WHARF MINE
LEAD, SOUTH DAKOTA
SINGLE CELL SELENIUM LEACHING MODEL
Area - Cleopatra Creek Rock Facility

INPUT BLOCK

INFILTRATION	Total Drainage Area:	36.83	ac
	Unreclaimed Infiltration Rate:	9	in/yr
	Reclaimed Infiltration Rate:	4.5	in/yr

LEACHABLE SELENIUM	Average Se Concentration:	0.159	mg/kg
	Leachable Se:	0.070	%
	Leachable Se Concentration:	0.01113	mg/kg

TIME	Start Time	yrs	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
	Time Step	yrs	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	End Time	yrs	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00
	Calendar Year	year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TIME DEPENDENT DATA	Infiltration Rate	in/yr	9	9	9.0	9.0	9.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	Barren Rock Backfill Added	tons	2,321,800	2,321,800	2,321,800	2,321,800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Spent Ore Backfill Added	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cumulative Backfill	tons	2,321,800	4,643,600	6,965,400	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200

CALCULATION BLOCK

DATA BLOCK	VARIABLE		FORMULA	UNITS	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
INFILTRATION	Inflow from Infiltration	A	drainage area x infiltration rate	ft^3	1,203,236	1,203,236	1,203,236	1,203,236	1,203,236	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618
WATER:ROCK RATIO	Backfill	B		tons	2,321,800	4,643,600	6,965,400	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200
	Water	C	A x conversion factor	L	34,071,856	34,071,856	34,071,856	34,071,856	34,071,856	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
	Rock	D	B x conversion factor	kg	2,106,301,529	4,212,603,059	6,318,904,588	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117
	Annual Water:Rock Ratio	E	C / D	L/kg	0.016176	0.008088	0.005392	0.004044	0.004044	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022
	Cumulative Water:Rock Ratio	F	E + previous year F	L/kg	0.016176	0.024264	0.029656	0.033700	0.037744	0.039766	0.041788	0.043810	0.045832	0.047854	0.049876	0.051898	0.053921	0.055943	0.057965	0.059987	0.062009	0.064031	0.066053
LEACHED CHEMICALS	Cumulative Leached Chemical	G	$1.45 \times F^{0.222}$	%	0.5805907	0.6352758	0.6642165	0.6833363	0.7007465	0.7089120	0.7167606	0.7243191	0.7316109	0.7386565	0.7454742	0.7520801	0.7584888	0.7647131	0.7707647	0.7766543	0.7823914	0.7879848	0.7934423
	Cumulative Leached Chemical	H	G x leachable chemical concentration	mg/kg	6.46197E-03	7.07062E-03	7.39273E-03	7.60553E-03	7.79931E-03	7.89019E-03	7.97755E-03	8.06167E-03	8.14283E-03	8.22125E-03	8.29713E-03	8.37065E-03	8.44198E-03	8.51126E-03	8.57861E-03	8.64416E-03	8.70802E-03	8.77027E-03	8.83101E-03
	Annual Leached Chemical	I	H - previous year H	mg/kg	6.46197E-03	6.08646E-04	3.22110E-04	2.12804E-04	1.93775E-04	9.08823E-05	8.73551E-05	8.41260E-05	8.11574E-05	7.84179E-05	7.58809E-05	7.35240E-05	7.13281E-05	6.92765E-05	6.73550E-05	6.55511E-05	6.38539E-05	6.22539E-05	6.07428E-05
	Annual Leached Chemical	J	I x D	mg	13,610,867	2,563,982	2,035,381	1,792,915	1,632,592	765,702	735,985	708,779	683,768	660,687	639,312	619,455	600,954	583,669	567,479	552,281	537,982	524,502	511,770
OUTFLOW	Water Out	K	C	L	34,071,856	34,071,856	34,071,856	34,071,856	34,071,856	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
	Water Outflow Rate	L	K x conversion factor	gpm	17.12	17.12	17.12	17.12	17.12	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56
	Average Chemical Concentration	M	J / K	mg/L	0.39947535	0.075252197	0.059737908	0.052621569	0.047916149	0.044946293	0.043201934	0.041604972	0.040136825	0.038781962	0.03752729	0.036361694	0.035275671	0.034261045	0.033310745	0.032418616	0.03157928	0.030788012	0.030040645

19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	39.00	40.00	41.00	42.00	43.00	44.00	45.00	46.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	39.00	40.00	41.00	42.00	43.00	44.00	45.00	46.00	47.00
2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618

9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200
17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117
0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022
0.068075	0.070097	0.072119	0.074141	0.076163	0.078185	0.080207	0.082229	0.084251	0.086273	0.088295	0.090317	0.092339	0.094361	0.096383	0.098405	0.100427	0.102449	0.104471	0.106493	0.108515	0.110537	0.112559	0.114581	0.116603	0.118625	0.120647	0.122669

0.7987714	0.8039788	0.8090705	0.8140524	0.8189296	0.8237072	0.8283895	0.8329809	0.8374853	0.8419064	0.8462475	0.8505120	0.8547028	0.8588229	0.8628748	0.8668611	0.8707842	0.8746463	0.8784495	0.8821959	0.8858874	0.8895257	0.8931126	0.8966498	0.9001387	0.9035808	0.9069776	0.9103304
8.89033E-03	8.94828E-03	9.00495E-03	9.06040E-03	9.11469E-03	9.16786E-03	9.21998E-03	9.27108E-03	9.32121E-03	9.37042E-03	9.41873E-03	9.46620E-03	9.51284E-03	9.55870E-03	9.60380E-03	9.64816E-03	9.69183E-03	9.73481E-03	9.77714E-03	9.81884E-03	9.85993E-03	9.90042E-03	9.94034E-03	9.97971E-03	1.00185E-02	1.00569E-02	1.00947E-02	1.01320E-02
5.93129E-05	5.79577E-05	5.66712E-05	5.54482E-05	5.42839E-05	5.31740E-05	5.21146E-05	5.11023E-05	5.01338E-05	4.92062E-05	4.83170E-05	4.74637E-05	4.66440E-05	4.58560E-05	4.50978E-05	4.43676E-05	4.36639E-05	4.29852E-05	4.23302E-05	4.16975E-05	4.10860E-05	4.04946E-05	3.99223E-05	3.93682E-05	3.88314E-05	3.83110E-05	3.78062E-05	3.73164E-05
499,723	488,305	477,467	467,162	457,353	448,002	439,076	430,547	422,387	414,573	407,081	399,891	392,986	386,346	379,958	373,806	367,878	362,159	356,640	351,310	346,158	341,175	336,354	331,685	327,162	322,778	318,525	314,399

17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56
0.029333488	0.02866326	0.028027034	0.027422188	0.026846371	0.026297461	0.025773545	0.02527289	0.024793919	0.024335202	0.023895431	0.02347341	0.023068046	0.022678333	0.022303347	0.021942237	0.021594217	0.021258561	0.020934594	0.020621694	0.020319282	0.020026817	0.019743798	0.019469756	0.019204256	0.018946887	0.018697267	0.018455038

47.00	48.00	49.00	50.00	51.00	52.00	53.00	54.00	55.00	56.00	57.00	58.00	59.00	60.00	61.00	62.00	63.00	64.00	65.00	66.00	67.00	68.00	69.00	70.00	71.00	72.00	73.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
48.00	49.00	50.00	51.00	52.00	53.00	54.00	55.00	56.00	57.00	58.00	59.00	60.00	61.00	62.00	63.00	64.00	65.00	66.00	67.00	68.00	69.00	70.00	71.00	72.00	73.00	74.00
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060

4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200

2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618	601,618
9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200	9,287,200
17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117	8,425,206,117
0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022	0.002022
0.124691	0.126713	0.128735	0.130757	0.132779	0.134801	0.136823	0.138845	0.140867	0.142889	0.144911	0.146933	0.148955	0.150977	0.152999	0.155021	0.157043	0.159066	0.161088	0.163110	0.165132	0.167154	0.169176	0.171198	0.173220	0.175242	0.177264
0.9136404	0.9169090	0.9201372	0.9233262	0.9264771	0.9295908	0.9326685	0.9357109	0.9387191	0.9416939	0.9446361	0.9475465	0.9504259	0.9532751	0.9560947	0.9588855	0.9616481	0.9643832	0.9670914	0.9697732	0.9724293	0.9750602	0.9776665	0.9802487	0.9828072	0.9853426	0.9878553
1.01688E-02	1.02052E-02	1.02411E-02	1.02766E-02	1.03117E-02	1.03463E-02	1.03806E-02	1.04145E-02	1.04479E-02	1.04811E-02	1.05138E-02	1.05462E-02	1.05782E-02	1.06100E-02	1.06413E-02	1.06724E-02	1.07031E-02	1.07336E-02	1.07637E-02	1.07936E-02	1.08231E-02	1.08524E-02	1.08814E-02	1.09102E-02	1.09386E-02	1.09669E-02	1.09948E-02
3.68409E-05	3.63790E-05	3.59301E-05	3.54937E-05	3.50692E-05	3.46562E-05	3.42541E-05	3.38625E-05	3.34809E-05	3.31091E-05	3.27466E-05	3.23930E-05	3.20480E-05	3.17113E-05	3.13826E-05	3.10616E-05	3.07479E-05	3.04415E-05	3.01419E-05	2.98489E-05	2.95624E-05	2.92821E-05	2.90078E-05	2.87393E-05	2.84765E-05	2.82190E-05	2.79668E-05
310,392	306,501	302,719	299,042	295,466	291,985	288,598	285,298	282,084	278,951	275,897	272,918	270,011	267,174	264,405	261,700	259,058	256,476	253,952	251,483	249,070	246,708	244,397	242,135	239,920	237,751	235,626
17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928	17,035,928
8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56
0.018219864	0.017991429	0.017769435	0.017553603	0.017343671	0.017139389	0.016940525	0.016746856	0.016558175	0.016374282	0.016194991	0.016020124	0.015849513	0.015682999	0.015520429	0.01536166	0.015206555	0.015054983	0.01490682	0.014761948	0.014620254	0.01448163	0.014345974	0.014213187	0.014083177	0.013955853	0.013831129