACA(9) = 0,
FRACA(10) = 0,
FRACA(11) = 0,

FRACA(12) = 0,
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DIET(2) = 14,
DIET(3) = 92,
DIET(4) = 63,
DIET(5) = 5.4,
DIET(6) = .9,
SOIL = 175.2,
DWI = 510,
FDW = 1,
FHHW = 1,
FLW = 1,
FIRW = 1,
FR9 = .5,
FPLANT =-1,
FMEAT =-1,
FMILK =-1,
LFI5 = 68,
LFI6 = 55,
LWI5 = 50,
LWI6 = 160,
LSI = .5,
MLFD = .0001,
DM = .15,
DROOT = .9,
FGWDW = 1,
FGWHH = 1,
FGWLW = 1,
FGWIR = 1,
STOR_T(1) = 14,
STOR_T(2) = 1,
STOR_T(3) = 1,
STOR_T(4) = 20,
STOR_T(5) = 7,
STOR_T(6) = 7,
STOR_T(7) = 1,
STOR_T(8) = 1,
STOR_T(9) = 45,
FLOOR = .15,
DENSFL = 2.4,
TPCV = .4,
TPFL = .1,
PH2OCV = .05,

PH2OFL = .03,
DIFCV = .000002,
DIFFL = .0000003,
DIFCZ = .000002,
HMIX = 2,
WIND = 2,
REXG = .5,
HRM = 2.5,
FAI = 0,
DMFL =-1,
EMANA(1) = .25,
EMANA(2) = .15,
C12WTR = .00002,
C12CZ = .03,
CSOIL = .02,
CAIR = .98,
DMC = .3,
EVSN = .0000007,
REVSN = 1E-10,
AVFG4 = .8,
AVFG5 = .2,
H(1) = 4,
H(2) = 4,
H(3) = 4,
H(4) = 4,
H(5) = 4,
DENSUZ(1) = 1.5,
DENSUZ(2) = 1.5,
DENSUZ(3) = 1.5,
DENSUZ(4) = 1.5,
DENSUZ(5) = 1.5,
TPUZ(1) = .4,
TPUZ(2) = .4,
TPUZ(3) = .4,
TPUZ(4) = .4,
TPUZ(5) = .4,
EPUZ(1) = .2,
EPUZ(2) = .2,
EPUZ(3) = .2,
EPUZ(4) = .2,
EPUZ(5) = .2,
BUZ(1) = 5.3,
BUZ(2) = 5.3,

BUZ(3) = 5.3,
BUZ(4) = 5.3,
BUZ(5) = 5.3,
HCUZ(1) = 10,
HCUZ(2) = 10,
HCUZ(3) = 10,
HCUZ(4) = 10,
HCUZ(5) = 10,
INDPOPFLAG = 0,
OFFDISTANCE(1) = 250,
NUMDISTANCES = 0,
AMBIENTTEMP = 10,
LIDHEIGHT = 1000,
SOURCEHEIGHT = 10,
AGVEG(1) = 0,
AGVEG(2) = .5,
AGVEG(3) = .5,
AGMILK(1) = 0,
AGMILK(2) = .5,
AGMILK(3) = .5,
AGMEAT(1) = 0,
AGMEAT(2) = .5,
AGMEAT(3) = .5,
BEEFDENSITY = .164,
MILKDENSITY = .0207,
VEGLANDFRACTION = .0185,
YV(1) = .7,
YV(2) = 1.5,
YV(3) = 1.1,
TE(1) = .17,
TE(2) = .25,
TE(3) = .08,
TIV(1) = .1,
TIV(2) = 1,
TIV(3) = 1,
WLAM = 20,
RWET(1) = .25,
RWET(2) = .25,
RWET(3) = .25,
RDRY(1) = .25,
RDRY(2) = .25,
RDRY(3) = .25,
NUCNAM = 'Ac-227', 'Pa-231', 'Pb-210', 'Ra-226', 'Th-230', 'U-234',

'U-235', 'U-238', 'LAST',
S = 5*0, 1, .05, 1,
W = 8*0,
DCACTC = 20, 50, 100, 70, 60000, 3*50,
DCACTU1 = 20, 50, 100, 70, 60000, 3*50,
DCACTS = 20, 50, 100, 70, 60000, 3*50,
RLEACH = 8*0,
SOLUBK0 = 8*0,
NSENA = 0,
NUM_SAMPS = 0, NUMVAR = 0,
SELPATH = 131,
&END