UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS

UNITED STATES OF AMERICA, STATE OF ILLINOIS, Plaintiffs, v. KERR-MCGEE CHEMICAL LLC, Defendant.	CIVIL ACTION NO. _____

VOLUME 3

OF 11

APPENDICES TO CONSENT DECREE

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IN UNITED STATES AND ILLINOIS V. KERR-MCGEE CHEMICAL LLC
(N.D. ILLINOIS)

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APPENDIX D

676 PROPERTIES CURRENTLY CONSTITUTING THE RAS

Appendix D

676 Properties Currently Constituting the Residential Areas Site

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
133402	1	0133402001	30W185 Hahndorf
	2	0133402007	Westwood Apts, small portion at W edge of property behind 1248 Kings Circle
403101	3	0403101005	603 Arbor
	4	0403101006, 0403101007 (ROW)	ROW at 303 E. National
	5	0403101012	423 E. National
	6	0403101013	501 E. National
	7	0403101014	505 E. National
403204	8	0403204022, 0403204023	29W304 E. James
	9	0403204030	29W313 Lee
	10	0403204999	unimproved Ridgeland Ave
403300	11	0403300012, 0403300013	548 Belleview
403302	12	0403302006	533 Highland
	13	0403302007	523 Highland
	14	0403302009	509 Highland
	15	0403302010	505 Highland
	16	0403302011	558 Claremont
	17	0403302014	540 Claremont
	18	0403302015	532 Claremont
	19	0403302016	522 Claremont
	20	0403302019	504 Claremont
	21	0403302500	Alley ROW #110
403303	22	0403303002	vacant lot south of 502 E. National
	23	0403303003	545 Claremont
	24	0403303010	505 E. Elmwood
	25	0403303013	542 Elite
403305	26	0403305010, 0403305023	405 Arbor
	27	0403305011	224 E. Elmwood
	28	0403305013	442 Belleview
	29	0403305014, 0403305015	434 Belleview
	30	0403305022	413 Arbor
403307	31	0403307001, 0403307002	451 Highland
	32	0403307003, 0403307004	437 Highland
	33	0403307005	425 Highland
	34	0403307006	419 Highland
	35	0403307008	444 Claremont
	36	0403307009, 0403307010	436 Claremont
	37	0403307011, 0403307022	428 Claremont
	38	0403307014, 0403307015, 0403307016	411 E. Grand Lake
	39	0403307 ROW	Highland Ave ROW on W side of block (east side of street) at fire hydrant
403308	40	0403308005	435 Claremont
	41	0403308018, 0403308022	513 E. Grand Lake

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	42	0403308021	503 E. Grand Lake
403309	43	0403309002, 0403309003	449 Elite
	44	0403309005	435 Elite
	45	0403309013	434 Ingalton
	46	0403309500	Alley #120
403310	47	0403310007, 0403310008	226 E. Grand Lake
	48	0403310009	230 E. Grand Lake
403311	49	0403311009	344 Sophia
	50	0403311010	338 Sophia
	51	0403311015	217 E. York
	52	0403311020	333 Arbor
	53	0403311021	323 Arbor
403312	54	0403312007	230 E. York
	55	0403312009, 0403312010, 0403312011	225 E. McConnell
403313	56	0403313001	131 Arbor
	57	0403313005	122 Sophia
	58	0410100005	137 E.Washington
	59	0410100006	203 E. Washington
	60	0410100007	209 E. Washington
	61	0410100008	116 Sophia
403314	62	0403314011	359 Fairview
403315	63	0403315003, 0403315004, 0403315005	314 Fairview
	64	0403315023	357 E. York
	65	0403315024	361 E. York
403316	66	0403316017	121 Sophia
	67	0403316037	249 E. Washington
403317	68	0403317011	324 Ingalton
	69	0403317013 (ROW)	ROW at 304 Ingalton
403318	70	0403318007	130 N. Oakwood
	71	0410102001	115 Garden
403319	72	0403319020	421 Virgie
403322	73	0403322010	707 Elmwood
	74	0403322500	Alley #113
403323	75	0403323005	730 Elmwood
403324	76	0403324005	728 Wendall
403325	77	0403325011, 0403325012	725 Pine
403326	78	0403326005	225 Ingalton
	79	0403326025	222 N. Oak
	80	0403326500	City Alley #7
	81	0410104004	103 Ingalton
403329	82	0403329006, 0403329007	834 E. Elmwood
403331	83	0403331001	325 N. Oak
	84	0403331002	808 E. Grand Lake
	85	0403331010	815 Pine
403332	86	0403332012	203 N. Oak
	87	0403332020	220 N. Neltnor
	88	0403332022	vacant lot S of 220 N. Neltnor

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
403333	89	0403333004 (ROW)	ROW at 125 N. Oak
	90	0403333005 (ROW)	ROW at 121 N. Oak
	91	0410105006, 0410105007	557 E. Washington
403403	92	0403403008	403 N. Neltnor
403405	93	0403405010	29W178 Woodland
404400	94	0404400014	vacant lot N of 169 W. Grand Lake
	95	0404400015	169 W. GrandLake
	96	0404400016, 0404400017	163 W. GrandLake
	97	0404400018	147 W. GrandLake
	98	0404400025	215 W. GrandLake
404402	99	0404402001	118 W. National
	100	0404402002	553 Yale
	101	0404402003	549 Yale
	102	0404402011	119 W. Elmwood
	103	0404402015	546 Fremont
	104	0404402016	538 Fremont
	105	0404402019	524 Fremont
	106	0404402023	107 W. Elmwood
	107	0404402024	564 Fremont
	108	0404402025	554 Fremont
404403	109	0404403003	549 Fremont
	110	0404403004	545 Fremont
	111	0404403005	539 Fremont
	112	0404403006	533 Fremont
	113	0404403007	527 Fremont
	114	0404403008	521 Fremont
	115	0404403009	513 Fremont
	116	0404403015, 0404403016, 0404403017	546 Arbor
404404	117	0404404010	412 Fremont
	118	0404404012	103 W.Grand Lake
	119	0404404500	Alley #115
404405	120	0404405003	445 Fremont
	121	0404405014	442 Arbor
	122	0404405015	438 Arbor
404408	123	0404408031 (later changed to 04408069)	127 W. York
	124	0404408040	vacant lot on Fremont
	125	0404408059	336 Fremont
	126	0404408063	vacant lot on W. York
404409	127	0404409003	357 Fremont
	128	0404409012	307 Fremont
	129	0404409013	109 E. York
	130	0404409025	308 Arbor
	131	0404409500	Alley #127
404413	132	0404413002	223 Fremont
	133	0404413003	219 Fremont
	134	0404413005	230 Arbor
	135	0404413006	216 Arbor

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	136	0404413007	212 Arbor
404415	137	0409202004	110 Arbor
409103	138	0409103022	General Mills, 704 W. Washington, small portion along E edge of property
	139	0409103999	Avard Ave & ROW
409106	140	0409106017, 0409106018	2 vacant lots at SE corner of Avard & Harrison
	141	0409106019, 0409106020, 0409106021, 0409106022	4 vacant lots W of 232 Norris
	142	0409106023	vacant lot W of 236 Norris
	143	0409106024, 0409106025	2 vacant lots at NE corner of Avard & Fairbank
	144	0409106030	226 Norris
	145	0409106031, 0409106032	202 Norris
409108	146	0409108001, 0409108002, 0409108003, 0409108004	300 Norris
409112	147	0409112004	487 Ann
409200	148	0404410002, 0409200001	120 N. Aurora
	149	0404505003, 0404505005, 0404505006	RR yard
409201	150	0404411001, 0404411003, 0404414001, 0409201002, 0409201033	119 W. Washington
	151	0404412001	160 W. York
	152	0409201006, 0409201009	185 W.Washington
	153	0409201007	207 W. Washington
	154	0409201010	179/181/183 W. Washington
	155	0409201011	175 W. Washington
	156	0409201017	145/147 W.Washington
	157	0409201022	122/124 Fremont
	158	0409201032	157 W. Washington
	159	0409201036	133 N. Aurora
	160	0409201037	123 N. Aurora
409203	161	0409203014	118 W. Washington
409206	162	0409206004	413 W. Washington
	163	0409206005	405 W. Washington
	164	0409206006	400 W. Washington (parking lot)
	165	0409206007	355 W. Washington
	166	0409206008, 0409206009	351 W. Washington
	167	0409206015	303 W. Washington
409208	168	0409208010	341 Harrison
409210	169	0409210002	111 S. Aurora
	170	0409210003	117 S. Aurora
	171	0409210004	123 S. Aurora
	172	0409210005, 0409210009, 0409210011	126 Wood
	173	0409210999	S. Aurora St. ROW
	174	0409211001	125 Wood
409213	175	0409213004	410 Harrison

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	176	0409213008, 0409213009	229 Milo Ct
409214	177	0409214001	350 Harrison
409215	178	0409110001	481 Church
	179	0409215002	461 Church
	180	0409215004	447 Church
	181	0409215008	417 Church
	182	0409215010, 0409215011	403 Church
409216	183	0409216001	351 Church
	184	0409216008	303 Church
	185	0409217001	271 Church
409218	186	0409218001	253 Church
	187	0409218011	237/239 Church
409219	188	0409219012	320 Sherman
	189	0409219013	328 Sherman
	190	0409219014	421 George (empty lot)
	191	0409219016	406 Pearl
	192	0409219017	477 Ann
	193	0409219018	469 Ann
	194	0409219020, 0409219019	461 Ann
	195	0409219021	457 Ann
	196	0409219022	451 Ann
	197	0409219023	445 Ann
409220	198	0409220002	344 Church
	199	0409220008	322 Vine
	200	0409220009	332 Vine
	201	0409220010	336 Vine
	202	0409220013	319 George
	203	0409220014	313 George
	204	0409220015	309 George
409221	205	0409221002	310 Church
	206	0409221004	284 Church
	207	0409221005	274/276 Church
	208	0409221007	317 Vine
	209	0409221009	331 Vine
	210	0409221010	vacant lot E of 317 & 325 Vine
	211	0409221011	337 Vine
	212	0409221012	255 George
	213	0409221500	Alley ROW
409222	214	0409222001, 0409222002	256 Church
	215	0409222003	248 Church
	216	0409222004	242 Church
	217	0409222005	238 Church
	218	0409222010	312 Wood, Carrie Roundy School
409223	219	0409223006	HS parking lot "A", N side of Geneva St
409224	220	0409224001	108 W. Geneva
	221	0409224006	226/228 Joliet
409225	222	0409225001	424 George
	223	0409225002	402 Sherman
	224	0409225004	433 Ann

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	225	0409225005	427 Ann
	226	0409225006	423 Ann
	227	0409225009	405 Ann
409226	228	0409226005	312 George
	229	0409226006	304 George
	230	0409226007, 0409226008	258 George
	231	0409226009	331 Ann
	232	0409226010, 0409226011	323 Ann
	233	0409226012	311 Ann
	234	0409226013	vacant lot on Ann St.
	235	0409226014	303 Ann
	236	0409226015	318 George
	237	0409226500	Alley ROW
409227	238	0409227001	240 George
	239	0409227002	234 George
	240	0409227003	230 George
	241	0409227004	vacant lot on George St.
	242	0409227005	220 George
	243	0409227006	212 George
	244	0409227007	206 George
	245	0409227009	267 Ann
	246	0409227010	263 Ann
	247	0409227011	259 Ann
	248	0409227012	253 Ann
	249	0409227013	249 Ann
	250	0409227014	245 Ann
	251	0409227015, 0409227016	241 Ann
	252	0409227017	322 Wood
	253	0409227500	Alley ROW
409228	254	0409228010 et al. (including 0409222011, 0409222012, 0409222013, 0409222014, 0409222033, 0409222034, 0409224007, 0409224008, 0409224009, 0409228004, 0409228009, 0409228013, 0409228015)	326 Joliet, West Chicago High School
	255	0409228014	120 Geneva, Lincoln Elementary School
409403	256	0409403058, 0409404057, 0409405029, 0409406043, 0409411055, 0409411056, 0409411057, 0409412063, 0409413033, 0409414027, 0409414049	Pioneer Park
	257	0409411020 (ROW)	ROW at 0N185 Sherman
	258	0409411038	418 W. Brown
	259	0409411500	alley ROW
409407	260	0409407003	422 Ann
	261	0409407004, 0409407005	418 Ann

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	262	0409407006, 0409407007	410 Ann
	263	0409407011	427 W. Blair
	264	0409407013	419 W. Blair
	265	0409407015	407 W. Blair
409408	266	0409408002, 0409408003	428 W. Blair
	267	0409408016	524 Sherman
409409	268	0409409001, 0409409002, 0409409003	3 vacant lots on W. Stimmel
	269	0409409008	604 Sherman
	270	0409409017	420 W. Stimmel
	271	0409409019	412 W. Stimmel
	272	0409409023	30W266 Pomeroy
	273	0409409500	Alley ROW
409410	274	0409410018 (ROW)	ROW at 30W267 Pomeroy
409415	275	0409415001	505 Sherman
	276	0409415002	324 Ann
	277	0409415003	320 Ann
	278	0409415004	314 Ann
	279	0409415005, 0409415006	308 Ann
	280	0409415007	304 Ann
	281	0409415008	329 W. Blair
	282	0409415009	323 W. Blair
	283	0409415010	319 W. Blair
	284	0409415011	315 W. Blair
	285	0409415012	311 W. Blair
	286	0409415013	307 W. Blair
	287	0409415500	abandoned alley ROW
409416	288	0409416001	515 Sherman
	289	0409416002	322 W. Blair
	290	0409416003	318 W. Blair
	291	0409416004	314 W. Blair
	292	0409416005	310 W. Blair
	293	0409416006	306 W. Blair
	294	0409416007	523 Sherman
	295	0409416008	323 W. Stimmel
	296	0409416009	319 W. Stimmel
	297	0409416010	315 W. Stimmel
	298	0409416011	311 W. Stimmel
	299	0409416012	307 W. Stimmel
	300	0409416500	abandoned alley ROW
409417	301	0409417005, 0409417006, 0409417011, 0409417012	4 Kerr-McGee vacant lots W of REF at Stimmel, Pomeroy & EJ&E RR
	302	0409417007, 0409417008, 0409417009, 0409417010	4 vacant lots at NE corner of Pomeroy & Sherman
	303	0409417013	603 Sherman
	304	0409417014	320 W. Stimmel
	305	0409417015	316 W. Stimmel
	306	0409417500	Alley ROW

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
409418	307	0409418001 through 0409418012	12 vacant lots W of REF at Pomeroy, Sherman, Brown & EJ&E RR
	308	0409418500	Alley ROW
409424	309	0409424001, 0409424002	2 Kerr-McGee vacant lots at SE corner of Ann & Factory
	310	0409424003	242 Ann
	311	0409424004	238 Ann
	312	0409424005	232 Ann
	313	0409424007, 0409424008	243 W. Blair
	314	0409424009	237 W. Blair
	315	0409424010	231 W. Blair
	316	0409424500	Alley ROW
409425	317	0409425001, 0409425002	244 W. Blair
	318	0409425003	240 W. Blair
	319	0409425004	236 W. Blair
	320	0409425005	232 W. Blair
	321	0409425006, 0409425007, 0409425008	3 Kerr-McGee vacant lots at NE corner of Stimmel & Factory
	322	0409425009, 0409425010	233 W. Stimmel
	323	0409425500	Alley ROW
	324	0409425 ROW	Wood St. ROW on E side of block (W side of Wood St.)
409426	325	0409426001 through 0409426009	9 Kerr-McGee vacant lots between Factory, Wood, Stimmel & Pomeroy
	326	0409426010	233 W. Pomeroy
409427	327	0409427001	246 W. Pomeroy
	328	0409427002	242 W. Pomeroy
	329	0409427003	238 W. Pomeroy
	330	0409427004	604 Wood
	331	0409427005, 0409427006	249 W. Brown
	332	0409427007	243 W. Brown
	333	0409427008	237 W. Brown
	334	0409427009	650 Wood
	335	0409427500	Alley ROW
409428	336	0409428001	222 Ann
	337	0409428002	218 Ann
	338	0409428003	212 Ann
	339	0409428004	208 Ann
	340	0409428005	202 Ann
	341	0409428006	227 W. Blair
	342	0409428007, 0409428008	215 W. Blair
	343	0409428009, 0409428010	203 W. Blair
	344	0409428500	Alley ROW
409429	345	0409429001	222 W. Blair
	346	0409429002	218 W. Blair
	347	0409429003	216 W. Blair
	348	0409429004	212 W. Blair
	349	0409429005	504 Weyrauch

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	350	0409429006	223 W. Stimmel
	351	0409429007	219 W. Stimmel
	352	0409429008	213 W. Stimmel
	353	0409429009	205 W. Stimmel
	354	0409429010	203 W. Stimmel
	355	0409429500	Alley ROW
409430	356	0409430001	603 Wood
	357	0409430002	216 W. Stimmel
	358	0409430003	212 W. Stimmel
	359	0409430004	206 W. Stimmel
	360	0409430005	204 W. Stimmel
	361	0409430006	223 W. Pomeroy
	362	0409430007	217 W. Pomeroy
	363	0409430008	211 W. Pomeroy
	364	0409430009	207 W. Pomeroy
	365	0409430010	201 W. Pomeroy
	366	0409430500	Alley #82
409431	367	0409431001	220 W. Pomeroy
	368	0409431002	216 W. Pomeroy
	369	0409431003	212 W. Pomeroy
	370	0409431004	206 W. Pomeroy
	371	0409431005	202 W. Pomeroy
	372	0409431006, 0409431007	219 W. Brown
	373	0409431008	213 W. Brown
	374	0409431009	207 W. Brown
	375	0409431010	652 Weyrauch
	376	0409431500	Alley #90
409432	377	0409432001	250 W. Brown
	378	0409432002	246 W. Brown
	379	0409432003	242 W. Brown
	380	0409432004	236 W. Brown
	381	0409432005, 0409432006	232 W. Brown
	382	0409432007	224 W. Brown
	383	0409432008	220 W. Brown
	384	0409432009	212 W. Brown
	385	0409432010	204 W. Brown
	386	0409432011	702 Weyrauch
	387	0409432500	Alley ROW
409434	388	0409434007	143 W. Blair
	389	0409434008	137 W. Blair
	390	0409434009	133 W. Blair
	391	0409434010	129 W. Blair
	392	0409434011	123 W. Blair
	393	0409434012	117 W. Blair
	394	0409434013	111 W. Blair
	395	0409434014	402 Joliet
	396	0409434017, 0409434006	HS parking lot "B" on S side of Ann St.
	397	0409434021	424 Joliet
409435	398	0409435001	505/509 Weyrauch

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	399	0409435002	138 W. Blair
	400	0409435003	132 W. Blair
	401	0409435004	vacant lot on W. Blair
	402	0409435005	124 W. Blair
	403	0409435006	118 W. Blair
	404	0409435007, 0409435008	139 W. Stimmel
	405	0409435009	133 W. Stimmel
	406	0409435010	129 W. Stimmel
	407	0409435011 (ROW)	ROW at 125 W. Stimmel
	408	0409435012	119 W. Stimmel
	409	0409435013	502 Joliet
	410	0409435014	510 Joliet
	411	0409435016	518 Joliet
	412	0409435017	524 Joliet
	413	0409435500	Alley ROW
409436	414	0409436001	603 Weyrauch
	415	0409436002	138 W. Stimmel
	416	0409436003	132 W. Stimmel
	417	0409436009	143 W. Pomeroy
	418	0409436010, 0409436011	139 W. Pomeroy
	419	0409436012	125 W. Pomeroy
	420	0409436015	610 Joliet
	421	0409436016, 0409436017, 0409436018	614 Joliet
409437	422	0409437001, 0409437002	140 W. Pomeroy
	423	0409437003, 0409437004	132 W. Pomeroy
	424	0409437005	122 W. Pomeroy
	425	0409437006	114 W. Pomeroy
	426	0409437007	653 Weyrauch
	427	0409437008	139 W. Brown
	428	0409437009	135 W. Brown
	429	0409437010	127 W. Brown
	430	0409437011	123 W. Brown
	431	0409437012	vacant lot W of 119 W. Brown
	432	0409437014, 0409437015	106 W. Pomeroy
	433	0409437017	642 Joliet
	434	0409437018, 0409437019	646 Joliet
	435	0409437500	Alley ROW
409438	436	0409438001	703 Weyrauch
	437	0409438002	138 W. Brown
	438	0409438006	141 W. Hazel
	439	0409438007	139 W. Hazel
	440	0409438008	133 W. Hazel
	441	0409438010	125 W. Hazel
	442	0409438012	700 Joliet
	443	0409438013, 0409438015	710 Joliet
	444	0409438017, 0409438018	105 W. Hazel
	445	0409438019, 0409438020	124 W. Brown
	446	0409438022	118 W. Brown

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	447	0409438500	Alley ROW
409439	448	0409439001	142 W. Hazel
	449	0409439002	138 W. Hazel
	450	0409439003, 0409439004	134 W. Hazel
	451	0409439005, 0409439006	122 W. Hazel
	452	0409439007	743 Weyrauch
	453	0409439008	137 W. Lester
	454	0409439009, 0409439010	133 W. Lester
	455	0409439022, 0409439023	121 W. Lester
	456	0409439500	ROW and alley
409440	457	0409440004, 0409440005	118 W. Lester
	458	0409440006	114 W. Lester
	459	0409440007	826 Joliet
	460	0409440008, 0409440009, 0409440010, 0409440019, 0416202005, 0416202006	900 Joliet
	461	0409440011	802 Joliet
410109	462	0410109011	vacant lot on High St
410110	463	0410110001	203 High
	464	0410110003	217 High
	465	0410110004	221 High
	466	0410110005	229 High
	467	0410110007	200 Fulton
	468	0410110008	206 Fulton
	469	0410110009	212 Fulton
410113	470	0410113006	314 High
410114	471	0410114001	202 Center
	472	0410114007	302 Fulton
	473	0410114008	314 Fulton
	474	0410114009	318 Fulton
410116	475	0410116005	416 E. Washington
	476	0410116021	443 Summit
410117	477	0410117001	524 E. Washington
410118	478	0410118008	444 Summit
	479	0410118015	431 Colford - vacant lot
	480	0410118017	449 Colford
	481	0410118018, 0410118019	453 Colford
410119	482	0410119001	405 Main
	483	0410119002	411 Main
	484	0410119007	210 Chicago
	485	0410119040	447 Main
410121	486	0410121019	242 Allen
410122	487	0410122016, 0410122017, 0410122018, 0410122019, 0410122022	155 Spencer
	488	0410122025	230 Parker
	489	0410122026	236 Parker
	490	0410122028, 0410122029	213 Spencer
410124	491	0410124001	305 Joliet

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	492	0410124002	112 Spencer
	493	0410124005	325 Joliet
	494	0410124006	333 Joliet
	495	0410124007	345 Joliet
	496	0410124010	312 Allen
	497	0410124012	328 Allen
	498	0410126006	302 Barber
410127	499	0410127006	319 Barber
	500	0410127007	329 Barber
410201	501	0410201018	130 Easton
410204	502	0410204003	312 Easton
	503	0410204004	320 Easton
	504	0410204009, 0410204010	326 Easton
410300	505	0410125001	357 Joliet
	506	0410300004	413 Joliet
	507	0410300006	425 Joliet
	508	0410300009, 0410300010	138 Conde
	509	0410300013	412 Barber
	510	0410300014	418 Barber
410301	511	0410301001	202 Conde
410305	512	0410305002	511 Joliet
	513	0410305017	137 E. Stimmel
	514	0410305020	138 E. Blair
	515	0410305500	Alley ROW
410306	516	0410306002	206 E. Blair
	517	0410306003, 0410306004	212 E. Blair
	518	0410306005	218 E. Blair
	519	0410306011	207 E. Stimmel
	520	0410306012	213 E. Stimmel
410309	521	0410309002	611 Joliet
	522	0410309003	615 Joliet
	523	0410309004, 0410309005	621 Joliet
	524	0410309009	132 E. Stimmel
	525	0410309010, 0410309011, 0410309012	140 E. Stimmel
	526	0410309013	119 E. Pomeroy
410310	527	0410310012	209 E. Pomeroy
410311	528	0410311020	311 E. Pomeroy
	529	0410311021	315 E. Pomeroy
410313	530	0410313004 (ROW)	ROW at 645 Joliet
	531	0410313005	647/653 Joliet
	532	0410313012	144 E. Pomeroy
410314	533	0410314001	204 E. Pomeroy
	534	0410314003	218 E. Pomeroy
	535	0410314004	226 E. Pomeroy
	536	0410314006	236 E. Pomeroy
	537	0410314007	634 Blakely
410315	538	0410315004	314 E. Pomeroy
410317	539	0410317008	727 Joliet

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	540	0410317009, 0410317010	733 Joliet
	541	0410317025	320 E. Brown
	542	0410317032	313 E. Hazel
	543	0410317041	208 E. Brown
410321	544	0410321001	530 E. Brown
	545	0410321012	700 S. Neltnor
410322	546	0410322001, 0410322002	747 Joliet
	547	0410322007	238 E. Hazel, West Chicago Junior High School
	548	0410322012, 0410322013	847 Joliet
410414	549	0410414051	29W074 Bolles
411317	550	0411317007, 0411317008, 0411317009 (ROW)	ROW at 28W755 Lester
	551	0411317036	28W739 Lester
	552	0411317999	Lester Street N of block 0411317
414304	553	0414304007	28W744 Gary's Mill Rd
	554	0414304008	28W721 Roosevelt
415100	555	0415100001	130 E. Forest, Gary Elementary School
415101	556	0415101002 (later changed to 0415101029)	336 E. Forest
	557	0415101027	933 Bishop
	558	0415101032	901 Bishop
415117	559	0415117018	vacant lot E of Jewel on Roosevelt
415200	560	0415200003	0S315 Rt. 59, vacant lot near STP
415300	561	0415300005, 0415300009	0S551 Joliet
415305	562	0415305002	0S641 Joliet
	563	0415305006	29W516 Wilson
	564	0415305007	vacant lot on Wilson
416200	565	0416200006	0S110 Pearl
416201	566	0416201001, 0416201002	2 Kerr-McGee vacant lots on Pearl
	567	0416201003	0S031 Pearl
416206c	568	0416206001 *	30W185 Roosevelt vacant lot *
	569	0416206002	30W131 Roosevelt
416206	570	0416206006 *	30W176 May *
	571	0416206007	30W160 May
	572	0416206009	30W134 May
	573	0416206017, 0416206018	30W368 May
416401	574	0416205001 *	30W216 May *
	575	0416401001	0S410 Circle
	576	0416401012 *	vacant lot on Joy, W of creek *
416402	577	0416402001 *	0S451 Circle *
	578	0416402002, 0416402003 *	0S501 & 0S511 Circle *
	579	0416402004 *	0S525 Circle *
	580	0416402005 *	0S425 Circle *
	581	0416402999 *	Circle Drive at May Street *
	582	0416207001	30W151 May
	583	0416403001	0S410 Gunness
	584	0416403002	0S424 Gunness
	585	0416403003	0S438 Gunness

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	586	0416403004	0S450 Gunness
	587	0416403005	0S464 Gunness
	588	0416403006	0S478 Gunness
	589	0416403007	vacant lot on Gunness
	590	0416403008	vacant lot at Gunness & Joy
416404	591	0416208002	0S400 Melolane
	592	0416404002	0S425 Gunness
	593	0416404003	0S437 Gunness
	594	0416404004	0S451 Gunness
	595	0416404005	0S463 Gunness
	596	0416404006	0S477 Gunness
	597	0416404010	0S410 Melolane
	598	0416404011	0S424 Melolane
	599	0416404012	0S438 Melolane
	600	0416404013	0S450 Melolane
	601	0416404014	0S464 Melolane
	602	0416404015	0S478 Melolane
	603	0416404016	0S504 Melolane
	604	0416404017	0S520 Melolane
416405	605	0416405001	0S411 Melolane
	606	0416405002	0S423 Melolane
	607	0416405003	0S437 Melolane
	608	0416405004	0S451 Melolane
	609	0416405005	0S463 Melolane
	610	0416405006	0S479 Melolane
	611	0416405007	0S503 Melolane
	612	0416405008	0S521 Melolane
	613	0416405009	0S531 Melolane
	614	0416209002, 0416405010	1400 Joliet
	615	0416405012	1424 Joliet
	616	0416405014	1450 Joliet
	617	0416405015	1464 Joliet
	618	0416405016	1478 Joliet
	619	0416405019	1532 Joliet
416406	620	0416406001 *	30W121 Joy *
	621	0416406003	30W075 Joy
	622	0416406004	30W065 Joy
	623	0416406005	30W055 Joy
	624	0416406006	30W047 Joy
	625	0416406007	30W035 Joy
	626	0416406008, 0416406009	1556 Joliet
416407	627	0416407001 *	30W150 Wilson *
422104	628	0422104003 *	1S275 Edgewood *
Lobe 05	629	0415401002	0S450 RiverGlen
Lobe 06	630	0411319019	vacant lot at Sunset & Barnes
	631	0411319032 (ROW)	ROW at 28W668 Forest
	632	0411320005	vacant lot on Sunset
	633	0411320006	0 N 007 Sunset
	634	0411320024, 0411320025	0N035 Sunset

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	635	0411319999	Sunset St. between Barnes & Forest
Lobe 07	636	0410403001, 0410403002, 0410403003	0N340 & 0N370 Prince Crossing
	637	0410407007, 0410407008	29W092 Pomeroy
	638	0410407009, 0410407010, 0410407011	29W084 Pomeroy
	639	0410407021 (ROW)	ROW at 29W069 Blair
	640	0410407023 (ROW)	ROW at 29W041 Blair
	641	0410407999	Blair St. ROW between Coolidge & Prince Crossing
Lobe 08	642	0410404014	0N327 S. Neltnor
	643	0410404018	0N300 Easton
	644	0410404019, 0410404020	29W356 Pomeroy
	645	0410404033	29W330 Pomeroy
	646	0410405002, 0410405003	0N315 Easton
	647	0410405004	0N283 Easton
	648	0410405005	vacant lot at Easton & Pomeroy
	649	0410409004, 0410409005	0N231 Easton
	650	0410409018 (ROW)	ROW at 29W280 Brown
Lobe 09	651	0403408003	1N117 Ridgeland
	652	0403408004	1N119 Ridgeland
	653	0403408005	1N063 Ridgeland
Lobe 10	654	0403331013, 0403331014	837 Pine
Lobe 11	655	0404102008, 0404102009	30W680 Lee
	656	0404102010, 0404102011	1N561 Lane
	657	0404102012	1N599 Lane
Lobe 12	658	0406401011, 0406401012, 0406401013	vacant lots at 1N070 Kress Rd.
ROWs W of REF	659	Pomeroy St. undeveloped ROW	undeveloped Pomeroy St. ROW between blocks 409417 & 409418
EJ&E RR Project at Ann St.	660	0409506001	portion of parcel for EJ&E RR project, areas N & S of Ann St
BN RR	661	BN RR ROW	Burlington Northern Railroad ROW between EJ&E RR & Town Rd.
EJ&E RR	662	EJ&E RR ROW	EJ&E RR ROW between Westwin Subdivision & Lee Rd area
Misc. Streets	663	Hazel St. ROW	Hazel St. between Weyrauch & Joliet
	664	Lester St. ROW	Lester St. between Weyrauch & Joliet
	665	Weyrauch St. ROW	Weyrauch St. between Lester & Brown
Streets/ Plastic Barriers	666	Ann St. ROW	Ann St. ROW at Factory St.
	667	Blair St. ROW	Blair St. ROW, 2 blocks between Factory & Weyrauch
	668	Brown St. ROW	Brown St. ROW, 2 blocks between Factory & Weyrauch
	669	0409227999	George St. ROW between Wood & EJ&E RR

Deliverable Unit Identifier[1]	Property Count	Parcel ID Number[2,3,4]	Street Address or Other Identifier[2]
	670	0409226999	George St. ROW between EJ&E RR & Sherman
	671	0406401999	Kress Rd. ROW east of 1N070 Kress
	672	Pomeroy St. ROW	Pomeroy St. ROW between Factory & Wood
	673	Sherman St. ROW at George St.	Sherman St. ROW at 402, 320 & 328 Sherman
	674	0409409999	Sherman St. ROW between Stimmel & Pomeroy, east of 30W266 Pomeroy
	675	Stimmel St. ROW	Stimmel St. ROW, 2 blocks between Factory & Weyrauch
	676	Wood St. ROW	Wood St. ROW, 4 blocks from Ann to Brown

Footnotes:

[1] Deliverable Unit: discreet grouping of adjacent parcels, typically (but not always) based on contiguous city block identified by first 7 digits of tax ID # after dropping leading "0"

[2] ROW: right-of-way

[3] "500" in parcel ID number designates alley

[4] "999" in parcel ID number designates street

* RAS does not include contaminated areas of property being addressed as part of Kress Creek Site

Consent Decree in the matter of United States and Illinois v. Kerr-McGee Chemical LLC, relating to the Kerr-McGee West Chicago NPL Sites.

APPENDIX E

RAS RECORD OF DECISION

EPA Region 5 Records Ctr.
200911

Kerr- McGee Residential Areas Site

Record of Decision

West Chicago, Illinois

United States
Environmental Protection Agency

Region 5

September 2003

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This Record of Decision (ROD) documents the remedy selected for the Kerr-McGee Residential Areas Site in West Chicago, DuPage County, Illinois. The ROD is organized in three sections: a *Declaration*, a *Decision Summary* and a *Responsiveness Summary*.

1.0 DECLARATION

This section summarizes the information presented in the ROD and includes the authorizing signature page.

1.1 Site Name and Location

The Kerr-McGee Residential Areas Site (CERCLIS #ILD980824015) is comprised of residential, institutional, commercial, industrial and municipal properties in and around West Chicago, DuPage County, Illinois, located about 30 miles west of downtown Chicago. EPA's study area for the site included 2,174 individual properties.

1.2 Statement of Basis and Purpose

This decision document presents the selected remedy for the Kerr-McGee Residential Areas Site in West Chicago, Illinois. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). Information used to select the remedy is contained in the Administrative Record file for the site. The Administrative Record file is available for review at the EPA Region 5 Records Center, 77 West Jackson Boulevard, Chicago, Illinois, and on CD-ROM at the West Chicago Public Library, 118 West Washington Street, West Chicago, Illinois.

1.3 Description of Selected Remedy

EPA has determined that the ongoing non-time-critical removal action at the Kerr-McGee Residential Areas Site is eliminating existing and potential risks to human health and the environment at the site. As a result, the selected remedy for the Kerr-McGee Residential Areas Site is no further action after the ongoing non-time-critical removal action is completed.

1.4 Statutory Determinations

EPA has determined that no further remedial action is necessary at the Kerr-McGee Residential Areas Site. EPA issued an Action Memorandum for the Residential Areas Site in November 1994 for a non-time-critical removal action at the site. The Action Memorandum concluded that contaminated soil should be removed until a cleanup criterion of 5 picoCuries per gram (pCi/g) above background for total radium (radium-226 + radium-228) was achieved. EPA measured the background concentration at the Residential Areas Site as 2.2 pCi/g, thereby establishing the cleanup criterion for the Residential Areas Site at 7.2 pCi/g.

Kerr-McGee initiated a non-time-critical removal action at the Residential Areas Site in April 1995, and EPA anticipates that the cleanup of all contaminated properties that don't have unresolved access issues will be completed during 2003. EPA has concluded that the ongoing removal action is successfully removing the radiologically-contaminated soil from the site. As of September 1, 2003, 670 of the 676 contaminated properties identified by EPA have been cleaned up to levels at or below the cleanup criterion for the site. Since the 7.2 pCi/g cleanup criterion is considered protective of human health and the environment, the ongoing non-time-critical removal action has eliminated the need to conduct further remedial action. Therefore, no further action is necessary to protect public health or the environment at the Residential Areas Site after completion of the non-time-critical removal action.

1.5 Support Agency Acceptance

The State of Illinois has indicated a willingness to concur with the selected remedy. The State of Illinois' concurrence letter will be added to the Administrative Record upon receipt.

1.6 Authorizing Signatures

9/29/03

William E. Muno, Director
Superfund Division
United States Environmental Protection Agency, Region 5

Date

2.0 DECISION SUMMARY

2.1 Site Name, Location and Description

The Kerr-McGee Residential Areas Site (CERCLIS #ILD980824015) is located in and around West Chicago, DuPage County, Illinois, approximately 30 miles west of downtown Chicago. The West Chicago area is shown in Figure 1. The area is characterized as suburban, with primarily high-density, single-family residential housing built before 1960. The site was placed on the National Priorities List (NPL) in 1990. EPA conducted a fund-lead remedial investigation at the site, with the State of Illinois (including the Illinois EPA and the Illinois Department of Nuclear Safety) serving as the support agency. In 1994 EPA ordered Kerr-McGee (the potentially responsible party at the site) to conduct a non-time-critical removal action at the site. EPA expects Kerr-McGee to complete the cleanup of all contaminated properties (with the exception of a small number that have unresolved access issues) during 2003.

The Residential Areas Site is comprised of residential, institutional, commercial, industrial and municipal properties in the West Chicago area that were contaminated with radioactive waste materials that originated from the West Chicago Rare Earths Facility (REF), a facility that conducted thorium milling operations. Additional background information about the REF is provided in the following section.

2.2 Site History and Enforcement Activities

The radioactive contamination at the Residential Areas Site originated at the REF. The REF, operated by Lindsay Light and Chemical Company and its successors from 1932 until 1973, produced radioactive elements such as thorium, radium and uranium, along with gas lantern mantles, for private entities and the United States government's use in federal atomic energy programs. The REF produced these elements by extracting them from monazite sands, bastnasite (rare earth ore) and other ores using an acid leaching process. Production of these radioactive elements resulted in the generation of radioactive mill tailings that contained residual levels of thorium, radium and uranium, as well as certain other insoluble metals. Over several decades, before the health risks associated with radioactive materials were generally recognized, the mill tailings were available for use as free fill material by residents and contractors. Winds also may have spread some of the mill tailings stored on the REF to nearby properties. As a result of the wind-blown contamination and the use of the tailings as fill material, the soil at many properties in the West Chicago area became contaminated with radioactive materials. Kerr-McGee purchased the REF in 1967 and maintained operations until closing the facility in 1973. The REF was licensed by the Nuclear Regulatory Commission (NRC).

After the facility's closure, Argonne National Laboratory conducted radiological characterization activities for the NRC from 1976 to 1978 to identify properties outside the REF that were contaminated with materials from the REF. These studies included an aerial radiological flyover survey in 1977 by EG&E Aerial Measurements, a street-by-street vehicle survey, external gamma

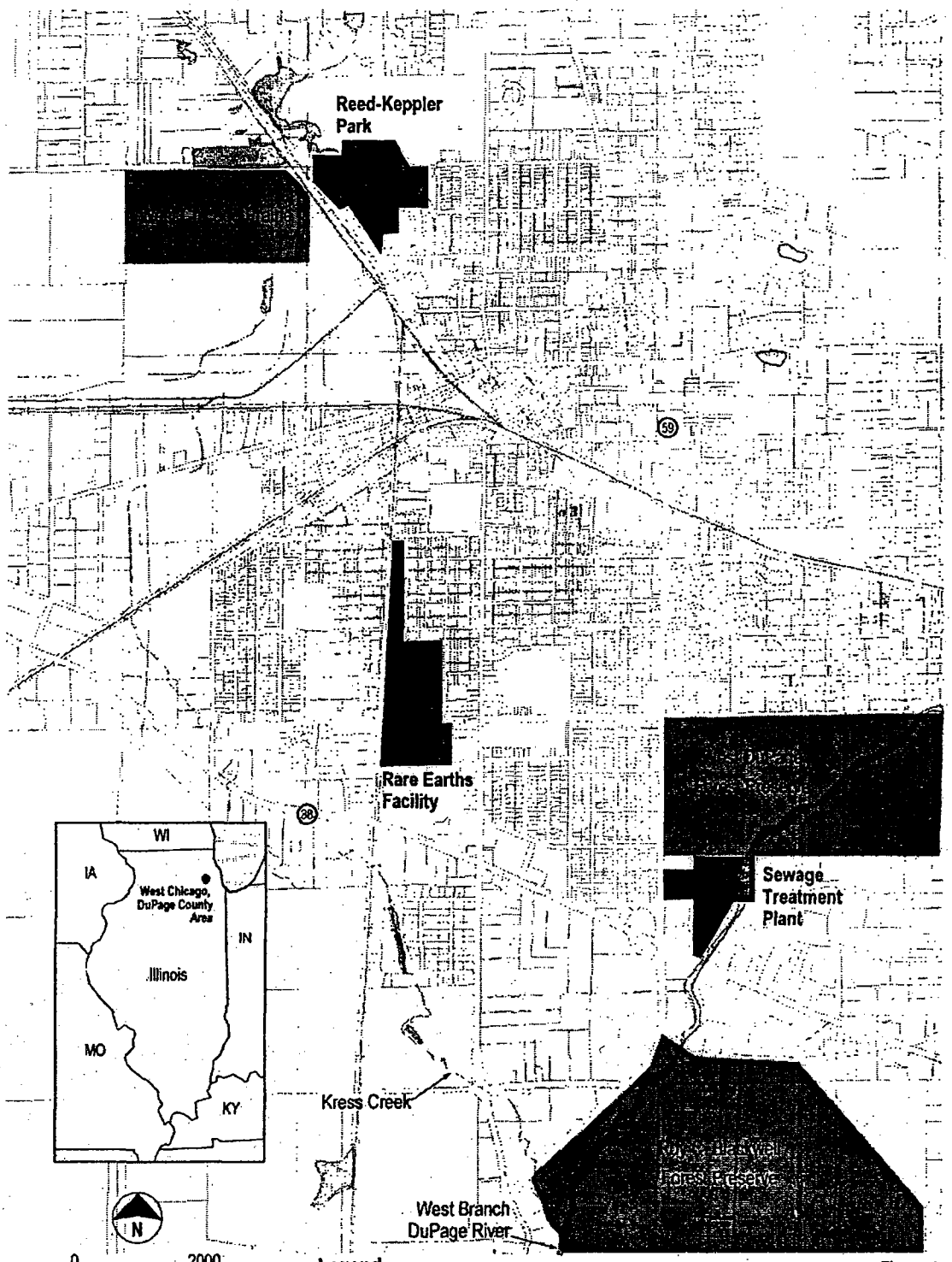


Figure 1
Location Map of West Chicago
Kerr-McGee West Chicago

exposure rate surveys and soil sampling. In addition to identifying contaminated areas in Reed-Keppler Park, the Sewage Treatment Plant and Kress Creek/West Branch DuPage River (all of which were eventually placed on the NPL and which are depicted on Figure 1), these studies identified radiological contamination in a number of residential areas. NRC conducted some additional radiological surveys in the neighborhoods surrounding the REF in 1981.

In anticipation of proposing the Residential Areas Site for the NPL, EPA conducted additional radiological testing in 1983 and 1984 at a limited number of properties located near the REF, including indoor radon monitoring and outdoor gamma surveys. EPA proposed the site for the NPL in October 1984.

Following the NRC's earlier surveys, Kerr-McGee conducted radiological surveys at properties throughout the city and identified 117 with radiation exposure rates exceeding 30 micro-Roentgens per hour (μR/hr) at 1 meter, the level established by the company for initiation of cleanup. In 1984 and 1985, Kerr-McGee and the City of West Chicago conducted a voluntary residential cleanup program (the city was responsible for property restoration), removing the most highly contaminated materials from properties within the city. Kerr-McGee placed the excavated materials at the REF, which is located within the city limits. When Kerr-McGee later began to clean up the most highly contaminated materials from a number of properties located in unincorporated West Chicago, the city would not allow Kerr-McGee to bring contaminated materials from outside the city into the city. As a result, even after the voluntary cleanup program ended, thorium residuals still existed at properties both above and below the 30 μR/hr cleanup level established by Kerr-McGee.

Prior to finalization of the NPL listing, in 1986 EPA prepared a remedial investigation (RI) report for the "Kerr-McGee Radiation Sites" covering residential areas as well as Reed-Keppler Park, the Sewage Treatment Plant and Kress Creek. The 1986 RI relied predominantly on existing data from the sites and drew conclusions about potential exposure routes and risks to human health and the environment from exposure to the radiological contaminants. The RI did not include extensive sampling to determine the extent of contamination at the sites.

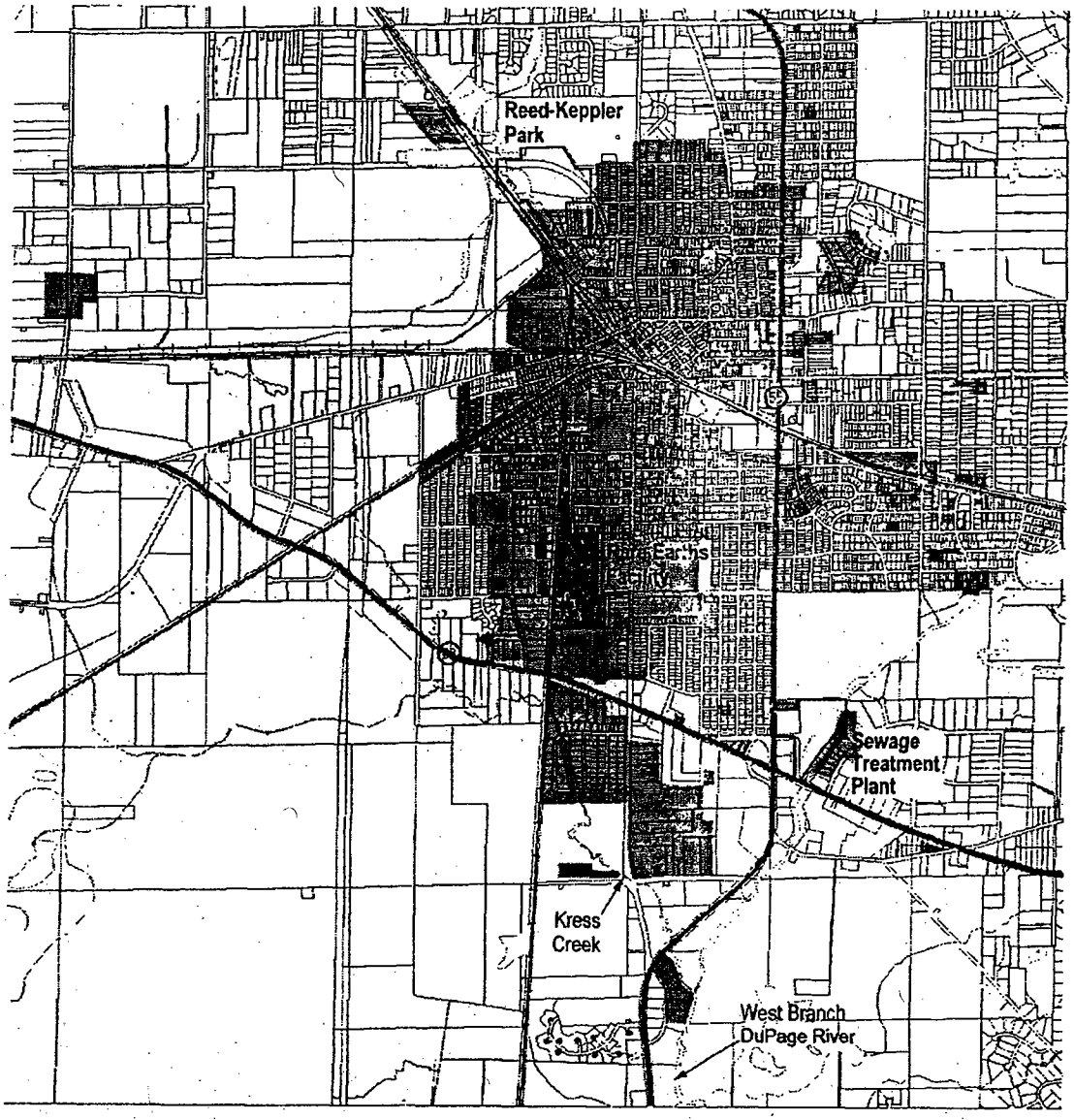
The State of Illinois petitioned the NRC for amendment of the agreement-state licensing program to include licensing control of REF material. The Illinois Department of Nuclear Safety (IDNS) gained licensing authority in November 1990. During the previous year (1989), EG&G Aerial Measurements conducted a second aerial flyover survey of the West Chicago area for IDNS. The 1989 flyover was more sensitive than the 1977 survey and identified additional areas of elevated radioactivity. Following the flyover, IDNS conducted ground-level radiological surveys of a number of residential properties to identify the cause of the radiological anomalies identified by the flyover. The IDNS surveys consisted of outdoor gamma walkover surveys and collection of soil samples if elevated readings were found. Additionally, at the request of the school district, IDNS conducted radiological surveys of seven schools.

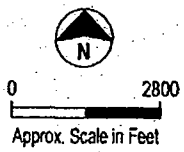
EPA placed the Residential Areas Site on the NPL in August 1990 and began a fund-lead remedial investigation/feasibility study (RI/FS) at the site in 1993. EPA's RI was designed to identify those areas in and around West Chicago most likely to have been impacted by site contaminants and to identify contaminated properties by testing all potentially-impacted properties. EPA's study area for the site ultimately included 2,174 individual properties, most of which were residential properties but which also included schools, businesses and city-owned properties. EPA's original study area at the beginning of the RI was based on the results of the 1989 flyover and included approximately 1,300 properties that were located within the boundaries of the areas identified by the flyover. EPA later expanded the site study area based on (1) the results of its 1995 and 1996 "scanner van" surveys that identified additional areas of elevated radioactivity and (2) other available radiological survey information obtained from the City and the State. EPA's final study area for the site is depicted in Figure 2.

Knowing that there were limited options for cleaning up radioactive contamination and that the site investigation fieldwork could last several years due to the size of the site and the number of properties to be tested, EPA decided early in the RI process to accelerate site cleanup by using removal authorities. EPA conducted a preliminary focused risk assessment in 1993 based on limited sampling data that was available for seven contaminated properties. The preliminary risk assessment concluded that risks to human health at the contaminated residential properties exceeded EPA's acceptable risk range. EPA established cleanup criteria for the site in 1993 based on applicable or relevant and appropriate requirements (ARARs) from existing federal and state regulations. Remedial actions under CERCLA are required to comply with ARARs, while removal actions must comply with ARARs "to the extent practicable." Even though EPA decided to conduct a removal action at the site, EPA chose to fully comply with ARARs during the removal action in anticipation of the removal action being the final action at the site.

The primary cleanup criterion EPA established for the site was for outdoor soil concentrations and specified a cleanup standard of 5 pCi/g above background for total radium. The cleanup standard was derived from the federally-promulgated regulations found at 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings." The 40 CFR 192 standards apply to specific designated sites subject to the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). The regulations at 40 CFR 192 are not applicable to the Kerr-McGee Residential Areas Site, but EPA deemed portions of the regulations (and the state regulations derived from them) as relevant and appropriate to the site. The 5 pCi/g-above-background standard in 40 CFR 192 was developed as a health-based standard and is considered protective of human health and the environment.

Because EPA planned to pursue a non-time-critical removal action at the site, EPA conducted an Engineering Evaluation/Cost Analysis (EE/CA) to evaluate various removal alternatives. The EE/CA was finalized in August 1994 and recommended that the removal action consist of excavation and off-site disposal of the radiologically-contaminated materials.





Legend

EPA's Approximate Site Study Area

Figure 2
EPA's Site Study Area
Kerr-McGee West Chicago

In April 1994 EPA sent Kerr-McGee a general notice of potential liability for the site. EPA attempted to negotiate an Administrative Order on Consent (AOC) with Kerr-McGee for the removal action, but negotiations failed and on November 18, 1994, EPA simultaneously signed an Action Memorandum and issued a Unilateral Administrative Order (UAO) to Kerr-McGee. The Action Memo selected excavation and off-site disposal as the non-time-critical removal action to be implemented at the site and specified the cleanup standard of 5 pCi/g above background for total radium. (EPA later determined site background to be 2.2 pCi/g, resulting in a cleanup standard of 7.2 pCi/g.) The Action Memo also specified that additional measures (such as institutional controls) could be implemented as part of the removal action for those limited and exceptional situations where complete excavation of contaminated materials could not be accomplished and such measures were needed to reduce exposures and associated risks. The UAO required Kerr-McGee to conduct the removal action. Kerr-McGee complied with the UAO and began cleanup work at the site in April 1995.

During the removal action, Kerr-McGee, EPA and IDNS all played important roles. EPA, under its fund-lead RI fieldwork, would identify contaminated properties and notify Kerr-McGee of its findings. After having detailed discussions with the affected property owners, Kerr-McGee would excavate the contaminated materials from each property until it believed it had achieved the cleanup standard. EPA would then notify IDNS, and IDNS would conduct testing and laboratory analysis to verify that the cleanup standard was met. After confirming that the standard was met, EPA would authorize Kerr-McGee to backfill and restore the property. This process continued throughout the removal action on a property-by-property basis. Kerr-McGee transported the excavated materials to the REF, where the materials were loaded on railcars and shipped to a licensed permanent disposal site in Utah.

EPA conducted the bulk of its site investigations from 1994 through 1996, and after expanding the site study area, from 1998 through 2000. IDNS also conducted site investigations for EPA at a number of properties as EPA gained access from property owners who previously had not granted access. The EPA and IDNS investigations consisted of outdoor gamma radiation walkover surveys at each property and, if needed, collection and analysis of soil samples. EPA also conducted indoor testing at some properties during the early years of its investigation but discontinued them after 1996 because they were not adding value to the investigation.

To help refine the site study area, in 1995 and 1996 EPA used the mobile scanner van from EPA's Office of Radiation and Indoor Air in Las Vegas to conduct street-by-street radiological surveys in the West Chicago area. The scanner van is a modified commercial delivery truck equipped with sensitive radiation detection instruments. The scanner van surveys identified additional radiological anomalies outside EPA's original site study area and helped shape EPA's decision to significantly expand the site study area in 1998. Other factors leading to expansion of the study area included radiological survey information obtained from IDNS (which routinely tests properties at the request of the owner for properties located outside EPA's study area) and the City of West Chicago (which tests areas of planned city construction projects if located outside EPA's study area).

As a result of the EPA and IDNS site investigations, EPA identified 676 contaminated properties. Only three of the 2,174 properties in the site study area have not yet been tested, and five of the identified contaminated properties have unresolved access issues currently preventing cleanup of those properties. EPA will continue its efforts to gain access to those properties for testing and/or cleanup. In accordance with the November 1994 Action Memo, in the event that cleanup cannot be accomplished at some or all of the remaining properties within a reasonable amount of time (due to unresolved access issues or other factors), institutional controls would be put into effect as part of the removal action until such time as cleanup can be completed. If necessary, institutional controls such as deed notices could be used to ensure that prospective purchasers and new owners were aware that the property is contaminated and has not yet been cleaned up. Similar deed notices could be used for the properties not yet tested to notify people that the property is located within EPA's study area but has not yet been tested. EPA would be responsible for implementing and monitoring such institutional controls to ensure their effectiveness until such time as the testing and required cleanup of all properties is completed under the removal action.

As of September 1, 2003, Kerr-McGee has cleaned up 670 of the 676 contaminated properties and has removed 110,627 cubic yards of contaminated soil from the site. A summary of cleanup progress is shown in Table 1.

Table 1
Summary of Cleanup Progress

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
Number of Properties Cleaned Up	44	94	129	116	114	95	71	7	(a)	670
Volume Removed (yd^3)	12,452.3	36,086.3	16,047.4	21,969.0	8,134.0	9,455.5	5,515.5	967.5	(a)	110,627.5

(a) Cleanup numbers from 2003 pending.

The verification data collected by IDNS at the 670 properties already cleaned up show that the removal action is successfully removing the contamination from the site and achieving protective cleanup levels. IDNS collected 2,604 samples from the 670 properties to verify that Kerr-McGee met the cleanup standard. The average result from those samples was 2.9 pCi/g, which is well below the 7.2 pCi/g cleanup standard.

EPA finalized its RI report for the site early in July 2003 and issued a Proposed Plan for public comment on July 10, 2003. Because the removal action was adequately remediating the site and achieving protective cleanup levels, EPA did not prepare an FS report for the site.

When the removal action at the site is completed, Kerr-McGee will submit a final removal action report to EPA for review and approval.

2.3 Community Participation

The Proposed Plan for the Residential Areas Site was made available to the public for comment on July 10, 2003. On that day, copies of the Proposed Plan and the final RI Report (as well as other supporting documents) were placed in the local Information Repository located at the West Chicago Public Library, 118 West Washington Street, West Chicago, Illinois, and copies of the Proposed Plan were mailed to all interested persons on EPA's community relations mailing list for the site that has been developed over the past decade of site activity. Copies of the Proposed Plan also were mailed to all persons on the distribution list for minutes of the West Chicago Intergovernmental Forum, and copies of the final RI Report were provided to forum members who requested copies. The Intergovernmental Forum is a group comprised of persons representing city, county, state and federal government entities (including local, state and federal elected officials), the Thorium Action Group (a local community activist group), and Kerr-McGee.

Copies of all documents supporting the remedy outlined in the Proposed Plan are located in the Administrative Record file for the site, located at the EPA Records Center, 77 West Jackson Boulevard, Chicago, Illinois. The Administrative Record file was available for review as of July 10, 2003. In addition, a copy of all the documents in the Administrative Record file was put on CD-ROM and mailed to the local Information Repository on July 31, 2003.

A public comment period was held from July 10, 2003, to August 11, 2003. A public meeting was held at the West Chicago City Hall on July 29, 2003, to present the Proposed Plan. The notice announcing the public meeting and the availability of the Proposed Plan was published in the ***Daily Herald*** on July 21, 22, 27 and 29, 2003, and in the ***West DuPage Post/Press*** on July 24, 2003. Representatives of EPA, the Illinois EPA and IDNS were present at the public meeting to answer questions regarding the proposed remedy. Responses to comments received during the public comment period (including comments received at the public meeting) are included in the Responsiveness Summary, which is Section 3.0 of this ROD.

Prior to EPA issuing the Proposed Plan, there were other opportunities for public input related to the cleanup activities at the site. The two most notable opportunities are briefly described below:

- When developing the cleanup criteria for the site, EPA released the draft cleanup criteria for public comment in March 1993 and held a well-attended public meeting on March 15, 1993, to present the proposed criteria and obtain input. As a result of public comments received, EPA made changes to the cleanup criteria when it finalized the cleanup criteria document in November 1993.

- The public comment period for the EE/CA, which was extended based on a timely request for a 15-day extension, ran from August 4 to September 19, 1994. EPA published notice of the public comment period, the public meeting and the availability of the EE/CA in the ***West Chicago Press*** on August 4, 1994. EPA held a public meeting on

August 17, 1994, to explain the recommended removal action, answer questions, and accept public comments on the plan. Notice of extension of the public comment period was published in the ***Daily Herald*** on September 7, 1994.

In addition to the two public comment periods noted above, EPA also mailed out fact sheets and held public meetings and/or availability sessions at various times during the project, including at the start of the RI, when EPA expanded the site study area, and during the removal action to provide progress reports to the public regarding cleanup progress at the site. EPA also developed a Community Relations Plan for the Kerr-McGee West Chicago sites in 1994.

Lastly, since February 1993 EPA has been a principal participant in the West Chicago Intergovernmental Forum meetings. The forum meetings have proven to be an effective two-way communication tool between EPA and representatives of various stakeholder groups.

2.4 Scope and Role of Operable Unit or Response Action

The Residential Areas Site is being addressed as a single operable unit under the CERCLA framework. Therefore, the selected remedy specified in this ROD will serve as the final action for the entire site.

2.5 Site Characteristics

The Residential Areas Site was contaminated by thorium mill tailings from the REF that were used as fill material at properties or that reached properties near the REF through windblown deposition. As a result, most of the contamination at the site was located primarily at the surface, lending itself to discovery through radiological surface scans of potentially affected properties.

The contaminants of concern at the Residential Areas Site are radionuclides. The mill tailings from the REF (the original source of the contaminants) consisted primarily of thorium-232 but also contained uranium-238. Each of these radionuclides is the parent of a radiological decay chain. Thorium-232 decays to produce radium-228, and uranium-238 decays to produce radium-226. For the Residential Areas Site, the concentrations of radium-228 and radium-226 were combined, and known as "total radium", to characterize the amount of radioactive contamination in site soil. Based on the comparatively high radiotoxicity of radium-226 and radium-228, those specific two radionuclides are the contaminants of concern at the Residential Areas Site.

Ionizing radiation has been shown to be a carcinogen, a mutagen and a teratogen. The probability of cancer induction increases with increasing radiation dose. EPA classifies all radionuclides as known human carcinogens, based on their property of emitting ionizing radiation and on the extensive weight of evidence provided by epidemiological studies of radiogenic cancers in humans. EPA's evaluation of the health risks from radionuclides consider the carcinogenic effects only, because in most cases, cancer risks are limiting, exceeding both mutagenic and teratogenic risks.

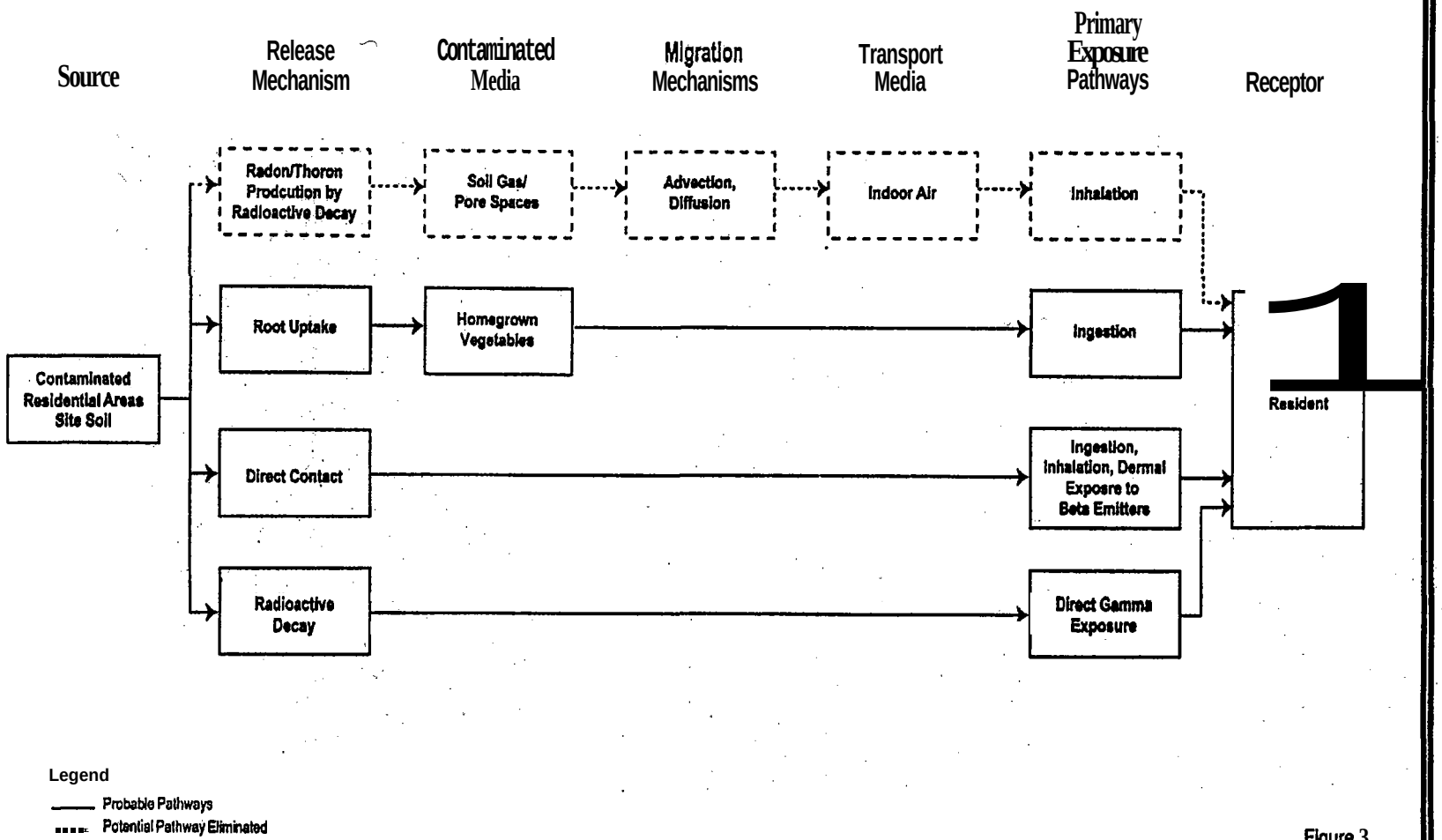
The radiological contaminants of concern are very insoluble (unless in the presence of strong acids) and immobile. This fact, combined with the surface deposition of the contamination, led EPA to eliminate ground water and surface water as media of concern very early in the RI planning process. Additionally, IDNS has performed sampling and analysis of private wells since 1989 at the owners' request. No private wells have ever shown any indication of radiological contamination, even at properties with extensive amounts of soil contamination. Ground water and surface water, therefore, are not discussed further in this document.

The tailings from the REF also were known to contain metals such as barium, lead and chromium. EPA conducted testing for these metals at the Residential Areas Site at the beginning of the RI field investigation and found that concentrations of metals at the site did not exceed levels of concern. Therefore, metals were eliminated as contaminants of potential concern (COPCs). However, even if metals had been retained as COPCs, due to their chemical and physical properties (e.g., very immobile) they would have been co-located with the radiological contamination and would have been removed along with the radiological contamination during the removal action.

EPA developed a conceptual site model during the planning phase of the RI and then continued to refine it throughout the investigation. The final conceptual site model is shown in Figure 3.

Potential receptors (humans) can be exposed to site contaminants in soil by three main release mechanisms and their resulting exposure pathways: (1) uptake of contaminants by plant roots, with subsequent ingestion of homegrown vegetables, (2) direct contact with the contaminants through ingestion, inhalation and dermal contact, and (3) radioactive decay of the contaminants, with exposure to the resulting external gamma radiation. A fourth mechanism, production of radon (radon-222, from the uranium-238 decay chain) and thoron (radon-220, from the thorium-232 decay chain) and the resulting inhalation of those constituents, was eliminated as a potential pathway after EPA evaluated the results of the indoor testing conducted early in the investigation; elevated levels of radon and thoron were not observed, even at properties with contamination adjacent to the walls of the house. Because the land use at the site is predominantly residential, EPA did not include ecological receptors in its conceptual site model.

The study area for the Residential Areas Site included 2,174 individual properties, resulting in EPA testing approximately 945 acres of land. Only 3 of the 2,174 properties remain to be tested. So far, 676 contaminated properties have been identified. In the final RI report EPA estimated the total size of the contaminated areas it identified as approximately 53 acres. EPA conducted the bulk of its site investigations from 1994 through 1996, and after expanding the site study area, from 1998 through 2000. IDNS also conducted site investigations for EPA at a number of properties as EPA gained access from property owners who previously had not granted access. (The acreage numbers above do not include properties/contaminated areas that were surveyed/



Legend

—— Probable Pathways

▪▪▪▪ Potential Pathway Eliminated

Potential contaminants of concern: Th-232 and U-238 and daughters

Figure 3
Conceptual Site Model
Kerr-McGee West Chicago

identified by IDNS. The number of properties tested by IDNS was far fewer than the number tested by EPA, so the acreage numbers above would increase by a small amount if the IDNS surveys were included.)

Due to the contaminants at the site being located in deposits at or near the surface of properties, EPA's sampling strategy for each property included outdoor gamma radiation walkover surveys of virtually 100% of all accessible areas of the property. Gamma surveys provided data on the location, surface distribution and relative amount (based on gamma count rate) of surface soil radiological contamination. Radiation survey instruments were coupled to a global positioning system (GPS), with gamma count rates and location coordinates recorded every two seconds. This resulted in the collection of about 1,100 point readings (northing, easting, and gamma activity) for a typical property measuring roughly 10,000 square feet. Data were later uploaded into a database and a geographic information system (GIS) was used to map survey results.

Early in the field investigation EPA conducted a pilot study to develop a correlation (for the instrumentation used in the investigation) between gamma radiation readings and soil concentrations of total radium. After developing this correlation, EPA relied primarily on the gamma survey results to make decisions about whether properties were contaminated. Soil samples still were collected as needed, however, particularly in areas where gamma results indicated radiological concentrations close to the 7.2 pCi/g cleanup standard. All soil samples were analyzed by the IDNS laboratory in West Chicago.

During the removal action at the site, for the 670 properties already cleaned up, Kerr-McGee has removed 110,627 cubic yards of contaminated soil from the site. The lateral and vertical extent of the contamination on each contaminated property varied widely, with some properties having less than 1 cubic yard of contamination and others having several thousand cubic yards. Concentrations of contaminants also varied widely, with some properties having concentrations slightly greater than the 7.2 pCi/g cleanup standard and others having concentrations of several hundred to a few thousand pCi/g. (Some of the highest concentrations were measured by Kerr-McGee during the cleanup of certain properties; those readings were not discovered during EPA's field investigation and were not included in EPA's risk assessment for the site.) Except for the properties located adjacent to the REF that had windblown contamination, there was no predictable pattern of contamination, as use of the tailings as fill material varied from neighborhood to neighborhood and even from property to property on the same block.

2.6 Current and Potential Future Site and Resource Uses

The Residential Areas Site, as its name implies, is comprised primarily of residential properties. The West Chicago area is characterized as suburban, with primarily high-density, single-family residential housing. While the site does include some properties with other land uses (e.g., schools, businesses, vacant lots), the predominant current land use is residential. EPA assumed that the long-term future land use would continue to be residential. Based on EPA's discussions over the years with representatives of the local community and other stakeholders, there is no

disagreement with EPA's assumption regarding future land use. EPA's cleanup criteria for the site used during the non-time-critical removal action are protective of human health and the environment for residential land use.

As mentioned in section 2.5 of this document, neither ground water nor surface water are media of concern at the Residential Areas Site, so information on the potential beneficial uses of those media are not discussed in this document.

2.7 Summary of Site Risks

Even though the removal action had addressed nearly all of the contaminated properties and removed most of the contamination from the site, EPA's July 2003 RI report included a human health risk assessment based upon the pre-removal conditions at the site. The risk assessment in the RI report helped demonstrate that there was a health-based need to remove the thorium contamination from the Residential Areas Site. EPA previously had conducted (in 1993, prior to the removal action) a preliminary focused risk assessment based on limited sampling data available at the time. This section of the ROD will discuss only the risk assessment contained in the RI report, as it was based on a much more extensive data set. Because the land use at the site is predominantly residential, and knowing that risks to human health would drive the cleanup, EPA did not conduct an ecological risk assessment at the site.

Radium-226 and radium-228, both carcinogens, were the contaminants of concern at the site, so only carcinogenic risks were evaluated. The risk associated with the intake of a known or suspected carcinogen is reported in terms of the incremental lifetime cancer risk presented by that contaminant of concern, as estimated using the appropriate slope factor and the amount of material available for uptake. The acceptable risk range, as defined by CERCLA and the NCP, is 1×10^{-4} to 1×10^{-6} (one human in ten thousand to one human in one million incremental cancer incidence).

The risk assessment developed point of contact estimates for five specific properties that represented the reasonable maximum exposure (RME) scenario for the site. All exposure assumptions were based on residential land use at the site. The risk assessment concluded that risks for the RME scenario at the site (prior to the removal action) exceeded the upper limit of the acceptable risk range (1×10^{-4}). Specifically, risks at the site ranged from 1×10^{-3} to 7×10^{-3}. More detailed information with respect to how this risk was calculated can be found in the *Final Remedial Investigation Report, Kerr-McGee Residential Areas Site, July 2003*. This risk assessment supported the need to take action at the site.

As mentioned in Section 2.2 of this document, EPA issued a UAO to Kerr-McGee in November 1994 requiring Kerr-McGee to conduct a non-time-critical removal action at the site. Kerr-McGee began cleanup work in April 1995 and, as of September 1, 2003, has cleaned up 670 of the 676 identified contaminated properties.

The verification data collected by IDNS at the 670 properties already cleaned up show that the removal action is successfully removing the contamination from the site and achieving protective cleanup levels. IDNS collected 2,604 samples from the 670 properties to verify that Kerr-McGee met the cleanup standard. The average result from those samples was 2.9 pCi/g, which is well below the 7.2 pCi/g cleanup standard. Therefore, once the removal action at the site is completed, the soils at the Residential Areas Site will be considered protective of human health and the environment and no further action will be needed at the site.

2.8 Documentation of Significant Changes

The Proposed Plan for the Residential Areas Site was released for public comment on July 10, 2003. The Proposed Plan recommended that no further action be taken at the site after completion of the ongoing removal action. EPA reviewed all written and verbal comments submitted during the public comment period and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

3.0 RESPONSIVENESS SUMMARY

This section of the ROD presents public comments regarding the Proposed Plan for the Kerr-McGee Residential Areas Site and provides responses to those comments. EPA carefully considered all comments prior to selecting the final site remedy documented in this ROD.

EPA received three written comments during the 30-day public comment period from July 10, 2003, to August 11, 2003, and three verbal comments during the public meeting on July 29, 2003. The comments and EPA's responses to the comments are presented below:

Comment #1: This public comment is submitted on behalf of the City and residents of West Chicago with respect to the U.S. EPA's Final Remedial Investigation Report and Proposed Plan for the Residential Site. Based on the most recently published Fact Sheet on the Residential Site, we understand that the public comment period for the above-referenced documents runs to August 11, 2003. Therefore this comment must be considered to have been submitted in a timely manner.

The Proposed Plan presents the U.S. EPA determination that no further response action is needed for the Residential Sites once the ongoing removal action is completed. It is our understanding, that completion of the removal action will entail not only completion of the activities at the six to nine remaining identified properties, but also a resolution on any questions as to the adequacy of the mid-1980's clean up. That earlier clean up reflected a different standard than the 7.2 pCi/gram total radium standard used for the ongoing removal action. Therefore a question exists as to whether any of the properties subject to the prior clean up require additional work to make sure that the 7.2 pCi/gram standard has been met. It is our understanding that resolution of that question, as well as any supplemental work that is required will be completed as part of the ongoing removal action before the no further action decision becomes effective.

In the Final Remedial Investigation Report, the Agency used a partition coefficient (kd) of 250 which was derived from a literature source. It is our understanding that Agency policy for risk assessments is generally to use measured kd values or to rely on default values, in this instance, RESRAD defaults. As a general matter, measured or appropriate defaults should be incorporated in risk evaluations as provided in Agency guidance. Because the literature value used is virtually identical to the measured kd value, in this instance, there is no need to change from the kd value used.

West Chicago and its residents have been intimately involved in the implementation of the removal action throughout the community. We are very pleased with and thankful for the U.S. EPA's management of this complex action over the past several years, and are especially pleased to be nearing a no further action determination. We wholeheartedly support that no further action approach once the ongoing removal activities are completed as presented in the Proposed Plan.

Response #1: Although the Proposed Plan does not specifically address the issue of the adequacy of the mid-1980's cleanup, EPA and City representatives have discussed this issue and your understanding is indeed correct. EPA has agreed to evaluate and resolve the issue, and if any additional work is needed at the properties subject to prior cleanup, to conduct that additional work as part of the ongoing removal action. Only after the ongoing removal action is complete will the no further action decision become effective.

EPA's risk assessment guidance gives the Agency discretion and allows professional judgement in selecting appropriate distribution coefficients for a particular site. It is true that the risk assessment guidance is generally to use measured kd values, but only if a sufficient number of data points are available so that the Agency can be confident that the measured values are statistically significant and representative of soils at the site. In this case, EPA judged that the number of samples (5 composites) reported in the 1981 Law Engineering report was fairly limited. This, in combination with the fact that the samples were composited from different strata representative of surface and subsurface soils, led EPA to not rely solely on the measured kd values. In lieu of measured values, default values (in this case RESRAD defaults) can be used, but any default values should be evaluated to ensure they are representative of site soils and appropriate for use at the site. EPA judged that the RESRAD defaults were not representative of the soils at the West Chicago Residential Areas Site and therefore not appropriate for use in the Residential risk assessment. As a result, EPA relied on values obtained from a literature source for the specific soil types found at the West Chicago Residential Areas Site, and judged that the literature values were more appropriate for the site than the RESRAD default values. The literature values, as you note, were virtually identical to the measured kd value.

EPA understands that you support the selected remedy and appreciates your comment.

Comment #2: In reviewing the final Remedial Investigation Report and Proposed Plan for the Residential Site in West Chicago, we noted that no mention is made of the homes on Brown and Wood Streets which were subject to clean up last year. We understand that that clean up was done by Kerr-McGee under Illinois Department of Nuclear Safety oversight. However, we believe it would be appropriate for the circumstances surrounding this residential area to be explained in the Remedial Investigation Report so that the public is aware of the scope and results of the clean up. Additionally, we believe some means of including this area within the proposal of No Further Action for the Residential Site is important.

Response #2: The purpose of the Remedial Investigation Report is to document EPA's investigation of the Residential Areas Site, the findings of the investigation, and to briefly summarize the ongoing removal action to support selection of a final remedy. EPA made a conscious decision not to include any property-specific information in the Remedial Investigation Report due to privacy concerns for privately-owned residential properties. Therefore, neither the properties along Brown and Wood Streets nor any other specific neighborhoods are explicitly mentioned in the report. The properties on Brown and Wood Streets are located within EPA's study area, and thorium contamination in that neighborhood was investigated and cleaned up as

part of the Residential Areas Site. Therefore, these properties are included in the Remedial Investigation Report and are included in the "No Further Action" proposal for the site.

After cleanup of the thorium contamination in that specific neighborhood, additional cleanup work at some of the properties along Brown and Wood Streets was found to be necessary after discovery of an old buried pipe that apparently carried uranium in an easterly direction years ago from the Kerr-McGee facility. The testing that was conducted for the uranium contamination was not part of EPA's remedial investigation for the site, nor was the cleanup of the uranium contamination part of EPA's Superfund cleanup of the site. As a result, EPA did not include a discussion of the uranium cleanup in the Remedial Investigation Report. The uranium investigation and cleanup was conducted under the direction of the Illinois Department of Nuclear Safety (IDNS, now the Illinois Emergency Management Agency, Division of Nuclear Safety) as part of the ongoing cleanup of the Kerr-McGee facility under that facility's radioactive materials license. EPA will inform the IDNS of your comment and will suggest that they or Kerr-McGee include a discussion of the uranium cleanup along Brown and Wood Streets in a publicly-releasable document.

Also, please note that all property owners whose property was cleaned up as part of the EPA removal action will receive a letter from EPA documenting that their property was cleaned up. EPA understands that IDNS already has sent letters to the property owners along Brown and Wood Streets whose properties underwent the uranium cleanup.

Comment #3: I would like to propose a nine hole golf course for the land where the factory and Kerr-McGee office and train loading facility was located. I propose the land be donated to the city of West Chicago and the golf course be operated by a private company. The golf course could also be a part of the West Chicago Park District open to the public and also used by the high school for a golf program.

Response #3: Thank you for your comment. EPA is not really involved in the cleanup of the Kerr-McGee facility nor decisions about its future use. EPA understands that, under the terms of an agreement between Kerr-McGee and the City of West Chicago, the facility will be turned over to the City once the cleanup of the facility is complete. EPA will forward your comment to the City of West Chicago for its consideration.

Comment #4: (From the public meeting of July 29, 2003) - I would like to say that everyone I have worked with, the EPA guys, Kerr-McGee, any of them, have gone out of their way to help and tried to understand my feelings. My house was on stilts for three months. No basement, no nothing. I was in Batavia for three months. And I couldn't have been treated any better. Of course it was upsetting, but that was part of it.

Response #4: Thank you for your comment.

Comment #5: (From the public meeting of July 29, 2003) - Basically I just want to say that I believe this is not only appropriate, but the best proposed action, no further cleanup. And yet it leaves contingency that the sites that have been identified to be tested to get consent and to be cleaned up will be completed and that any new sites can be addressed through IDNS and Kerr-McGee. So I feel that this has been - - all these entities have worked together, especially the EPA, as kind of a lead entity on this in a precedent-setting manner and that this proposed action is justified. And I, as a city official and a member of the Thorium Action Group, have all confidence that this has accomplished and will be accomplishing exactly the kind of cleanup that the people of West Chicago deserve.

Response #5: EPA understands that you support the selected remedy and appreciates your comment.

Comment #6: (From the public meeting of July 29, 2003) - I think it would be a good idea to go ahead and write the record of decision on this, and go ahead and move forward. One more chapter closed, you know.

Response #6: EPA understands that you support the selected remedy and appreciates your comment.

Consent Decree in the matter of United States and Illinois v. Kerr-McGee Chemical LLC, relating to the Kerr-McGee West Chicago NPL Sites.

APPENDIX F

RAS UNILATERAL ADMINISTRATIVE ORDER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region V

IN THE MATTER OF: Kerr-McGee Residential Areas Removal Site Kerr-McGee Chemical Corporation, Respondent Proceeding Under Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. § 9606(a))	)	Docket No. V-W- '95-C-272

UNILATERAL ADMINISTRATIVE ORDER
FOR REMOVAL ACTIONS

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I. INTRODUCTION AND JURISDICTION

1. This Order directs Respondent to perform the removal actions described herein to abate an imminent and substantial endangerment to the public health, welfare or the environment that may be presented by the actual or threatened release of hazardous substances at or from the Site. This Order is issued to Respondent by the United States Environmental Protection Agency ("U.S. EPA") under the authority vested in the President of the United States by § 106(a) of CERCLA. This authority was delegated to the Administrator of U.S. EPA on January 23, 1987, by Executive Order 12580 (52 Fed. Reg. 2,926), and was further delegated to the Regional Administrator on September 13, 1987 by U.S. EPA Delegation No. 14-14-A and 14-14-B, and to the Director, Waste Management Division, Region V, by Regional Delegation Nos. 14-14-A and 14-14-B.

II. PARTIES BOUND

2. This Order shall apply to and be binding upon Respondent and its successors and assigns. Respondent is responsible for carrying out all actions required by this Order. No change in the ownership, corporate status, or other control of Respondent shall alter any of Respondent's responsibilities under this Order.

3. Respondent shall provide a copy of this Order to any prospective owners or successors before a controlling interest in Respondent's assets, property rights, or stock are transferred to the prospective owner or successor. Respondent shall provide a copy of this Order to each contractor, subcontractor, laboratory, or consultant retained to perform any Work under this Order, within five days after the effective date of this Order or on the date such services are retained, whichever is later. Respondent shall also provide a copy of this Order to any person acting on behalf of Respondent with respect to the Site or the Work and shall ensure that all contracts and subcontracts entered into hereunder require performance under the contract to be in conformity with the terms and Work required by this Order. With regard to the actions undertaken pursuant to this Order, each contractor and subcontractor shall be deemed to be related by contract to Respondent within the meaning of § 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3). Notwithstanding the terms of any contract, Respondent is responsible for compliance with this Order and for ensuring that its contractors, subcontractors and agents perform all Work in accordance with this Order.

4. Not later than thirty (30) days prior to any transfer of any interest of Respondent in any real property included within the Site, Respondent shall submit a true and correct copy of the transfer documents to U.S. EPA, and shall identify the

transferee(s) by name, principal business address and effective date of the transfer.

III. DEFINITIONS

5. Unless otherwise expressly provided herein, terms used in this Order which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in the statute or its implementing regulations. Whenever terms listed below are used in this Order or in the documents attached to this Order or are incorporated by reference into this Order, the following definitions shall apply:

a. "Action Criteria Document" shall mean the November 1993 U.S. EPA document entitled "Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site, West Chicago, Illinois" which is attached hereto as Attachment 3. The Action Criteria Document is incorporated into this Order and is an enforceable part of this Order.

b. "Action Memorandum" shall mean the U.S. EPA Action Memorandum relating to the Site signed in November 1994 by the Remedial Project Manager/On-Scene Coordinator and the Regional Administrator, U.S. EPA, Region V, and all attachments thereto, which is attached as Attachment 2. The Action Memo is incorporated into this Order and is an enforceable part of this Order.

c. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601 to 9675.

d. "City" shall mean the City of West Chicago, DuPage County, Illinois.

e. "Day" shall mean a calendar day unless expressly stated to be a working day. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the end of the next working day.

f. "EE/CA" shall mean the August 1994 Engineering Evaluation and Cost Analysis conducted by U.S. EPA pursuant to Section 300.415(b)(4)(i) of the NCP.

g. "IEPA" shall mean the Illinois Environmental Protection Agency.

h. "IDNS" shall mean the Illinois Department of Nuclear Safety.

i. "Kress Creek NPL Site" shall mean the Kerr-McGee Kress Creek/West Branch of DuPage River Site placed on the NPL in February 1991.

j. "Lindsay Light" shall mean the Lindsay Light and Chemical Company.

k. "National Contingency Plan" or "NCP" shall mean the National Contingency Plan promulgated pursuant to § 105 of CERCLA, 42 U.S.C. § 9605, and codified at 40 C.F.R. Part 300, and any amendments thereto.

l. "NPL" means the "National Priorities List" as defined in Section 300.5 of the NCP.

m. "NRC" means the United States Nuclear Regulatory Commission.

n. "Paragraph" shall mean a portion of this Order identified by an Arabic numeral.

o. "Performance Standards" shall mean those cleanup standards, standards of control, and other substantive requirements, criteria or limitations, identified in the Action Criteria Document, Action Memorandum and Statement of Work, that the Work required by this Order must attain and maintain.

p. "REF" shall mean the Kerr-McGee Rare Earths Facility, 258 Ann Street, West Chicago, Illinois.

q. "Residential Areas NPL Site" shall mean the Kerr-McGee Residential Areas Site placed on the NPL in August 1990.

r. "Residential Areas Removal Site" or "Site" shall mean all properties within the Residential Areas NPL Site and the Kress Creek NPL Site at which U.S. EPA determines that Respondent shall perform Work.

s. "Respondent" shall mean the Kerr-McGee Chemical Corporation.

t. "Response Costs" shall mean all costs, including direct costs, indirect costs, and interest incurred by the United States to perform or support response actions at the Site, including, but not limited to, contract and enforcement costs.

u. "RPM/OSC" shall mean U.S. EPA's Remedial Project Manager/On-Scene Coordinator.

v. "Section" shall mean a portion of this Order identified by a Roman numeral and includes one or more paragraphs.

w. "Section 106 Administrative Record" shall mean the Administrative Record which includes all documents considered or relied upon by U.S. EPA in preparation of this Order. The Section 106 Administrative Record Index is a listing of all documents included in the Section 106 Administrative Record, and is appended hereto as Appendix 1.

x. "State" shall mean the State of Illinois.

y. "Statement of Work" or "SOW" shall mean the statement of work for implementation of the removal actions at the Site, which is attached hereto as Attachment 1. The Statement of Work is incorporated into this Order and is an enforceable part of this Order.

z. "Work" shall mean all actions Respondent is required to perform under this Order and all attachments hereto, including, but not limited to removal actions.

IV. FINDINGS OF FACT

Based on available information, including the Section 106 Administrative Record in this matter, U.S. EPA hereby finds that:

6. The REF was established in 1932 by Lindsay Light to extract thorium and rare earth compounds from ore, a process which

produced mill tailings classified as "11(e)(2) byproduct material" pursuant to 42 U.S.C. § 2014(e)(2). NRC records indicate that, during the 1930's and 1940's, Lindsay Light transported mill tailings from the REF for disposal at the areas now known as the Kerr-McGee Reed-Keppler Park and West Chicago Sewage Treatment Plant NPL Sites and that, in the process of such transport, mill tailings came to be located at the Site. Preliminary investigations by the U.S. EPA indicate that Lindsay Light also transported mill tailings in a company truck from the REF to the Site upon request for use as fill, posted a notice on a company bulletin board advertising the availability of mill tailings for general use as fill, and allowed people to remove mill tailings from the REF for use as fill at the Site.

7. The Lindsay Light and Chemical Company merged into the American Potash & Chemical Company in 1958; the American Potash & Chemical Company merged into Respondent in 1967.

8. The REF ceased operations in 1973 and is undergoing closure proceedings through the IDNS.

9. The REF mill tailings located at the Site contain radionuclides, which radioactively decay, emitting ionizing radiation such as alpha particles, beta particles and gamma radiation. Exposure to ionizing radiation, if at sufficiently high doses and dose rates, can cause carcinogenic, genetic and

teratogenic effects. The mill tailings also contain heavy metals, including lead, barium and chromium. Effects of chronic exposure to low levels of lead range from anemia to impairment of the nervous, hematopoietic and cardiovascular systems. The effects of exposure to barium can include paralysis, cardiovascular abnormalities and gastroenteritis. Chronic ingestion of hexavalent chromium can cause kidney damage, while chronic inhalation can cause lung cancer.

10. The Site is not secured to protect the general public or individual residents from contact with hazardous substances.

11. Based on results of investigations done on behalf of the NRC and the U.S. EPA, and taking into account such factors as populations at risk, the potential of hazardous substances being present, the potential for contamination of drinking water supplies and the destruction of sensitive ecosystems, the Residential Areas NPL Site was placed on the NPL in August 1990.

12. During 1984 and 1985, Kerr-McGee and the City conducted cleanup actions at 116 contaminated properties within the City that had been identified as contaminated by Kerr-McGee, based on a gamma exposure rate criterion of 30 μR/hr at 1 meter from the ground surface. Several properties within the City were not cleaned up, either through failure to obtain access from the property owner or technical impractic-bilities in removing

contaminated material. In addition, although a number of properties outside the City exceeded the 30 μR/hr criterion, only one of them was cleaned up, because the City declined to allow the contaminated materials to be brought into the City. U.S. EPA staff was sometimes present at these cleanups, but the cleanups were never formally approved by U.S. EPA or carried out pursuant to any U.S. EPA program.

13. In November 1993, U.S. EPA established criteria for the identification and cleanup of radionuclides at the Site. The U.S. EPA criteria are more stringent than the 30 μR/hr criterion used in the 1984 and 1985 cleanups and are contained in the Action Criteria Document. The U.S. EPA believes that the presence of any lead, barium and chromium at the Site is due to the presence of the mill tailings and that excavation of the mill tailings to the cleanup standards for radionuclides contained in the Action Criteria Document will adequately mitigate any risk presented by these metals. U.S. EPA is conducting a pilot study to determine if metals are present at levels of concern. If, after completion of the pilot study, U.S. EPA determines that response action beyond that required under the current terms of this Order is necessary to mitigate any risk presented by the metals, U.S. EPA will follow the procedures in Section IX (Additional Work).

14. Since U.S. EPA will have had a planning period of at least six months before on-Site actions are initiated, the removal actions at the Site are considered "non-time-critical" and, therefore, U.S. EPA conducted the EE/CA, as required by Section 300.415(b)(4)(i) of the NCP.

15. In January 1994, EPA began fieldwork to identify areas that exceed the Discovery and Characterization Criteria set forth in the Action Criteria Document.

16. On April 14, 1994, U.S. EPA sent Respondent a general notice of potential liability, which notified Respondent that Respondent is considered a potentially responsible party under Section 107(a) of CERCLA and encouraged Respondent to agree to reimburse U.S. EPA for costs incurred by U.S. EPA at the Site and to voluntarily perform removal actions at the Site. In reply to the notice, Respondent indicated that it would be willing to enter negotiations with U.S. EPA regarding an administrative order on consent for such response actions. Respondent and U.S. EPA pursued negotiations through October 1994. On October 31, 1994, Respondent notified U.S. EPA that it could not accept the terms of the administrative order on consent offered by U.S. EPA, and, therefore, U.S. EPA deemed negotiations to have failed.

17. In November 1994 U.S. EPA issued the Action Memorandum for the Site, pursuant to OSWER Directive 9360.3-01, selecting the removal actions described in Paragraph 25.

V. CONCLUSIONS OF LAW AND DETERMINATIONS

Based on the Findings of Fact set forth above, and the Section 106 Administrative Record, U.S. EPA has determined that:

18. The Site is a "facility" as defined by Section 101(9) of CERCLA.

19. Radionuclides, lead, chromium and barium are "hazardous substances" as defined by Section 101(14) of CERCLA.

20. Respondent is a "person" as defined by Section 101(21)of CERCLA.

21. Respondent is a person who may be liable under Section 107(a) of CERCLA and, therefore, subject to an administrative order under Section 106(a) of CERCLA.

22. The conditions described in the Findings of Fact above and the Action Memorandum constitute an actual or threatened "release" of a hazardous substance from the facility into the "environment" as defined by Sections 101(8) and (22) of CERCLA.

23. The conditions present at the Site constitute a threat to public health, welfare, or the environment based upon the factors set forth in Section 300.415(b)(2) of the NCP. These factors include, but are not limited to, the following:

a. actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants; this factor is present at the Site due to the existence of mill tailings in the soils of residential and non-residential properties, including areas which are or may be used for recreation or gardening.

b. high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; this factor is present at the Site due to the existence of mill tailings in surface and near subsurface soils that may migrate due to wind, erosion, deliberate human movement, or migration of radon/thoron gas from soils into structures.

c. weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released; this factor is present at the Site due to the existence of mill tailings in surface and near subsurface soils that may migrate due to wind or erosion.

24. The actual or threatened release of hazardous substances from the Site may present an imminent and substantial endangerment to the public health, welfare, or the environment within the meaning of Section 106(a) of CERCLA.

25. Based on the conditions at the Site and the actual or threatened release of hazardous substances from the Site, U.S. EPA determined in the Action Memorandum that the following removal actions are necessary (more details on the selected removal actions are contained in the Action Memorandum):

a. excavating contaminated materials from properties at the Site found to exceed the discovery and characterization criteria contained in the Action Criteria Document until levels at or below the verification criteria contained in the Action Criteria Document are reached, including following the "As Low As Reasonably Achievable" principle;

b. providing additional measures for those limited and exceptional situations that may occur where complete excavation of contaminated soils cannot be accomplished and such measures are needed to reduce exposure and associated risks;

c. minimizing the potential health hazards to workers performing the removal action and to nearby residents during the removal action;

d. backfilling the excavations with clean soil and restoring properties to their original condition or to such other condition as may be arranged with the property owner;

e. using appropriate environmental monitoring during and after removal to verify that cleanup levels are reached and short-term impacts are minimized; and

f. after excavation, transporting all contaminated soils away from affected properties and shipping all contaminated materials removed from affected properties by rail to a licensed permanent disposal facility.

26. The removal actions selected in the Action Memorandum directly address actual or threatened releases of hazardous substances at the Site. Excavation and off-Site disposal of the hazardous substances permanently segregates the contaminated soils from the public and effectively reduces exposure to nearby populations. For certain limited situations where complete excavation of contaminated soils cannot be accomplished, providing additional measures as necessary also reduces exposure to nearby populations.

27. The removal actions required by this Order are necessary to protect the public health, welfare, or the environment, and are not inconsistent with the NCP or CERCLA.

VI. NOTICE TO THE STATE

28. U.S. EPA has notified the IEPA and IDNS that U.S. EPA intends to issue this Order. As U.S. EPA deems appropriate, U.S. EPA will consult with the IEPA and IDNS, and the IEPA and IDNS will have the opportunity to review and comment to U.S. EPA regarding all Work to be performed, including reports, technical data and other deliverables, and any other issues which arise while the Order remains in effect. The IDNS has also been conducting some discovery and characterization activities at the Site for U.S. EPA and will conduct verification activities at the Site in the future, as described in the SOW.

VII. ORDER

29. Based on the foregoing, Respondent is hereby ordered to comply with all of the provisions of this Order, including but not limited to all attachments to this Order, all documents incorporated by reference into this Order, and all schedules and deadlines contained in this Order, attached to this Order, or incorporated by reference into this Order.

VIII. WORK TO BE PERFORMED

30. Within five (5) days after receiving notification from U.S. EPA pursuant to Paragraph II.a. of the SOW that any parcel of property owned by Respondent requires excavation and restoration Work, Respondent shall record notice of and/or a copy of this Order in the appropriate governmental office where land ownership and transfer records are filed or recorded, and shall ensure that the recording of said notice and/or Order is indexed to the title of each and every parcel of property owned by Respondent at the Site, so as to provide notice to third parties of the issuance and terms of this Order with respect to those properties. Respondent shall, within ten (10) days after such recording and indexing, send notice of such recording and indexing to U.S. EPA.

31. All work plans, reports, engineering design documents, and other deliverables (work plans and deliverables), as described throughout this Order, will be reviewed and either approved, approved with modifications, or disapproved by U.S. EPA. In the event of approval or approval with modifications by U.S. EPA, Respondent shall proceed to take any action required by the work plan, report, or other item, as approved or modified by U.S. EPA. If the work plan or other deliverable is approved with modifications or disapproved, U.S. EPA will provide, in writing, comments or modifications required for approval. Respondent shall amend the work plan or other deliverable to incorporate only those comments or modifications required by U.S. EPA.

Within fourteen (14) days of the date of U.S. EPA's written notification of approval with modifications or disapproval, Respondent shall submit an amended work plan or other deliverable, except that Respondent shall submit any amended monthly schedule required in Paragraph II.2. of the SOW within five (5) days of the date of such notification. U.S. EPA shall review the amended work plan or deliverable and either approve or disapprove it. Failure to submit a work plan, amended work plan or other deliverable within the specified time frame shall constitute noncompliance with this Order. Submission of an amended work plan or other deliverable which fails to incorporate all of U.S. EPA's required modifications, or which includes other unrequested modifications, shall also constitute noncompliance with this Order. Approval by U.S. EPA of the (amended) work plan or other deliverable shall cause said approved (amended) work plan or other deliverable to be incorporated herein as an enforceable part of this Order. If any (amended) work plan or other deliverable is not approved by U.S. EPA, Respondent shall be deemed to be in violation of this Order.

32. In the event of an inconsistency between this Order and any subsequent approved (amended) work plan or other deliverable, the terms of this Order shall control.

33. The Work performed by Respondent pursuant to this Order shall, at a minimum, achieve the performance standards specified

in the Action Criteria Document, the Action Memorandum and the Statement of Work. Nothing in this Order, or in U.S. EPA's approval of any (amended) work plan or other deliverable, shall be deemed to constitute a warranty or representation of any kind by U.S. EPA that full performance of the removal actions required by this Order will achieve the performance standards set forth in the Action Criteria Document, the Action Memorandum and the SOW. Respondent's compliance with such approved documents does not foreclose U.S. EPA from seeking additional Work.

34. All materials removed from the Site shall be disposed of at a facility approved in advance of removal by U.S. EPA's RPM/OSC and in accordance with: 1) § 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3); 2) the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 to 6992k, as amended; 3) the Procedures for Planning and Implementing Off-Site Response Actions, 58 Fed. Reg. 49,200 (September 22, 1993); and 4) all other applicable federal, State, and local requirements. Respondent shall provide written notice to the RPM/OSC which shall include all relevant information regarding the receiving facility, including the information required by Paragraph 35, before the hazardous substances are actually shipped off-Site.

35. Prior to any off-Site shipment of hazardous substances from the Site to an out-of-state waste management facility, Respondent shall provide written notification to the appropriate state

environmental official in the receiving state and to U.S. EPA's RPM/OSC of such shipment of hazardous substances. However, the notification of shipments to the state shall not apply to any off-Site shipments when the total volume of all shipments from the Site to the state will not exceed ten (10) cubic yards. The notification shall be in writing, and shall include the following information, where available: (1) the name and location of the facility to which the hazardous substances are to be shipped; (2) the type and quantity of the hazardous substances to be shipped; (3) the expected schedule for the shipment of the hazardous substances; and (4) the method of transportation. Respondent shall notify the receiving state of major changes in the shipment plan, such as a decision to ship the hazardous substances to another facility within the same state, or to a facility in another state.

36. Respondent shall cooperate with U.S. EPA in providing to the public information regarding the Work. When requested by U.S. EPA, Respondent shall participate in the preparation of such information for distribution to the public and in public meetings which may be held or sponsored by U.S. EPA to explain activities at or relating to the Site.

37. Within 30 days of the effective date of this Order, Respondent shall submit to U.S. EPA a work plan for the Excavation and Restoration Phase of the non-time-critical removal

actions at the Site described in Paragraph II.b of the SOW ("Work Plan"). Respondent shall develop the Work Plan in conformance with the SOW, the Action Criteria Document, the Action Memorandum, CERCLA and the National Contingency Plan. The Work Plan shall be subject to review, modification, and approval or disapproval by the U.S. EPA, as provided in Paragraph 31.

38. Respondent shall implement the Work detailed in the Work Plan, according to the schedule contained therein, if and when the Work Plan is fully approved by U.S. EPA. Unless otherwise directed by the RPM/OSC, Respondent shall not commence field activities until approval, in writing, by U.S. EPA of the Work Plan. The final, U.S. EPA-approved Work Plan shall be attached to this Order and deemed incorporated into and made an enforceable part of it. All Work shall be conducted in accordance with the Action Criteria Document, Action Memorandum, SOW, National Contingency Plan, CERCLA and the requirements of this Order, including the standards, specifications and schedule contained in the approved Work Plan.

39. Within 60 days after completion of all on-Site Work required under this Order, Respondent shall submit for U.S. EPA review a final report summarizing the actions taken to comply with this Order. The final report shall conform to the requirements set forth in Section 300.165 of the NCP. The final report shall also include a good faith estimate of total costs incurred in

complying with the Order, a listing of quantities and types of materials removed off-Site or handled on-Site, a listing of the ultimate destinations of those materials, a presentation of the analytical results of all sampling and analyses performed by or on behalf of Respondent, and accompanying appendices containing all relevant documentation generated during the removal action (e.g., manifests, invoices, bills, contracts, and permits).

40. The final report shall also include a statement that the on-Site Work has been completed in full satisfaction of the requirements of this Order as well as the following certification of completion signed by a responsible official of Respondent or Respondent's Project Coordinator:

> "To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

If U.S. EPA concludes, following the initial or any subsequent certification of completion by Respondent that the Work has been fully performed in accordance with this Order, U.S. EPA may notify Respondent that the Work has been fully performed. U.S. EPA's notification shall be based on present knowledge and Respondent's certification to U.S. EPA, and shall not limit U.S. EPA's right to perform periodic reviews pursuant to § 121(c) of CERCLA, 42 U.S.C. § 9621(c), or to take or require any action

that in the judgment of U.S. EPA is appropriate at the Site, in accordance with 42 U.S.C. §§ 9604, 9606, or 9607.

IX. ADDITIONAL WORK

41. In the event that U.S. EPA determines that additional Work or modifications to Work are necessary to meet performance standards, to maintain consistency with this Order or to otherwise protect human health or the environment, U.S. EPA will notify Respondent that additional Work is necessary. U.S. EPA may also require Respondent to modify any plan, design, or other deliverable required by this Order, including any approved modifications.

42. Within thirty (30) days of receipt of notice from U.S. EPA that additional Work is necessary, Respondent shall submit for approval an Additional Work Plan pursuant to Paragraph 31 herein. The Additional Work Plan shall conform to this Order's requirements for the Work Plan. Upon U.S. EPA's approval of the (amended) Additional Work Plan, the (amended) Additional Work Plan shall become an enforceable part of this Order, and Respondent shall implement the (amended) Additional Work Plan for additional Work in accordance with the standards, specifications, and schedule contained therein. Failure to submit an Additional Work Plan within the specified time frame shall constitute noncompliance with this Order.

X. ENDANGERMENT AND EMERGENCY RESPONSE

43. If any event during the performance of the Work causes or threatens to cause a release of a hazardous substance or may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action to prevent, abate, or minimize the threat, and shall immediately notify U.S. EPA's RPM/OSC or alternate RPM/OSC. If neither of these persons is available, Respondent shall notify the U.S. EPA Emergency Response Unit, Region V at 312/353-2318. Respondent shall take further action in consultation with U.S. EPA's RPM/OSC and in accordance with all applicable provisions of this Order, including but not limited to the health and safety plan and the contingency plan. In the event that Respondent fails to take appropriate response action as required by this Paragraph, and U.S. EPA takes that action instead, Respondent shall reimburse U.S. EPA upon written demand for all costs of the response action not inconsistent with the NCP.

44. Nothing in the preceding Paragraph or in any other provision of this Order shall be deemed to limit any authority of the United States to take, direct, or order all appropriate action to protect human health and the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances on, at, or from the Site.

XI. PROGRESS REPORTS

45. In addition to the other deliverables set forth in this Order, Respondent shall provide monthly progress reports to U.S. EPA with respect to actions and activities undertaken pursuant to this Order. The progress reports shall be submitted on or before the 15th day of each month following the effective date of this Order. Respondent's obligation to submit progress reports continues until U.S. EPA gives Respondent written notice under Paragraph 80 of this Order. At a minimum these progress reports shall: (1) describe the actions which have been taken to comply with this Order during the prior month; (2) include all results of sampling and tests and all other data received by Respondent and not previously submitted to U.S. EPA; (3) describe all Work planned for the next forty-five (45) days with schedules relating such Work to the overall project schedule for removal action completion; and (4) describe all problems encountered and any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

XII. QUALITY ASSURANCE, SAMPLING AND DATA ANALYSIS

46. Respondent shall use the quality assurance, quality control, and chain of custody procedures described in the "U.S. EPA NEIC Policies and Procedures Manual," May 1978, revised May 1986, U.S. EPA-330/9-78-001-R; U.S. EPA's "Guidelines and Specifications for Preparing Quality Assurance Program Documentation," June 1, 1987;

U.S. EPA's "Data Quality Objective Guidance," (U.S. EPA/540/G87/003 and 004), and any amendments to these documents, while conducting all sample collection and analysis activities related to air monitoring and sampling of backfill material. To provide quality assurance and maintain quality control, Respondent shall:

a. Prior to the commencement of any sampling and analysis related to air monitoring or sampling of backfill material, submit a Quality Assurance Project Plan (QAPP) to the U.S. EPA that is consistent with Task 2 of the SOW, (amended) work plans, U.S. EPA's "Interim Guidelines and Specifications For Preparing Quality Assurance Project Plans" (QAM-005/80), the U.S. EPA Region V Model QAPP, and any subsequent amendments.

b. Prior to the development and submittal of the QAPP, attend a pre-QAPP meeting sponsored by U.S. EPA to identify all monitoring and data quality objectives. U.S. EPA, after review of the submitted QAPP, will either approve, conditionally approve, or disapprove the QAPP. Upon notification of conditional approval or disapproval, Respondent shall make all required modifications to the QAPP within fourteen (14) days of receipt of such notification.

c. Use only laboratories which have a documented Quality Assurance Program that complies with U.S. EPA guidance document QAMS-005/80 and subsequent amendments.

d. Ensure that the laboratory used by Respondent for analyses, performs according to a method or methods in the approved QAPP.

e. Ensure that U.S. EPA personnel and U.S. EPA's authorized representatives are allowed access to the laboratory and personnel utilized by Respondent for analyses.

47. Respondent shall notify U.S. EPA in advance of any sample collection activity related to air monitoring or sampling of backfill material. At the request of U.S. EPA, Respondent shall allow U.S. EPA or its authorized representatives to take split or duplicate samples of any samples collected by Respondent with regard to air monitoring or sampling of backfill material. In addition, U.S. EPA shall have the right to take any additional samples that U.S. EPA deems necessary.

XIII. COMPLIANCE WITH APPLICABLE LAWS

48. All actions by Respondent taken pursuant to this Order shall be performed in accordance with the requirements of all applicable federal and State laws and regulations. U.S. EPA has determined that the activities contemplated by this Order are not inconsistent with the National Contingency Plan.

49. Except as provided in § 121(e) of CERCLA and in the NCP, no permit shall be required for any portion of the Work conducted entirely on-Site. Where any portion of the Work, including off-

Site activities necessary for completion of the Work, requires a federal or State permit, Respondent shall submit timely applications and take all other actions necessary to obtain and to comply with all such permits or approvals.

50. This Order is not and shall not be construed to be, a permit issued pursuant to any federal or state statute or regulation.

XIV. REMEDIAL PROJECT MANAGER/ON-SCENE COORDINATOR

51. All communications, whether written or oral, from Respondent to U.S. EPA shall be directed to U.S. EPA's RPM/OSC, unless the RPM/OSC directs Respondent otherwise. Except in emergency situations, communications from Respondent should not be directed to the Alternate RPM/OSC without prior direction from the RPM/OSC. Respondent shall submit to U.S. EPA as many copies of any documents, including plans, reports, and other correspondence, which are developed pursuant to this Order as the RPM/OSC requires, and shall send these documents by certified mail (return receipt requested) or by express mail.

U.S. EPA's Remedial Project Manager is:

Rebecca Frey
Illinois/Indiana Remedial Response Branch
U.S. EPA, Region 5
77 W. Jackson Blvd. (HSRL-6J)
Chicago, Illinois 60604-3590
312/886-4760

U.S. EPA's Alternate RPM/OSC is:

David Seely
Illinois/Indiana Remedial Response Branch
U.S. EPA, Region 5
77 W. Jackson Blvd. (HSRL-6J)
Chicago, Illinois 60604-3590
312/886-7058

52. U.S. EPA may change its RPM/OSC or Alternate RPM/OSC. If U.S. EPA changes its RPM/OSC or Alternate RPM/OSC, U.S. EPA will inform Respondent in writing of the name, address, and telephone number of the new RPM/OSC or Alternate RPM/OSC.

53. U.S. EPA's RPM/OSC and Alternate RPM/OSC shall have the authority lawfully vested in a Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) by the National Contingency Plan. U.S. EPA's RPM/OSC or Alternate RPM/OSC shall have authority, consistent with the NCP, to halt any Work required by this Order, and to take any necessary response action.

XV. PROJECT COORDINATOR AND CONTRACTORS

54. All aspects of the Work to be performed by Respondent pursuant to this Order shall be under the direction and supervision of a Project Coordinator qualified to undertake and complete the requirements of this Order. The Project Coordinator shall be the RPM/OSC's primary point of contact with Respondent and shall possess sufficient technical expertise regarding all aspects of the Work. Within five (5) working days after the effective date of this Order, Respondent shall notify U.S. EPA in

writing of the name and qualifications of the Project Coordinator, including primary support entities and staff, proposed to be used in carrying out the Work. U.S. EPA reserves the right to disapprove the proposed Project Coordinator.

55. Within fourteen (14) days after U.S. EPA approves the Work Plan, Respondent shall identify a proposed construction contractor and notify U.S. EPA in writing of the name, title, and qualifications of the construction contractor proposed to be used in carrying out the Work.

56. Respondent shall submit a copy of the construction contractor solicitation documents to U.S. EPA not later than five (5) days after publishing the solicitation documents. Upon U.S. EPA's request, Respondent shall submit complete copies of all bid packages received from all contract bidders.

57. At least seven (7) days prior to commencing any Work at the Site pursuant to this Order, Respondent shall submit to U.S. EPA a certification that Respondent or its contractors and subcontractors have adequate insurance coverage or have indemnification for liabilities for injuries or damages to persons or property which may result from the activities to be conducted by or on behalf of Respondent pursuant to this Order. Respondent shall ensure that such insurance or indemnification is maintained for the duration of the Work required by this Order.

58. U.S. EPA retains the right to disapprove of the Project Coordinator and any contractor retained by Respondent. In the event U.S. EPA disapproves a Project Coordinator or contractor, Respondent shall retain a new project coordinator or contractor to perform the Work, and such selection shall be made within fifteen (15) days following the date of U.S. EPA's disapproval. If at any time Respondent proposes to use a new project coordinator or contractor, Respondent shall notify U.S. EPA of the identity of the new project coordinator or contractor at least fifteen (15) days before the new project coordinator or contractor performs any Work under this Order.

XVI. SITE ACCESS AND DOCUMENT AVAILABILITY

59. Prior to undertaking its own discovery and characterization activities, U.S. EPA intends to contact property owners in an attempt to obtain access for such activities (described in Paragraph II.a. of the SOW). For those properties owned or in possession of someone other than Respondent for which U.S. EPA has not already requested access to perform discovery and characterization activities, U.S. EPA intends to also request from the property owner permission for Respondent to perform any necessary excavation and restoration Work. If the owner does not grant access for excavation and restoration Work in response to U.S. EPA's letter and such Work is necessary at the property, U.S. EPA will notify Respondent in writing of the owner's denial. Within fourteen (14) calendar days of receipt of such

notification, Respondent shall contact the property owner and request access to perform the excavation and restoration Work. For properties where U.S. EPA has already requested access to perform discovery and characterization activities but did not request access to perform excavation and restoration Work, Respondent shall contact the property owners within fourteen (14) days of receipt of notification from U.S. EPA that the properties require excavation and restoration Work, and request access.

60. In all cases, Respondent shall use its best efforts to obtain a written agreement for access to the property, including providing reasonable compensation in consideration of access. Said agreements shall provide access for U.S. EPA, its contractors and oversight officials, the State and its contractors, and Respondent or Respondent's authorized representatives and contractors. Said agreements shall specify that Respondent is not U.S. EPA's representative with respect to liability associated with Site activities. Copies of such agreements shall be provided to U.S. EPA prior to Respondent's initiation of field activities at those properties. If access agreements are not obtained within the time referenced above, Respondent shall promptly notify U.S. EPA of its failure to obtain access.

61. If Respondent cannot obtain the necessary access agreements, U.S. EPA may exercise non-reviewable discretion to: (1) use its

legal authorities to obtain access for Respondent; (2) conduct response actions at the property in question; or (3) terminate this Order. If U.S. EPA conducts a response action and does not terminate the Order, Respondent shall perform all other removal actions required by this Order that do not require access to that property. Respondent shall integrate the results of any such tasks undertaken by U.S. EPA into its reports and deliverables. Respondent shall reimburse U.S. EPA upon written demand for all response costs (including attorney fees) incurred by the United States to obtain access for Respondent.

62. Respondent shall allow U.S. EPA and its authorized representatives and contractors to enter and freely move about all property at the Site and off-Site areas subject to or affected by the Work under this Order or where documents required to be prepared or maintained by this Order are located, for the purposes of inspecting conditions, activities, the results of activities, records, operating logs, and contracts related to the Site or Respondent and its representatives or contractors pursuant to this Order; reviewing the progress of Respondent in carrying out the terms of this Order; conducting tests as U.S. EPA or its authorized representatives or contractors deem necessary; using a camera, sound recording device or other documentary type equipment; and verifying the data submitted to U.S. EPA by Respondent. Respondent shall allow U.S. EPA and its authorized representatives to enter the Site, to inspect and copy

all records, files, photographs, documents, sampling and monitoring data, and other writings related to Work undertaken in carrying out this Order. Nothing herein shall limit U.S. EPA's right of entry or inspection authority under federal law, and U.S. EPA retains all of its information gathering and enforcement authorities and rights under CERCLA, RCRA, and any other applicable statutes and regulations.

XVII. RECORD PRESERVATION

63. On or before the effective date of this Order, Respondent shall submit a written certification to U.S. EPA that it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information relating to its potential liability with regard to the Site since the time of its notification of potential liability by U.S. EPA. Respondent shall not dispose of any such documents without prior approval by U.S. EPA. Within ten (10) days of the effective date of this Order, Respondent shall make all such documents available to U.S. EPA and shall submit a log of any such documents claimed to be privileged for any reason. This privilege log shall list, for each document, the date, author, addressees (including courtesy copies or "cc"s and "bcc"s) and subject matter of the document.

64. Respondent shall provide to U.S. EPA upon request, copies of all documents and information within its or its contractors', subcontractors' or agents' possession or control relating to

activities at the Site or to the implementation of this Order, including but not limited to sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, traffic routing, correspondence, or other documents or information. Respondent shall also make available to U.S. EPA its employees, agents, or representatives for purposes of investigation, information gathering or testimony concerning the performance of the Work.

65. Until ten (10) years after U.S. EPA provides notice pursuant to Paragraph 80 of this Order, Respondent shall preserve, and shall instruct its contractors and agents to preserve, all documents, records, and information of whatever kind, nature or description relating to the performance of the Work. Upon the conclusion of this document retention period, Respondent shall notify the United States at least ninety (90) days prior to the destruction of any such records, documents or information, and, upon request of the United States, Respondent shall deliver all such documents, records and information to U.S. EPA.

66. Respondent may assert a claim of business confidentiality covering part or all of the information submitted to U.S. EPA pursuant to the terms of this Order under 40 C.F.R. § 2.203, provided such claim is not inconsistent with § 104(e)(7) of CERCLA or other provisions of law. This claim shall be asserted in the manner described by 40 C.F.R. § 2.203(b) and substantiated

by Respondent at the time the claim is made. Information determined to be confidential by U.S. EPA will be given the protection specified in 40 C.F.R. Part 2. If no such claim accompanies the information when it is submitted to U.S. EPA, it may be made available to the public by U.S. EPA or the State without further notice to Respondent. Respondent shall not assert confidentiality claims with respect to any data or documents related to Site conditions, sampling, or monitoring. The identification of individual residential properties and their owners shall be kept confidential by Respondent and may be released by Respondent only to the U.S. EPA unless U.S. EPA otherwise agrees in writing. However, Respondent may make use of such data without the written agreement of U.S. EPA in connection with litigation related to the hazardous substances or to the REF, provided that the presiding court deems identification of individual residential properties and their owners necessary.

67. Respondent shall maintain, for the period during which this Order is in effect, an index of documents that Respondent claims contain confidential business information ("CBI"). The index shall contain, for each document, the date, author, addressee, and subject of the document. Respondent shall submit an updated copy of the index to U.S. EPA with each new document(s) claimed to be CBI. The updated index shall also indicate any documents for which CBI claims have been withdrawn.

XVIII. DELAY IN PERFORMANCE

68. Any delay in performance of this Order according to its terms and schedules that U.S. EPA deems is not properly justified by Respondent under the terms of this Section shall be considered a violation of this Order. Any delay in performance of this Order shall not affect Respondent's obligations to fully perform all obligations under the terms and conditions of this Order.

69. Respondent shall notify U.S. EPA of any delay or anticipated delay in performing any requirement of this Order. Such notification shall be made by telephone to U.S. EPA's RPM/OSC or Alternate RPM/OSC within forty-eight (48) hours after Respondent first knew or should have known that a delay might occur. Respondent shall adopt all reasonable measures to avoid or minimize any such delay. Within seven (7) days after notifying U.S. EPA by telephone, Respondent shall provide written notification fully describing the nature of the delay, any justification for delay, any reason why Respondent should not be held strictly accountable for failing to comply with any relevant requirements of this Order, the measures planned and taken to minimize the delay, and a schedule for implementing the measures that will be taken to mitigate the effect of the delay. Increased costs or expenses associated with implementation of the activities called for in this Order is not a justification for any delay in performance.

XIX. UNITED STATES NOT LIABLE

70. The United States and U.S. EPA are not to be construed as parties to, and do not assume any liability for, any contract entered into by Respondent to carry out the activities pursuant to this Order. The proper completion of the Work under this Order is solely the responsibility of Respondent. The United States and U.S. EPA, by issuance of this Order, also assume no liability for any injuries or damages to persons or property resulting from acts or omissions by Respondent, or its directors, officers, employees, agents, representatives, successors, assigns, contractors, or consultants in carrying out any action or activity required by this Order.

XX. ENFORCEMENT AND RESERVATIONS

71. U.S. EPA reserves the right to bring an action against Respondent under § 107 of CERCLA for recovery of any response costs incurred by the United States related to this Order, the Site or any other site at which Respondent may be a liable person. This reservation shall include but not be limited to past costs, direct costs, indirect costs, the costs of oversight, the costs of compiling the cost documentation to support oversight cost demand, as well as accrued interest as provided in § 107(a) of CERCLA.

72. Notwithstanding any other provision of this Order, at any time during the removal actions, U.S. EPA may perform its own

studies, complete the removal actions (or any portion of the removal actions) as provided in CERCLA and the NCP, and seek reimbursement from Respondent for its costs, or seek any other appropriate relief.

73. Should Respondent violate this Order or any provision hereof, EPA may terminate this Order and carry out the required removal actions unilaterally, pursuant to Section 104 of CERCLA, and/or may seek judicial enforcement of this Order pursuant to Section 106 of CERCLA.

74. Nothing in this Order shall preclude U.S. EPA from taking any additional enforcement actions, including modification of this Order or issuance of additional Orders, and/or additional remedial or removal actions as U.S. EPA may deem necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA or any other applicable law. This Order shall not affect Respondent's liability under CERCLA § 107(a) for the costs of any such additional actions.

75. Notwithstanding any provision of this Order, the United States hereby retains all of its information gathering, inspection and enforcement authorities and rights under CERCLA, RCRA and any other applicable statutes or regulations.

76. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person for any liability it may have arising out of or relating in any way to the Site.

77. If a court issues an order that invalidates any provision of this Order or finds that Respondent has sufficient cause not to comply with one or more provisions of this Order, Respondent shall remain bound to comply with all provisions of this Order not invalidated by the court's order.

XXI. ACCESS TO ADMINISTRATIVE RECORD

78. The Section 106 Administrative Record is available for review on normal business days between the hours of 9:00 a.m. and 5:00 p.m. at the U.S. EPA, Region V, 77 West Jackson Boulevard Chicago, Illinois. An Index of the Administrative Record is attached hereto as Appendix 1.

XXII. EFFECTIVE DATE AND TERMINATION

79. This Order shall become effective twelve (12) days after the date of issuance.

80. After it receives Respondent's certification of completion under Paragraph 40, U.S. EPA may require such additional activities as may be necessary to complete the Work or U.S. EPA may, based upon such certification and U.S. EPA's concurrent

knowledge, issue written notification to Respondent that the Work has been completed, as appropriate. U.S. EPA's notification shall not limit U.S. EPA's right to take or require any action that in the judgment of U.S. EPA is appropriate at the Site, in accordance with Section 104, 106 or 107 of CERCLA. The provisions of this Order shall be deemed to be satisfied when U.S. EPA notifies Respondent in writing that Respondent has demonstrated, to U.S. EPA's satisfaction, that all terms of the Order have been completed. This notice shall not, however, terminate Respondent's obligation to comply with Section XVII (Record Preservation).

XXIII. NOTICE OF INTENT TO COMPLY

81. On or before the effective date of this Order, Respondent must submit to U.S. EPA a written notice stating its unequivocal intention to comply with all terms of this Order. In the event Respondent fails to provide said written notice of its unequivocal intention to comply with this Order on or before the effective date, Respondent shall be deemed to have refused to comply with this Order. If Respondent fails to provide timely notice of its intent to comply with this Order, it shall thereafter have no authority to perform any response action at the Site, pursuant to §§ 104(a) and 122(e)(6) of CERCLA. In the event Respondent subsequently changes its decision and desires to acquire authority from U.S. EPA under §§ 104(a) and 122(e)(6) of CERCLA to undertake the Work described in this Order, Respondent

must provide the notice described in this Paragraph to U.S. EPA and receive from U.S. EPA written permission and authority to proceed with Work under this Order.

XXIV. PENALTIES

82. Respondent shall be subject to civil penalties under § 106(b) of CERCLA, 42 U.S.C. § 9606(b), of not more than $25,000 for each day in which Respondent violates, or fails or refuses to comply with this Order without sufficient cause. In addition, failure to properly provide removal action under this Order, or any portion hereof, may result in liability under § 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3), for punitive damages in an amount at least equal to, and not more than three times the amount of any costs incurred by the Fund as a result of such failure to take proper action.

XXV. OPPORTUNITY TO CONFER

83. On or before the effective date of this Order, Respondent may submit written comments to U.S. EPA. If Respondent asserts a "sufficient cause" defense under § 106(b) of CERCLA, Respondent shall describe the nature of any "sufficient cause" defense using facts that exist on or prior to the effective date of this Order. The absence of a response by U.S. EPA shall not be deemed to be acceptance of Respondent's assertions.

84. Within five (5) days after the date of issuance of this Order, Respondent may request a conference with the U.S. EPA to discuss this Order. If requested, the conference shall occur with 12 (twelve) days of the date of issuance of this Order, at the office of U.S. EPA, Region 5, in Chicago, Illinois.

85. The purpose and scope of the conference shall be limited to issues involving the implementation of the Work and the extent to which Respondent intends to comply with this Order. This conference is not an evidentiary hearing and does not constitute a proceeding to challenge this Order. It does not give Respondent a right to seek review of this Order or to seek resolution of potential liability. No record of the conference (e.g. stenographic, tape or other physical record) will be made. At any conference held pursuant to Respondent's request, Respondent may appear in person or by an attorney or other representative. Requests for a conference must be by telephone followed by written confirmation to U.S. EPA's RPM/OSC.

ADMINISTRATIVE ORDER FOR KERR-McGEE RESIDENTIAL AREAS REMOVAL SITE

So Ordered, this 18th day of November, 1994.

BY: _____
William E. Muno, Director
Waste Management Division
U.S. Environmental Protection Agency, Region V

ATTACHMENT 1

Attachment to Unilateral Administrative Order

STATEMENT OF WORK FOR
NON-TIME-CRITICAL REMOVAL ACTIONS
AT THE
KERR-McGEE RESIDENTIAL AREAS REMOVAL SITE
WEST CHICAGO, ILLINOIS

I. PURPOSE

The purpose of this Statement of Work ("SOW") is to set forth the requirements for implementation of non-time-critical removal actions at the Kerr-McGee Residential Areas Removal Site ("Site"). Respondent shall implement all Work described in this SOW in accordance with the Order to which this SOW is attached, the Action Criteria Document and the Action Memorandum. In the event of any inconsistency between this SOW and the Order, the Order shall govern.

II. DESCRIPTION OF THE NON-TIME-CRITICAL REMOVAL ACTIONS TO BE CONDUCTED BY RESPONDENT

The activities associated with the non-time-critical removal actions are being conducted in three concurrent phases. Respondent shall conduct one phase of the activities, as generally described in Paragraph II.b. below. U.S. EPA and/or IDNS will conduct other phases of the activities, as generally described in paragraphs II.a. and c. below.

a. **DISCOVERY AND CHARACTERIZATION PHASE**: During this phase, U.S. EPA will survey, sample and test properties in the West Chicago area to determine which properties exceed the Discovery and Characterization Criteria contained in the Action Criteria Document. Based on the results of those surveys, samples and tests, U.S. EPA will identify properties that exceed the Discovery and Characterization Criteria and, therefore, require Excavation and Restoration Phase Work. U.S. EPA will notify Respondent which properties U.S. EPA determines require Excavation and Restoration Phase Work. The notification U.S. EPA provides to Respondent may be in either hard copy or electronic format and will include appropriate information about the properties that U.S. EPA gathers during this phase. Within 30 days of the effective date of the Order, U.S. EPA will provide to Respondent an initial list of properties that U.S. EPA has determined require Excavation and Restoration Phase Work. Thereafter, U.S. EPA will provide such notification to Respondent on a routine basis as discovery/characterization activities continue.

b. **EXCAVATION AND RESTORATION PHASE:** During this phase, Respondent shall remove contaminated materials from each property that U.S. EPA determines exceeds the Discovery and Characterization Criteria and notifies Respondent pursuant to Paragraph II.a. requires Excavation and Restoration Phase Work. As used in this SOW, "contaminated materials" means soils that exceed the Discovery and Characterization Criteria and any other materials (e.g., concrete or wood) that have become contaminated with hazardous substances as a result of the thorium mill tailings at the Site. Respondent shall excavate contaminated materials from each such property to levels that meet the Verification Criteria contained in the Action Criteria Document. Prior to backfilling any excavated area with clean soil, Respondent shall notify U.S. EPA that Respondent believes the Verification Criteria have been met at that area. U.S. EPA/IDNS then will conduct verification activities (described below) to confirm that Respondent has met the Verification Criteria. If U.S. EPA, in consultation with IDNS, determines that the Verification Criteria have not been met, Respondent shall conduct additional excavations as necessary to meet the Verification Criteria. If U.S. EPA, in consultation with IDNS, determines that the Verification Criteria have been met at any excavated area, U.S. EPA shall so notify Respondent, and Respondent shall backfill the excavation with clean soils and shall restore the property, to the extent practicable, to its original condition or such other condition as the property owner may have approved in writing.

c. **VERIFICATION PHASE:** During this phase, U.S. EPA/IDNS will conduct sampling, surveying and testing activities to determine whether the Verification Criteria have been met at all properties undergoing the Excavation and Restoration Phase Work. U.S. EPA/IDNS will conduct this phase of the project at each such property: 1) after excavation Work but before backfilling and restoration Work, i.e., after Respondent notifies U.S. EPA that it believes it has met the Verification Criteria; and 2) after backfilling of the excavation. For the verification activities that occur in the open excavation, U.S. EPA will notify Respondent whether the Verification Criteria have been met so the excavation may be backfilled and the property restored.

A more detailed description of the Work to be conducted by Respondent during the Excavation and Restoration Phase is provided below:

1. Access Agreements

Respondent shall obtain access agreements to areas of the Site not under its control as provided in Section XVI of the Order (Site Access and Document Availability). In order to minimize disputes regarding future restoration of the property, prior to any excavation, Respondent shall document the existing physical conditions of the property by photographs or video recordings.

2. Excavation of Properties

As stated above in Paragraph II.a., U.S. EPA will provide to Respondent within 30 days of the effective date of the Order an initial list of properties that require Excavation and Restoration Phase Work, and shall thereafter provide such notification to Respondent on a routine basis as discovery/ characterization activities continue. The initial list of properties (hereinafter known as the "Initial List") shall consist of properties that have not been the subject of cleanup activities by Respondent in the mid-1980s.

U.S. EPA recognizes that it is not possible to undertake any excavation or restoration activities during the winter months (December through March) and that weather conditions may affect excavation or restoration activities at other times of the year. In addition, U.S. EPA recognizes that discoveries during the conduct of excavations, the need to obtain applicable off-Site licenses, permits and authorizations or unanticipated difficulties in the conduct of excavations may affect the schedule for the Work. As a result, the time schedules for the conduct of excavation or restoration Work may be subject to adjustment by U.S. EPA to reflect weather, scheduling or other appropriate considerations. Respondent shall provide notice to U.S. EPA of the need for any such adjustment and U.S. EPA may, at its discretion, adjust the schedule if U.S. EPA determines that such adjustment is appropriate.

Within 21 days after U.S. EPA's approval of Respondent's Excavation and Restoration Phase Work Plan ("Work Plan") (described in Section III of this SOW and Paragraph 38 of the Order), Respondent shall begin excavation Work at some or all of the properties that U.S. EPA has notified Respondent require excavation and restoration Work and that are included in the Initial List. For additional properties subsequently identified by U.S. EPA as needing excavation and restoration Work, Respondent shall begin excavation Work at such properties in accordance with the monthly schedule (described below) as approved by U.S. EPA. All excavation Work shall be conducted to meet the Verification Criteria using such procedures and equipment as necessary and appropriate and as described in the

approved Work Plan. Respondent shall supply adequate staffing of excavation crews to ensure that Work at each affected property and at the Site as a whole is conducted without unnecessary delay, as determined by U.S. EPA.

On the 15th day of each month, as part of the monthly written progress report described in Section XI of the Order (Progress Reports), Respondent shall submit a monthly schedule containing a list of the properties scheduled to be excavated and the proposed level of staffing of work crews in the following 45 days. U.S. EPA will approve, approve with modifications or disapprove the schedule in accordance with Paragraph 32 of the Order and Respondent shall amend the schedule accordingly within 5 business days of receipt of the modifications. The approved schedule shall become an enforceable part of the Order.

As a general rule, Respondent shall provide in the monthly schedule for excavations at properties on a block-by-block or neighborhood-by-neighborhood basis (which is how U.S. EPA intends to conduct the Discovery and Characterization Phase) in order to minimize the number of times excavation crews must visit any one area of the Site. During its review of the monthly schedules, U.S. EPA may re-prioritize certain properties in accordance with U.S. EPA's "worst sites first" philosophy. Respondent shall conduct excavations at the properties in the order of precedence established in the approved schedule.

When Respondent believes, after conducting excavation Work, that it has met the Verification Criteria at a property, it shall immediately notify U.S. EPA in accordance with the procedures established in the approved Work Plan and provide any documentation supporting this belief. After receiving such notice, U.S. EPA/IDNS will conduct Verification Phase sampling, surveying and testing at that property. If U.S. EPA, in consultation with IDNS, determines that the Verification Criteria have not been met, Respondent shall conduct additional excavation Work as necessary to meet the Verification Criteria and again notify U.S. EPA that it believes it has met the Verification Criteria. If U.S. EPA, in consultation with IDNS, determines that the Verification Criteria have been met, U.S. EPA shall so notify Respondent, and Respondent shall commence restoration of the property.

3. <u>Restoration of Properties</u>

After U.S. EPA has notified Respondent that Respondent has met the Verification Criteria at a property based on U.S. EPA/IDNS surveys, samples and tests in the open excavation, Respondent shall begin restoration of the property as promptly as is practicable, but no later than 7 days after the receipt of such

notice. Respondent shall complete restoration of the property as expeditiously as practicable. Respondent shall use clean soils to backfill the areas from which contaminated materials have been excavated, and shall re-establish previous contours. Excavated and/or disturbed areas shall be restored, to the extent practicable, to original conditions or such other conditions as the owner of the property may approve in writing. Sod or grass seed shall be used for areas that were grass-covered prior to excavation and Respondent shall replace any vegetation that has been removed with appropriate nursery stock.

After restoration of a property, Respondent shall use its best efforts to obtain written acceptance of the restoration Work from the property owner, showing that the property owner agrees that Respondent has fulfilled its agreement to restore the property. In the event that Respondent and the property owner cannot reach an agreement that the property has been properly restored, the U.S. EPA Remedial Project Manager/On-Scene Coordinator ("RPM/OSC") shall resolve the dispute. Respondent shall promptly take any actions the U.S. EPA RPM/OSC deems necessary to restore the property.

Respondent shall supply adequate staffing of restoration crews to ensure that Work at each property and at the Site as a whole is conducted without unnecessary delay, as determined by U.S. EPA.

4. <u>Handling, Transportation and Disposal of Excavated Materials</u>

The contaminated materials at this Site have been classified as "11(e)(2) byproduct material" as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. § 2014(e)(2). Immediately after excavation Work at any property, Respondent shall transport all contaminated materials away from the Site to a facility licensed to accept 11(e)(2) byproduct material, in accordance with the procedures in the approved Work Plan.

Respondent shall arrange for the disposal of all contaminated materials removed from affected properties pursuant to this SOW at a permanent disposal facility licensed to accept and permanently dispose of 11(e)(2) byproduct material.

Respondent shall keep track of all materials excavated or removed from the Site by keeping a log of all activities on a property-by-property and project-wide basis. Such information shall include, at a minimum, dates of excavation and volumes of materials excavated from affected properties, dates and volumes of materials handled and transported away from such properties, and dates and volumes of materials transported to the licensed permanent disposal facility or facilities. Such information shall be transmitted to U.S. EPA in electronic format suitable

for incorporation into U.S. EPA's electronic database for this Site.

5. Dust Control Measures and Air Monitoring

During all excavation, restoration, transportation and associated materials-handling Work, Respondent shall implement dust control measures to minimize the occurrence of dust and/or contaminated soil from becoming airborne. Respondent shall conduct monitoring near excavation locations to provide both for worker protection and protection of the general public from contaminated dust and radon/thoron emissions. Respondent shall include in the Work Plan a detailed description of the dust control measures and monitoring that will be conducted during the Excavation and Restoration Phase.

III. SCOPING AND PLANNING DOCUMENTS FOR REMOVAL ACTION

Respondent shall prepare and submit to U.S. EPA for review and approval as provided in Paragraph 32 of the Order the scoping and planning documents described below. The approved documents will become enforceable parts of the Order. The documents shall describe in detail the steps to be taken to implement the design, construction, operation and maintenance of the Excavation and Restoration Phase at the Site. Respondent is responsible for the timely implementation of the Excavation and Restoration Phase Work in accordance with the U.S. EPA-approved plans. The schedule for submittal of the documents is described in Section IV of this SOW.

Task 1: Excavation and Restoration Phase Work Plan

- **Subtask A: Dust Control Plan**
- **Subtask B: Air Monitoring Plan**
- **Subtask C: Permitting and Access Requirement Plan**
- **Subtask D: Traffic Control Plan**
- **Subtask E: Site Security Plan**
- **Subtask F: Pre-Verification Screening Sampling Plan**

Task 2: Quality Assurance Project Plan and Field Sampling Plan

Task 3: Construction Quality Assurance Plan

Task 4: Health and Safety Plan

Task 5: Emergency Contingency Plan

Task 6: Preconstruction Meeting and Routine Progress Meetings

Task 1: Excavation and Restoration Phase Work Plan

Respondent shall submit a Work Plan for U.S. EPA review and approval in accordance with Section VIII of the Order (Work to be Performed), and in accordance with the schedule in Section IV of this SOW. The Work Plan shall document and detail the overall scope and management strategy for performing the design, construction, operation, maintenance and monitoring of the Excavation and Restoration Phase Work. The Work Plan shall document the responsibility and authority of all organizations and key personnel involved with the implementation of the Excavation and Restoration Phase Work and shall include a description of qualifications of key personnel directing the activities, including key contractor personnel and leaders of the excavation/ restoration work crews. The Work Plan shall describe in detail the equipment, procedures and materials that may be used during all phases of the Excavation and Restoration Phase Work (including excavation, restoration, materials handling and transportation), including identification of the source and physical characteristics of the soil that will be used as backfill to restore properties. U.S. EPA recognizes that such details as the number of days per week and the hours each day when excavation/restoration Work will be conducted, the number of excavation/restoration crews to be used and the number of people per crew cannot be specified until the extent of excavation/restoration Work to be conducted is known. The Work Plan shall describe the notification procedures to be used to notify U.S. EPA when Respondent believes, after excavation but before backfilling, that it has met the Verification Criteria at properties designated for excavation and restoration Work. In addition, the Work Plan shall describe the data collected and recorded by Respondent in connection with the Excavation and Restoration Phase Work and the procedures for transferring that information to U.S. EPA as that Work progresses. If at all possible, such information shall be transmitted to U.S. EPA in electronic format suitable for incorporation into U.S. EPA's electronic database for this Site. The Work Plan also shall contain a schedule for the Excavation and Restoration Phase Work, although U.S. EPA recognizes that some aspects of the schedule are dependent on the extent of excavation/restoration to be conducted, which for the project as a whole is unknown at this time.

In addition to addressing the above-listed items, the Work Plan shall contain detailed descriptions of the plans for the subtasks listed below:

Subtask A: Dust Control Plan

Respondent shall submit a Dust Control Plan which shall describe in detail, at a minimum, the methods to be employed during all phases of the Excavation and Restoration Phase (including excavation, restoration, transportation and associated materials handling Work) to minimize the occurrence of dust and/or contaminated soil from becoming airborne, and the corrective measures to be implemented in the event that excessive dust and/or contaminated soil becomes airborne. If water is used as a dust control measure, the plan shall describe the procedures that will be used to control or contain runoff.

Subtask B: Air Monitoring Plan

Respondent shall submit an Air Monitoring Plan which shall describe in detail, at a minimum, the methods to be used to conduct air monitoring around the excavation locations. Monitoring near excavation locations shall be conducted as necessary to ensure that excessive airborne contaminated dust and radon/thoron is not being released. Monitoring shall be conducted both within restricted excavation areas (for worker protection) and at the perimeter of and/or outside restricted areas (for protection of the general public).

Subtask C: Permitting and Access Requirement Plan

Respondent shall submit a plan which shall outline and include, at a minimum, a comprehensive list of all permits required in conjunction with the Excavation and Restoration Phase Work, procedures and estimated time frames for acquiring required permits, procedures and methods to be implemented to ensure compliance with permitting requirements, and procedures and methods to be implemented to obtain access and to follow up when access is not obtained. The plan also shall describe the procedures to be used to ensure that buried underground utilities are not damaged during removal activities, and corrective measures to be taken in the event that such damage occurs.

Subtask D: Traffic Control Plan

Respondent shall submit a plan which shall describe the procedures to be used to control traffic in the event that

excavation/restoration Work must be conducted on or near roadways or sidewalks.

Subtask E: Site Security Plan

Respondent shall submit a plan which shall describe in detail the procedures that shall be used to prevent access from the general public to areas where excavation/ restoration Work is being conducted, including those times when an excavation is left open during periods of no on-Site activity.

Subtask F: Pre-Verification Screening Sampling Plan

Respondent shall submit a plan which shall describe in detail the field methods, sampling procedures and analytical methods that Respondent will use during excavation activities, prior to the verification activities that will be conducted by U.S. EPA/IDNS, to determine when Respondent believes it has met the Verification Criteria at a property. The plan shall contain sufficient information to ensure that, if Respondent follows such methods and procedures, U.S. EPA/IDNS verification activities will indeed confirm that the Verification Criteria have been met. (Note that this plan is not a Quality Assurance Project Plan.) Respondent shall use adequate field and laboratory instruments, in up-to-date calibration and good working order, to perform the pre-verification screening sampling.

Task 2: Quality Assurance Project Plan and Field Sampling Plan

Respondent shall develop a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP) for the following limited aspects of the Work:

1) Air monitoring activities; and

2) Sampling of backfill material to ensure that the material used to restore excavated properties is clean, meaning that the radiological and chemical composition of the backfill material must be within background ranges for the Site as established by U.S. EPA during the first phase of the discovery/characterization fieldwork.

The FSP shall supplement the QAPP and shall address all sample collection activities associated with the above-listed aspects of the Work.

Respondent shall attend a pre-QAPP meeting with U.S. EPA prior to preparation of the QAPP. The QAPP shall address all sample analysis and data handling for the above-listed aspects of the work, and shall be prepared in accordance with the U.S. EPA Region 5 model QAPP. The QAPP shall at a minimum include:

Project Description
* Facility Location History
* Past Data Collection Activity
* Project Scope
* Sample Network Design
* Parameters to be Tested and Frequency
* Project Schedule

Project Organization and Responsibility

Quality Assurance Objectives for Measurement Data
* Level of Quality Control Effort
* Accuracy, Precision and Sensitivity of Analysis
* Completeness, Representativeness and Comparability

Sampling Procedures

Sample Custody
* Field Specific Custody Procedures
* Laboratory Chain of Custody Procedures

Calibration Procedures and Frequency
* Field Instruments/Equipment
* Laboratory Instruments

Analytical Procedures
* Non-Contract Laboratory Program Analytical Methods
* Field Screening and Analytical Protocol
* Laboratory Procedures

Internal Quality Control Checks
* Field Measurements
* Laboratory Analysis

Data Reduction, Validation and Reporting
* Data Reduction
* Data Validation
* Data Reporting

Performance and System Audits
* Internal Audits of Field Activity

* Internal Laboratory Audit
* External Field Audit
* External Laboratory Audit

Preventive Maintenance
* Routine Preventive Maintenance Procedures and Schedules
* Field Instruments/Equipment
* Laboratory Instruments

Specific Routine Procedures to Assess Data Precision, Accuracy and Completeness
* Field Measurement Data
* Laboratory Data

Corrective Action
* Sample Collection/Field Measurement
* Laboratory Analysis

Quality Assurance Reports to Management

Task 3: Construction Quality Assurance Plan

Respondent shall submit a Construction Quality Assurance (CQA) Plan which describes the Site-specific components of the quality assurance program that Respondent will use to ensure that the physical characteristics of the soil being used as backfill material are appropriate for the intended use of the area (e.g., can support structures) and that backfilled areas will maintain their contours over the long term (i.e., backfilled areas will not settle).

The CQA Plan shall describe the qualifications of the CQA officer and supporting inspection personnel to demonstrate that they possess the training and experience necessary to fulfill their identified responsibilities. The CQA Plan also shall describe the proposed quality assurance sampling activities that will be used to monitor the construction, including the scope and frequency of each type of sampling activity, acceptance and rejection data sheets, and all associated documentation. Reporting requirements for CQA activities shall be described in detail in the CQA Plan, as well as provisions for the final storage of all records and documentation.

Task 4: Health and Safety Plan

Respondent shall develop a Health and Safety Plan which is designed to protect on-Site personnel and area residents from physical, chemical, radiological and all other hazard

posed by excavation and restoration Work. Respondent shall designate a Health Physicist as a Health and Safety officer to ensure that all Work associated with such excavation and restoration is conducted in a manner protective to the workers and local residents. The Health and Safety officer shall be responsible for ensuring that the Health and Safety Plan is followed by all employees and contractors of Respondent. The Health and Safety Plan shall develop the performance levels and specifications necessary to address the following areas:

- Site Description
- Personnel
- Levels of Protection
- Safe work practices and safeguards
- Concepts and methodologies to be followed by workers to keep radiation doses "As Low As Reasonably Achievable" (ALARA)
- Procedures for weather-related problems (such as hypothermia, heat stress and heat exhaustion)
- Special training required for work crews and on-site personnel
- Medical surveillance
- Personal and environmental air monitoring
- Personal protective equipment
- Personal hygiene
- Decontamination - personal and equipment
- Site work zones and access control
- Contaminant control
- Procedures for conducting equipment release surveys and specification of release criteria
- Contingency and emergency planning
- Logs, reports and record keeping

The Health and Safety Plan shall follow U.S. EPA guidance and all OSHA requirements as outlined in 29 CFR 1910 and 1926.

Task 5: Emergency Contingency Plan

Respondent shall submit an Emergency Contingency Plan describing procedures to be used in the event of an accident or emergency at the Site. The Emergency Contingency Plan shall contain, at a minimum, the following:

1. Name of the person or entity responsible for responding in the event of an emergency incident.

2. Plan for meeting(s) with the local community, including local, State and Federal agencies involved in the

cleanup, as well as local police, fire, utility and emergency personnel and hospitals.

3. First aid medical information.

4. Air Monitoring Plan

5. Spill Prevention, Control, and Countermeasures (SPCC) Plan, as specified in 40 CFR Part 109, describing measures to prevent and contingency plans for potential spills and discharges from materials handling and transportation.

Task 6: Preconstruction Meeting and Routine Progress Meetings

A. PRECONSTRUCTION MEETING

Before excavation Work pursuant to this SOW may commence, Respondent shall participate with the U.S. EPA and IDNS in a preconstruction meeting to:

1) Review methods for documenting and reporting data collected during the removal action;

2) Review lines of communication and methods to be used by Respondent to keep U.S. EPA and IDNS apprised of status of Work and notify U.S. EPA when Respondent believes it has met the Verification Criteria at a property;

3) Review methods for distributing and storing documents and reports;

4) Review work area security, safety protocol and the Health and Safety and Emergency Contingency Plans;

5) Discuss any appropriate modifications to the Quality Assurance Project Plan and/or Construction Quality Assurance Plan to ensure that Site-specific considerations are addressed;

6) Review excavation methods, dust control measures, air monitoring methods, materials handling and transportation methods, equipment storage locations, and any other procedures relevant to implementation of the removal action;

7) Review instrument calibration methods, calibration frequencies, cross-checks at regular intervals and with U.S. EPA/IDNS instrumentation, and air monitor flow

checks to assure data quality and confirm agreement between instruments; and

8) Revise schedules and sequence of activities as necessary.

B. ROUTINE PROGRESS MEETINGS

After excavation/restoration Work begins, Respondent shall participate in routine progress meetings with U.S. EPA and IDNS on a monthly basis or more frequently as determined by U.S. EPA. All of the items listed under item A above shall be reviewed and updated if necessary. Problems encountered or anticipated and solutions implemented or planned shall be discussed.

IV. SUMMARY OF MAJOR DELIVERABLES/SCHEDULE

A summary of the project schedule and reporting requirements contained in this SOW is presented below.

Submission/Event	Due Date
1. Excavation and Restoration Phase Work Plan	Thirty (30) days after effective date of Order
2. QAPP/FSP	Thirty (30) days after effective date of Order
3. CQA Plan	Thirty (30) days after effective date of Order
4. Health and Safety Plan	Thirty (30) days after effective date of Order
5. Emergency Contingency Plan	Thirty (30) days after effective date of Order
6. Submit revised plans (see Section VIII of Order)	Within fourteen (14) days of receipt of U.S. EPA disapproval/ comments

7.	Obtain access to properties (see Section XVI of Order)	Contact property owner within fourteen (14) days of notification from U.S. EPA
8.	Preconstruction Meeting	Prior to any excavation work
9.	Begin excavation activities (see Section II.2. of this SOW)	Within twenty-one (21) days after U.S. EPA approval of Work Plan
10.	Transport excavated materials away from properties	Immediately after excavation
11.	Begin restoration activities at individual properties	Within seven (7) days of receipt of U.S. EPA notification that Verification Criteria met
12.	Complete restoration activities at individual properties	As expeditiously as practicable
13.	Monthly Written Progress Reports (see Section XI of Order)	Within fifteen (15) days of end of preceding month
14.	Routine Progress Meetings	Monthly after preconstruction meeting, or more frequently as determined by U.S. EPA
15.	Complete excavation/restoration Work at the site	Without unnecessary delay
16.	Submit Final Report (see Section VIII of Order)	Sixty (60) days after completion of all on-Site Work

ATTACHMENT 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

MEMORANDUM

DATE: NOV 18 1994

SUBJECT: ACTION MEMORANDUM - Determination of Threat to Public Health or Welfare or the Environment at the Kerr-McGee Residential Areas Site and Portions of the Kress Creek/ West Branch of DuPage River Site, DuPage County, Illinois (Residential Areas Site ID #QV, Kress Creek Site ID #QS)

FROM: Rebecca Frey
Remedial Project Manager/On-Scene Coordinator

TO: Valdas V. Adamkus
Regional Administrator

THRU: William E. Muno, Director
Waste Management Division

I. PURPOSE

The purpose of this Action Memorandum (or "Action Memo") is to document the determination of an imminent and substantial threat to public health or welfare or the environment posed by the presence of contaminated soils at the Kerr-McGee Residential Areas Site and residential portions of the Kress Creek/West Branch of DuPage River Site ("Kress Creek Site"), DuPage County, Illinois, and to document approval of the proposed non-time-critical removal action described herein.

The proposed removal action seeks to mitigate the imminent and substantial threat to human health and the environment posed by the presence of uncontrolled hazardous substances at the Sites, both of which are on the National Priorities List ("NPL"). The removal action involves excavating contaminated soils from contaminated properties, backfilling and restoring the properties, and disposing of the soils at a licensed permanent off-site disposal facility. Properties that will undergo removal action include: (1) those properties at the Kerr-McGee Residential Areas NPL Site at which mill tailings from the Kerr-McGee West Chicago Rare Earths Facility ("REF") have come to be located outdoors and at which EPA determines exceed established cleanup criteria, and (2) floodplain soils at residential properties along the Kress Creek NPL Site at which mill tailings from the REF have come to be located outdoors and at which EPA

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determines exceed established cleanup criteria. For purposes of this Action Memo, these properties will collectively be referred to as the Kerr-McGee Residential Areas Removal Site. The removal action is expected to be conducted by Kerr-McGee Chemical Corporation, a potentially responsible party ("PRP").

II. SITE CONDITIONS AND BACKGROUND

Residential Areas Site: CERCLIS ID #ILD980824015.
Kress Creek Site: CERCLIS ID #ILD980823991.
This is a non-time-critical removal action.

The Kerr-McGee Residential Areas NPL Site is located in and around the City of West Chicago, in DuPage County, Illinois, approximately 30 miles west of Chicago, Illinois. The Site encompasses not only residential properties, but also institutional, commercial, municipal and other properties that became contaminated by thorium mill tailings from the REF. The mill tailings contain radionuclides and heavy metals. The properties became contaminated primarily because thorium mill tailings from the REF were used as fill or spilled while being transported elsewhere, although some of the properties may have become contaminated due to windblown material from the REF. The exact number of contaminated properties is unknown at this time, but will be determined by EPA through fund-lead remedial activities that already are underway. Approximately 1500 properties are included in EPA's study area for the Residential Areas NPL Site.

The Kress Creek NPL Site is located south of the City of West Chicago, in unincorporated DuPage County. The Kress Creek Site became contaminated as a result of surface drainage and possibly direct discharges which travelled from the REF through a storm sewer and into the creek. It consists of contaminated sediments in the bed and banks of Kress Creek and the West Branch of the DuPage River (downstream of its confluence with Kress Creek), as well as floodplain soils which became contaminated as a result of flooding and deposition of contaminated sediments over the years. The Kress Creek NPL Site passes through portions of EPA's study area for the Residential Areas NPL Site, as well as through open lands and heavily wooded areas. Some residential properties extend into the floodplain of the Kress Creek Site, and exhibit elevated radiation levels. As described in Section I of this Action Memo, the only portions of the Kress Creek Site addressed in this Action Memo are those portions of the floodplain (not the bed or banks of the creek and river) that are actual residential properties. Specifically, such residential properties are located in the areas numbered 1 and 2 on the map shown in Attachment 2.

The Residential Areas NPL Site and the Kress Creek NPL Site are two of four Kerr-McGee NPL sites in the West Chicago area. The

other two NPL sites, Reed-Keppler Park and the Sewage Treatment Plant, are not addressed by this action. The REF, which is the source of the contamination at all four NPL sites, is not listed on the NPL, but is undergoing cleanup, closure and decommissioning activities under the regulatory authority of the Illinois Department of Nuclear Safety ("IDNS").

From approximately 1932 to 1973, the facility that is now known as the REF was operated by three different companies to extract thorium and other elements from various ores. The facility began operation in 1932, when the Lindsay Light and Chemical Company began producing thorium and other rare earth materials. In 1958, the Lindsay Light and Chemical Company merged into the American Potash & Chemical Company, and in 1967, as part of a larger corporate merger, the Kerr-McGee Chemical Corporation ("Kerr-McGee") acquired the facility. Kerr-McGee maintained operations at the facility until its closure in 1973. When it was operating, the facility reportedly was the largest producer of rare earth and thorium compounds in the world.

Production of thorium, a radioactive material, yielded radioactive mill tailings primarily containing thorium and residual levels of radium and some uranium. These tailings were stockpiled at the REF, and during the early years of operation of the REF (1930's into the 1950's and possibly later), were available for use as fill material at residential and other properties throughout the area. The tailings were also disposed of at Reed-Keppler Park and the Sewage Treatment Plant. During transportation to these sites, some tailings spilled along the route. In addition, the materials stockpiled at the REF also may have been subject to wind dispersal. As a result, the soils at numerous properties throughout the area became contaminated. Other contaminants, contained in surface runoff and possibly direct plant discharges, travelled via a storm sewer to Kress Creek. In 1954, thorium production became subject to federal regulation with the passage of the Atomic Energy Act, implemented by the U.S. Atomic Energy Commission ("AEC"). A license to operate the REF was granted in 1956 to Lindsay Light and Chemical Company and subsequently transferred with REF ownership to Kerr-McGee via its acquisition of American Potash in 1967. In 1974, under the Energy Reorganization Act, the AEC was abolished and its licensing and regulatory authority was transferred to the U.S. Nuclear Regulatory Commission ("NRC"). The State of Illinois petitioned NRC for amendment of the agreement-state licensing program to include licensing control of REF material (categorized as 11(e)(2) by-product material as defined by the Atomic Energy Act), and IDNS was granted licensing authority on November 1, 1990.

The initial base study to identify and briefly characterize contaminated properties outside the REF was conducted from March 1976 to May 1978 by Argonne National Laboratory ("ANL") for the

NRC. This study, conducted by Frigerio et al., identified 77 thorium-processing waste deposits in the area (the main body of the report identified 75 areas, and an appendix identified an additional 2 areas); the locations included Reed-Keppler Park, the Sewage Treatment Plant, and Kress Creek, but also properties located to the east of the REF and other locations outside of the City limits. Techniques used to delineate the contaminated areas included an Aerial Radiological Monitoring Survey ("ARMS") flyover in 1977, a street-by-street instrumented vehicle survey, an external gamma exposure rate survey, soil contamination measurements using subsurface sampling, and a radiological walkover survey along the waterways and banks of Kress Creek and parts of the West Branch of the DuPage River. (The report of this study, entitled "Thorium Residuals in West Chicago, Illinois," is included in the Administrative Record, the index of which is attached to this Action Memo as Attachment 1.)

Around 1981, the NRC reported on external gamma exposure rates at the REF fenceline and surrounding residential neighborhoods, and indicated that exposure rates were the result of both on-REF and off-REF sources; however, the relative contribution of each was not established.

In 1981, Oak Ridge Associated Universities ("ORAU"), led by P.W. Frame, conducted a study of Kress Creek for the NRC as a followup to the early study by Frigerio, et al. The study included analysis of sediment samples from the creek bed and surface soil samples within several meters of the edge of the creek. The report of this study, entitled "Radiological Survey of Kress Creek, West Chicago, Illinois," is included in the Administrative Record (see index, Attachment 1).

Around 1983, ANL conducted indoor radon measurements for EPA in 10 homes in West Chicago. The indoor radon levels in the homes that were tested were generally less than 0.02 Working Levels ("WL") in living areas. (0.02 WL is one of the criteria being used by EPA in current efforts to identify contaminated properties, and also is one of the criteria that will be used to verify proper remediation of properties.)

In 1982 and 1983, ORAU conducted another study of Kress Creek for the NRC as a followup to the 1981 study. The study, again led by P.W. Frame, was much more comprehensive than the first, with the intent of determining not only the direct radiation levels, but also the depth distribution of contamination in the creek and river beds and in bank soil along the creek and river. The 1984 report, entitled "Comprehensive Radiological Survey of Kress Creek, West Chicago, Illinois," is included in the Administrative Record (see index, Attachment 1).

In 1984 and 1985, Kerr-McGee, with assistance from the City of West Chicago, conducted a voluntary cleanup program to identify

and remediate contaminated properties. Kerr-McGee specified an external gamma exposure criterion of 35 microRoentgen per hour ("μR/hr") at 1-meter height for the discovery of contaminated properties. However, Kerr-McGee based cleanup decisions in the field on a criterion of 30 μR/hr. (At the time, background was considered to be approximately 15 μR/hr.) Over 2700 properties within the City were surveyed during this program, and 117 locations that exceeded the Kerr-McGee external gamma exposure criterion were identified. Kerr-McGee excavated 34,868 cubic yards ("yd^3") of thorium residuals from 116 of the 117 identified properties within the City by the end of 1985 and returned the materials to the REF. (Seventy-one of the 77 locations identified by Frigerio et al. were accounted for in the Kerr-McGee program effort.) One of the property owners refused access for excavation of the materials, and, at several other properties where excavation work was conducted, some residuals were left behind (e.g., under foundations, near a support wall for a swimming pool). At the majority of properties remediated, the thorium materials at the identified locations were excavated until the exposure rate was reduced to background or below 15 μR/hr.

In late 1985, Kerr-McGee initiated surveys in areas outside the City, and identified additional properties that exceeded the external gamma exposure criterion, including properties along Kress Creek. Kerr-McGee was unable to remove contaminated materials from these properties, however, because the City would not allow thorium materials from outside the City to be brought back into the City (to the REF). Therefore, the properties that Kerr-McGee identified as contaminated (above 30 uR/hr at 1-meter height) in 1985 in the unincorporated areas of West Chicago remain contaminated.

In October 1984, EPA proposed four sites in the West Chicago area for placement on the NPL, including the Kerr-McGee Residential Areas Site and the Kerr-McGee Kress Creek/West Branch of DuPage River Site.

In 1989, EG&G conducted a second aerial radiological survey of the West Chicago area for IDNS. The 1989 aerial survey used improved instrumentation and flew at lower elevations compared to the 1977 ARMS flyover. A map showing the boundary of elevated gamma levels was submitted to IDNS, but no supporting documentation was provided.

In 1989, IDNS began performing screening-level surveys of residential properties as part of its environmental program in and around the West Chicago area. Surveys initially were conducted to "ground-level-verify" the results of the 1989 aerial survey. IDNS currently conducts surveys at the request of potentially-affected property owners. These surveys generally consist of outdoor gamma exposure rate surveys and a soil sample

from the location on the property with the highest gamma reading. Also, at the request of the school districts, in 1990 IDNS conducted radiological surveys of seven school properties as well as outdoor radon/thoron and air particulate evaluations for several schools. In the period July 31, 1989, through August 12, 1993, IDNS surveyed approximately 160 properties in the West Chicago area, and had categorized 48 of these as "contaminated."

In August of 1990, the Kerr-McGee Residential Areas Site was finalized on the NPL. As described below, EPA remedial activities at the Residential Areas NPL Site are underway and will continue concurrent with and in support of the removal action discussed in this Action Memo.

In February of 1991, the Kerr-McGee Kress Creek/West Branch of DuPage River Site was finalized on the NPL. EPA remedial activities are underway at the Kress Creek NPL Site, and will continue after the removal action discussed in this Action Memo is complete. EPA is conducting a Remedial Investigation/ Feasibility Study at the Site, and will then select a remedy for the entire Site. The removal action discussed in this Action Memo addresses only a small portion of the Kress Creek NPL Site, specifically contaminated residential properties in the floodplain.

In 1993, EPA completed a Preliminary Focused Risk Assessment ("PFRA") for the Residential Areas NPL Site. The PFRA used data that had been collected by IDNS from 4 residences and 3 schools and was conducted to provide a preliminary indication of the general risk range that possibly may be present at the Site. Soil contamination at the selected residences ranged from 28 to 780 picoCuries per gram ("pCi/g"), with external gamma exposures (measured at 1-meter height) ranging from 52 to 590 μR/hr above background (considered to be approximately 7 μR/hr). The risks at the selected residences under current and future land use conditions were generally above what EPA considers acceptable. The levels of soil contamination at the 3 schools that were evaluated ranged from slightly above background to 35 pCi/g, and with different exposure assumptions (compared to residential exposure assumptions), the risks were less than for the residences. However, risks for potential future residential use of the school properties were above acceptable levels.

In November 1993, EPA finalized the Discovery and Characterization Criteria for the Residential Areas NPL Site and the Verification Criteria for the Residential Areas Removal Site. These criteria, contained in the document "Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site, West Chicago, Illinois," are being used for the discovery and characterization of contaminated properties, and will be used for verification activities during and after the removal action. Although there are criteria for several different parameters

(including outdoor soil concentration, outdoor gamma exposure rates, indoor gamma exposure rates, and indoor radon/thoron decay product concentrations), the primary criterion that will be used to make cleanup decisions is outdoor soil concentration. Specifically, properties will be targeted for removal action if dry soil concentrations of total radium (Ra-228 plus Ra-226) exceed 5 pCi/g above background. (EPA currently is establishing background levels, but it is expected that the background levels of Ra-228 and Ra-226 will be roughly 1 pCi/g each.) Cleanups shall proceed until levels no longer exceed 5 pCi/g above background. In addition, cleanups will use the concept of "ALARA" (As Low As Reasonably Achievable). A summary of the verification criteria, which will be used during and after the removal action, is shown in Attachment 3. A complete description of all the action criteria (discovery/characterization and verification) is contained in the action criteria document cited above, which is included in Appendix A of the Engineering Evaluation/Cost Analysis, which is attached to this Action Memo as Attachment 8.

Currently, EPA is conducting Fund-lead remedial activities in order to identify those contaminated properties needing remediation. This work, known as the discovery and characterization phase, will support the removal action recommended in this Action Memo, and will address all affected properties in the Residential Areas NPL Site and residential properties located in the floodplain of the Kress Creek NPL Site. EPA is using the results of the 1989 aerial radiological survey to define the boundary of the study area for the discovery and characterization phase. Attachment 2 is a map of EPA's study area, which includes approximately 1500 properties. EPA began the discovery and characterization fieldwork in January 1994 by commencing indoor radon/thoron and indoor gamma surveys at homes within the study area. The outdoor discovery and characterization fieldwork began in April 1994 and will continue throughout 1995. (The discovery and characterization work EPA is conducting is described in detail in the document "Work Plan for the Engineering Evaluation/Cost Analysis and Remedial Investigation/Feasibility Study, Kerr-McGee Residential Areas, West Chicago, Illinois," February 1994. The Work Plan is included in the Administrative Record (see index, Attachment 1).

IDNS has been working cooperatively with EPA during the planning and implementation of remedial activities at the Residential Areas NPL Site. Soil samples collected by EPA during discovery and characterization fieldwork are being analyzed at the IDNS laboratory. When the removal action commences, IDNS will conduct the verification activities for EPA at the Residential Areas Removal Site to ensure that the cleanups are done in accordance with the established cleanup criteria. EPA anticipates that the actual removal action will be conducted by Kerr-McGee.

In conjunction with the Fund-lead remedial activities which are underway, EPA has been conducting and will continue to conduct community relations activities to keep the community informed about the Site and involved in the decision-making process. A Community Relations Plan has been prepared and is included in the Administrative Record.

The materials of concern at the Site are thorium mill tailings which contain radionuclides such as thorium, uranium and radium, and heavy metals such as lead, barium and chromium. All of these are hazardous substances as defined by Section 101(14) of CERCLA. Access to the hazardous substances currently is unrestricted, and due to the nature of the Site (e.g., residential properties), it would be difficult and impractical to restrict access. As a result, the primary routes of exposure include direct exposure to gamma radiation from contaminated soil, incidental ingestion of contaminated soil, inhalation of radon/thoron decay products, ingestion of contaminated vegetables grown in contaminated soil, and direct contact with skin. Because thorium is very insoluble (unless in the presence of very strong acids), contamination of groundwater from the contamination at the Residential Areas Removal Site is not considered a pathway of concern. However, because the contaminated soil is expected to be largely at or near the ground surface, wind, erosion or deliberate human movement could cause the hazardous substances to migrate.

As mentioned earlier, the number of contaminated properties, and thus the volume of contaminated soil to be removed, is unknown at this time. However, a range of volumes and cost estimates for the removal action has been developed in an Engineering Evaluation/Cost Analysis prepared by EPA dated August 1994. (Volume and cost estimates are described in Section V.B. of this Action Memo.)

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Conditions at the Kerr-McGee Residential Areas Removal Site currently exist which, if not addressed by implementing the response action documented in this Action Memorandum, may present an imminent and substantial endangerment to public health or welfare or the environment. The conditions at the Residential Areas Removal Site meet the criteria for a removal action as set forth in the NCP, Section 300.415(b)(2), specifically:

A) Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby human populations, animals or the food chain.

This factor is present at the Residential Areas Removal Site because of the existence of thorium mill tailings

in the soils of residential and non-residential properties, including municipal, commercial and institutional properties. The thorium mill tailings contain radionuclides such as thorium, uranium and radium, and heavy metals such as lead, barium and chromium, all of which are hazardous substances as defined by Section 101(14) of CERCLA. Nearby human populations and animals may be exposed to the hazardous substances by the following routes of exposure:

1) Direct gamma exposure both inside and outside structures resulting from radioactive decay from contaminated soil outside structures

2) Incidental ingestion of contaminated soil

3) Inhalation of radon and thoron decay products within enclosed structures (i.e., homes) emanating from contaminated soil beneath or against the foundation of the structure

4) Ingestion of contaminated homegrown vegetables

5) Dermal exposure to beta emitters from direct contact of skin with contaminated soils

An unknown number of properties at the Residential Areas Removal Site contain levels of radionuclides that exceed the Site-specific action level of 5 pCi/g above background. EPA believes that the presence of any additional hazardous substances, such as the metals lead, barium and chromium, is due to the presence of the mill tailings and that excavation of the mill tailings to the cleanup standards for radionuclides described in Section II of this Action Memo and the action criteria document (Appendix A of Attachment 8) will adequately mitigate any risk presented by these metals. EPA currently is investigating whether such metals are present at levels of concern.

The thorium mill tailings at the Residential Areas Removal Site emit ionizing radiation. Exposure to ionizing radiation, if at sufficiently high doses and dose rates, can cause carcinogenic, genetic and teratogenic effects. For this Site, the potential for cancer induction in exposed individuals is considered to be the greatest health concern. Ionizing radiation is a demonstrated human and animal carcinogen, based on data that correlates high exposures of radiation to cancer induction. Although significant uncertainty exists from extrapolating high-level information to low-level effects, current radiation protection

standards are based on the idea that each increment of radiation exposure causes a linear increase in the risk of cancer.

In addition to hazards from exposure to radiological emission products, uranium is chemically toxic to the kidneys.

Lead is the most common toxic metal in the environment, and there are many effects from chronic exposure to low levels, ranging from anemia to impairment of the nervous, hematopoietic and cardiovascular systems. The effects of exposure to barium can include paralysis, cardiovascular abnormalities and gastroenteritis. Chronic ingestion of hexavalent chromium can cause kidney damage, while chronic inhalation can cause lung cancer.

The Illinois Department of Public Health, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry, conducted a Public Health Assessment for the "Kerr-McGee Radiation Areas." The Public Comment Release version of the Public Health Assessment (included in Administrative Record; see index, Attachment 1) stated that although the health outcome data that has been evaluated indicated increases in certain cancers in the community and workers at the REF, the studies were inconclusive with respect to identifying the Kerr-McGee wastes as the cause of the cancers.

The Public Health Assessment concluded that the conditions at the site "are a public health hazard because of the risk to human health resulting from past, present and potential future exposure to radioactive and nonradioactive substances at concentrations that may result in adverse health effects." The Public Health Assessment recommended that "Action should be taken to reduce public exposure in residential areas which still have tailings, including properties along Kress Creek and the West Branch of the DuPage River. If no permanent solution is available, interim measures should be taken." (See Attachment 4, which consists of selected pages from the Public Health Assessment.)

B) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.

This factor is present at the Residential Areas Removal Site due to the existence of thorium mill tailings in

surface and near subsurface soils that may migrate due to wind, erosion, deliberate human movement, or migration of radon/thoron gas from soils into structures.

The action level for this Site is 5 pCi/g above background for total radium (Ra-228 plus Ra-226). It is expected that background levels of Ra-228 and Ra-226 are approximately 1 pCi/g each. The four residences sampled by IDNS that EPA evaluated in the Preliminary Focused Risk Assessment had soil concentrations ranging from 28 to 780 pCi/g. The Frame reports (1981 and 1984) indicate that the data from the banks of Kress Creek fell within this range. Most of the properties remediated by Kerr-McGee in the mid-1980s had concentrations (according to Kerr-McGee unvalidated data) in this same range prior to excavation, but several had concentrations significantly higher than this. It is expected that the majority of properties that will be identified by EPA during the discovery and characterization phase will have levels within the same range as those evaluated in the Preliminary Focused Risk Assessment, but some properties with higher levels still may exist. Most of the contamination is expected to be found in the top 2 feet of soil (as was found during the mid-1980s cleanup effort by Kerr-McGee).

Radon-222 (commonly known as radon) and radon-220 (commonly known as thoron) are the gaseous decay products of uranium and thorium, respectively. If mill tailings are located in the soils against or beneath the foundation of a structure, radon and thoron can migrate through the soils and into the structure through sumps or cracks in the foundation. Although indoor air monitoring was not routinely done during Kerr-McGee's cleanup effort in the mid-1980s, Kerr-McGee found at least one home with significantly elevated levels of thoron due to mill tailings beneath the house.

The hazardous substances at the Site also may migrate due to wind or erosion (if there are contaminated areas without a good vegetative cover) or by deliberate human movement of soils.

C) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

This factor is present at the Residential Areas Removal Site due to the existence of thorium mill tailings in surface and near subsurface soils that may migrate due

to wind or erosion. Such migration may occur if there are contaminated areas without a good vegetative cover or if there are contaminated areas that have been disturbed by human activities.

IV. ENDANGERMENT DETERMINATION

Given the Site conditions, the nature of the radioactive hazardous substances in residential and non-residential properties at the Site at levels above the established cleanup criteria for the Site, the public health risks from the Site as documented in the Public Health Assessment (see Attachment 4) prepared by the Illinois Department of Public Health under cooperative agreement with the Agency for Toxic Substances and Disease Registry, and the actual or potential exposure pathways to nearby populations described in Sections II and III above, the actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed Action Description

The following actions are proposed to mitigate the imminent and substantial endangerment to human health or welfare or the environment posed by contaminated soils at the Site:

a) Excavate contaminated materials from properties in the Residential Areas Removal Site (including affected properties at the Kerr-McGee Residential Areas NPL Site and affected residential properties along the Kress Creek NPL Site) found to exceed EPA's discovery and characterization criteria until levels at or below the verification criteria are reached, including implementing the ALARA principle (see action criteria document, Appendix A of Attachment 8).

b) Provide additional measures (e.g., indoor engineering controls for radon/thoron, institutional controls) for those limited and exceptional situations that may occur where complete excavation of contaminated materials cannot be accomplished and such measures are needed to reduce exposures and associated risks.

c) Minimize the potential health hazards to workers performing the removal action and to nearby residents during the removal action.

d) Backfill the excavations with clean soil and restore properties to their original condition or to such other condition as may be arranged with the property owner.

e) Use appropriate environmental monitoring during and after removal to verify that cleanup levels are reached and short-term impacts (e.g. generation of dust during removal) are minimized.

f) After excavation, transport all contaminated materials away from the affected properties and ship all contaminated materials removed from affected properties by rail to a permanent off-site disposal facility licensed to accept and dispose of 11(e)(2) byproduct material.

The response actions described in this memorandum directly address actual or threatened releases of hazardous substances at the Residential Areas Removal Site which may pose an imminent and substantial endangerment to public health and safety, and to the environment. These response actions do not impose a burden on affected property disproportionate to the extent to which that property contributes to the conditions being addressed. The response action will comply with the Off-Site Rule (58 F.R. 49200, September 22, 1993). The appropriate State officials in the receiving State will be notified, prior to actual shipment of wastes, that wastes from the Residential Areas Removal Site will be shipped to a disposal area in that State as part of this response action.

Currently, EPA anticipates that the removal action will be conducted by Kerr-McGee. If so, Kerr-McGee would use the REF as a staging area for the wastes, which then would be shipped by rail to a permanent disposal site in Utah (Envirocare) concurrent with other wastes from the REF. In the unlikely event that transportation of the wastes to the permanent disposal facility is delayed, interim storage of the wastes at the REF would be allowed by EPA, subject to any necessary State or local approvals.

In the event that Kerr-McGee does not conduct the removal action and such action must be carried out by EPA as a Fund-lead action, an off-REF staging area probably would be used by EPA. Such staging area would consist of an available railyard where properly packaged wastes would be staged and loaded onto railcars for shipment to the disposal site.

Wastes would need to be properly packaged, labeled, manifested, and otherwise ready for shipment when taken to the off-REF staging area to avoid the need for licensing of the staging area. In the event that Kerr-McGee does not conduct the removal action and this contingent action becomes necessary, another Action Memorandum would be required to request and secure funding for the Fund-lead action, and more details would be provided as necessary in that Memorandum.

EPA evaluated a number of possible response actions in the Engineering Evaluation/Cost Analysis (Attachment 8), and has determined that excavation of the contaminated soils and off-site disposal (the alternative recommended) is the only feasible long-term solution for mitigating the threats posed by the Site. Excavation permanently segregates the contaminated soils from the public and is therefore effective at reducing exposure to nearby populations. Excavation technology using standard construction procedures and conventional equipment has been successfully applied at the similarly contaminated sites throughout the United States.

Although excavation of contaminated soils is the primary component of the removal action, situations may be encountered where complete excavation cannot be accomplished and additional measures are needed to reduce exposures and associated risks. In such limited and exceptional situations, it may be necessary to provide additional measures such as institutional controls or engineering controls for radon/thoron.

EPA must continue its discovery and characterization activities in order to fully characterize the extent of the contamination at the Site (i.e., number of contaminated properties and the volume of contaminated soil). However, removals need not wait until the entire Site has been characterized, but should begin as soon as possible (weather permitting) on the properties that already been been identified as contaminated.

A public comment period was held on the Engineering Evaluation/Cost Analysis ("EE/CA") (see Section V.A.4. of this Memo). EPA reviewed all public comments received during the public comment period and determined that the scope of the removal action recommended in the EE/CA did not need to be changed as a result of the comments. However, as indicated in the written response to significant comments (Attachment 9), EPA continues to evaluate additional recontamination prevention measures to prevent the residential properties along Kress Creek from becoming recontaminated after they are cleaned up due to future flood

events and will complete this evaluation before excavation begins at any of the Kress Creek properties. In the EE/CA, EPA had evaluated recontamination prevention measures, such as an earthen berm or steel sheet piling, and recommended that such measures not be implemented. However, one of the commenters suggested a different recontamination prevention measure, namely a geomembrane fabric or "silt fence." If EPA determines that such a measure is appropriate, based on an evaluation against the criteria of effectiveness, implementability and cost, EPA will amend this Action Memo, if necessary.

2. Contribution to Remedial Performance

The proposed removal action will contribute to the efficient performance of the long-term remedial action for the Residential Areas NPL Site, and will contribute to and is consistent with the long-term remedial action for the Kress Creek NPL Site. The proposed action is consistent with the concept of the Superfund Accelerated Cleanup Model, which encourages taking early actions at sites to promptly reduce risks. A Record of Decision ("ROD") has not been written for the Residential Areas NPL Site or the residential properties along the Kress Creek Site, but would undoubtedly select the same actions (e.g., excavation and off-Site disposal) proposed in this Memo.

For the Residential Areas NPL Site, EPA will continue to collect additional data on the nature and extent of contamination as it proceeds with the discovery and characterization fieldwork already in progress. Additionally, verification data collected from properties during and after excavation of contaminated soils will be evaluated to assess the conditions of the post-removal Site (i.e., amount of residual materials remaining after removal and risks from such residuals). All such data will be incorporated into a Remedial Investigation/Feasibility Study for the Site. At some point during this process, EPA will write a ROD documenting the decision on the final remedial action for the Site. EPA anticipates that properties at the Residential Areas NPL Site undergoing removal action as a result of this Action Memo will require no further action in the future.

For the Kress Creek NPL Site as a whole, EPA is conducting a Remedial Investigation/Feasibility Study which will lead to selection of the final remedy for the Site, the majority of which is not addressed by the actions proposed in this Action Memo. For the residential properties along the Kress Creek NPL Site addressed by this Action Memo, removal of the contaminated soil will contribute to and is consistent with the long-term remedial action for the NPL Site. The

possibility exists that additional measures may be needed at these properties in the future, however, because the sediments of the creek will remain contaminated until addressed by the final remedy for the Site, and future flood events may recontaminate the properties to some extent. It is unknown whether a severe flood event will occur in the interim, and if it does, it is unknown to what extent the properties would be recontaminated, if at all. EPA believes that such recontamination, if it occurred, would be less than the contamination that currently exists on the properties. Therefore, in order to achieve prompt risk reduction to the affected residents, EPA believes that the contaminated residential properties along Kress Creek should be included in the Residential Areas Removal Site and undergo removal action at the same time as other properties, even though additional actions may be necessary in the future. The residents who live along the creek who did submit comments to EPA support this approach. Also, as discussed in Section V.A.1. of this Action Memo, EPA will continue to evaluate additional recontamination prevention measures for the residential properties along Kress Creek, and will amend this Action Memo in the future if necessary.

3. Description of Alternative Technologies

Alternative treatment technologies were considered in the EE/CA but are not proposed. As discussed in detail in the EE/CA, the physical and chemical treatment technologies available did not pass the initial screening of alternatives because they were judged not to be effective for the radioactively contaminated soils from this Site.

4. Engineering Evaluation/Cost Analysis - EE/CA

The EE/CA Approval Memorandum, dated August 19, 1993, is attached to this Action Memo as Attachment 7. The actual EE/CA, dated August 1994, is attached to this Action Memo as Attachment 8. The EE/CA should be consulted for further information regarding the range of possible removal alternatives considered and the evaluation of alternatives against the criteria of effectiveness, implementability and cost.

A public comment period on the EE/CA and the recommended removal action began on August 4, 1994, and originally was scheduled to end on September 2, 1994. During that time, however, EPA received a timely request for an extension, and thus extended the public comment period until September 19, 1994. A public meeting was held on August 17, 1994, with a court reporter present to record the proceedings, including verbal comments on the EE/CA and the recommended removal action. A transcript of the meeting is included in the

Administrative Record. During the public comment period, written comments were received from several residents of the West Chicago area, the Illinois Department of Public Health, the City of West Chicago, and Kerr-McGee Chemical Corporation. All written comments are included in the Administrative Record. EPA considered all significant comments prior to recommending the proposed actions contained in this Action Memo. Attached to this memo as Attachment 9 is EPA's written response to the significant (verbal and written) comments that EPA received.

5. Applicable or Relevant and Appropriate Requirements ("ARARs")

Appendix B of the EE/CA discusses in detail the preliminary list of federal and state ARARs for the removal action at the Residential Areas Removal Site. (State ARARs were provided by the State prior to finalization of the EE/CA.) For all on-Site activities during the removal action, compliance with the Action Criteria for this Site (Appendix A of Attachment 8) is deemed to be compliance with all federal and state ARARs related to cleanup levels of radioactive contamination. The Action Criteria will be complied with during the removal action to the maximum extent practicable considering the exigencies of the situation. Other federal and state ARARs (discussed in Appendix B of the EE/CA) address other aspects of the removal action, and also will be complied with to the extent practicable considering the exigencies of the situation.

6. Project Schedule

The exact length of time to carry out the removal action is unknown at this time because the extent of contamination (number of contaminated properties and volume of contamination) is not yet known. EPA's discovery and characterization fieldwork to define the extent of contamination began early in 1994 and is scheduled to continue through the end of 1995, and will include the investigation of approximately 1500 properties in and around West Chicago. The removal action need not wait until the entire Site has been characterized, but should begin as soon as possible (weather permitting) on the properties that already have been identified, and continue for as long as necessary to address all properties found to be contaminated.

If, as EPA anticipates, Kerr-McGee implements the removal action, Kerr-McGee would submit a Removal Action Work Plan and other associated documents which detail how the removal will be conducted. Excavation can begin after the Work Plan is approved by EPA. Because of the approaching winter

months and the need to have an approved Work Plan for the Site work, excavation work will not begin until Spring 1995. EPA currently expects that the removal work would continue through the end of the 1995 construction season, and depending on the number of properties needing remediation, may continue into the 1996 construction season.

B. Estimated Costs

EPA anticipates that this removal action will be conducted by Kerr-McGee, therefore, detailed cost estimates are not required in this Memo. However, the following cost estimates are provided for informational purposes only. (EPA's discovery and characterization costs are considered part of the RI/FS for funding purposes, and therefore are not discussed herein.)

The costs for the removal action at this Site will be directly dependent on the extent of contamination (number of contaminated properties and volume of material), which has not yet been determined. However, using information from the previous Kerr-McGee cleanup effort in the mid-1980s, along with other available information and some reasonable assumptions, the EE/CA presented a possible range of costs for the response action. In order to have a consistent basis on which to estimate costs between the alternatives considered, the EE/CA assumed that all of the waste would be packaged in durable plastic bags for shipment to the disposal site. If Kerr-McGee conducts the removal action, wastes probably would be handled and shipped in bulk, so costs would vary from the estimates in the EE/CA. Additionally, the terms of Kerr-McGee's contract with the disposal facility (Envirocare) are confidential, so EPA does not know at this time the exact unit cost to Kerr-McGee for disposal; the EE/CA had to estimate this cost as well.

Cost estimates are provided in the EE/CA for four different volume scenarios, as shown in the table in Attachment 5. The costs range from $22 million for 15,000 yd^3 of material (estimated volume from 50 properties) to $119 million for 120,000 yd^3 of material (estimated volume from 400 properties). The actual costs probably will fall somewhere between these two extremes. The figure in Attachment 6 graphically depicts the estimated cost breakdown for each of the four volume scenarios. More details on the cost estimates are included in the EE/CA (Attachment 8).

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

If action is delayed or not taken, public health risks to the population living on or adjacent to contaminated properties at

the Site will increase due to prolonged exposure to direct gamma radiation, incidental ingestion of contaminated soil, inhalation of radon and thoron decay products, ingestion of contaminated homegrown vegetables, and direct contact with contaminated soils.

VII. OUTSTANDING POLICY ISSUES

None.

VIII. ENFORCEMENT

EPA sent Kerr-McGee a "General Notice of Potential Liability" letter on April 14, 1994, notifying Kerr-McGee that it is considered a PRP with regard to the Site, and asking Kerr-McGee about its willingness to negotiate an agreement for the conduct of removal actions at the Site. Kerr-McGee indicated a willingness to negotiate with EPA. The parties negotiated through October 1994. On October 31, 1994, Kerr-McGee indicated that it could not accept the terms of EPA's final offer. EPA has reason to believe that Kerr-McGee would comply with a Unilateral Order.

Further details regarding EPA's negotiation and enforcement strategy are considered "enforcement sensitive." For administrative purposes, such information is contained in an Enforcement Confidential Addendum to this Action Memo.

IX. RECOMMENDATION

This decision document represents the selected removal action for the Kerr-McGee Residential Areas Removal Site in DuPage County, Illinois, developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based on the Administrative Record for the Site. Conditions at the Site meet the NCP Section 300.415(b)(2) criteria for a removal and I recommend your approval of the proposed removal action. Please indicate your decision by signing below.

APPROVED: _____ DATE: 11/18/94
for Regional Administrator

DISAPPROVED: _____ DATE: _____
Regional Administrator

Enforcement Confidential Addendum

Attachments

1. Index to Administrative Record
2. Site Map
3. Summary Table of Verification Criteria
4. Selected Pages from Public Comment Release Version of the Public Health Assessment for the Kerr-McGee Radiation Areas
5. Table -- Cost Estimates
6. Figure -- Cost Estimates
7. EE/CA Approval Memorandum
8. Engineering Evaluation/Cost Analysis (EE/CA)
9. Written Response to Significant Public Comments

cc: Terri Johnson, EPA HQ, 5202G
Don Henne, U.S. Department of the Interior
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bcc (w/out EE/CA): A.Baumann
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J.Cisneros
L.Fabinski, ATSDR
O.Warnsley
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L.Jensen
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K.Tindall
J.Traub
W.Muno
K.Westlake
M.Radell
A.Turner, CH2M Hill

Original: Kerr-McGee Residential Areas Site File

ATTACHMENT 1

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL ACTION

ADMINISTRATIVE RECORD
FOR
KERR-MCGEE RESIDENTIAL AREAS REMOVAL SITE

WEST CHICAGO, ILLINOIS

NOVEMBER 18, 1994

DATE	AUTHOR	RECIPIENT	TITLE DESCRIPTION	PAGES
06/00/74	U.S. Atomic Energy Commission		Regulatory Guide 1.86: Termination of Operating Licenses for Nuclear Reactors	5
09/00/78	Frigerio, N., et al.; Argonne National Laboratory	U.S. NRC	Report: Thorium Residuals in West Chicago, IL (NUREG/CR-0413; ANL/ES-67)	33
00/00/80	Russell, J. U.S. EPA	Jensen, L., Region 5/ U.S. EPA	Memorandum re: External Exposure Rates from Thorium and Uranium in Soil	3
04/00/81	Ad Hoc Technical Group	U.S. EPA	Findings of Ad Hoc Technical Group on Cleanup of Open Land Contaminated with Uranium Mill Tailings	22
11/00/81	Frame, P., Oak Ridge Associated Universities, TN	U.S. NRC	Final Report: Radiological Survey of Kress Creek, West Chicago, IL	21
10/00/82	ORP/U.S. EPA	U.S. EPA	Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192): Volume I (EPA 520/4-82-013-1)	

10/00/82	ORP/U.S. EPA	U.S. EPA	Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192): Volume II (EPA 520/4-82-013-2)	
09/00/83	ORP/U.S. EPA	U.S. EPA	Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192): Volume I (EPA 520/1-83-008-1)	
09/00/83	ORP/U.S. EPA	U.S. EPA	Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192): Volume II (EPA 520/1-83-008-2)	
02/00/84	Frame, P., Oak Ridge Associated Universities, TN	U.S. NRC	Final Report: Comprehensive Radiological Survey of Kress Creek, West Chicago Area, IL	93
02/08/90	U.S. DOE	U.S. EPA	DOE Order 5400.5: Radiation Protection of the Public and the Environment	87
12/00/90	OSWER/ U.S. EPA	U.S. EPA	Superfund Removal Procedures: Action Memorandum Guidance (EPA/540/P-90/004)	65
03/00/92	Russell, J., and Richardson, C., ORP/ U.S. EPA		Paper Presented at Waste Management '92 Symposium: Cleanup Standards for Radium Contaminated Soils	7
01/00/93	Sanford Cohen & Associates, Inc.	U.S. EPA	Preliminary Focused Risk Assessment for West Chicago Vicinity Properties	103

02/25/93	Kerr-McGee Chemical Corporation	U.S. EPA	Comments on the Focused Risk Assessment and Associated Fact Sheet	30
02/25/93	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter re: the Focused Risk Assessment and Associated Fact Sheet	2
03/01/93	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter re: Comments on the Focused Risk Assessment and Associated Fact Sheet	2
03/29/93	Kerr-McGee Chemical Corporation	U.S. EPA	Comments on the Action Criteria for Superfund Removal Actions and the Associated Fact Sheet	90
03/29/93	Kerr-McGee Chemical Corporation	U.S. EPA	Exhibits to Comments on the Action Criteria for Superfund Removal Actions and the Associated Fact Sheet	310
03/29/93	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter re: Action Criteria for Superfund Removal Actions (Review Draft: March 1993)	1
04/28/93	Meserve, R., Covington & Burling	Frey, R. and Radell, M., U.S. EPA	Letter re: Various Comments on the West Chicago Superfund Sites w/Attachment	7
05/05/93	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter re: Proposed Storage of Tailings at Manville Oaks Park w/Attachment	3
06/00/93	Kathren, R., et al.	U.S. NRC	Scientific and Public Issues Committee Position Statement: Radiation Standards for Site Cleanup and Restoration (Health Physics Society Newsletter)	4

06/02/93	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter Forwarding Various Attached U.S. EPA Documents re: Criteria to Guide Response Actions	107
06/18/93	Oge, M., ORIA/U.S. EPA	Kee, D., Region 5/ U.S. EPA	Memorandum re: Technical Input on Cleanup Criteria for West Chicago Residential Area Superfund Site w/Attachment	5
07/00/93	U.S. NRC		Regulatory Guide 8.37: ALARA Levels for Effluents from Materials Facilities	6
08/00/93	OSWER/ U.S. EPA	U.S. EPA	Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA/540-R-93-057; Publication 9360.0-32; PB93-963402)	66
08/11/93	U.S. EPA		Statement of Work for Conducting an EE/CA and RI/FS	31
08/19/93	Frey, R. U.S. EPA	File	Action Memorandum: Request for Authorization to Proceed with Contracting for the Performance of an EE/CA and RI/FS	2
08/19/93	Frey, R., U.S. EPA	File	EE/CA Approval Memorandum	2
09/17/93	McReynolds, M., U.S. EPA	CH2M Hill	Work Assignment Form: Initial Assignment of Work Dated August 17, 1993	1
10/05/93	Meserve, R., Covington & Burling	Frey, R. and Seely, D., U.S. EPA	Letter re: Indoor Radon Levels	3
10/22/93	Meserve, R., Covington & Burling	Frey, R. and Seely, D., U.S. EPA	Letter re: the Radium-in-Soil Standard	7

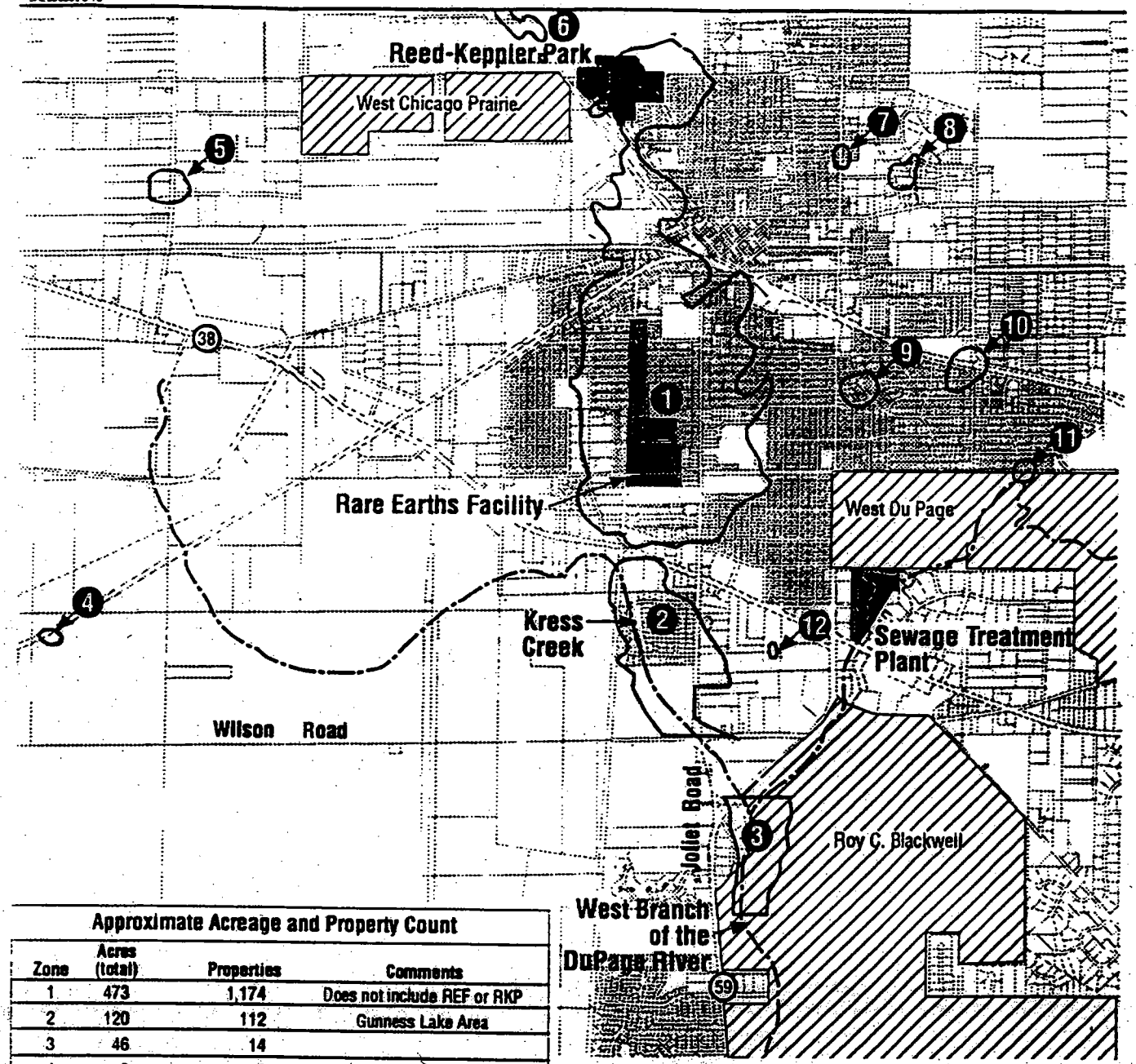
10/22/93	Meserve, R., Covington & Burling	Oge, M., ORIA/U.S. EPA	Letter re: Radium-in-Soil Cleanup Standards for Certain CERCLA Sites in West Chicago	2
11/00/93	Illinois Dept. of Public Health; et al.		Public Health Assessment--Public Comment Release re: Kerr-McGee Radiation Areas, West Chicago, IL	202
11/00/93	U.S. EPA		Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site	19
12/00/93	U.S. EPA		Summary of Responses to Public Comments on the March 1993 Review Draft of Action Criteria for Superfund Removal Actions	16
12/01/93	McReynolds, M., U.S. EPA	CH2M Hill	Work Assignment Form: Authorization to Start Work on the EE/CA Task	1
12/07/93	Oge, M., ORIA/U.S. EPA	Meserve, R., Covington & Burling	Letter re: Cleanup Criteria for the Kerr-McGee West Chicago NPL Sites	2
02/00/94	CH2M Hill	U.S. EPA	Work Plan for the EE/CA and RI/FS	103
02/18/94	Meserve, R., Covington & Burling	Frey, R., and Seely, D., U.S. EPA	Letter re: Action Criteria for Superfund Removal Actions	8
03/00/94	U.S. EPA	Public	Fact Sheet: U.S. EPA Begins Field Work at Kerr-McGee Residential Areas Site	6
06/10/94	PRC Environmental Management, Inc.	U.S. EPA	Community Relations Plan	89

07/14/94	OSWER/ U.S. EPA	U.S. EPA	Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (OSWER Directive #9355.4-12)	25
08/00/94	CH2M Hill	U.S. EPA	Engineering Evaluation/Cost Analysis, Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site	179
08/00/94	U.S. EPA	Public	Fact Sheet: U.S. EPA Recommends Cleanup Plan for the Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site	6
08/04/94	U.S. EPA	Public	Public Notice: U.S. EPA Announcement of Public Meeting and Public Comment Period re: the EE/CA Document for Removal Actions	1
08/05/94	Meserve, R., Covington & Burling	Frey, R., U.S. EPA	Letter re: Request for an Extension to the Public Comment Period on the EE/CA	2
08/17/94	County Court Reporters, Inc.	U.S. EPA	Transcript of August 17, 1994 Public Meeting	153
08/18/94	Andrews, B., West Chicago Resident	Frey, R., U.S. EPA	Letter re: Public Comment on the EE/CA	1
08/18/94	Baughman, T., Illinois Dept. of Public Health	Deamer, E.,	Letter re: Comments on the Draft EE/CA	6
08/19/94	Hamlin, J., West Chicago Resident	Deamer, E., U.S. EPA	Public Comment Form re: the EE/CA	2
08/24/94	Kautzky, H., West Chicago Resident	Deamer, E., U.S. EPA	Letter re: Public Comment on the EE/CA	2

08/25/94	Pande, D. & L. West Chicago Residents	Frey, R., U.S. EPA	FAX Transmittal re: Public Comment on the EE/CA	2
08/31/94	Frey, R., U.S. EPA	Meserve, R., Covington & Burling	Letter re: U.S. EPA's Extension of the Public Comment Period on the EE/CA	1
09/07/94	U.S. EPA	Public	Public Notice: U.S. EPA Announcement of Extension to the Public Comment Period on the EE/CA	1
09/16/94	Kerr-McGee Chemical Corporation	U.S. EPA	Section-by-Section Comments on the EE/CA	176
09/16/94	Meserve, R., Covington & Burling	Deamer, E., U.S. EPA	Letter re: Comments on the EE/CA w/Attachment	26
09/19/94	Magel, B., Karganis & White, Ltd.	Frey, R., U.S. EPA	Letter re: Comments on the EE/CA	8
11/00/94	U.S. EPA		Written Response to Significant Public Comments on the August 1994 EE/CA	58
00/00/00	Frey, R., U.S. EPA	U.S. EPA	Action Memorandum: Determination of Threat to Public Health or Welfare or the Environment at the Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site [PENDING]	

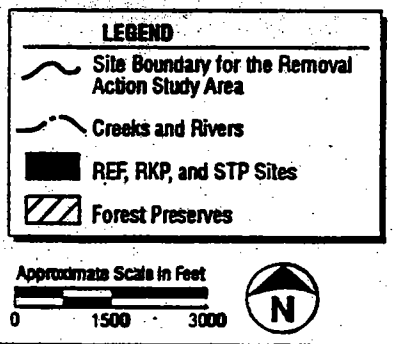
ATTACHMENT 2

SAE86668.FB 10



Approximate Acreage and Property Count

Zone	Acres (total)	Properties	Comments
1	473	1,174	Does not include REF or RKP
2	120	112	Gunness Lake Area
3	46	14	
4	2	3	
5	10	6	
6	7	9	
7	3	11	
8	6	16	Edgewood Walk Area
9	9	39	
10	11	35	
11	4	14	
12	1	1	
	692 ac	1,434	



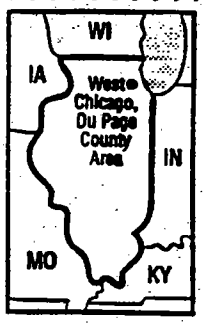


Figure 1-2
Study Area
Residential Areas Site and Portions of the Kress Creek Site

ATTACHMENT 3

Table 3-1
Summary of EPA Action Criteria for the Verification Phase

Topic	Unit of Measure	Background[a]	Criteria
Indoor thoron and radon decay product concentrations	WL (working level)	0.002 WL	Reasonable efforts must be made to achieve an annual average concentration (including background) in occupied buildings of no more than 0.02 WL; in any case, the concentration (including background) must not exceed 0.03 WL [40 CFR 192.12(b)(1) and 192.40(b)].
Outdoor gamma exposure rate	μR/hr (microRoentgen per hour)	5 to 13 μR/hr.	After backfilling, the outdoor gamma exposure rates must not statistically exceed background at a distance of 100 cm from the surface [Illinois Administrative Code, Section 332.150(b)(2)].
Indoor gamma exposure rate	μR/hr (microRoentgen per hour)	Background data unavailable	Indoor gamma exposure rates must not statistically exceed background [Illinois Administrative Code, Section 332.150(b)(2)]. Note: This criterion will be used as a "finding tool" during verification to help determine if additional removal is necessary.
Radionuclide activity (concentration) in outdoor soils	pCi/g (picoCurie per gram) of dry soil	2.25 to 3 pCi/g[b]	Dry soil concentrations of total radium (Ra-226 plus Ra-228) must not exceed 5 pCi/g above background levels averaged over areas up to 100 m^2 in any 15-cm depth [based on relevant and appropriate portions of Illinois Administrative Code, Section 332.150(b)(1)].
General approach for removal action	Not applicable	Not applicable	Every reasonable effort should be made to maintain exposures and radioactive material quantities ALARA [Illinois Administrative Code, Part 340; 10 CFR 20; Department of Energy (DOE) Order 5400.5; NRC Regulatory Guide 8.37].

[a]Background values shown are approximate and are based on current available data. Additional background data will be obtained during the pilot-test and discovery phases of the removal.
[b]This background value is for total radium: Ra-228 at 0.85 to 1.6 pCi/g and Ra-226 at 1.4 pCi/g (see Section 2.2.7).

ATTACHMENT 4

PUBLIC COMMENT RELEASE

PUBLIC HEALTH ASSESSMENT

KERR MCGEE RADIATION AREAS

DUPAGE COUNTY

WEST CHICAGO, ILLINOIS

CERCLIS NOs.
KRESS CREEK = ILD980823991
REED-KEPPLER PARK = ILD980824007
RESIDENTIAL AREAS = ILD980824015
WASTEWATER TREATMENT PLANT = ILD980824031

Prepared by:

Illinois Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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CONCLUSIONS

On the basis of the information reviewed, IDPH has concluded that the Kerr-McGee Facility, Residential Areas, Reed-Keppler Park, the West Chicago Regional Wastewater Treatment Plant (WTP), Kress Creek, and the West Branch of the DuPage River are a public health hazard because of the risk to human health resulting from past, present and potential future exposure to radioactive and nonradioactive substances at concentrations that may result in adverse health effects. As noted in the previous sections, exposure to contaminants in and around these areas may have occurred via any combination of: inhalation of contaminated dust and gases; the ingestion of polluted dust, food, groundwater, sediment, soil, and surface water; and dermal exposure to contaminated dust, gases, soil, and surface water.

People in homes and businesses adjacent to the Kerr-McGee Facility, homes in contaminated residential areas, and visitors of Kress Creek and the West Branch of the DuPage River may be exposed to elevated levels of gamma radiation. Surface contamination is likely present in some areas, although this has not been well-investigated. Children may be exposed to radionuclides, gamma radiation, and lead in residential properties and along Kress Creek and the West Branch of the DuPage River. Lead contaminated media is of particular concern in areas frequented by children. The radioactive half-life of thorium-232 is about 14 billion years, and lead does not decompose, so the wastes will remain hazardous essentially forever. In the distant future, the greatest health hazard would occur if someone builds houses or other structures on the Kerr-McGee Facility or fenced spoil area of Reed-Keppler Park. Any such buildings would probably have elevated indoor radon and gamma radiation levels, and their yards would likely have high soil concentrations of lead and radionuclides, as well as elevated gamma radiation. Home building at the Wastewater Treatment Plant or near the banks of Kress Creek or the West Branch of the DuPage River are unlikely, yet home building in these areas would have similar concerns.

Exposures to airborne contaminants were certainly higher when the plant was still operating; however, the available data are too limited to fully assess the situation. Exposures were probably highest for plant workers, and the levels were probable high enough to increase the risk of adverse health effects as described in the Public Health Implications section of this report. Workers may have also increased the risk of their families if they took their clothes home to launder and did not shower before going home.

The greatest current risk of airborne exposure is for people in houses with tailings along their foundations or basements. These buildings may be at increased risk of elevated radon-220 and radon-222 levels. At this time, airborne exposure to radionuclides around the Kerr-McGee Facility is generally negligible. While radon-220 concentrations can become elevated around it, this is not a general occurrence and is of little health concern. However, remediation activities may greatly increase airborne emissions of radon and contaminated dust. This warrants measures to reduce these emissions. Elevated gamma radiation levels exist on and around the Kerr-McGee Facility. As previously noted, surficial radioactivity and elevated airborne radon levels in Reed-Keppler Park are restricted to the fenced area, while ambient long-lived radionuclides are at background levels. While some areas of elevated gamma radiation occur outside of the fence, it is unlikely that people are exposed to them for long periods. However, in the future, erosion or excavation could expose wastes buried outside of the fenced area, so this could change. Other areas have potentially negligible airborne exposure.

The community is concerned about their risk of cancer from exposure to the radioactive wastes of the Kerr-McGee Facility and around their community, radioactive contamination of groundwater, and direct radiation from the Kerr-McGee Facility. Contrary to the beliefs of some people in West Chicago, the radioactivity in the public water supply of the City comes from naturally occurring radium in the deep Ironton-Galesville Formation, and not from the Kerr-McGee wastes. While it is natural, it could add to other types of radioactive exposure and thus contribute to the problem.

Although the evaluated health outcome data indicated increases in certain cancers in the community and plant workers, these studies were basically inconclusive with respect to identifying the Kerr-McGee wastes as the cause of these cancers. However, these studies had several previously discussed problems, which could be addressed in a follow-up study.

RECOMMENDATIONS

* Action should be taken to reduce public exposure in residential areas which still have tailings, including properties along Kress Creek and the West Branch of the DuPage River. If no permanent solution is available, interim measures should be taken.

* The hydrogeology of the Kerr-McGee Facility, Reed-Keppler Park, the West Chicago Regional Wastewater Treatment Plant (WTP), Kress Creek, and the West Branch of the DuPage River should be investigated to assess the actual or potential contamination of private wells.

* The leachability of the wastes at the Kerr-McGee Facility, Reed-Keppler Park, and the WTP should be assessed.

* The presence, use, and water quality of private wells near the Kerr-McGee Facility, Reed-Keppler Park, and the WTP should be assessed.

* The water quality of Kress Creek and the West Branch of the DuPage River should be assessed. Additional sampling of the West Branch of the DuPage River should be undertaken to define the extent and nature of radioactive and nonradioactive contamination of sediments and soils in and along the river.

* The concentrations of chemicals in filets of fish from Kress Creek and the West Branch of the DuPage River should be determined.

* The nature and concentrations of nonradioactive airborne contaminants, especially lead, in and around the Kerr-McGee Facility, Reed-Keppler Park, and the WTP should be examined.

* The presence and concentration of PCBs and other nonradioactive compounds in the sediment and soils of Kress Creek and the West Branch of the DuPage River, should be assessed. Because contamination is variable in these areas, they should be surveyed prior to remediation. The possibility that radioactive and nonradioactive contaminants have affected downstream properties in Warrenville and Naperville should be investigated.

* The contribution of present runoff from the Kerr-McGee Facility to the contamination of the sediments, adjacent soils, and water of Kress Creek and the West Branch of the DuPage River should be investigated.

* The nature and extent of radioactive and nonradioactive contamination of the storm sewers in the Kerr-McGee Facility and residential areas should be determined.

* Surface and subsurface contamination by radionuclides, lead, and other non-radioactive contamination in residential yards in and around West Chicago, the Kerr-McGee Facility, the WTP, Kress Creek, and the West Branch of the DuPage River should be investigated. Because nonradioactive and radioactive contaminant levels are not necessarily correlated, cleanup objectives should include all contaminants of concern.

* Radon levels should be measured in all houses with tailings next to their foundations, and follow-up radon measurements should be performed after remediation, including the 11 houses originally tested.

* In the various environmental media, the presence and concentrations of other chemicals used by Kerr-McGee should be assessed, including PCBs, lead, benzene, toluene, and xylene.

* In homes with radioactive and/or non-radioactive contamination in garden soils, the edible portions of the foodstuffs should be analyzed.

* During remediation, the dispersal of airborne radon and contaminated dust should be minimized. Computer modelling should be employed to estimate the dispersal of airborne contaminants which occurred during plant operation.

HEALTH ACTIVITIES RECOMMENDATION PANEL (HARP) RECOMMENDATIONS

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, the six Kerr-McGee areas have been evaluated for appropriate follow-up with respect to health activities. Kerr-McGee workers and members of the public have been exposed to contaminants from the areas. Action should be taken to reduce public exposure in residential areas which still have tailings, including properties along Kress Creek and the West Branch of the DuPage River. If no permanent solution is available, interim measures should be

taken. The results of the epidemiologic studies of workers and people in yards with tailings showed no conclusive relationship between radiation exposure and types of cancer which may be caused by radioactive materials. If the completed Remedial Investigation suggests exposure to hazardous substances has occurred at levels which may cause adverse health effects, IDPH, in conjunction with ATSDR, will reevaluate these six areas for any indicated follow-up.

As part of the ATSDR Physician Education Cooperative Agreement, IDPH will inform area health professionals of the public health implications associated with these six areas and others in the vicinity.

Further environmental characterization and sampling of the six areas during the RI/FSs should be designed to address the environmental and human exposure pathways discussed above. When additional information and data become available, e.g., the completed RI/FSs, such material will form the basis for further assessment by IDPH or ATSDR.

PUBLIC HEALTH ACTIONS

Based on the recommendations made in the health assessment, the following public health actions have been or will be undertaken:

1. As part of the ATSDR Physician Education Cooperative Agreement, IDPH will inform area health professionals of the public health implications associated with the Kerr-McGee areas and other sites in the vicinity.

2. In the upcoming USEPA Remedial Investigation, the nature and extent of contamination in the four NPL areas (Reed-Keppler Park, WTP, Residential Areas, and Kress Creek + West Branch of the DuPage River) will be investigated. In addition, the adequacy of past removal activities will be evaluated.

ATTACHMENT 5

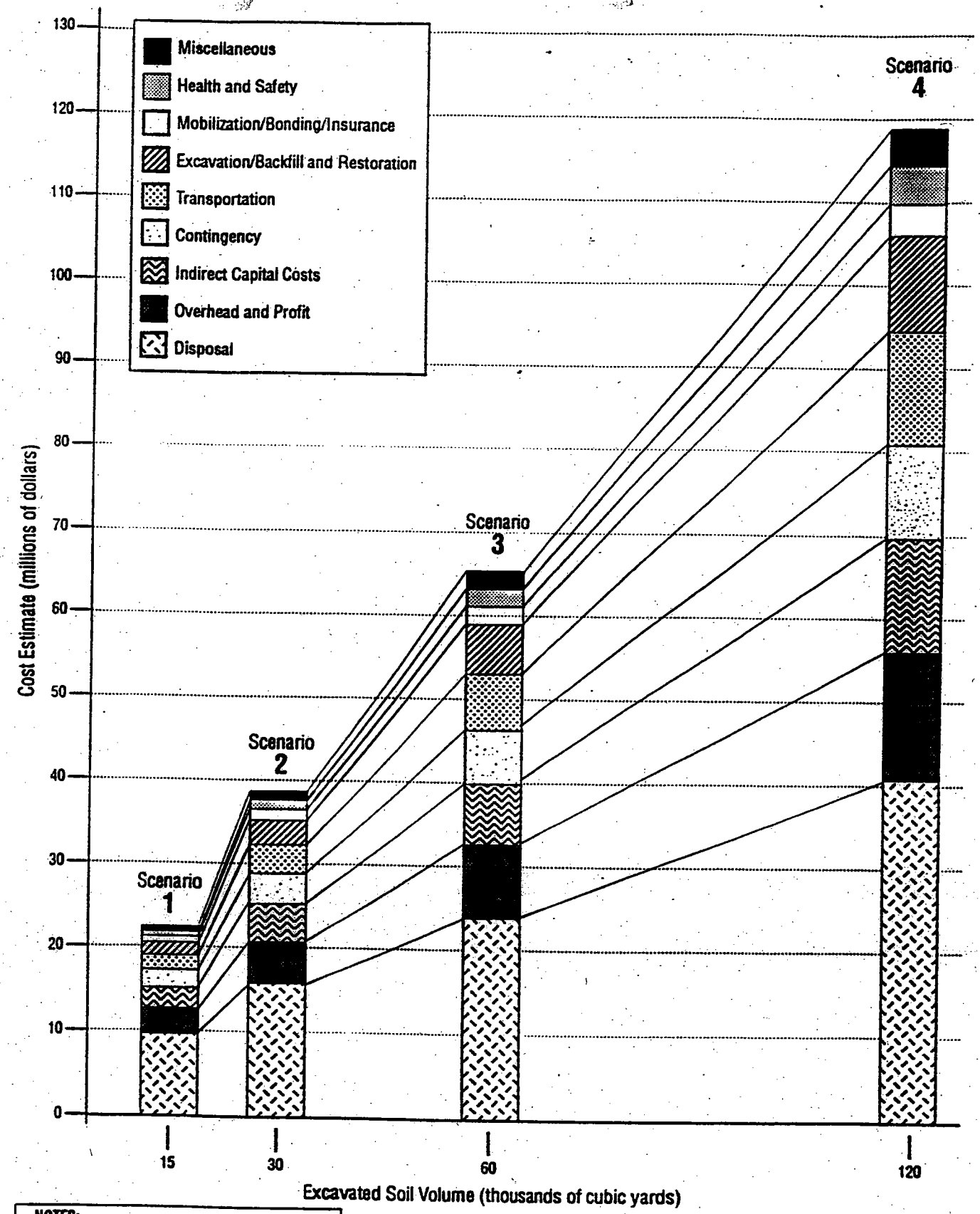
Table 5-1
Cost Estimates for Alternative 2, Source Removal

Item	Soil Volume Scenario 1[a]	Soil Volume Scenario 2[a]	Soil Volume Scenario 3[a]	Soil Volume Scenario 4[a]
Volume (yd^3)	15,000	30,000	60,000	120,000
Number of Properties	50	100	200	400
Direct Capital Cost Items				
Health and Safety	$615,200	$1,161,900	$2,264,500	$4,478,900
Transportation	1,708,500	3,417,000	6,834,000	13,668,000
Excavation, Backfill, and Restoration	1,445,500	2,891,000	5,782,000	11,564,000
Disposal	9,750,000	15,750,000	24,000,000	40,500,000
Miscellaneous[b]	589,005	1,142,010	2,248,020	4,460,040
Subtotal Direct Capital Cost	**$14,108,205**	**$24,361,910**	**$41,128,520**	**$74,670,940**
Overhead and Profit	$2,927,453	$5,055,096	$8,534,168	$15,494,220
MOB[c]/Bond/Insurance (5% of subtotal)	705,410	1,218,096	2,056,426	3,733,547
Contingency (15% of subtotal)	2,116,231	3,654,287	6,169,278	11,200,641
Total Direct Capital Cost (rounded off)	**$19,857,000**	**$34,289,000**	**$57,888,000**	**$105,099,000**
Indirect Capital Cost Items				
Engineering and Design (8% of total)	$1,588,560	$2,743,120	$4,631,040	$8,407,920
Legal and Administrative (3% of total)	595,710	1,028,670	1,736,640	3,152,970
Licensing and Permitting (2% of total)	397,140	685,780	1,157,760	2,101,980
Subtotal Indirect Capital Cost	**$2,581,410**	**$4,457,570**	**$7,525,440**	**$13,662,870**
Grand Total (rounded off)	**$22,400,000**	**$38,700,000**	**$65,400,000**	**$118,800,000**

[a]Basis for volume scenarios is discussed in Table 4-2.
[b]Miscellaneous costs include loading, packaging, and sampling the waste material; verification sampling; and temporary family relocation.
[c]MOB = Mobilization.

Note: Costs are order of magnitude estimates with an expected accuracy of +50 to -30 percent. Detail for direct capital costs is in Appendix C. The order of magnitude costs have been prepared for the purpose of assessing the relative expense of a given alternative as compared with any other alternative and should not be considered as final estimates for negotiation. They are based on information available at the time of the estimate, information gathered from suppliers, and, to a large extent, on the experience and judgment of the study team. The final costs of the project will depend on actual labor and material costs, actual site conditions, final project scope, implementation schedule, and other variable factors.

ATTACHMENT 6



NOTES:

1 Costs are order of magnitude estimates with an expected accuracy of +50 to -30 percent.

2 This figure is based on Table 5-1 data. Detail for direct capital costs is in Appendix C.

Figure 5-1
Cost Estimates for Alternative 2, Source Removal
Residential Areas Site and Portions of the Kress Creek Site

ATTACHMENT 7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: August 19, 1993

SUBJECT: Engineering Evaluation/Cost Analysis (EE/CA) Approval Memorandum for the Kerr-McGee Residential Areas Site, West Chicago, IL

FROM: Rebecca Frey
Remedial Project Manager

TO: File

PURPOSE

The purpose of this memorandum is to document that U.S. EPA Region 5 (EPA) has decided to address contamination problems at the Kerr-McGee Residential Areas NPL site by non-time critical removal actions whenever possible. After numerous briefings between EPA staff and upper management, all participants agree that early action at this site is appropriate in accordance with the Superfund Accelerated Cleanup Model (SACM) philosophy. All parties also agree that any early action should be carried out as a non-time-critical removal action because a planning period of at least six months is available.

BACKGROUND

The Kerr-McGee Residential Areas site consists of an unknown number of residential and other properties contaminated with radioactive thorium mill tailings. The mill tailings, which originated at the now closed Kerr-McGee Rare Earths Facility in West Chicago, Illinois, were used as fill material during the 1930s and 1940s. Although Kerr-McGee conducted voluntary cleanups of over 100 properties in the mid-1980s, many other properties remain contaminated.

Additional site background information can be found in the Action Memorandum dated August 19, 1993, which requests authorization to conduct and procure funding for an EE/CA and RI/FS at the site, and in the Statement of Work for the EE/CA and RI/FS dated August 11, 1993, which provides direction to the Superfund contractor.

NCP CRITERIA FOR INITIATING A REMOVAL ACTION

Section 300.415(b)(2) of the National Oil and Hazardous Substances Contingency Plan (NCP) sets forth the factors that should be used to determine whether a release constitutes a threat to public health or welfare or the environment. If such a threat exists, EPA may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release.

EPA has determined that the conditions present at the site constitute a threat to public health or welfare or the environment. This determination is based on, but is not limited to, the following factors:

1. actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants; this factor is present at the site due to the existence of radioactive mill tailings in the soils of residential and non-residential properties, including areas which are or may be used for recreation or gardening.

2. high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; this factor is present at the site due to the existence of radioactive mill tailings in surface and near subsurface soils that may migrate due to wind, erosion or deliberate human movement.

3. weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released; this factor is present at the site due to the existence of radioactive mill tailings in surface and near subsurface soils that may migrate due to wind or erosion.

MANAGEMENT APPROVAL AND FUNDING TO CONDUCT AN EE/CA

As indicated above, EPA management has been very involved in the decision to conduct a non-time-critical removal action at this site, and thus to conduct an EE/CA. Management approval of the EE/CA and the funding to conduct the EE/CA will be obtained when the funding package for the EE/CA and RI/FS go through signoff.

ATTACHMENT 8

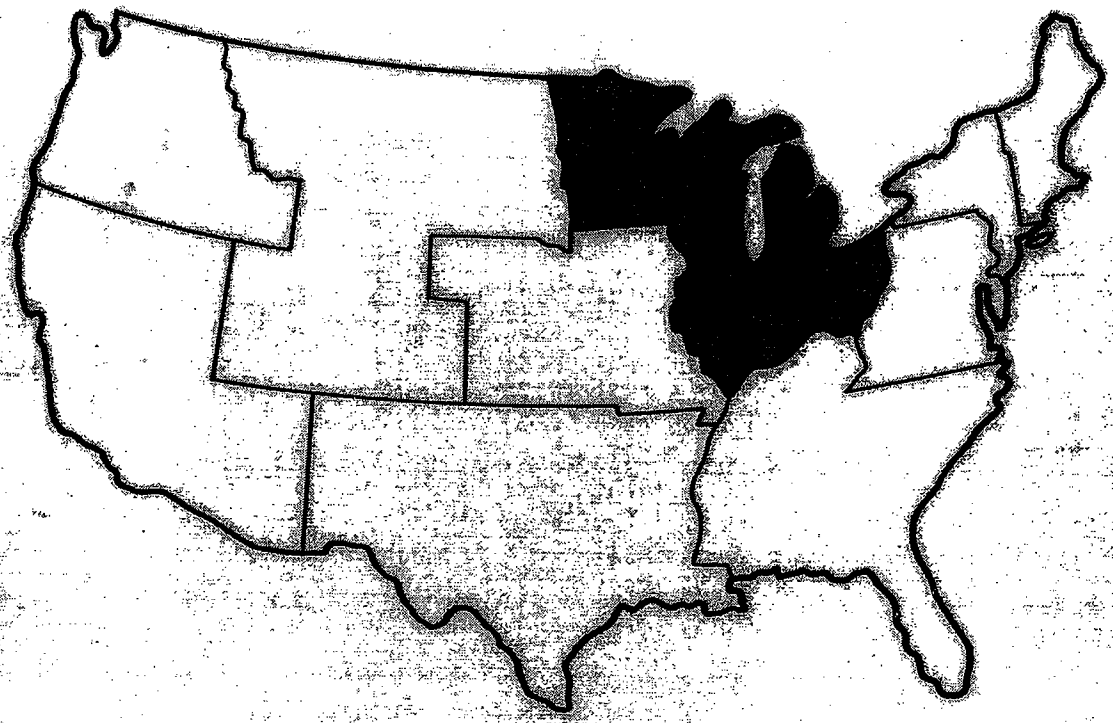
ARCS V

Remedial Activities at Uncontrolled Hazardous Waste Sites in Region V

EPA United States Environmental Protection Agency

Engineering Evaluation/Cost Analysis
Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site
In and Near West Chicago, Illinois

WA 71-5LQV/Contract No. 68-W8-0040
August 1994



CH2M HILL

Engineering Evaluation/Cost Analysis
Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site In and Near West Chicago, Illinois

WA 71-5LQV/Contract No. 68-W8-0040
August 1994

This document has been prepared for the U.S. Environmental Protection Agency under Contract No. 68-W8-0040. The material contained herein is not to be disclosed to, discussed with, or made available to any person or persons for any reason without the prior expressed approval of a responsible official of the U.S. Environmental Protection Agency.

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Acronyms

AEA	Atomic Energy Act
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ARARs	applicable or relevant and appropriate requirements
ARMS	Aerial Radiological Monitoring Survey
bls	below land surface
BNI	Bechtel National, Inc.
CAA	Clean Air Act
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cpm	counts per minute
CRP	Community Relations Plan
CWA	Clean Water Act
DOE	Department of Energy
DOT	Department of Transportation
dpm	disintegrations per minute
DWR	Department of Water Resources
EDE	effective dose equivalent
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPTOX	Extraction Procedure Toxicity Characteristic
FEMA	Federal Emergency and Management Association
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
HEAST	Health Effects Assessment Summary Table
HF	hydrofluoric acid
HNO_3	nitric acid
HSL	Hazardous Substances List
HSP	Health and Safety Plan
ICRP	International Commission on Radiation Protection
IDNS	Illinois Department of Nuclear Safety
IDOT	Illinois Department of Transportation
IDW	investigation-derived waste
LLW	low-level waste
LSA	low specific activity
mph	miles per hour
NaOH	sodium hydroxide
NCP	National Contingency Plan
NESHAPS	National Emission Standards for Hazardous Air Pollutants

Acronyms
(continued)

NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
ppb	parts per billion
OSWER	Office of Solid Waste and Emergency Response
PPE	Personal Protective Equipment
PRG	preliminary removal goal
PRP	potentially responsible party
PRSC	post-removal site control
PSF	Physical Separation Facility
QA	quality assurance
QC	quality control
RA	Remedial Action
RAO	removal action objectives
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SACM	Superfund Accelerated Cleanup Model
SARA	Superfund Amendments and Reauthorization Act
SC&A	Sanford Cohen & Associates, Inc.
SRE	Streamlined Risk Evaluation
SSC	Site Safety Coordinator
TBC	to-be-considered
TCLP	Toxicity Characteristic Leaching Procedure
TEDE	total effective dose equivalent
UBK	Uptake Biokinetic
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WL	working level

Executive Summary

This Engineering Evaluation/Cost Analysis (EE/CA) has been prepared by the U.S. Environmental Protection Agency (EPA) in accordance with 40 Code of Federal Regulations (CFR) Part 300.415 (Removal Action) of the National Contingency Plan (NCP). This EE/CA addresses the proposed expedited removal of contaminated soils from the Kerr-McGee Residential Areas site and portions of the Kress Creek site located in and around West Chicago, Illinois. The EE/CA identifies the objectives and goals of the removal action, analyzes and compares various alternatives that may be used to satisfy those objectives and goals, documents the selection of the preferred alternative, and provides a vehicle for public involvement in the selection process. Removal implementation will begin only after the EE/CA has undergone public comment and an Action Memorandum has been issued by EPA. The Action Memorandum is a primary summary and decision document that substantiates the need for a removal action, identifies the proposed action, and explains the rationale for the removal action selection.

The Residential Areas site and the Kress Creek/West Branch of the DuPage River (Kress Creek) site are two of four sites in the West Chicago area listed by EPA on the National Priorities List (NPL). The contamination at these four sites originated from ore processing operations at the Kerr-McGee West Chicago Rare Earths Facility. The Residential Areas site encompasses residential and other properties in the general area around the Rare Earths Facility where thorium-contaminated mill tailings may have been windblown or transported for use as fill. The Kress Creek site passes through the Residential Areas site. Some residential properties located along the creek extend into the contaminated floodplain of the Kress Creek site. The portions of the Kress Creek site addressed in this EE/CA are those floodplains that are in residential areas.

The contamination consists of radioactive thorium, uranium, and associated decay products such as radium, radon, and thoron. Elevated metals also may be present. As a result of the radioactive decay of thorium and uranium in soil, elevated indoor concentrations of thoron and radon gas and daughter particulates may be exhibited in some houses, while others may exhibit elevated levels of indoor and/or outdoor gamma radiation.

Wherever practicable, EPA intends to address the contamination problems at the Residential Areas site and portions of the Kress Creek site by removal actions. Two key strategies for the site are as follows: (1) the removal action serves as an early action that precedes the site's Remedial Action (RA) and (2) the detailed and comprehensive site investigation will be performed concurrently with removal implementation. The direct result of these two strategies is prompt risk reduction. Because the detailed site investigation is yet to be performed, complete property-specific information is unavailable for the EE/CA; the resulting uncertainties for the EE/CA include the volume of contaminated material to be excavated and the nature of metals contamination at the site. The removal action scope does not address (1) naturally occurring soil contamination or (2) groundwater and surface water.

Past site investigation programs initiated voluntarily by Kerr-McGee in the mid 1980s included surveys of essentially all properties in West Chicago that might contain thorium residuals. Of the 2,733 properties surveyed, this program detected residuals at 117 sites that exceeded the Kerr-McGee external gamma exposure criterion of 30 μR/hr at 1-m height. With assistance from the city, Kerr-McGee excavated almost 35,000 yd^3 of thorium residuals from 116 of the 117 identified sites within the city by the end of 1985. The thorium residuals were transported to and placed at the factory site for storage.

Since 1988, ongoing surveillance activities of the Illinois Department of Nuclear Safety (IDNS) have identified additional properties with elevated radiation exposure levels beyond those properties identified and remediated by Kerr-McGee. EPA initiated a preliminary focused risk assessment of the site in 1991 and determined that excess lifetime carcinogenic health risks at the contaminated residential properties are of concern. Based on the preliminary focused risk assessment, the most probable exposure pathways that could result in exposure are anticipated as (1) direct gamma exposure of human receptors, (2) incidental ingestion of contaminated soil, and (3) human inhalation of radon and thoron gas emanating to indoor areas from contaminated soil.

The removal action objectives (RAOs) for the site are to minimize potential health hazards to humans living or working on contaminated properties, to minimize potential environmental impacts from the soil contamination, to be cost-effective, to utilize permanent solutions to the maximum extent practicable, and to establish soil conditions that comply with all applicable or relevant and appropriate requirements (ARARs). Specific removal goals to meet the above objectives have been established by EPA in their *Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site: West Chicago, Illinois*, released in November 1993 (see Appendix A). The goals (for verification of cleanup) specify the following:

- Radium-specific activity in soil—Dry soil concentrations of total radium must not exceed 5 pCi/g above background levels averaged over areas up to 100 m^2 in any 15-cm depth.

- Outdoor gamma exposure rates—The exposure rates must not statistically exceed background at a distance of 100 cm from the ground surface.

- Indoor gamma exposure rates—The exposure rates should not statistically exceed background. (This criterion will be used as a "finding tool" during removal implementation to determine if additional removal is necessary.)

- Indoor radon and thoron decay product concentrations—Reasonable efforts must be made to achieve an annual average concentration (including background) in occupied buildings of no more than 0.02 working level (WL); in any situation, the concentration (including background) must not exceed 0.03 WL.

- As low as reasonably achievable (ALARA)—Every reasonable effort shall be made to maintain radiation exposures and the amount of radioactive materials in unrestricted areas to levels that are as low as is reasonably achievable.

The potential metals of concern, based on soil data collected at the Kerr-McGee Rare Earths Facility and other Kerr-McGee Superfund sites, are lead, barium, and chromium. The removal action goal for lead is based on an EPA-recommended interim lead cleanup limit in soil of 400 mg/kg and is considered protective for direct contact in residential settings. Health-based removal action goals for barium and chromium, developed following standard EPA risk assessment protocols, are 11,600 mg/kg for barium and 830 mg/kg for chromium.

A series of general response actions, applicable for the removal action, were identified in support of the RAOs. These general response actions were radon and thoron reduction, institutional controls, containment, excavation and restoration, treatment, interim storage, disposal, and recontamination prevention. This last response action refers to minimizing risks of recontamination from potential floods to portions of the Kress Creek site. If the floodplains are cleaned up before the rest of the Kress Creek site is remediated, flooding could deposit contaminated sediments on the floodplains, which would then require additional cleanup if the contaminant levels exceed EPA's action criteria. As allowed under the EE/CA guidance, experience at similar sites and best professional judgment were used to screen the general response actions. After screening, the remaining response actions were assembled into the following RA alternatives:

- Alternative 1—No Action
- Alternative 2—Source Removal

Alternative 2 consisted of excavation of the contaminated soil (to meet the removal action objectives and goals), backfill of excavated areas with clean soil, restoration of the properties to the original condition, packaging and transportation of the soil to the Rare Earths Facility railspur by truck, transloading the soil onto rail cars at the Rare Earths Facility, and then shipping the soil to a licensed commercial waste management facility (e.g., Envirocare of Utah) for final disposal.

Two contingent actions were also identified for Alternative 2 in the event that difficulties occurred in staging, transporting, or disposing of the excavated soil:

- Alternative 2, Contingent Action A—Interim Storage (temporary storage of the excavated soil at the Rare Earths Facility for up to 1 year)

- Alternative 2, Contingent Action B—Off-Rare Earths Facility Staging Area (for transporting the packaged soil by truck to a railspur different from the one at the Rare Earths Facility)

A third contingent action was identified for Alternative 2 as a temporary mitigation measure for potential flooding of cleaned-up portions of the Kress Creek site:

- Alternative 2, Contingent Action C—Recontamination Prevention (installing steel sheet piling between the stream and the residential properties)

The alternatives were evaluated using the criteria of effectiveness, implementability, and cost. A comparative analysis for each evaluation criterion was performed for each alternative relative to the others (see Table ES-1). Key issues related to the contingent actions are discussed in Table ES-2.

Based on a comparison of alternatives, the preferred alternative is source removal (Alternative 2) for the Residential Areas site. Contingencies A and B would be implemented only if needed. The source removal alternative essentially eliminates the exposure pathways from the contaminated soil to the public and the environment, while reducing its potential for migration by placing it into a permanent disposal facility. This alternative is judged to be effective in the long term, while being technically feasible to implement. However, the cost to implement this alternative is high.

Source removal is also the preferred alternative for portions of the Kress Creek site because of similarities in contamination, geographical area, and the potential threat to public health. Contingent Action C, though technically feasible and potentially less expensive than a second cleanup (if needed), is not preferred because of administrative hurdles to implementation, the potential displeasure of property owners with the flood barrier, and the assumption that the probability is low for a flood with significant consequences to occur prior to the Kress Creek site remediation.

Table ES-1
Comparative Analysis of Removal Action Alternatives
Residential Areas Site and Portions of the Kress Creek Site

Criteria	Alternative 1 – No Action	Alternative 2 – Source Removal
Effectiveness	No protection provided; no immediate change in human health and environmental impacts.	Short-term impacts on human health and the environment during the removal can be mitigated.
	Exposure could potentially increase in localized areas if below-surface contamination is inadvertently disturbed.	Protective of public health and the environment over the long term for the Residential Areas site; additional (post-removal) remediation of the properties will likely not be necessary. Overall effectiveness of removal action for portions of the Kress Creek site is dependent on the probability of recontamination.
	Does not comply with ARARs.	Complies with ARARs.
	No reduction in toxicity, mobility, or volume.	No reduction in toxicity, mobility, or volume, but waste is contained at disposal facility.
Implementability	Technical feasibility not applicable.	Alternative is technically feasible since excavation, restoration, transportation, disposal, and health physics aspects use standard techniques and readily available equipment.
	Alternative is administratively infeasible given state and local concerns about perceived and actual risks, reduced property values, marketability, and potentially restricted land use.	Alternative is administratively feasible, but advance planning is critical for EPA's aggressive schedule. Time will be needed to obtain agreements with property owners, obtain permits from state and local authorities, and provide for a waste transloading facility and rail shipment. A license amendment may be needed for Kerr-McGee to receive material at the Rare Earths Facility from the Superfund sites.
	Availability of services and materials not applicable.	All services and materials needed for implementation are obtainable.
Cost	Zero cost.	Total costs are estimated as follows: - \$22 million for 15,000 yd^3 (50 properties) - \$39 million for 30,000 yd^3 (100 properties) - \$65 million for 60,000 yd^3 (200 properties) - \$119 million for 120,000 yd^3 (400 properties) Costs will increase in rough proportion to the number of properties with contamination found under structural foundations.

Table ES-2
Key Issues Analyses of Alternative 2 Contingent Actions

Criteria	Contingent Actions		
	A: Interim Storage	**B: Off-Rare Earths Facility Staging Area**	**C: Recontamination Prevention**
Effectiveness[a]	Action decreases exposure at the properties by not delaying removal. Incremental increases of exposure around the Rare Earths Facility do not cause the regulatory limit to be exceeded.	Action decreases exposure at the residences by not delaying removal. No incremental exposures are expected for the worker. Incremental exposures to the public at the staging area are slight.	Action provides a temporary access barrier to contaminated stream sediments and a flood barrier to prevent recontamination for cleaned-up floodplain soils. The measure disturbs wetlands and natural drainage within the floodplain.
	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Implementability	Technically feasible.	Staging areas are available.	Installation can be performed with readily available equipment.
	A license amendment for storage is required from IDNS.	Administratively feasible.	Regulatory requirements are exacting and may delay installation. The barrier impacts aesthetics of and access to the stream.
	All services and materials needed for implementation are obtainable.	All services and materials needed for implementation are obtainable.	All services and materials needed for implementation are obtainable.
Cost[b]	3 to 4%	0.8 to 1.2%	1 to 7%[c]

[a]The contingent actions are all temporary responses, and so some of the effectiveness criteria, such as long-term protectiveness of public health and the environment, as well as reduction of toxicity, mobility, or volume through treatment, do not apply.
[b]The costs are incremental costs above the base cost of Alternative 2, shown as percentages of the base cost.
[c]The incremental cost does not include potential flood volume mitigation expenses. The incremental cost shown is less expensive by a factor of 2 to 3 than cleaning up the floodplain's soils a second time given a hypothetical situation where a significant fraction of the floodplains was recontaminated to levels above the action criteria. However, full cost effectiveness can only be demonstrated if it is assumed that the probability is high for occurrence of such a severe flood.

Section 1
Introduction

This Engineering Evaluation/Cost Analysis (EE/CA) has been prepared for the U.S. Environmental Protection Agency (EPA) under authorization of EPA Contract Number 68-WA-0040 and Work Assignment No. 71-5LQV. This EE/CA addresses the proposed expedited removal of contaminated materials from the Kerr-McGee Residential Areas site and portions of the Kress Creek site in and near West Chicago, Illinois.

1.1 General Purpose of an EE/CA

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; commonly known as Superfund), as amended by the Superfund Amendments and Reauthorization Act (SARA), authorizes EPA to take appropriate removal actions whenever a threat exists to public health or welfare or the environment from hazardous substances released into the environment. In general, a removal action may be taken to abate, prevent, minimize, stabilize, mitigate, or eliminate a release or threat of release. An EE/CA is used to evaluate removal action alternatives and is required under the National Contingency Plan (NCP) prior to conducting non-time-critical removal actions for a site [see 40 Code of Federal Regulations (CFR) 300.415]. Non-time-critical removal actions may be interim or final actions. The general purposes of an EE/CA, and the purposes of this EE/CA for the Residential Areas site and portions of the Kress Creek site, are to identify the objectives of the removal action, to analyze and compare various alternatives that may be used to satisfy these objectives, to document the proposed selection of an alternative, and to provide a vehicle for public involvement in the selection process (see Figure 1-1).

1.2 Site Eligibility for EPA Response

The Kerr-McGee Residential Areas site and the Kress Creek/West Branch of the DuPage River (Kress Creek) site are two of four sites (see Table 1-1) in West Chicago, Illinois, and adjacent DuPage County, that are contaminated with radioactive thorium (and to a lesser extent, uranium) and associated decay products. The other two sites, which are not subjects of this EE/CA, include the Sewage Treatment Plant and Reed-Keppler Park. The thorium contamination at these four sites originated from ore processing operations at the Kerr-McGee Chemical Corporation West Chicago Rare Earths Facility.

The Residential Areas site consists of the general area around the Rare Earths Facility (see Section 1.3) where thorium-contaminated mill tailings may have been windblown or transported and used as fill. As a result of the radioactive decay of thorium (and uranium) in the soil, elevated levels of outdoor and/or indoor gamma radiation may be exhibited at properties where the tailings are located. Some homes may additionally exhibit elevated

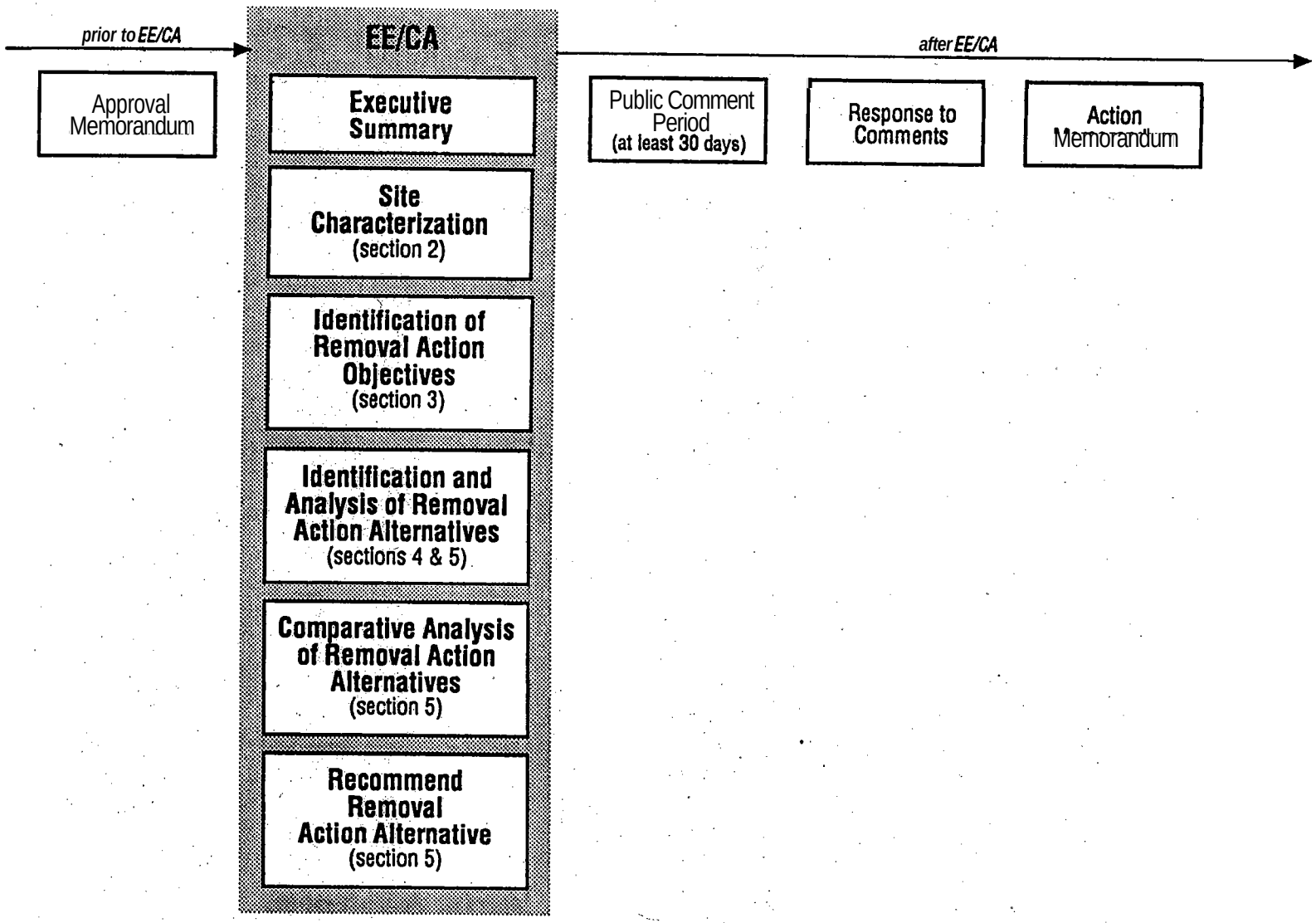

Figure 1-1
EE/CA Development Process
Residential Areas Site and Portions of the Kress Creek Site

[Extracted from Reference: EPA (1993b)]

Table 1-1
Kerr-McGee Sites in West Chicago on the NPL

Site Name	Location (see Figure 1-2)	Source of Contamination	Current Status (July 1994)
Residential Areas	General vicinity of the Rare Earths Facility	Rare Earths Facility tailings used as fill; windblown material	Removal (EE/CA)
Sewage Treatment Plant	Site is ~1 mile southeast of the Rare Earths Facility	Rare Earths Facility tailings used as fill	Remedial (RI/FS)
Reed-Keppler Park	Site is ~1 mile north of the Rare Earths Facility	Rare Earths Facility tailings used as fill	Remedial (RI/FS)
Kress Creek	Site runs south-southeast from the Rare Earths Facility	Rare Earths Facility discharges and runoff via a storm sewer	Remedial (RI/FS) and Removal (EE/CA)

Abbreviations:

NPL = National Priorities List
EE/CA = Engineering Evaluation/Cost Analysis
RI/FS = Remedial Investigation/Feasibility Study

indoor concentrations of thoron (and radon) gas and thoron (and radon) decay products. The Kress Creek site, contaminated by surface drainage from the Rare Earths Facility, consists of portions of the West Branch DuPage River and its tributary, Kress Creek, and neighboring floodplains (a floodplain is an area bordering a river or creek channel that is subject to flooding). The Kress Creek site passes through the Residential Areas site. Some residential properties located along the river or creek extend into the floodplain of the Kress Creek site. These floodplains may exhibit elevated levels of gamma radiation. The portions of the Kress Creek site addressed in this EE/CA are those floodplain areas that are residential.

Portions of the Kress Creek site are included in this EE/CA with the Residential Areas site because of similarities in contamination, geographical area, the potential threat to public health or welfare, and the potential removal actions.

The four Kerr-McGee sites are listed by EPA on the National Priorities List (NPL). The NPL is a list of hazardous waste sites that are eligible for EPA response actions under Superfund, and placement on the list indicates that site contamination may present an imminent and substantial endangerment to public health, welfare, or the environment. The four sites were placed on the "proposed" NPL by EPA in October 1984 and on the "final" NPL by February 1991. Each of the four NPL sites will be addressed by EPA in separate actions. The Rare Earths Facility is where the contamination originated, but it has not been listed on the NPL; it is regulated under the licensing authority of the Illinois Department of Nuclear Safety (IDNS). Decommissioning, cleanup, and closure of the Rare Earths Facility currently is being addressed in separate actions under that authority.

1.3 Location of Study Area

As mentioned above, the Residential Areas site encompasses all those areas in and around West Chicago, Illinois, that are potentially contaminated with thorium mill tailings from the Rare Earths Facility, but are not part of the other three Superfund sites (i.e., Sewage Treatment Plant, Reed-Keppler Park, and Kress Creek) or the Rare Earths Facility. The site includes residential properties as well as institutional properties, commercial properties, and public or community infrastructure areas such as parks, streets, curbs, parkways, and alleys, if found to be contaminated.

The removal action may also deal with the contaminated portions of residential properties above the waterline in the floodplain (not the channel sediments) of the Kress Creek site. This site is bounded by the surface stream, Kress Creek, at the Kerr-McGee Rare Earths Facility storm sewer outfall and extends to its confluence with the West Branch DuPage River (approximately 1.4 miles), then extends down the West Branch DuPage River to Illinois Route 56 (approximately 2.6 miles). The site extends laterally to 400 ft on each side, incorporating the 100-year floodplain. Kress Creek has received radiologically contaminated wastes via a storm sewer discharge from the Rare Earths Facility. The storm sewer carries surface drainage from the facility and empties directly to the creek.

In 1989, EG&G performed an aerial radiological survey (flyover) for the IDNS in and around West Chicago, Illinois, and identified general zones of elevated gamma readings. With few exceptions, the contaminated properties are expected to be located within or near the boundaries of elevated gamma readings (i.e., flyover contours). Although the Residential Areas site and relevant portions of the Kress Creek site have not yet been characterized in detail, a major fraction of the area enclosed by the flyover contours has been designated by EPA as the practical areal extent for the removal action study area (see Figure 1-2). (Flyover contour zones not assigned to the study area have been assigned to the Sewage Treatment Plant and the Kress Creek sites—these zones are not shown in Figure 1-2.) To test whether the flyover contours enclose the contaminated properties, the site investigation for discovery and characterization (see Section 1.4) will include properties within the contours as well as those slightly outside the contours. In addition, EPA is currently considering other activities and methods to investigate the areas outside the contours for possible contamination from Rare Earths Facility thorium mill tailings. If contaminated properties are found outside of the flyover contours, the site boundaries will expand to include them. However, for purposes of discussion in this EE/CA and until characterization data indicate otherwise, the boundaries for the study area are equivalent to the boundaries of elevated gamma readings shown in Figure 1-2.

Figure 1-2 also shows the approximate acreage and number of properties associated with each of 12 noncontiguous areas of the removal action study area. The largest zone of the study area (Zone 1), corresponding to the largest area of elevated gamma readings, encompasses approximately 473 acres and contains approximately 1,174 private and public properties. These acreage and property count values do not include the Rare Earths Facility or the portion of the Reed-Keppler Park that lie within the flyover contour. The Rare Earths Facility is being addressed under authority of the IDNS, and Reed-Keppler Park is being addressed by EPA in a separate action. The second largest zone of the study area (Zone 2) is the northern half of the second largest area of elevated gamma readings where Kress Creek flows. This zone encompasses approximately 120 acres and 112 properties. The portions of the Kress Creek site addressed in this EE/CA are the residential properties along Kress Creek in Zone 2 (18 properties) and the residential properties along Kress Creek/DuPage River in Zone 3 (6 properties). [The other portions of the Kress Creek site not addressed in this EE/CA are part of a separate EPA Remedial Action (RA)]. The removal action study area, including all 12 zones, encompasses approximately 692 acres and 1,434 properties.

1.4 Regulatory Strategy

Two key strategies for the Residential Areas site and portions of the Kress Creek site are that (1) the removal action serves as an early action that precedes the sites' RA and (2) the detailed site investigation will be performed concurrently with removal implementation.

The direct consequence of these strategies is prompt risk reduction. These two strategies are further discussed below.

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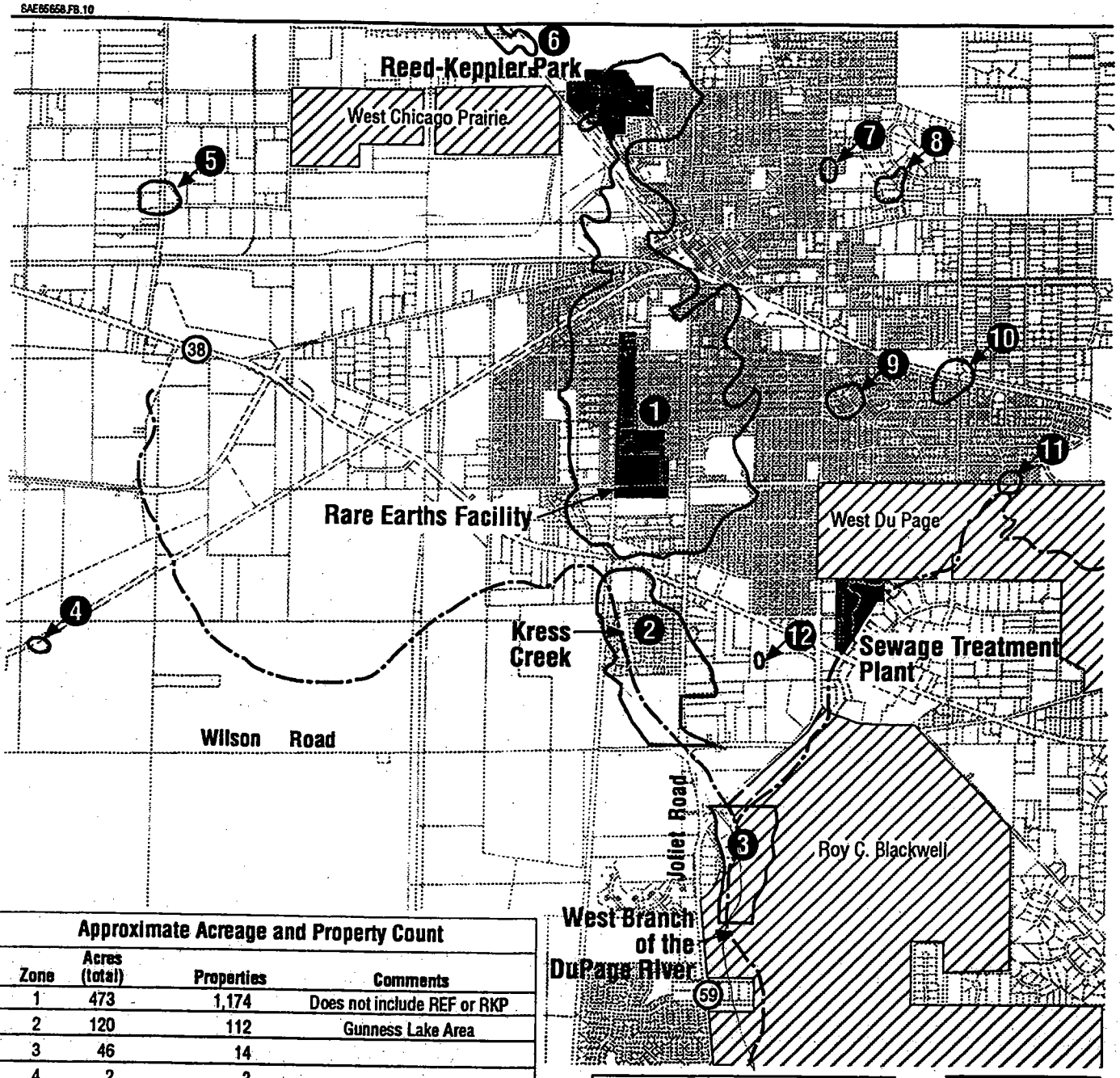


Approximate Acreage and Property Count			
Zone	Acres (total)	Properties	Comments
1	473	1,174	Does not include REF or RKP
2	120	112	Gunness Lake Area
3	46	14	
4	2	3	
5	10	6	
6	7	9	
7	3	11	
8	6	16	Edgewood Walk Area
9	9	39	
10	11	35	
11	4	14	
12	1	1	
	692 ac	1,434	

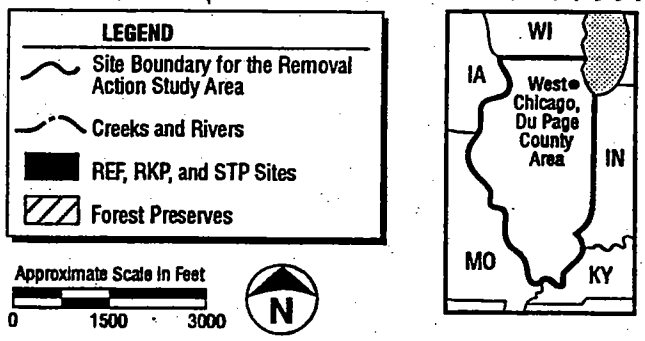


Figure 1-2
Study Area
Residential Areas Site and Portions of the Kress Creek Site

1.4.1 Removal as an Early Action

The current system for Superfund cleanups is based on two programs—remedial and removal.

- The remedial program is traditionally geared toward long-term remedies, often addressing risks with comprehensive multi-media alternatives. These remedies are usually more expensive; thus, the evaluation of alternatives is often more elaborate.

- The removal program has traditionally been used to clean up immediate risk threats, both those requiring immediate attention (emergency and time-critical removals) and those that even with some immediate risk can afford some planning activities (non-time-critical removals).

Removal actions generally have both cost and time constraints: "Fund-financed removal actions [...] shall be terminated after $2 million has been obligated for the action or 12 months have elapsed from the date that removal activities begin on-site, unless the lead agency determines that: (i) There is an immediate risk to public health [...] or (ii) Continued response action is otherwise appropriate [...]" [40 CFR 300.415 (b)(5)]. These statutory limits are not in effect if potentially responsible parties (PRPs) do the work. Because of lower costs and more immediate or obvious risks, the site characterization and alternative evaluation phases of a removal action are also more focused. This focus can save time and money over a traditional remedial documentation approach.

Flexibility in Superfund activities is being encouraged by EPA through the new Superfund Accelerated Cleanup Model (SACM). SACM encourages early actions, such as non-time-critical removal actions, to be taken at sites. This allows focused actions that reduce risk to be taken sooner at sites that already have been characterized and for which remedial alternatives are known or limited. This concept of expedited removals to mitigate risk is being applied to the Residential Areas site and portions of the Kress Creek site in West Chicago.

Following the non-time-critical removal, a final Remedial Investigation/Feasibility Study (RI/FS) will be conducted to determine if additional action is warranted. The decision whether further remediation is warranted will be heavily based on a residual risk assessment that will be conducted on the post-removal site. Data to support the risk assessment will generally be collected prior to the RI/FS (i.e., the approach taken for the Residential Areas site and portions of the Kress Creek site will be to collect data during the removal action to support the removal action and the RI/FS, and thereby avoid another sampling event during the RI/FS).

1.4.2 Investigation and Removal as Concurrent Activities

One of the major regulatory strategies for the Residential Areas site and portions of the Kress Creek site is that a detailed site investigation will be performed concurrently with removal implementation. Figure 1-3 shows a simplified removal action timeline indicating major activities and participants for the Residential Areas site. Additional detail on some project activities such as project management, quality control (QC), data management and evaluation, and coordination among participants can be found in the Residential Areas site Work Plan (EPA, 1994). EPA is conducting an RI/FS on the entire Kress Creek site concurrent with removal actions on residential areas.

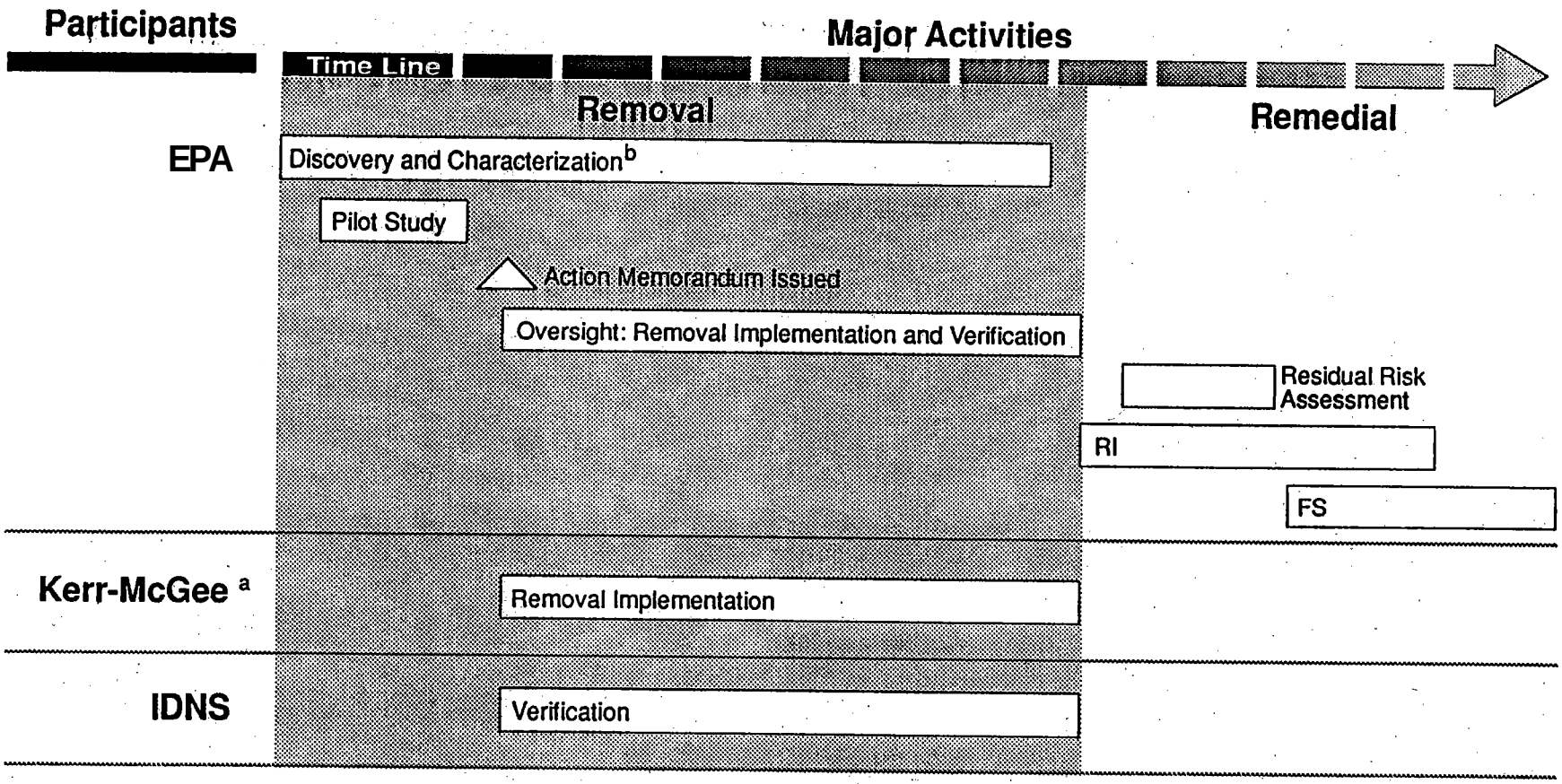
For the removal action, a discovery and characterization phase of investigation will be conducted to determine locations that are contaminated and that will undergo removal implementation. EPA has established conservative discovery criteria to minimize the chances of overlooking properties where contamination is present. The discovery criteria are based on outdoor soil activity concentrations, outdoor gamma exposure rates, indoor gamma exposure rates, and indoor radon/thoron decay product concentrations (see Appendix A).

The use of various monitoring technologies is being proposed to expedite the collection of information for the outdoor soil activity concentration and outdoor gamma exposure rates. A pilot study is being conducted by EPA in the early stages of discovery to determine the specific uses, correlations, and limitations of these monitoring tools as well as to quantify background and other soil conditions.

Characterization will be conducted on a particular property if the results of the discovery measurements for that property are conflicting or inconclusive, or if elevated results are suspected to originate from natural conditions (i.e., unrelated to thorium tailings) or interference from other areas. The type of characterization will vary with the cause of the uncertainty.

The project activities during the discovery and characterization phase of the investigation are designed to provide the maximum amount of information, as required by EPA, as efficiently as possible. Information from the studies will be periodically summarized and evaluated by EPA for a removal decision on the properties investigated. Only evidence of soil contamination related to thorium tailings material exceeding the discovery criteria will result in a removal decision. Elevated results will not necessitate removal if they result from natural conditions or other radioactive materials that are not related to the Rare Earths Facility.

If the results of the measurements indicate no contamination, the property may be a candidate for no removal. Removal implementation will begin only for the "discovered" properties, and only after the EE/CA has undergone public comment and an Action Memorandum has been issued by EPA. The Action Memorandum is a primary summary and decision document that substantiates the need for a removal action, identifies the



[a] *For project planning purposes, it is assumed that Kerr-McGee will be performing removal implementation.*

[b] *Discovery and characterization activities prior to completion of the pilot study will be limited to indoor radon/thoron decay product air sampling and gamma surveying.*

Figure 1-3
Major Activities and Participants
Residential Areas Site

proposed action, and explains the rationale for the removal action selection. For the purpose of preparing this EE/CA, it is assumed that through EPA's negotiations with Kerr-McGee, Kerr-McGee will conduct the actual removal actions in the field, and EPA will provide oversight of the removal implementation.

During and at the completion of a removal action at each location, IDNS will conduct a verification phase of investigation to confirm that the verification criteria (see Appendix A) for the removal action have been met. EPA will provide oversight of the verification effort.

When the discovery and characterization phase is concluded for a particular property, sufficient data will have been collected for deciding if a removal is warranted and for establishing general site conditions. However, uncertainties about nature and extent of contamination will remain. The discovery and characterization phase is not intended to eliminate all uncertainty, because experience has shown that for all but the simplest waste sites, the marginal value of collecting and analyzing "the next sample" declines rapidly once general site conditions are ascertained. Because of the basic complexity of a hazardous waste site and its associated uncertainties, engineers inevitably enter the implementation phase with many unresolved questions. The existing uncertainties need not hamper the removal action either by being ignored or by suspending removal implementation until the uncertainty is removed. The strategy presented in the Residential Areas site Work Plan (EPA, 1994) is to collect data during the implementation of the removal, as needed, to resolve the remaining uncertainties.

A corollary to the strategy that the detailed site investigation and removal implementation proceed concurrently (and after the EE/CA is written) is that the EE/CA does not benefit from a comprehensive site characterization. The EE/CA must rely on estimates and predictions based on past limited collections of site-specific data. The major uncertainty for the EE/CA is the volume of contaminated material.

Section 2
Site Characterization

This section provides background on the Rare Earths Facility as the source of the contamination for the Residential Areas site and the Kress Creek site (Section 2.1), describes the general physical characteristics of the Residential Areas site and portions of the Kress Creek site (Section 2.2), summarizes past site investigations and cleanup efforts (Section 2.3), and analyzes site conditions that justify a removal action (Section 2.4).

2.1 Background

From approximately 1932 to 1973, the Rare Earths Facility was operated as a thorium extraction facility for various purposes. Lindsay Light and Chemical Company operated the Rare Earths Facility from 1932 until 1958, extracting thorium and other elements from monazite sands, bastnasite (rare earth ore), fluorspar, and other ores. The nominal content of the ores was 0.15 to 0.4 percent uranium oxide equivalent, 4 to 8 percent thorium oxide, and 50 to 60 percent rare earth oxides. The ores were processed with sulfuric acid (H_2SO_4), hydrofluoric acid (HF), hydrochloric acid (HCl), or nitric acid (HNO_3) and, after 1969, with sodium hydroxide (NaOH) (EPA, 1986). The extracted elements, such as thorium, radium, uranium, and rare earths were supplied to private parties and the government. The site was also used for the manufacture of gas mantels (that contain thorium) and production of HF acid. Ownership of the processing facility changed through corporate mergers, becoming American Potash and Chemical Company in 1958, while the production of thorium continued. In 1967, Kerr-McGee purchased the facility and maintained operations until facility closure in 1973.

Production of thorium, a radioactive material, yielded radioactive tailings primarily containing Th-232 and residual levels of radium (Ra-226 and Ra-228). These tailings were stockpiled at the factory site and were available for use as fill material at residential and other properties throughout the West Chicago area, resulting in widespread surface and subsurface contamination of soils. In addition, piles of the material were subject to wind dispersal. In 1954, thorium production became subject to federal regulation with the passage of the Atomic Energy Act (AEA) by the U.S. Atomic Energy Commission (AEC). A license was granted in 1956 to Lindsay Light and Chemical Company and subsequently transferred with Rare Earths Facility ownership to Kerr-McGee in 1967. In 1974, under the Energy Reorganization Act, the AEC was abolished and the licensing and regulatory authority was transferred to the U.S. Nuclear Regulatory Commission (NRC). The State of Illinois petitioned NRC for amendment of the agreement-state licensing program to include licensing control of Rare Earths Facility material [categorized as 11(e)2 by-product material; see Section 4.1.7]. IDNS was granted licensing authority on November 1, 1990.

2.2 Site Physical Setting

Much of the site physical information discussed in this section (as well as past investigative information in Section 2.3) is taken from the *Remedial Investigation Report: Kerr-McGee Radiation Sites, West Chicago, Illinois* (EPA, 1986) that details a previous RI of West Chicago sites conducted by EPA; this document is not specifically cited elsewhere in the text but is listed in the Works Cited section. Other documents used to support individual statements are appropriately cited within the text.

2.2.1 Physiography

The City of West Chicago lies within the Great Lake and Till Plains sections of the central Lowland Provence, about 30 miles west of Lake Michigan. This portion of DuPage County is characterized by gently rolling topography with greater relief near rivers and creeks. Elevations in this part of the county range from 810 ft north of West Chicago to 700 ft southeast of West Chicago on the West Branch DuPage River. Properties adjacent to the Rare Earths Facility primarily include residential homes and commercial businesses. Much of the area is characteristic of a developed community where asphalt, concrete, buildings, and other structures exist.

2.2.2 Geology

The surficial geology of the region is characterized by glacial drift that was deposited by the Lake Michigan Lobe of a Wisconsinian-age glacier. The drift varies in composition from clay tills to gravels and sands. The thickness of glacial sediments ranges from less than 50 ft south of West Chicago to 150 to 200 ft north of West Chicago (Zeizel et al., 1962). The surficial stratigraphy is characterized by generally alternating layers of silts/clays and sands/gravels. At the bottom of the glacial drift is a laterally persistent basal sand comprised of gravel grading upward to sands and silts. Above the basal sand is clay/silt till. Above the till is a well-sorted sand and gravel outwash with some silt and clay. The sand and gravel outwash is laterally discontinuous and may not extend beneath the site. The uppermost unit overlying the outwash, or contiguous with the lower till where the outwash is absent, is a clayey till consisting of a poorly sorted clay/silt with some sand and gravel (Law Engineering Testing Company, 1981).

The bedrock geology of this region consists of alternating formations of dolomites, shales, sandstones, and siltstones.

The floodplain soils along the West Branch DuPage River, Kress Creek, and tributaries of the river are typically silty clay loams overlying sand and gravel or sands and silt, and some outwash and river sand and gravels along the West Branch DuPage River.

2.2.3 Hydrogeology

The four aquifer systems in the West Chicago area are the Glacial Drift, the Silurian, the Cambrian-Ordovician, and the Mt. Simon Sandstone. Based on the reported limited depths of contamination and low environmental mobility of thorium and its progeny, the site investigation activities do not include groundwater quality studies or hydrogeologic investigations. Details on the regional hydrogeology and groundwater use can be found in the RI report (EPA, 1986); these details are not included in this EE/CA because the site has not likely impacted the subsurface. Previous groundwater investigations have shown no evidence of thorium contamination [Sanford Cohen & Associates, Inc. (SC&A) et al.,1993].

2.2.4 Surface Water Hydrology

The DuPage River, located in northeastern Illinois within the greater Chicago metropolitan region, flows through Cook, DuPage, and Will Counties. The headwaters of the DuPage River consist of two branches, the West Branch DuPage River originating in Cook County and the East Branch originating in DuPage County. The land through which the DuPage River flows is characterized as topographically flat to rolling prairie with some marshy areas in the northern portions of the watershed. The DuPage River is a part of the 1,386 square mile Des Plaines River Drainage Basin as it flows in a southward direction approximately 58 miles (93.5 km) from its origins into the Des Plaines River at Channahon, Illinois.

The West Branch DuPage River, which flows from its origin in Cook County and through DuPage County and portions of Will County, is 28.3 miles long, has an average gradient of 3.7 ft per mile, and an approximate drainage area of 380 square miles (Northeastern Illinois Planning Commission, 1978). The West Branch DuPage River flows southward through forest preserve districts, agricultural lands, and urbanized areas toward its junction with the East Branch DuPage River.

In the study area, the West Branch DuPage River is fairly consistently 40 to 50 ft wide and 2 to 5 ft deep (Frame, 1984). At one point along the river's length, the east bank is bordered by a forest preserve and the west bank is bordered by undeveloped land and residential properties. The river has gravel banks and a stream bed that is stony and covered with vegetation.

From the headwaters, Kress Creek is 7.5 miles long, has an average gradient of 6.61 ft per mile, and an approximate drainage area of 19 square miles (Northeastern Illinois Planning Commission, 1978). The creek varies from 10 to 45 ft (Gunness Lake) in width and is generally 1 to 2 ft in depth (Frame, 1984). The creek banks are heavily vegetated in some sections and vary in height and slope, ranging from low to 2-ft vertical banks. The creek bed is mostly sand and rock with some regions of hard clay and limited amounts of aquatic vegetation (Frame, 1984). Along both Kress Creek and West Branch DuPage River, wet areas are connected to the water bodies only during high flows.

Kress Creek originates in an industrial area north of the Fermi National Accelerator Laboratory property. It flows on or near the Fermi Laboratory property and east and south toward the West Branch DuPage River. Beyond the boundaries of the Fermi grounds, Kress Creek passes under the Elgin, Joliet, and Eastern Railroad tracks, approximately 1,000 ft south of Route 38. Several feet beyond these tracks, a storm sewer outfall and trackside drainage ditch carrying water, including some from the Kerr-McGee Rare Earths Facility, empty into the creek. For the first 330 ft downstream from the storm sewer outfall, Kress Creek flows through undeveloped properties covered by trees and brush. Beyond the undeveloped property, the creek flows through a subdivision, between May and Joy Streets, where it expands to a width of 45 ft to form Gunness Lake. South of Joy Street the creek flows through open fields and a West Chicago park, beneath Wilson Street Bridge, through farmland and the grounds of a religious temple where it reaches Illinois Route 59. The creek continues its course beneath Illinois Route 59 and behind the Edgewood Walk Subdivision before reaching its confluence with the West Branch DuPage River.

The southern portions of the Residential Areas site study area are near either the West Branch of the DuPage River or Kress Creek.

2.2.5 Flow Patterns and Data

The U.S. Geological Survey (USGS) and the State of Illinois maintain two gaging stations in the West Branch DuPage River near West Chicago to measure discharge rates and water quality. One gaging station is located about 2 miles northeast of West Chicago, the other station is approximately 4 miles southeast of the city in Warrenville. Another gaging station is located in Kress Creek, near Joliet Street, slightly upstream from the confluence with the West Branch DuPage River.

The gaging station in the West Branch DuPage River upstream from Kress Creek has an approximate drainage area of 28.5 square miles. During the period from October 1985 to September 1990, the monthly average flows recorded at the station ranged from 47 cubic feet per second (cfs) in October to 75 cfs in March, with a yearly average of 67 cfs.

Downstream from Kress Creek, records at the Warrenville gaging station show that the West Branch DuPage River encompasses an approximate drainage area of 90.4 square miles at this station. During the period from October 1985 to September of 1990, recorded monthly average flows ranged from 107 cfs in July to 197 cfs in March, with a yearly average of 164 cfs.

The USGS records for Kress Creek were available from November of 1985 to September of 1990 and indicate that the creek has an approximate drainage area of 18.1 square miles. Monthly average flows ranged from 17 cfs in July to 40 cfs in August, with a yearly average of 26 cfs.

These records indicate that the stream flows within this region vary seasonally, with higher flows typically occurring in the spring from March until May or June, lower flows occurring in summer from July to October, and moderate flows occurring during the winter from November to February. As is typical with streams in the area, during high flow, surface water discharges to the groundwater, and during low flow, groundwater discharges to the surface water.

The average flows reported represent the net impact of several factors leading to substantial variability in the stream flows:

- Meteorologic conditions are highly variable. Average flow in any of the streams can vary an order of magnitude from year to year. Flows between drought and flood conditions can be expected to vary by several orders of magnitude.

- The drainage basin contributing flow to the stream also varies. Rapid urbanization in the past two decades can be expected to have substantially reduced low flows, increased high flows, and increased annual runoff volumes.

Flooding of the Kress Creek and the West Branch DuPage River is not uncommon. Heavy rains have been reported to cause Kress Creek to rise as much as 11 ft and overflow its banks from 200 to 800 ft total. Bank overflow occurs more frequently over the western banks of the creek and river.

2.2.6 Surrounding Land Use

The Kerr-McGee Residential Areas site encompasses residential, institutional, commercial, and municipal properties in and around the City of West Chicago, Illinois. Residential properties within the Residential Areas site study area are primarily located to the northwest, north, northeast, and south of the Rare Earths Facility.

The site area is generally single-family residential housing. The area surrounding the Rare Earths Facility is generally more high-density, single-family residential housing built prior to 1961.

Population along Kress Creek and the West Branch DuPage River in unincorporated West Chicago resides primarily in single-family home subdivisions. Homes exist in the May and Joy Street Subdivision along Kress Creek (Zone 2 in Figure 1-2), and in the Edgewood Walk subdivision (Zone 3), located along the West Branch DuPage River immediately south of the Kress Creek confluence. Many of these homes lie within the floodplain.

Much of the land area surrounding the West Branch DuPage River is forest preserve land, specifically, the Roy C. Blackwell Forest Preserve.

2.2.7 Climatology

The climate of the State of Illinois is typically continental with warm summers, cold winters, and frequent periods of temperature, humidity, and wind direction fluctuations caused by easterly migrating weather systems. The West Chicago area, situated about 30 miles west of Lake Michigan, experiences some climate modifications from the lake. The annual average temperature is 48.9°F.

The predominant wind direction is out of the southwest quadrant, with a predominance of generally westerly winds. The average wind speed is 11 miles per hour (mph).

2.2.8 Natural Background Radiation

Typical background gamma radiation exposure rates for the West Chicago area vary from about 5 microRoentgen per hour (μR/hr) to 13 μR/hr (Frigerio et al., 1978; Frame, 1984; Booth et al., 1982; IDNS, 1993).

The natural activity of Th-232 in soil in the West Chicago area has been reported as about 0.85 picoCuries per gram (pCi/g) by IDNS (1993), and as 1.6 pCi/g by Frame (1984). Under natural conditions, Ra-228, an alpha decay product of Th-232, is in secular equilibrium with Th-232; this means that the background Ra-228 level is also about 0.85 to 1.6 pCi/g. According to Booth et al. (1982), the background concentration for Ra-226, a daughter of U-238, is approximately 1.4 pCi/g.

Radon-222 (radon) and Rn-220 (thoron), which are noble gas decay products from the U-238 and Th-232 decay chains, respectively, are present under ambient conditions. These gases diffuse or migrate from soil and rock that contain the parent radionuclides. Because uranium and thorium are found naturally in most soils, radon and thoron are typically found in most buildings. The average indoor radon level in the U.S. is estimated to be about 1.3 pCi/L, and about 0.4 pCi/L of radon is normally found in the outside air. Levels in excess of 4 pCi/L are considered elevated according to EPA guidelines (EPA, 1993d); a regulatory standard for radon has not been established. The average indoor thoron level in the U.S. is estimated to be about 0.25 pCi/L, and average outdoor thoron levels are about 0.27 pCi/L (Li et al., 1992; Schery and Grumm, 1992). A regulatory standard for thoron has not been established.

Illinois and specifically the West Chicago area are unique because of generally high concentrations of Ra-226 in deep groundwater that are related to naturally occurring uranium deposits. Private wells screened in the shallow Silurian Dolomite Aquifer have been found to contain radium, thorium, and uranium levels near regional background levels taken from Lake Michigan (Fermi Lab et al., 1981). Radium-226 levels in municipal wells screened in the deep Ironton-Galesville [1,350 to 1,465 ft below land surface (bls)] were above background levels in Lake Michigan by one to two orders of magnitude because of natural radium, not because of thorium wastes. These levels were above EPA drinking

water standards until the water was diluted with water from shallow wells (Fermi Lab et al., 1981).

2.3 Past Investigations and Responses

2.3.1 Residential Areas Site

Numerous investigations and response actions have occurred at the Rare Earths Facility and the four Kerr-McGee sites on the NPL. The most notable investigations and responses for the Residential Areas site include the following:

- Initial characterization and aerial radiological survey by Argonne National Laboratory (ANL) for the NRC (1976 to 1978)
- External gamma exposure rate survey by the NRC over selected areas [circa (ca.) 1981]
- Voluntary surveys and soil excavation by Kerr-McGee for 30 μR/hr exceedances (completed in 1985 for properties within city limits)
- Radon monitoring in 10 homes by ANL for EPA (ca. 1983)
- Second aerial radiological survey by EG&G for IDNS (1989)
- School and residential surveys by IDNS (1989 through present)

Each of these is summarized briefly below; general conclusions are presented at the end of this subsection.

Initial characterization by ANL for NRC. The initial base study to identify and briefly characterize properties outside the Rare Earths Facility was conducted from March 1976 to May 1978 by ANL for NRC (Frigerio et al., 1978). Frigerio et al. (1978) identified 75 thorium-processing waste deposits in this study; the sites included Reed-Keppler Park, the Sewage Treatment Plant, and Kress Creek, but also properties distributed to the east of the Rare Earths Facility. Fourteen of the sites identified were outside of the city limits. Techniques used to delineate the contaminated areas included an Aerial Radiological Monitoring Survey (ARMS) flyover in 1977, a street-by-street instrumented vehicle survey, an external gamma exposure rate survey, and soil contamination measurements using subsurface sampling.

External gamma exposure rate survey by NRC over selected areas. The NRC Office of Inspection and Enforcement, Region III, reported on external gamma exposure rates (at a 1-m height) at the Rare Earths Facility fenceline and surrounding residential neighborhoods to the north, east, and west of the Rare Earths Facility (NRC, 1981). Data collection

indicated that exposure rates resulted from both on-Rare Earths Facility and off-Rare Earths Facility sources; however, the relative contribution of each was not established. Exposures to residents of the area were determined to be less than the NRC regulatory limits set forth in 10 CFR 20 applicable at that time.

Voluntary surveys and soil excavation by Kerr-McGee for 30 μR/hr exceedances. Kerr-McGee voluntarily initiated a program in the mid-1980s to survey essentially all properties in the city that might contain thorium residuals. Kerr-McGee specified an external gamma exposure criterion of 35 μR/hr at 1-m height for the discovery and mitigation of the contaminated properties. However, the discovery was implemented in the field using a criterion of 30 μR/hr so that properties with exposure levels at or slightly below 35 μR/hr were not excluded because of instrument variability. This criterion was for a gross measurement that included both natural background and any exposure from waste material. The field criterion of 30 μR/hr, minus a nominal background of 10 μR/hr (see Section 2.2.7), is equal to the value specified by EPA in 40 CFR 192 of 20 μR/hr for indoor gamma radiation greater than background.

Of the 2,733 properties surveyed within the city, this program detected residuals at 117 locations that exceeded the Kerr-McGee external gamma exposure criterion. (Section 1.3 mentioned that approximately 1,434 properties are located within the practical boundary of the Residential Areas site study area; thus, Kerr-McGee's surveys extended beyond the site's current planning boundary.) Contamination at the surveyed properties ranged from windblown material and spillage from trucks to apparent deliberate emplacement of residuals as backfill in yards and under structures.

Kerr-McGee, with assistance from the city, excavated 34,868 yd^3 (Denny, 1986) of thorium residuals from 116 of the 117 identified locations within the city by the end of 1985. [Seventy-one of the 75 sites identified by Frigerio et al. (1978) were accounted for in the Kerr-McGee program effort.] With few exceptions, the residuals were excavated until the exposure rate was reduced to background or below 15 μR/hr (Denny, 1985; Meldgin, 1986). The exceptions are residuals left under foundations at a few properties; several properties that may not contain residuals but where permission to survey the property for residuals was not given; a location where material is associated with the support walls for a swimming pool; a property where permission was not granted for removal of material from a backyard; and the Bolles Opera House at 185 West Washington (former laboratory and marketing facility) where thorium wastes were excavated from behind the building but contamination was left in the interior of the building (Denny, 1985; Meldgin, 1986). The RI report (EPA, 1986) indicates that even though thorium residuals indicating exposures above 15 μR/hr were left on some properties, the exposure rates prior to backfilling were often below 30 μR/hr. The thorium residuals were transported to and placed at the factory site for storage.

Surveys of properties in areas outside of West Chicago were initiated by Kerr-McGee in late 1985. Kerr-McGee did not remove these materials because the city would not allow thorium residuals from outside the city to be returned to the Rare Earths Facility.

Radon monitoring in 10 homes by ANL for EPA. ANL conducted indoor radon measurements in 10 homes for EPA ca. 1983 prior to any mitigation efforts (ANL, 1983). The radon and thoron working levels (WLs) were generally less than 0.02 WL in living areas. [One WL is the quantity of radon progeny in 1 L of air that will result in 1.3 x 10^5 million electron volts (MeV) of emitted alpha energy.]

Second radiological aerial survey by EG&G for IDNS. In 1989, EG&G conducted a second aerial radiological survey of West Chicago for IDNS. A map showing the boundary of elevated gamma levels was submitted to IDNS, but no supporting documentation was written. The results of the second aerial survey were used to define the boundary for the Residential Areas site study area (see Section 1.3).

School and residential surveys by IDNS. Beginning in 1989, IDNS has been performing screening-level surveillances of residential properties as part of its environmental program in and around West Chicago. These surveillances have generally consisted of outdoor gamma exposure rate surveys and sometimes a soil sample from the location on the property where the highest reading was obtained. Also, at the request of the school districts, IDNS conducted radiological surveys of seven school properties as well as outdoor radon/thoron and air particulate evaluations for several schools. In the period July 31, 1989, through August 12, 1993, IDNS has surveyed approximately 160 properties in the City of West Chicago and unincorporated DuPage County. Of these 160, 48 are categorized as "contaminated."

A preliminary focused risk assessment (see Section 2.4.3) was conducted and developed by EPA using three school properties and four residences identified and sampled by IDNS to determine the potential risk that might be expected to occur for a maximally exposed individual. Data used in the preliminary focused risk assessment shows Th-232 activity at the schools varying from 3 to 35 pCi/g, with external gamma exposures ranging from 3 to 11 μR/hr above background. Thorium-232 activities at residences included in the preliminary focused risk assessment varied from 28 to 780 pCi/g, with net external gamma exposures ranging from 52 to 590 μR/hr.

General conclusions regarding the site. Based on past investigations, the following general conclusions relevant to this EE/CA have been drawn from the data collected.

- Many of the contaminated sites were found in alleys, under streets, around buried pipelines, and in sections of private residents' yards. Thorium residuals were used around or under foundations in several homes (Frigerio et al., 1978; Denny, 1985 and 1986).

- Additional properties with elevated radiation exposure levels have been identified beyond those properties identified and remediated in earlier studies.

- Relatively few data are available with regard to thoron and radon gas or decay product concentrations in houses.

- In the previous removal, contaminated soil generally was limited to the top 2 ft of soil and often to the top 1 ft of soil.

- The radiological conditions (e.g., radionuclide concentrations in the soil and gamma exposures) are highly variable and heterogeneous at the properties investigated. The extent of contaminated material on the properties ranges from small, isolated hotspots to extensive deposits.

- Although properties located adjacent to the Rare Earths Facility had a somewhat higher frequency of contamination, a specific trend in distribution of contaminants at the Residential Areas site cannot be identified.

2.3.2 Relevant Portions of the Kress Creek Site

The primary sources of radiological data for the floodplain soils of the Kress Creek site are as follows:

- A walkover radiological survey along the waterways and banks of Kress Creek and the West Branch DuPage River (Frigerio et al., 1978)

- Comprehensive radiological surveys performed in 1981 and 1984 (Frame, 1984)

During the 1984 comprehensive radiological survey, the findings from the previous study were evaluated and incorporated. The area surveyed included a length of Kress Creek beginning at a location approximately 330 ft (100 m) downstream from the storm sewer outfall and extended to the confluence and approximately 660 ft (200 m) upstream and downstream on the West Branch DuPage River. Adjacent to the waterways, surveys extended a lateral distance of 80 ft (25 m) from each bank.

The Frame (1984) study results indicated the sediments in Kress Creek contained the highest levels of thorium contamination, where activities varied from less than 0.34 pCi/g up to 131 pCi/g in random locations throughout the length of the creek. Reportedly, thorium activity overall did not decrease with downstream reaches, but attenuated with depth. With the exception of the area located near the storm sewer outfall, ambient thorium activity was generally attained at approximately 1-ft depths. Near the outfall, thorium contaminant levels of approximately 50 pCi/g appeared constant to an approximate depth of 1.3 ft (40 cm). Along the West Branch DuPage River, the thorium activity in the sediments ranged from 2.24 pCi/g upstream of Kress Creek to 27.2 pCi/g downstream from Kress Creek, suggesting that the primary source of thorium contamination in the West Branch DuPage River is the sediments in Kress Creek.

The average ambient levels of naturally occurring thorium (total) in the floodplain soils adjacent to Kress Creek were 1.6 pCi/g. Generally, thorium activity in the floodplain soils were found to decrease with increasing distance from Kress Creek. The average total

thorium concentrations in the soils at approximately 3 ft (1 m) distant from the Kress Creek bank reportedly were 26.1 pCi/g at the surface and 18.7 pCi/g at 1- to 3-ft depths. At a distance of 80 ft (25 m), thorium activity levels averaged approximately three times the ambient levels. The highest activity of thorium detected in the floodplain soils was 555 pCi/g at a depth of about 2 ft. Similar to the sediment samples, thorium concentrations in the soils adjacent to Kress Creek did not generally decrease with increasing downstream distance, but tended to decrease with depth. Maximum thorium activities in soils adjacent to Kress Creek and the West Branch DuPage River typically occurred at 0.5- to 1-ft depths, with a few exceptions. Also similar to the sediments, higher contaminant levels were noted at isolated upstream locations near the storm sewer outfall.

Along the West Branch DuPage River, the average thorium activities in the soils at approximately 3 ft (1 m) from the bank were 3.45 pCi/g at the surface and 3.98 pCi/g at 1- to 3-ft depths upstream from the confluence with Kress Creek. Downstream from the confluence, average activities were 12.5 pCi/g at the surface and 11.3 pCi/g at 1- to 3-ft depths. At a distance of 80 ft (25 m) from the bank, thorium activities were only slightly above the ambient levels.

Results from the direct radiation measurements generally followed the pattern of decreasing values with increasing distance from the banks, as noted in the isotopic analysis results. In general, exposure rates averaged four times the ambient levels at the creek edge and decreased to approximately 1.5 times the ambient level at a distance of 80 ft.

Systematic exposure measurements taken 3 ft above the ground approximately 3 ft distant from the Kress Creek banks averaged 28 μR/h and 14 μR/h at a distance of 80 ft. Along the West Branch DuPage River banks upstream from the confluence with Kress Creek, exposure measurements averaged 14 μR/h at a distance of 3 ft and 12 μR/h 80 ft from the banks. Downstream measurements averaged 36 μR/h at 3 ft and 20 μR/h at a distance of 80 ft. Systematic exposure rates measured near the surface in the same areas were generally about 20 percent higher. The beta-gamma surface dose rates (μrad/h) were found to typically range one to two times the measured surface exposure rates. The radiological walkover survey confirmed the general patterns identified by the systematic measurements. Values ranged up to 820 μR/h at the surface and 210 μR/h 3 ft above the surface.

2.4 Site Conditions that Warrant a Removal Action

2.4.1 Nature of Contamination

The waste materials transported off the Rare Earths Facility contain a wide range of constituents. The waste materials include tailings from a number of processed ores, possibly untreated ores, and other waste products from other process and manufacturing activities at the Rare Earths Facility. Numerous sampling and analysis programs have been conducted for the original waste materials at the Rare Earths Facility and for the

Reed-Keppler Park and Sewage Treatment Plant wastes. As mentioned, the radiological residuals include such contaminants as thorium and uranium and their progeny. Nonradiological waste components include mineral by-products that contain metals such as lead, barium, and chromium. Analytical results for soils at the Rare Earths Facility, Reed-Keppler Park, and the Sewage Treatment Plant indicate a wide range of concentrations of various radionuclides and metals, which in turn indicates a heterogeneous composition for the wastes.

2.4.1.1 Radiological Contaminants

The decay chains for U-238 and Th-232 are illustrated in Figures 2-1 and 2-2, respectively. These decay chains indicate the progeny and the half-lives for each isotope and principal particles (alpha or beta) emitted during the decay. Released gamma energy is also a significant component of some of the decays.

Uranium-238 transforms via alpha and beta decay to Ra-226, the parent of Rn-222. Radon is a noble (chemically inert) gas that may diffuse or migrate through solids and be released to the atmosphere. The daughters of Rn-222, such as Po-218 and Pb-214, are generally formed as ions that attach to particulates. The decay chain ends with stable Pb-206.

Thorium-232 alpha-decays to Ra-228, which transforms to Ra-224 via beta and alpha decays. Radium-224 is the parent of a noble gas, Rn-220, often called thoron to distinguish it from radon, Rn-222, produced in the U-238 decay chain. Thoron decays with a 56-sec half-life to Po-216, which transforms via several beta and alpha decays to stable Pb-208.

The ore processing procedures at the Rare Earths Facility fractionated the various radionuclides into different products and by-products based on the chemical characteristics of the various elements. However, EPA (1986) states that the analytical results from numerous samples indicate that the decay products are in relative radioactive equilibrium because of ingrowth and decay of the various decay products over several decades. In radioactive equilibrium, the specific activities (i.e., pCi/g) of the various decay chain radionuclides are approximately equal to each other.

The removal action criteria described in Section 3 are based on total radium in the soil (Ra-226 plus Ra-228). Radium is one of the few daughter products of Th-232 or U-238 that has a cleanup standard in soil. However, because the daughter products are generally assumed to all be in equilibrium, radium activities are excellent indicators of the presence of U-238, Th-232, and other daughter products. (To confirm or investigate U-238 equilibrium conditions, radiological soil samples collected from Kress Creek, Reed-Keppler Park, and the Sewage Treatment Plant will be analyzed for U-238 and its daughter, Ra-226, directly through alpha spectrometry. Results will produce U-238 to Ra-226 ratios from materials all originating at the Rare Earths Facility, and therefore, may be used to determine the degree of equilibrium between U-238 and its decay products in residential soils.)

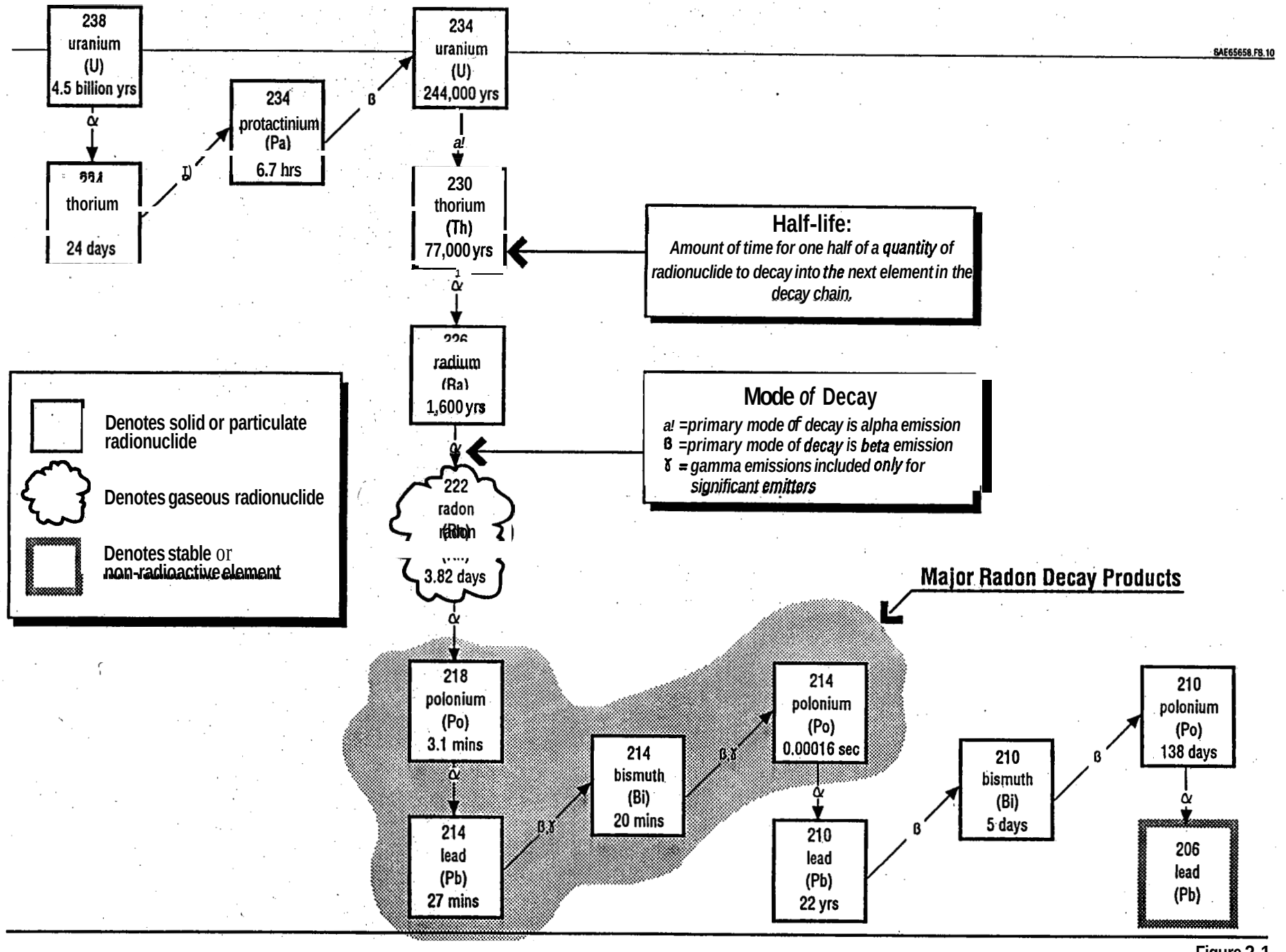


Figure 2-1
Decay Chain for Uranium-238
Residential Areas Site and Portions of the Kress Creek Site

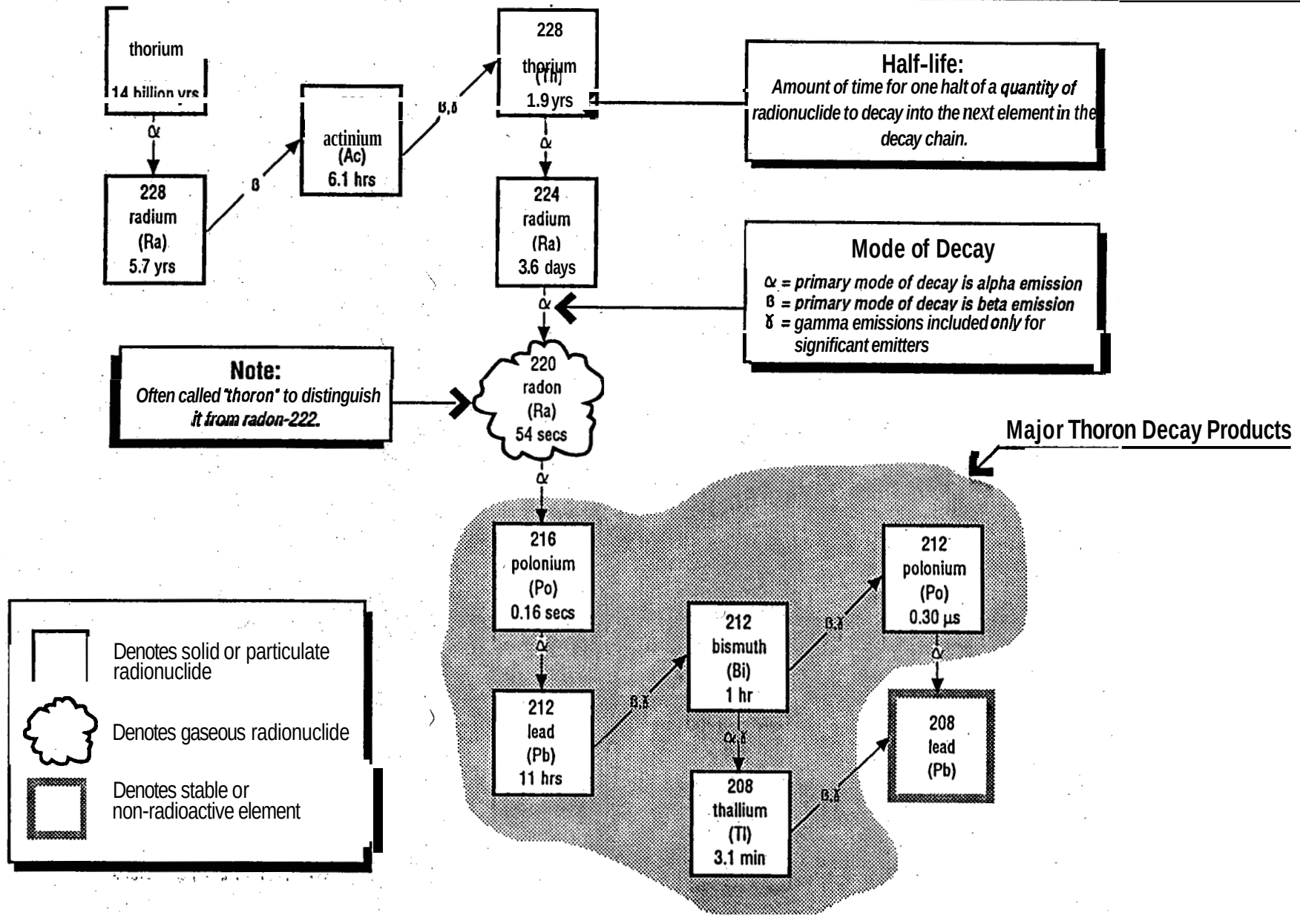


Figure 2-2
Decay Chain for Thorium-232
ResidentialAreas Site and Portions of the Kress Creek Site

The concentrations or specific activities of thorium and uranium and their decay products in the Residential Areas site and portions of the Kress Creek site are generally similar to those in the other Kerr-McGee Superfund sites. Because EPA (1986) reports that the nominal specific activities of U-238 decay chain radionuclides are approximately one-tenth of those for the Th-232 decay products at Reed-Keppler Park, the relative ratio of specific activities of uranium (and daughters) to thorium (and daughters) at the Residential Areas site and relevant floodplain soils is probably similar.

2.4.1.2 Metal Contaminants

Soils at the Residential Areas site and Kress Creek site have been analyzed in the laboratory for metals. However, the analytical results had not been evaluated prior to the publication and release of the EE/CA; thus, the suspected metal contamination has not been confirmed. The metals data for the Residential Areas site soils will be evaluated as part of the ongoing pilot study (see Section 1.4.2). The metals data for the Kress Creek site surface (floodplain) soils will be evaluated when the radiological analyses have been completed.

Metals have been found as co-contaminants with radionuclides at the Rare Earths Facility, Reed-Keppler Park, and the Sewage Treatment Plant, and because fill materials originated from the Rare Earths Facility, metals are expected in radioactively contaminated Residential Areas site soils and Kress Creek site floodplain soils. However, the Rare Earths Facility, Reed-Keppler Park, and the Sewage Treatment Plant may have significant sources of metal contamination other than those generated from ore processing; for example, Reed-Keppler Park and the Sewage Treatment Plant were landfills with multiple waste generators.

As an indication of which metal contaminants might be present, review of the findings at other Kerr-McGee West Chicago sites is useful. A preliminary comparison was made of metal analytical results from four Rare Earths Facility cores (Table 4-2 of EPA, 1986) with background results from 1993 Sewage Treatment Plant and Reed-Keppler Park sampling programs. Thirteen metals, grouped below by a health effect (carcinogen or systemic toxicant) and dietary importance (essential elements), were reported at the Rare Earths Facility at concentrations elevated above background:

- Potential carcinogen—chromium
- Systemic toxicants—barium, copper, lead, mercury, selenium, silver, thallium, and vanadium
- "Essential" elements—calcium, magnesium, potassium, and sodium

The elevated concentration of lead is not the result of thorium-series decay to stable lead, but is the result of Rare Earths Facility processing and/or the presence of lead in the Rare Earths Facility feed materials.

The concentrations of the elevated metals were next compared with their respective risk-based concentrations in residential soil [see EPA (1989 and 1991) for the lead cleanup level and EPA (1992) for the risk-based concentrations of the other metals] to predict which metals would be potential contaminants of concern from a health risk perspective. Most of the elevated metals have concentrations significantly below risk-based concentrations. Lead, a systemic toxicant with Rare Earths Facility concentrations ranging from 150 to 18,000 mg/kg, is an exception; the maximum lead concentration is higher than the interim soil cleanup level for total lead of 400 mg/kg (EPA, 1994). Thallium is also an exception, but is suspect because it was detected in only one Rare Earths Facility sample (of four), and was not detected at all at the Sewage Treatment Plant. Of those metals with concentrations that did not exceed their risk-based concentrations, barium was the closest (within a factor of four).

It follows from the above discussion that lead is a potential contaminant of concern for the Residential Areas site and portions of the Kress Creek site based on Rare Earths Facility soils data. However, the Residential Areas site and the Kress Creek site were listed on the NPL in part because of the (presumed) presence and threat from three metals: lead, barium, and chromium. For the purposes of this EE/CA, all three metals will be considered potential contaminants of concern, even though the Rare Earths Facility soils data indicate that barium and chromium will not exceed their respective risk-based concentrations.

Although some metals are considered potential contaminants of concern, metals data collection is not a principal focus of the site investigation. The reasons for this are as follows:

- Radiological constituents will have a significantly greater impact on risk because of their toxicity and expected concentration relative to metals.

- The relative ease with which radiological contaminants can be field monitored suggests that radiological contaminants may be used, with appropriate correlation, as a surrogate indicator of stable metals associated with the residuals and of the residuals in general. To the extent that the wastes composing the thorium residuals are intermixed or homogeneous and to the extent that the radionuclide and metal concentrations can be correlated, the radiation from thorium is a sufficient tracking measurement for all of the wastes, and hence a valid surrogate. If the wastes are very heterogeneous and if the lead and other metals are associated primarily with certain ores or waste residuals, the validity of the radiation surrogate assumption becomes questionable.

- For those alternatives incorporating final disposal, the presence of elevated metals in the waste is not expected to hinder or otherwise impact disposal of the 11(e)2 material or change the classification of the waste from 11(e)2 by-product material to Resource Conservation and Recovery Act (RCRA) or mixed hazardous waste (see Section 4.1.7).

Metals contamination at the Residential Areas site will be investigated during the pilot study and during waste disposal, but not during discovery/characterization unless the pilot study data prompts a modification of the site conceptual model (see Section 2.4.1). The pilot study will analyze for selected metals (e.g., lead, barium, and chromium) (1) to confirm the presence of metals as co-contaminants with radionuclides and (2) to confirm that radionuclides may serve as surrogate indicators for metals during the removal based on correlations of metal and radionuclide concentrations as a function of location.

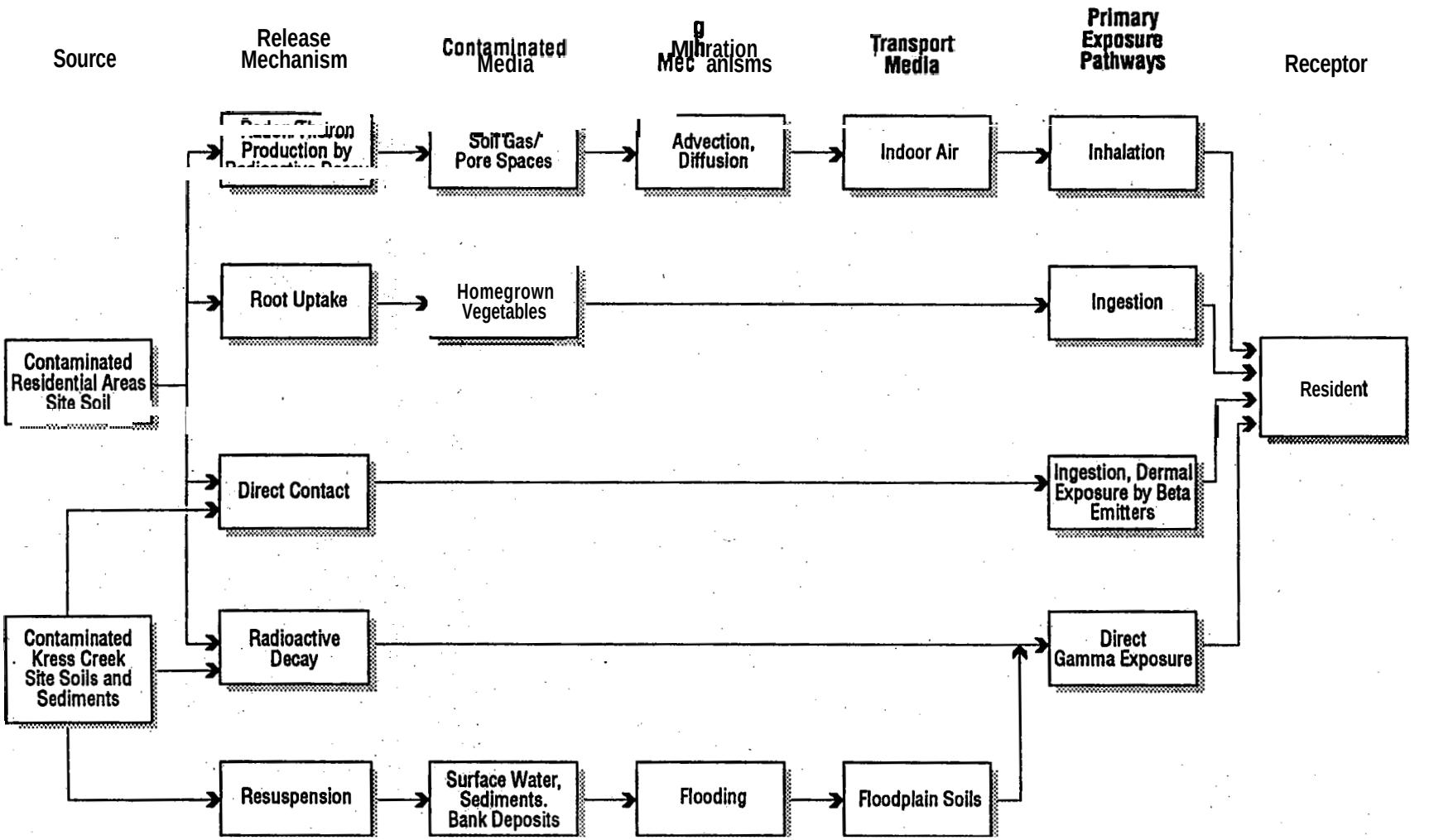
Preliminary information with regard to leachability can be extracted from EPA (1986), which reports that the Rare Earths Facility, Reed-Keppler Park, and the Sewage Treatment Plant samples were analyzed for EPA's Hazardous Substances List (HSL) analytes and evaluated using the Extraction Procedure Toxicity Characteristic (EPTOX) test. This test was used to assess the relative leachability of hazardous substances (including eight metals) in the waste under landfill-type conditions and to evaluate the potential for groundwater pollution. [EPA has since replaced the EPTOX test, previously referenced in 40 CFR 261, with a second-generation leaching procedure called the Toxicity Characteristic Leaching Procedure (TCLP).] Only small fractions of the metal concentrations available in the sample were leached by the EPTOX test, and the leached quantities were less than the EPTOX maximum concentrations established for the test. This indicates that the metals are in a form not easily leachable under "sanitary landfill" conditions that the EPTOX test was designed to model. (No inference should be made from the discussion of the EPTOX test that a sanitary landfill is being considered for the final disposal site.)

EPA reported that the EPTOX test was also performed for U-238, Th-232, and Ra-228, even though no specific EPTOX criteria were published for these constituents. However, the results indicate that the radionuclides tested, similar to the metals, are in a form with little potential for mobilization.

2.4.2 Conceptual Site Model

The current conceptual site model (Figure 2-3) is a framework within which the environmental pathways of potential concern are identified and illustrated. The media to sample for determining whether a release has occurred can be identified from this model. The model also serves as the framework for conceptualizing general response actions.

The model includes a set of hypotheses about the contaminated media and environmental pathways that are selected on the basis of existing data. For the focus of the removal action, the sources are contaminated Residential Areas site soil and Kress Creek site sediments and soil. Though not shown on the model, the original source of the contamination in the soil is the Rare Earths Facility, either as a result of tailings used as backfill or from wind blowing the material off the facility, or as a result of surface drainage and stormwater discharge to Kress Creek.



Probable Pathways

Potential contaminants of concern: Th-232 and U-238 and daughters, possibly lead, barium, and chromium

Figure 2-3
Current Conceptual Site Model
Residential Areas Site and Portions of the Kress Creek Site

A contaminant release mechanism is defined as any process that results in migration of a contaminant from a source area into the immediate environment. Once in the environment, contaminants can be transferred between media and transported away from the site.

The conceptual site model illustrates the various media, transport pathways, and exposure pathways that could be affected as a result of the residential soil contamination. Although this is specified as a model of current conditions, future conditions under a no-action scenario are expected to be similar. The land use is not expected to change in the future and, because the soil has been contaminated for up to 40 years, no new release mechanisms are expected in the future. Potential recontamination or continued buildup of contamination from windblown Rare Earths Facility material is not likely because the Rare Earths Facility waste piles are covered and protected, and the contaminated open land areas are covered with vegetation. However, the potential for windblown material may increase when each waste pile at the Rare Earths Facility is uncovered and excavated during the upcoming closure activities. The perimeter of the facility will be monitored and dust controls instituted as appropriate.

In the conceptual site model for the Residential Areas site, four release mechanisms for contaminants are as follows:

1. Gas release, molecular diffusion, and advection. Radon and thoron can be produced as a result of radioactive decay in the contaminated soil and then released into the soil pore spaces and to indoor (or other confined space) air.

2. Root uptake. Vegetables grown in the contaminated soil can uptake radionuclides into their mass.

3. Direct contact. The presence of the contamination in residential soils allows direct access to the contaminants without any release mechanism.

4. Radioactive decay. Gamma radiation can be emitted from the soil.

These release mechanisms allow for direct contact with the contaminants by the residents. However, they probably do not cause contamination of additional media.

The Kress Creek site adds a fifth release mechanism for contaminants: resuspension of sediments. Sediments can be resuspended by changing volumes/flow rates of surface water through Kress Creek and the West Branch Dupage River.

A potential release mechanism not included in the conceptual site model is erosion. Erosion resulting from surface water or wind has occurred in the past and has resulted in the contamination of soil that is considered part of the site. Further erosion is not likely for those developed areas with flat topography and vegetated or concrete/asphalt covers over most of the contamination, but erosion may still occur in undeveloped or disturbed areas. The impact of the small number of undeveloped or disturbed areas at the Residential Areas site or relevant portions of the Kress Creek site are expected to be minor.

Contaminant transport via runoff has impacted sediments and surface water (e.g., storm sewers and Kress Creek), neither of which are targets for the removal action. The Kress Creek site RI/FS will address sediment and surface water contamination, as well as floodplain contamination outside residential properties.

The low mobility of the contaminants and the surface deposition of much of the contamination means that leaching of contaminants at levels that would cause contamination of the underlying groundwater is unlikely. Additionally, split samples from groundwater samples collected at the Reed-Keppler Park site during the 1993 RI showed no evidence of other than naturally occurring radioactivity. Therefore, leaching is not included in the model.

Diffusion and advection of radon and thoron is the only potential migration pathway for the Residential Areas site. Because of the short half-life of thoron, the potential for migration indoors is low, although once thoron enters a home through foundation cracks or sumps, its long-lived decay product, Pb-212, may persist for some time and migrate quite a distance from the entry point. Some homes cleaned up by Kerr-McGee in the mid-1980s showed elevated indoor thoron decay product concentrations. Only indoor accumulation is considered a potential concern because of a possibility for accumulation of the radon to unacceptable levels in closed spaces.

Flooding is the only potential migration pathway for relevant portions of the Kress Creek site (i.e., contaminated floodplain areas within residential properties). Flooding is a concern because of its ability to continue to contaminate, or to recontaminate if cleaned up, any floodplain soils within residential properties.

The source of the contaminants in a flood would be resuspended Kress Creek site sediments and soils. Sediments in the Kress Creek site will remain a potential source of contaminants for the floodplain soils until the sediments are remediated. If the floodplains are cleaned up prior to the sediments, and then recontaminated during a flood, the recontamination would generally be in the form of a thin layer of contaminated sediments on the floodplain surface. It is impossible to predict with any certainty the frequency, severity, and impacts of flooding that may occur. In addition, the levels and extent of contamination that may result from such flooding is difficult to estimate.

2.4.3 Streamlined Risk Evaluation

This Streamlined Risk Evaluation (SRE) provides an evaluation of the potential risks of adverse health effects associated with site contaminants assuming a no further action (NFA) scenario. It follows recommendations provided in *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (EPA, 1993b) for preparation of an EE/CA.

This SRE is not intended to be a full baseline risk assessment, but rather a limited evaluation using a more general approach including existing data and information.

Information from the preliminary *Focused Risk Assessment for West Chicago Vicinity Properties* conducted by EPA (SC&A et al., 1993) is used in this evaluation. The information in this SRE is intended to project the potential risk of adverse health effects that may occur if no removal action is taken. The objectives are (1) to discuss contaminants that lead to increased exposures; (2) to identify current or potential human exposures that should be prevented through a removal action; (3) to evaluate potential risks using existing data and information; and (4) to discuss uncertainties in the information presented. The results of the SRE are used to support a removal action decision.

2.4.3.1 Contaminants of Concern

Contaminants of concern are defined as those most likely to contribute to risk as a result of exposure. Because thorium ore residuals from the Rare Earths Facility deposited within the Residential Areas site and relevant portions of the Kress Creek site contained Th-232 and its daughter products and lesser amounts of U-238 and its daughter products, these are considered probable contaminants of concern as stated in Section 2.4.1.1. These constituents likely present the limiting risk. The actinium series radionuclides (U-235 and its daughter products) are not considered contaminants of concern. Based on the natural abundance of U-235, the actinium series radionuclides are not expected to be present except in concentrations much less than the Th-232 and U-238 series radionuclides. In addition, the primary exposure route of concern for these radionuclides is through dust inhalation; however, this is not expected to be a significant pathway of exposure given that the residential areas are heavily vegetated. Thus, it is believed that the actinium series radionuclides pose negligible risk in comparison to the limiting risk of the thorium and uranium series radionuclides. This will be evaluated in greater detail after data are received.

Other potential contaminants of concern for the Residential Areas site and relevant portions of the Kress Creek site include some metals. Metals are presumed to be commingled with the radionuclide contamination at these sites as a result of Rare Earths Facility thorium ore processing. As stated in Section 2.4.1.2, 13 metals were found at the Rare Earths Facility at concentrations elevated above background sample concentrations from the Sewage Treatment Plant and Reed-Keppler Park. Of these, only lead exceeded its recommended interim soil cleanup level, which is 400 mg/kg. Lead, barium, and chromium were initially identified as contributors to overall site risk and contributed to listing the site on the NPL. Although an evaluation of the metals data for the Residential Areas site and relevant portions of the Kress Creek site had not been performed prior to release of the EE/CA, and although the preliminary focused risk assessment did not address metals, for the purposes of this SRE, they are considered to be potential contaminants of concern.

The following brief discussion of the potential toxicological effects of both the radiological and potential metal contaminants of concern does not imply that the effects described will *always* occur in humans; such effects are dependent on, but not limited to, the contaminant concentration in a particular medium, exposure characteristics such as route and duration of

exposure, and absorbed dose. This discussion is intended to provide a non-technical summary of the potential toxic effects associated with exposure.

General Hazards of Radiation Exposure. The effects of exposure to ionizing radiation from all of the radionuclides of concern fall into three general categories: carcinogenic, genetic, and teratogenic. Radiation produces damage in biological systems through ionization of molecules. Damage may occur directly, as when a chromosome breaks into smaller pieces after absorption of energy from radiation. Damage may also occur indirectly, through ionization of water molecules, to produce highly reactive free radicals. The free radicals may react with other cellular compounds and cause damage through oxidation reactions. For this assessment, the potential for cancer induction in the exposed individual is considered to have the most significant effect on health. Risks of genetic effects from radiation exposure to reproduction organs (i.e., exposure may produce adverse health effects in future generations) or of fetal (teratogenic) effects from radiation exposure to an unborn child (i.e., the exposure of a fetus may cause elevated frequencies of mental retardation or other adverse health effects) are considered less significant (EPA, 1989b). These assumptions are consistent with the current understanding of the effects of radiation.

Ionizing radiation is a demonstrated human and animal carcinogen. Data exist that correlate high exposures of radiation to cancer induction in humans. In general, scientists agree that the probability of cancer decreases with decreasing dose, but the dose-response model that predicts the effects of low-level exposure is still under debate. Current radiation protection standards are based on the idea that each increment of radiation exposure causes a linear increase in the risk of cancer. Significant uncertainty exists from extrapolating high-level information to low-level effects, but the models used are generally believed to be conservative (i.e., they will overestimate risks).

Uranium-238. The organs of most concern, as a result of uranium ingestion or inhalation, are the kidneys and bones. In addition to hazards from exposure to radiological emission products, uranium is chemically toxic to the kidneys.

The release of radon and subsequent decay products results in a potentially significant source of lung exposure—often referred to as radon decay product exposure. Radon-222 decays to Po-218, Pb-214, etc., which are particulate, short-lived decay products (see Figure 2-1). The most significant portion of lung exposure from inhalation of radon results from the alpha energy deposited in lung tissue by these short-lived decay products. In addition to lung exposure from radon decay products, uranium decay products also emit beta and gamma radiation. Gamma radiation exposes the entire body rather than a specific organ. Many of the uranium series radionuclides decay by beta particle emission. Skin doses from beta radiation may be possible if uranium series decay product contamination is present in soils on exposed skin surfaces.

Thorium-232. Thorium is relatively insoluble in water at environmental (near-neutral) pHs, binds tightly to the soil, and has a low uptake in plants. Therefore, thorium is generally less mobile in the environment than either uranium or radium. As mentioned, Th-232 decays to Rn-220 (thoron), which is a noble gas similar to Rn-222 (see Figure 2-2).

The gamma photon decay energies and number of photons emitted are greater for the Th-232 chain than for the U-238 chain. Hence, the gamma exposure rate per unit of activity for Th-232 is greater than for U-238. Thoron decay products have a lower adverse health risk in the lung than radon decay products (Ellett and Nelson, 1984; EPA, 1986). However, because the thoron decay product, Pb-212, has a relatively long half-life (11 hr), it has the potential to migrate out of the lungs to other organs of the body. As with uranium series beta emitters, skin doses may be possible if thorium series decay product contamination is present in soils on exposed skin surfaces.

General Hazards of Chemical Exposure. Two types of adverse health effects as a result of exposure to chemicals are described—carcinogenic effects and noncarcinogenic (or systemic) effects. Generally, chemicals exhibit primarily noncarcinogenic effects; however, some chemicals may exhibit both, with the carcinogenicity being the limiting effect.

The carcinogenicity of a chemical relates to its ability to interact with an organism's genetic material in a variety of tissues and organs and to produce abnormal cellular proliferation commonly called cancer. Cancer induction is considered by EPA to be a non-threshold effect (i.e., the risk of developing cancer increases linearly with each increment of exposure without regard to a minimum level below which risk is zero). In addition, the onset of cancer is believed to be a delayed response in many instances because symptoms do not occur immediately after exposure but rather several months or even years later. None of the chemical contaminants of concern are classified as carcinogenic via ingestion, which is considered the primary route of exposure for nonradionuclide contamination at the Residential Areas site.

Adverse toxic effects other than cancer may occur as a result of excessive exposure to certain chemicals. Noncarcinogenic or systemic toxicity may include injury or damage to tissues and organs as a result of inhibition or disruption of certain physiological or biochemical functions. Systemic toxicity may be classified as acute or chronic.

Acute toxicity refers to the rapid onset of symptoms after short exposure duration to relatively high chemical concentrations. This effect is most typical of inhalation exposure to high concentrations in air; however, exposure by ingestion to certain chemicals may also result in acute toxicity.

Chronic toxicity generally refers to a slower onset of symptoms as a result of continued exposure to low chemical concentrations. Such concentrations are termed sublethal because they are low enough not to cause immediate death. Chronic toxicity may be typical of both ingestion and inhalation exposure to very low concentrations of chemicals over long periods of time. It is this type of toxic effect that is of greatest concern with environmental contamination.

An assumption common to both acute and chronic toxicity is the concept of threshold, which is a level of exposure above which toxic effects would be manifested. This concept is used by EPA to develop a reference dose (RfD) for human exposure. An oral RfD is an

estimate of a daily human ingestion of a chemical that is likely to be without an appreciable risk of adverse health effect (EPA, 1989b). This value is derived from animal dose-response experiments with various factors applied to correct for uncertainties in the animal data and to add a degree of conservatism in the value estimated for humans. When evaluating the risk of adverse health effects of exposures to a noncarcinogenic contaminant, the estimated intake via a particular route of exposure is compared to that contaminant's RfD. Generally, if an exposure to a chemical exceeds a chronic RfD, adverse toxic effects are likely to occur.

Below are toxicity profiles for each of the nonradiological contaminants of concern detailing the potential health effects and their RfDs.

Lead. Lead is the most common toxic metal in the environment. Naturally occurring lead concentrations vary with location, while anthropogenic lead releases have many sources. The principal route of exposure is ingestion of contaminated food and water and, to a lesser degree, incidental ingestion of contaminated soil. Inhalation of lead particulates is also an important route of exposure, although emissions from automobiles and other sources have decreased. Lead toxicity is dependent on many factors, with age and nutritional status predominating.

The most likely exposure to lead in the environment is associated with chronic exposure to low levels. This type of exposure can cause affects to the hematopoietic system, the nervous system, and the cardiovascular system. One characteristic effect of chronic lead intoxication is anemia as a result of reduced hemoglobin production and shortened erythrocyte survival. The most significant effect of lead exposure is nervous system impairment and dysfunction, particularly in developing fetuses and adolescents. Minor effects include reductions in hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. More critical effects include encephalopathy and peripheral neuropathy. Lead can also impair the immune system. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans. Experiments involving lead exposures to animals suggests sterility in both males and females, spontaneous abortions, neonatal mortality, and morbidity. In some animal studies, exposures to high doses of lead salts have shown evidence of carcinogenic effects in the kidneys. Such evidence in humans is very limited and inconclusive.

Currently, no lead RfD has been approved by EPA. A default value for lead in soil has been recommended to guide remediation efforts. This value, 400 mg/kg, is based on ingestion of soil by a child in a residential exposure scenario (EPA, 1994).

Barium. Barium is present naturally in the environment and is found in nearly all plant and animal tissues. Its industrial uses are primarily in various metal alloys, paints, soap, paper, and other products. Exposure to barium may be via incidental ingestion of contaminated soil and inhalation of contaminated dust particles. The toxicity of barium compounds depends on their solubility. Soluble barium compounds are absorbed by the gastrointestinal tract after ingestion, and can cause paralysis, cardiovascular abnormalities,

and gastroenteritis. Prolonged inhalation of barium particulates has resulted in baritosis, a benign, reversible pneumonia-like respiratory disease, seen primarily in exposed industrial workers.

The chronic oral RfD for barium is 0.07 mg/kg/day.

Chromium. Chromium is a naturally occurring element existing in several oxidation states of which only the trivalent and hexavalent forms are of biological significance. Although trivalent chromium is the most common form in both geological and biological materials, hexavalent chromium has been associated with most harmful effects. Chromium compounds, particularly sodium chromate and dichromate, are used in the production of chrome pigments and for production of chromium salts used in leather tanning, mordant dying, wood preservatives, and anticorrosive agents. The primary route of exposure is inhalation resulting from industrial releases, although ingestion of food, water, and soil contaminated from atmospheric or anthropogenic deposition may also occur. Chronic ingestion of hexavalent chromium has resulted in kidney damage in animals and humans. Dermal exposures can result in skin reactions such as dermatitis in sensitive individuals. Inhalation studies in chromate-producing industry workers have shown excess lung cancer incidence. Although most adverse health effects are associated with the hexavalent form of chromium, trivalent chromium is an essential element in trace quantities, primarily for carbohydrate metabolism. Chromium compounds in this valence state are much less toxic, are neither irritating nor corrosive, and are not considered to be carcinogenic.

The chronic oral RfD for chromium is 0.005 mg/kg/day.

2.4.3.2 Potential Receptors

Current residents living at single-family dwellings (children and adults) are considered the most important receptors. These receptors would have the greatest potential for exposure to the contaminants of concern on a daily basis as a result of normal activity patterns within the home and outside within the confines of their own property. An intermittent-type receptor, such as a trespasser or visitor, is not considered a potential receptor because of the much lower integrated exposure time.

No changes in receptors are anticipated because the study area is fully developed primarily with single-family residences. This land use is not likely to change in the future; therefore, current receptors may also describe future receptors.

2.4.3.3 Potential Exposure Pathways

A complete exposure pathway consists of three elements:

- A source of contamination and release mechanism
- A point of potential receptor contact with the contaminant
- A route of exposure (i.e., a method of access into the body)

Exposure pathways may require a contaminant transport mechanism if no receptors exist at the source of contamination. However, at the Residential Areas site and portions of the Kress Creek site, contaminant transport is not necessary because the soil of the residences is contaminated.

The conceptual site model shown in Figure 2-3 illustrates the completed primary pathways under current site conditions. Because the area is residential, it is assumed that future site conditions will be the same. As shown in the conceptual site model, the probable completed pathways of exposure include the following:

- Direct gamma exposure both inside and outside structures resulting from radioactive decay from contaminated soil outside structures
- Incidental ingestion of contaminated soil by children and adults
- Inhalation of radon and thoron progeny within enclosed structures (i.e., homes) emanating from contaminated fill material

Other potential exposure pathways, although less likely to be completed pathways, include the following:

- Ingestion of contaminated homegrown vegetables
- Dermal exposure to beta emitters from contaminated soils on exposed skin surfaces (this pathway was not evaluated in the preliminary focused risk assessment)

Inhalation of contaminated soil suspended into the air by mechanical action or wind is not considered a significant route of exposure because of the extensive ground cover.

2.4.3.4 Risk Characterization

The preliminary focused risk assessment developed by EPA evaluated the risks to a resident receptor associated with exposure to radionuclide contaminants using data collected from four residences. The risks to residents are those resulting from an assumed 30 years of exposure, including 6 years as a child and 24 years as an adult. It is based on limited survey and soil sampling data from seven representative contaminated properties (four residences and three schools) and conservative exposure assumptions. It is intended to present estimates of the potential range of current and future human health risks associated with activities conducted at these properties resulting from exposures to radioactive constituents in soil. The results of the preliminary focused risk assessment provide an indication of the general risk range that possibly may be present at the Residential Areas site and portions of the Kress Creek site (SC&A et al., 1993).

Data for the preliminary focused risk assessment include ground level radiological survey and soil sampling data collected by IDNS in June of 1989 and include Th-232 and U-238 and their progeny. Both of these radionuclides are assumed to be in secular equilibrium with their progeny; therefore, the activity of each progeny equals that of the parent (SC&A et al., 1993). As previously discussed, the data used in this assessment are limited; generally, only one soil sample was collected at each property from the area with the highest outdoor gamma exposure rate measurement. Maximum concentrations used in estimating intake were conservatively assumed to be homogeneous throughout the entire contaminated area (SC&A et al., 1993).

Maximum external gamma measurements at the residences ranged from 28 pCi/g to 780 pCi/g of Ra-228, a decay product of Th-232. Each of the four residences had external gamma exposures greater than 50 μR/hr above natural background (approximately 7 μR/hr), which was measured 1 m above the ground surface.

As previously discussed, all radioactive progeny of the Th-232 decay chain were assumed to be in equilibrium. In addition, it was assumed that the U-238 concentrations are only 10 percent of the Th-232 concentrations. This is based on the RI for the Kerr-McGee facility (EPA, 1986) and is supported by the analysis of samples for the properties addressed in the preliminary focused risk assessment (SC&A et al., 1993).

In evaluating risks, excess lifetime cancer risk is expressed in terms of a unitless probability of an individual developing cancer over a lifetime of exposure over and above that already expected. Because cancer risk factors are often upperbound confidence limits of the probability of a response (generally the 95th percentile), the excess lifetime carcinogenic risk estimates will also be an upperbound estimate. Therefore, the actual risk, which may not be known, will likely not exceed the estimated risk. The excess lifetime risk management range established in the NCP is 10^{-4} to 10^{-6}. The lower bound of this range (10^{-6}) means that the probability of an exposed individual developing cancer is 1 in 1,000,000. The upper bound of this range (10^{-4}) means that the probability of an exposed individual developing cancer is 1 in 10,000.

Total excess lifetime risk estimates from the preliminary focused risk assessment ranged from 3.1×10^{-3} to 7.6×10^{-4}. The risks varied depending on the contaminant concentration and extent of contamination at the individual properties studied. Individual pathway risks included ingestion of soil at 2.5×10^{-4} to 8.8×10^{-6}, ingestion of vegetables at 5.2×10^{-4} to 8.3×10^{-5}, inhalation of radon/thoron at 7.0×10^{-4}, and gamma exposure at 1.9×10^{-3} to 8.5×10^{-5}. As shown by the individual pathway risks, external gamma exposure during outdoor activities as measured by gamma dose is the limiting pathway. Inhalation of contaminated particulates contributed less than 1 percent of the total risk and is, therefore, not considered a significant pathway of exposure for the Residential Areas site and relevant portions of the Kress Creek site.

No evaluations were made in the preliminary focused risk assessment of exposure to nonradiological contamination. While it is evident that the radiological contaminants drive the site risk in excess of the risk management range, the contribution of metals to overall

site risk is not known. [Preliminary removal goals (PRGs) for metals are discussed in Section 3.]

2.4.3.5 Uncertainties in the Preliminary Focused Risk Assessment

Several sources of uncertainties are recognized for the preliminary focused risk assessment:

- Characterization of site contamination
- Evaluation of exposure scenarios
- Use of radionuclide risk factors

Characterization of Site Contamination. Site contamination data used in the preliminary focused risk assessment are based on limited radiation surveys and single soil samples collected in the areas of maximum detected concentrations. In the focused preliminary risk assessment, EPA assumed that the maximum concentrations measured were homogeneous throughout the contaminated areas on the subject properties. Although this assumption may overestimate the risk level for some of the properties, EPA did not want limited data to cause them to underestimate potential risks from undetected contamination on the properties. In addition, surface coverings (asphalt, concrete, etc.) caused attenuation of the radiation exposure resulting, in many areas, in difficulty in identifying the highest radiation level. In the instance of soil samples, limited analyses were performed. They were generally analyzed by gamma spectroscopy; however, results were only reported for radionuclides related to Ra-226 and Ra-228. Secular equilibrium was assumed for all radionuclides in the decay chains (SC&A et al., 1993).

Adjustment factors and professional judgment were used in the calculations of intake and exposed dose to account for site-specific conditions such as size of contaminated area and amount of surface covering or overburden. The adjustment factors were necessary because the site characterization was based on limited radiation surveys, and the factors allowed EPA to make more reasonable estimates of the highest expected risks.

Because the contamination present at several of the properties is covered by overburden soil, the external gamma exposure rates measured were, in effect, reduced by a factor of 10 when compared to rates calculated assuming maximum soil concentrations. This reduction was caused by the shielding effect of the overburden soil. The approach of using actual measured gamma exposure rates provides a more reasonable assessment of present land use health risks. However, removal of the overburden soil would result in increased gamma exposure rate and increased risk (SC&A et al., 1993).

Evaluation of Exposure Scenarios. The characteristics of the actual exposed population are currently unknown. Therefore, conservative exposure scenarios were developed in the preliminary focused risk assessment to represent the population at the subject sites. This approach leads to upperbound risk estimates. Inclusion of a food pathway also leads to conservative estimates. Gardening and fruit trees occur on a relatively small scale in West

Chicago; however, the food pathway assumes that a significant fraction of the normal diet of fruits and vegetables for the West Chicago population is grown in the immediate area.

Use of Radionuclide Risk Factors. The risk factors used to convert intake or exposed dose to risk are derived from observations at high radiation doses; extrapolating the observed health effects to low dose levels presents a degree of uncertainty.

A toxicity assessment, as part of a baseline risk assessment, would provide detailed information concerning the uncertainties inherent in the radionuclide risk factors. This would serve to qualify these uncertainties and provide additional information for risk management decisions pertaining to removal actions and residual risk.

Section 3
Removal Action Objectives

This section addresses EPA's response authority and statutory limits (Section 3.1); the objectives and scope of the proposed removal action (Section 3.2); the removal schedule (Section 3.3); and regulatory requirements, advisories, and to-be-considered (TBC) guidance (Section 3.4).

3.1 Response Authority

EPA, as authorized by CERCLA and SARA amendments, intends to address the contamination problems at the Residential Areas site and portions of the Kress Creek site by removal actions to the extent practicable. However, EPA's actions under Superfund will be limited to those properties where the contamination originated from the factory (Rare Earths Facility) site. When naturally occurring radioactive materials not associated with Rare Earths Facility wastes are detected at levels exceeding EPA's action criteria (see Appendix A), any corrective actions must proceed through a mechanism separate from Superfund because Superfund generally does not give EPA the authority to remediate threats from naturally occurring substances (EPA, 1993).

The proposed expedited response action evaluated in this EE/CA is consistent with the overall cleanup strategy for the site and will not limit the choice of reasonable alternatives or prejudice the ultimate decision for which the follow-on RI/FS will be prepared. Thus, the removal action is an interim remedy that will be consistent with the final remedy.

3.2 Objectives and Scope

The removal action can be broadly defined as the management of contaminated materials at properties of the Kerr-McGee Residential Areas site and portions of the Kress Creek site. The removal action objectives (RAOs) for the site serve as the basis for identifying and evaluating appropriate response actions and alternatives that manage the contaminated materials.

The RAOs account for the nature and extent of the contamination, the conceptual site model, and the streamlined risk assessment discussed in Section 2. A brief summary of this information follows:

- The contaminants of concern are Th-232 and U-238 and their decay products. The action criteria for the removal action described in Section 3.2.1 are based on total radium in the soil (Ra-226 plus Ra-228). Additionally, the possibility of metals, particularly lead, barium, and chromium, as contaminants of concern will be investigated during the pilot

study (previously discussed in Section 1.4.2) and as part of the residual risk assessment.

- The contaminated media of concern are the soil (as a result of particulate radionuclides and possibly metals) and the air (resulting from radon and thoron releases to indoor areas). Sediments and surface water associated with the storm sewers and the Kress Creek site are not addressed by the removal action, except as they relate to possible recontamination of floodplain soils through flooding. Groundwater is not a medium of concern based on available data.

- The primary release mechanism for the radiological contaminants is direct gamma emissions, which are directly measurable. Radon and thoron emissions are potential release mechanisms that will be measured through indoor air monitoring. Another mechanism is direct contact, which is measured by soils analyses. These release pathways are the principal foci of the removal action.

- Adults and children residing on the contaminated properties are considered the most important receptors under reasonable maximum exposure scenarios.

The RAOs for the removal action are consistent with the basic site action requirements under CERCLA and the SARA amendment. They include the following:

- Minimize potential health hazards to humans living or working on properties having contaminated soils.

- Minimize potential environmental impacts from the soil contamination.

- Be cost effective.

- Utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent possible.

- Establish soil conditions that comply with all applicable or relevant and appropriate requirements [(ARARs); see Section 3.4] to the extent practicable. Under certain circumstances, an alternative may be selected that does not meet all the regulatory requirements; however, it must be protective of public health.

The properties currently considered for expedited response action under this EE/CA are those located within the study area boundary (see Figure 1-2) and found to be contaminated above EPA's action criteria. However, discovery and characterization will test the appropriateness of the boundary by investigating properties outside the boundary. In addition to the discovery and characterization methods, EPA is currently considering the use of other methods to investigate areas outside the study area. If any properties outside

the boundary are discovered with similar contamination, they will be encompassed by the Residential Areas site for removal and will be included under the scope of this EE/CA.

As mentioned previously, the scope of the removal action includes only those contaminated soils or materials originating from the Rare Earths Facility; naturally occurring soils or materials with elevated levels of radioactivity not associated with Rare Earths Facility materials are not included in the removal action.

3.2.1 Removal Goals for Radiological Contaminants

Specific removal goals to meet the above objectives, with regard to the radiological contaminants in the soil, have been established by EPA in their *Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site: West Chicago, Illinois*, released in November 1993 (Appendix A). EPA's action criteria document in Appendix A explains how the criteria were derived, quotes the ARARs that form the foundation of the criteria, and provides rationale based on the "as low as reasonably achievable" (ALARA) principle for deviations from the ARAR. Table 3-1 summarizes the EPA action criteria to be used to verify completion of the removal action. These verification criteria serve as the removal goals for radionuclide contaminants in the soil.

3.2.2 Removal Goals for Non-Radiological Contaminants

Preliminary removal goals (PRGs) are initial cleanup goals that are protective of human health and comply with ARARs. No action criteria nor ARARs exist for metal constituents; however, the recommended interim lead cleanup limit in soil is TBC guidance in the evaluation. (TBC does not refer to potential ARARs; it refers to criteria, advisories, guidance values, and proposed standards that are not legally binding, but may serve as useful guidance for setting protective cleanup levels.) Therefore, PRGs are calculated for the metal contaminants of concern to serve as a basis for evaluating the potential impact to human health.

As previously mentioned, the correlation between radionuclide contamination and metal contamination will be evaluated during the pilot study. Metal concentrations derived from this study may then be compared to PRGs to evaluate whether concentrations may exist in soils commingled with a given concentration of radionuclides that potentially exceed health-based criteria.

Health-based PRGs for soil are calculated using the RfDs presented in Section 2.4.3 and following guidance in *Risk Assessment Guidance for Superfund, Part B: Development of Risk-Based Preliminary Remediation Goals* (EPA, 1991). Standard default exposure parameters were used assuming a residential exposure scenario that included only ingestion of soil and include an age-adjusted soil ingestion rate of 114 mg-yr/kg-day over an assumed exposure duration of 30 years.

Table 3-1
Summary of EPA Action Criteria for the Verification Phase

Topic	Unit of Measure	Background[a]	Criteria
Indoor thoron and radon decay product concentrations	WL (working level)	0.002 WL	Reasonable efforts must be made to achieve an annual average concentration (including background) in occupied buildings of no more than 0.02 WL; in any case, the concentration (including background) must not exceed 0.03 WL [40 CFR 192.12(b)(1) and 192.40(b)].
Outdoor gamma exposure rate	μR/hr (microRoentgen per hour)	5 to 13 μR/hr	After backfilling, the outdoor gamma exposure rates must not statistically exceed background at a distance of 100 cm from the surface [Illinois Administrative Code, Section 332.150(b)(2)].
Indoor gamma exposure rate	μR/hr (microRoentgen per hour)	Background data unavailable	Indoor gamma exposure rates must not statistically exceed background [Illinois Administrative Code, Section 332.150(b)(2)]. Note: This criterion will be used as a "finding tool" during verification to help determine if additional removal is necessary.
Radionuclide activity (concentration) in outdoor soils	pCi/g (picoCurie per gram) of dry soil	2.25 to 3 pCi/g[b]	Dry soil concentrations of total radium (Ra-226 plus Ra-228) must not exceed 5 pCi/g above background levels averaged over areas up to 100 m^2 in any 15-cm depth [based on relevant and appropriate portions of Illinois Administrative Code, Section 332.150(b)(1)].
General approach for removal action	Not applicable	Not applicable	Every reasonable effort should be made to maintain exposures and radioactive material quantities ALARA [Illinois Administrative Code, Part 340; 10 CFR 20; Department of Energy (DOE) Order 5400.5; NRC Regulatory Guide 8.37].

[a]Background values shown are approximate and are based on current available data. Additional background data will be obtained during the pilot-test and discovery phases of the removal.
[b]This background value is for total radium: Ra-228 at 0.85 to 1.6 pCi/g and Ra-226 at 1.4 pCi/g (see Section 2.2.7).

Table 3-2 shows the PRGs calculated for barium and chromium. As previously discussed, an RfD for lead is not available; therefore, a PRG cannot be calculated. The default for this is the recommended soil cleanup limit of 400 mg/kg that is considered protective for direct contact at residential settings (EPA, 1994b). The PRGs estimated for the other metals of concern, barium and chromium, are 11,641 mg/kg and 832 mg/kg, respectively.

Because of the potential commingling of radiological and metal contamination and because soil leachability tests indicate that the constituents are in a form with little potential for mobilization (Section 2.4.1.2), removal of the radiological component that exceeds the discovery criteria will effectively remove any metals present, most likely to levels much lower than their PRGs. The resultant site risk will then be approximately equal to the estimated risk associated with the radiological cleanup guideline or lower levels as achieved through the implementation of ALARA principals. Therefore, the contribution to overall site risk from metals would be negligible. This assumes, however, that a positive correlation exists between radionuclide concentrations and metals concentrations.

3.3 Removal Schedule

According to the aggressive schedule for this site, the pilot study, as well as some of the indoor (radon/thoron and gamma) measurements, will be completed prior to the release of the Action Memorandum, and the main portion of the site investigation (such as outdoor gamma measurements and soil sampling) will be well under way. The start of the removal implementation will lag several months behind the start of outdoor discovery activities, and the completion of removal implementation and verification activities is estimated to occur within several months of the completion of discovery activities, depending on the number of properties that are found to need removal action. In general, the discovery, removal implementation, and verification phases will proceed in series at individual properties but in parallel at the site as a whole.

The estimated duration of the removal implementation is less than 19 months. In consultation with EPA, this duration will be revised depending on the number of contaminated properties and volume of contaminated soils found at the site and the resources available for project allocation. EPA will be periodically advised of the budget and schedule status as the removal actions are under way.

3.4 Regulatory Requirements

Under CERCLA, the lead agency, EPA, identifies all ARARs associated with the contaminant, location, and the removal actions considered (40 CFR 300.400). One of the RAOs in Section 3.2 specifies that the removal action must attain these ARARs to the extent practicable. In determining whether compliance with ARARs is practicable, EPA may consider appropriate factors, including the urgency of the situation and the scope of

Table 3-2
Risk-Based Preliminary Removal Goals
Residential Exposure Scenario

Chemical	Oral RfD (mg/kg/day)	Soil Concentration at Target Hazard Quotient HQ = 1 (mg/kg)
Barium	0.07	11,641
Chromium VI	0.005	832

Exposure Assumptions:

Target Hazard Quotient	1
Ingestion Rate (mg-y/kg-d)	114 (age-adjusted soil ingestion rate, 30-year exposure)
Exposure Frequency (d)	365
Averaging Time (d)	10,950

the removal action to be conducted. Waivers [described in 40 CFR 300.430(f)(1)(ii)(C)] may be used for removal actions.

"Applicable requirements" are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstances at a CERCLA site.

"Relevant and appropriate requirements" differ in that they are not directly "applicable," but they address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. In some circumstances, a requirement may be relevant but not appropriate for the site-specific situation.

In addition to ARARs, other TBC requirements may play a role in the selection and implementation of a preferred alternative. TBCs can include promulgated regulations that are not ARARs but still are useful in determining the necessary level of cleanup for protection of human health and the environment, or non-promulgated advisories or guidance issued by federal or state government. While actions conducted under Superfund are not required to meet TBCs, they can be useful in selecting between removal alternatives.

Three subgroups of ARARs can typically be identified: contaminant-specific, location-specific, and action-specific. Contaminant-specific ARARs address the particular pollutant under consideration, usually by way of a concentration limit. Location-specific ARARs are effective if the site conditions qualify for special consideration under a particular regulation (e.g., floodplains or wetlands). Some regulations, cited as action-specific ARARs, control the way in which a contaminated medium is handled.

A summary of the ARARs and TBCs potentially applicable to the Kerr-McGee Residential Areas site and portions of the Kress Creek site, divided into contaminant-, location-, and action-specific groupings, is presented in Appendix B; a final compilation of ARARs will be published in the RI/FS for the site. RCRA was not identified as a contaminant-specific ARAR, even with the possibility of elevated metals in the contaminated soils, because the definition of an 11(e)2 waste allows for the presence of process-related metals (see Section 4.1.7). However, RCRA may still be considered relevant and appropriate for action-specific activities.

Section 4
Identification of Removal Action Alternatives

Figure 4-1 shows the process used in this EE/CA to identify and analyze removal action alternatives for the Residential Areas site and portions of the Kress Creek site. This section identifies the alternatives, and Section 5 describes the analyses performed.

EE/CA guidance (EPA, 1993b) recommends that based on available information, only the most qualified actions that apply to a site should be addressed in detail in the EE/CA. A screening process against specified criteria "qualify" the general response actions for detailed evaluation. The use of presumptive remedies can, in many instances, provide rapid convergence of discussion and selection of preliminary alternatives, speeding the process by limiting the universe of identified actions. Presumptive remedies especially focus on those actions that have been applied and proven in the past at similar sites or for similar contaminants. Therefore, in concert with the EE/CA guidance, this section briefly describes general response actions applicable to radioactively contaminated soils and screens them to select the most qualified actions. Although example technologies associated with each general response action are sometimes mentioned, the screening process is performed for the response actions rather than at the level of detail required for the individual technologies.

This section summarizes the rationale for (1) identifying and screening relevant response actions that may be implemented for removal (Section 4.1), (2) combining response actions, as appropriate, into preliminary alternatives for the site to achieve the RAOs (Section 4.2), and (3) describing at a conceptual-level the preliminary alternatives (Section 4.3). Because of the nature of the contamination at the Residential Areas site and portions of the Kress Creek site, the number of practicable and suitable response actions and preliminary alternatives is limited.

4.1 Response Action Identification and Screening

General response actions potentially applicable for the removal action at the site properties include engineering controls for radon/thoron reduction, institutional controls, in situ containment, removal (excavation and restoration), treatment, interim storage, disposal, and recontamination prevention (Sections 4.1.1 through 4.1.8, respectively). The engineering controls and excavation address potential exposure to radon and thoron; all of the general response actions except for the engineering controls address contamination in the soil and the resulting gamma emissions. These actions are screened with regard to three broad criteria: effectiveness, implementability, and cost. The effectiveness of an action refers to its ability to meet the RAOs and goals; implementability is typically defined by its technical feasibility, including the availability of applicable technologies and its administrative feasibility; cost is used here as a relative ranking (e.g., high, medium, and low). Current

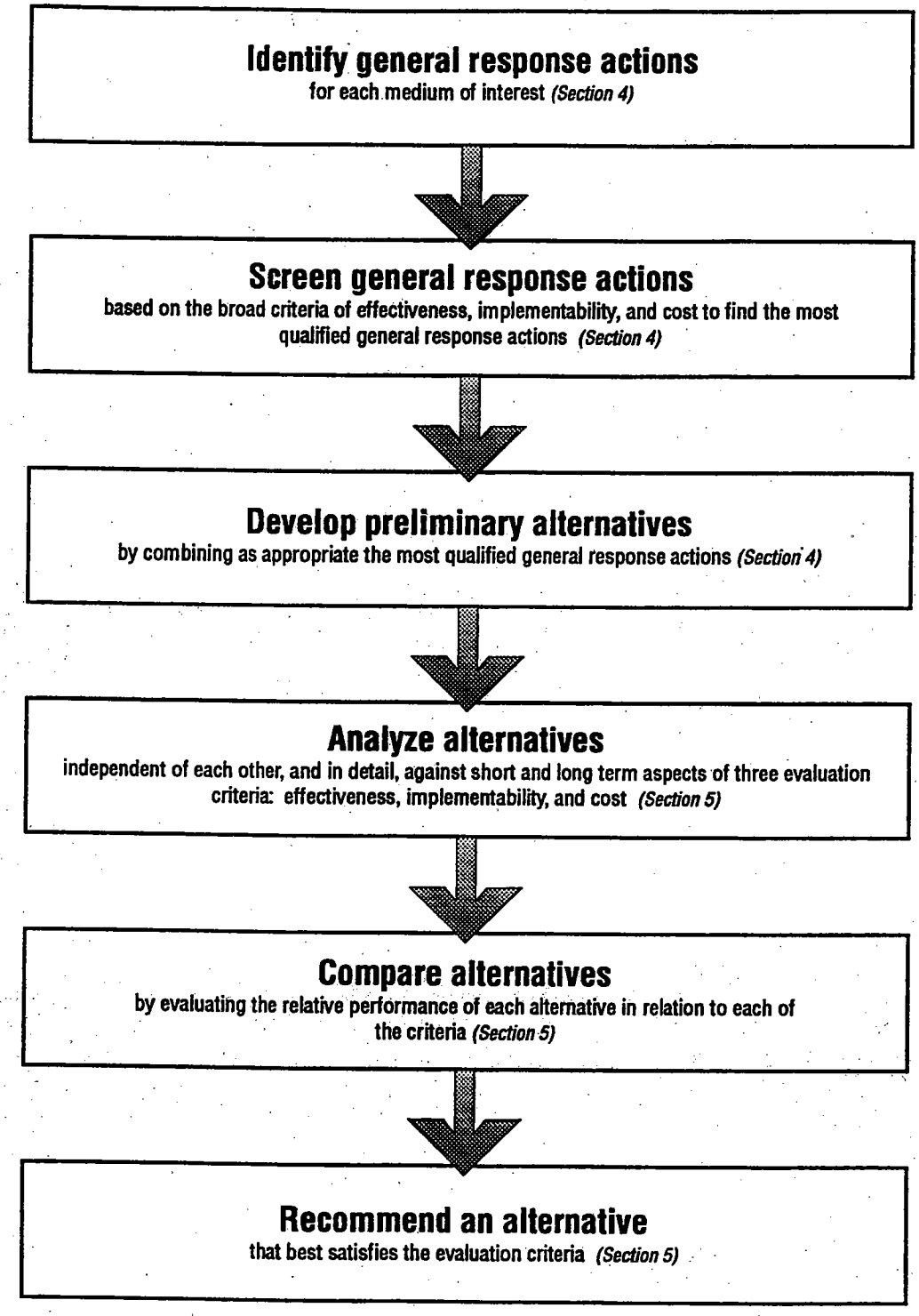


Figure 4-1
Process for Identification and Analysis of Removal Action Alternatives
Residential Areas Site and Portions of the Kress Creek Site

understanding of the contamination at the site properties and other general site conditions form the basis for the screening; property-specific conditions will be determined later during the discovery and characterization phases. Key considerations of the response action screening process are summarized in Table 4-1.

4.1.1 Radon and Thoron Reduction

To avoid indoor exposure to radon and thoron and their decay products from Rare Earths Facility-originating fill material, "engineering control" technologies may be implemented (1) to remove or dilute the noble gases from the air after they have entered a structure (e.g., ventilation in a crawlspace) and (2) to prevent entry of the gases into the structure (e.g., interior/exterior sealing to create gas barriers and soil gas ventilation/extraction to divert the gas before it reaches the structure). Combinations of reduction technologies may be required at certain properties. (Note: Soil removal, which also reduces radon and thoron concentrations, is discussed separately in Section 4.1.4.)

Screening comments on the radon and thoron reduction response action are as follows:

- This response action reduces human exposure to radon and thoron in indoor air. However, this action only addresses one effect of the contaminated soils—though a potentially significant one—but does not address the exposure pathways of direct contact, gamma exposure from the soil, or ingestion. For this reason, radon and thoron reduction technologies are best used in combination with other technologies that impact other routes of human exposures.

- Technical guidance on radon reduction technologies are available from EPA, and construction techniques for implementation are fairly standard with commonly available materials. There is no reason to believe that thoron reduction technologies will be substantially different from those for radon. With any system, the long-term maintenance and monitoring may be a public concern (e.g., an expense and inconvenience to property owners).

- Costs are considered to be low to moderate, depending on the combination of engineering controls used.

Engineering controls for radon and thoron reduction are not considered as exclusive removal actions that are used alone. However, engineering controls may be useful under special circumstances, such as the following:

- As a temporary measure to reduce inhalation risk where other more effective response actions (e.g., soil removal) cannot be implemented in a timely fashion; this could occur if discovery and characterization indicate a significant inhalation risk, but removal implementation at that particular location is delayed beyond the planned response time.

Table 4-1
Response Action Screening Summary

Technology	Effectiveness	Implementation	cost	Evaluation
Radon and Thoron Reduction (Indoors) (see Section 4.1.1)	Reduces inhalation exposure only. No effect on other routes of human exposure.	Can be successfully applied using standard construction techniques.	Low to moderate	Rejected as a sole remedy, but may be useful for special situations where other actions are delayed or are not cost effective.
Institutional Controls (see Section 4.1.2)	Reduces exposure by regulating or restricting people's behavior or activities.	Difficult to implement, administer, and enforce at privately owned properties.	LOW	Rejected as a sole remedy, but may be useful for special situations where other more active actions are inappropriate.
In Situ Containment (see Section 4.1.3)	Reduces exposure and/or contaminant movement; less effective for radon and thoron reduction.	Impractical for noncontiguous contamination in developed areas. Long-term monitoring, maintenance, and enforcement are difficult at privately owned properties.	Moderate	Rejected.
Excavation/Restoration (see Section 4.1.4)	Removes source of current and future exposure; fully complies with EPA's action criteria.	Can be successfully applied using standard construction techniques and conventional equipment.	High	Retained.
Treatment (see Section 4.1.5)	Volume reduction tests have only been partially successful. Immobilization is technically feasible but impractical.	The time required for treatability studies and additional testing of treatment technologies could delay the removal action several years.	High	Rejected.
Interim Storage (see Section 4.1.6)	Protects human health and the environment for the short term.	Interim storage will probably not be needed. However, a contingent action is to investigate the potential of using the Rare Earths Facility. No other offsite interim storage location is currently available or could be expected to become available within the time frame required for removal action.	Moderate to high	Feasible, but likely *unnecessary.*

Table 4-1
Response Action Screening Summary

Technology	Effectiveness	Implementation	cost	Evaluation
Final Disposal (see Section 4.1.7)	Protects human health and the environment for the long term.	A commercial disposal facility is licensed for 11(e)2 by-product material. Prior to receiving the material, this facility will need to comply with pre-receipt conditions stipulated by the license.	High	Retained.
Recontamination Prevention (see Section 4.1.8)	A temporary measure that protects the relevant floodplains from possible recontamination and protects human health and the environment from redeposited sediments. However, the frequency, severity, and impact of flooding cannot be predicted with certainty.	Can be successfully applied using standard construction techniques; however, the design data needs and administrative requirements are significant.	Moderate	Sheet piling retained.

- As a long-term measure to reduce inhalation risk where other more effective response actions are precluded for social or institutional reasons or cannot be implemented in a cost-effective manner because of interferences from structures or utilities.

4.1.2 Institutional Controls

Institutional controls are intended to limit or prevent human exposure to hazardous environmental conditions by regulating or restricting people's behavior or activities. Controls could be implemented to impact activities of both current and future residents. Examples of activities that disturb contaminated soil that may need to be restricted include garden cultivation, belowground structural repairs, fence post digging, and pool excavation. Examples of institutional controls, which could be implemented alone or in combination, include physical barriers, posting of warnings (e.g., signs), use of deed restrictions or notification, resident relocation, and screening of permits (per municipal, zoning, and health ordinances) for construction and utility connections.

Though legally permissible and though these controls may reduce the potential for exposure to contaminated soils, humans affected by the institutional controls would need to be educated about the nature and intent of the controls to enhance the effectiveness. Other relevant screening comments are as follows:

- Some institutional controls require additional funding and personnel for implementation, administration, and enforcement. If enforcement by local authorities is not performed, compliance would depend on self-enforcement by residents. Some controls are subject to legal challenge and delay and could require compensation. Because many of the site's properties are privately owned and noncontiguous, implementability of institutional controls is difficult.

- Costs associated with institutional controls are generally low on an annual basis, but may increase significantly if resident relocation becomes necessary. The total cost for long-term implementation may also be significant.

For the abovementioned reasons, institutional controls are eliminated from further consideration as a sole remedy, but may be applicable in unique situations as a substitute for more active measures that are less appropriate for those unique situations.

4.1.3 In Situ Containment

In the context of this removal action, in situ containment consists of measures (1) to confine contaminated media at their present location, or (2) to place a barrier (or shield) between the contaminated media (or source) and the humans in the Residential Areas site and portions of the Kress Creek site. The purpose of the containment is to reduce the

potential for contaminant movement and/or the associated potential for human exposure (e.g., exposure to gamma radiation and radionuclide ingestion). Containment for outdoor areas generally includes covering or capping contaminated surface soil with a geotextile fabric and a thin layer of soil and sod, and then properly maintaining the cover. Containment for indoor areas generally includes lead sheeting applied in layers to basement floors and walls until gamma radiation levels are reduced to the desired value. The sheeting would be covered with paneling or carpeting for aesthetic purposes and to prevent exposure to the lead.

Comments relative to using containment response actions at the Residential Areas site and portions of the Kress Creek site are as follows:

- This response action is effective at reducing the potential for contaminant movement and/or the potential for exposure through direct contact, gamma emission, and root uptake. However, containment is less effective for radon and thoron reduction.

- Containment for outdoor areas is generally considered impractical for the site properties because of the noncontiguous (i.e., hotspot) nature of the contamination, as well as the multiple soil penetrations (e.g., structures and trees) that may affect containment integrity.

- Actively enforced institutional controls and monitoring of long-term effectiveness are often included with this response action to guarantee that property owners will not remove or damage the containment. However, long-term controls and monitoring are difficult to implement because of the inconvenience to property owners and because those parties implementing the controls have no ownership rights (see Section 4.1.2).

- Costs are generally moderate.

The containment response action is inappropriate for the Residential Areas site and portions of the Kress Creek site and is therefore eliminated from further consideration.

4.1.4 Excavation and Restoration

This option involves excavation of Rare Earths Facility-originating soil contaminated at levels above the removal goals (see Section 3.2). The extent of contaminated soil requiring excavation varies from property to property. Removal has the following characteristics:

- Excavation segregates the contaminated soil from the public and is therefore effective at reducing human exposure for the long term.

- Excavation technology using standard construction procedures and conventional equipment has been successfully applied previously at the

Residential Areas site, as well as other similarly contaminated U.S. sites. The excavations are a significant inconvenience to the property owner, but the inconvenience is short term and the stigma of contamination is substantially reduced from future property transactions. Short-term risks from dust, runoff, or worker exposure can be minimized using proper controls.

- Costs are generally high; total costs will depend on the extent of the contamination.

Excavation (and restoration) is identified as an appropriate response action and is retained for further consideration.

4.1.5 Treatment

A limited number of in situ and ex situ physical and chemical options are available for treating radionuclides and metals in soil. They are as follows:

- Volume reduction via chemical recovery or physical separation

- Immobilization of soil contaminants via vitrification or matrix isolation (e.g., mixing and encapsulating with asphalt, cement, polymers, or resins). Immobilization processes bind the contaminants in a matrix to prevent their availability for transport or direct contact.

Costs for implementing these technologies are expected to be high.

At present, no in situ treatment technologies or series of in situ technologies have been proven to be viable and effective for treating radioactively contaminated soils in residential areas. The in situ treatments, whether volume reduction or immobilization, are generally impractical for application to developed areas with noncontiguous contamination. In addition, significant development is required for some in situ treatments for demonstrating feasibility in the field.

Immobilization, whether in situ or ex situ, is not a candidate for further consideration because (1) the immobilized waste forms are relatively ineffective in mitigating gamma exposure or radon/thoron pathways; (2) leachability studies (see Section 2.4.1.2) indicate that the radionuclide and metal contaminants, in their present form, are not easily leachable (i.e., they are already relatively immobile); (3) the mixing and encapsulating is often difficult to implement; and (4) waste volumes (for some technologies) would significantly increase. In situ immobilization has the additional inconvenience to property owners of having immobilized waste forms remaining near or at the property surface.

Electrical vitrification of contaminated soil to a glass matrix is an exception to two of the general disadvantages (Items 1 and 4) listed above for immobilization. Though still

infeasible at this site, vitrification would probably eliminate the radon/thoron pathway, reduce (but not eliminate) the gamma exposure pathway, and reduce slightly the waste volume.

Volume reduction options include solids separation and size reduction techniques (such as mechanical screening and gravity separation) and soil washing, where contaminants are concentrated by mechanically and/or chemically scrubbing soils to remove contaminants. In soil washing, the washing agent becomes contaminated and must be handled as a secondary waste stream.

The selection of ex situ volume reduction technologies for soils contaminated with radionuclides is predicated upon particle size separation. Radionuclides and metals tend to adhere to fine-grained particles because of a higher surface area-to-volume ratio. In theory, if coarse- and fine-grained materials can be separated, treatment may be beneficial for lowering the transportation and disposal costs through volume reduction. Treatability studies must be conducted on a site-by-site basis to determine whether a relationship exists between radionuclide (or metal) concentrations and particle-size distribution.

In general, preliminary testing of volume reduction techniques for radionuclide-contaminated soils has thus far had only limited success. Eagle et al. (1993) reported that pilot-scale soil washing tests (with water) of radium-contaminated soil produced a "coarse" fraction with a radium specific activity (13 pCi/g average) that was 3 to 4 times lower than the specific activity of the feed soil (40 pCi/g). Richardson (1989) reported that multi-stage acid extraction studies of radium- and thorium-contaminated soil produced fractions with specific activities that were 10 to 17 times lower than the specific activity of the feed soil. The acid extraction studies were laboratory-scale tests performed on selected (optimized) soil particle sizes; no bench- or pilot-scale soil tests have been performed. Further acid extraction studies have not been aggressively pursued by vendors because of predicted implementation difficulties; examples include public acceptance and siting issues for a process performing heat-bleaching with acids in residential areas, and the potential mixed waste disposal issues for the washing agent.

As part of the closure process for the Rare Earths Facility, tests have been conducted on Rare Earths Facility site materials showing that radium activity is concentrated in the finer particles. The feasibility, design, and construction of a Physical Separation Facility (PSF) at the Rare Earths Facility has been studied as part of Rare Earths Facility excavation planning. Over a planned period of several years, this facility would separate and water-wash some of the excavated materials at the Rare Earths Facility using both wet and dry vibrating screens, a rotating wet scrubber, a thickener, and filter presses. Topsoil and clayey materials would not be fed to the PSF. The initial design specified blending of feed materials for the PSF to produce a resulting coarse-washed fraction decontaminated to a level less than 15 pCi/g above background. Recently, however, IDNS mandated an ALARA standard of 5 pCi/g above background for the Rare Earths Facility cleanup. The impact of this ALARA standard on the feasibility of the PSF, as currently designed, had not been assessed at the time the EE/CA was released.

Although soil washing may be proposed for the Rare Earths Facility materials, volume reduction of soils via soil washing from the Residential Areas site and portions of the Kress Creek site is not retained for further consideration because the process is not presently sufficient to reduce the contaminant concentration to levels below the soil concentration action criteria for a significant fraction of the waste. That is, if the average specific activity for (blended) site soils is greater than 20 pCi/g, as expected based on data from EPA's preliminary focused risk assessment, it would be difficult to achieve 5 pCi/g above background. The topsoil and clayey fractions expected in the site soils also discourage application of soil washing. Additional pilot testing would be required before serious consideration could be given to implementation. If a pilot treatment scheme was eventually successful, either a treatment facility could be built or the PSF could be considered for use, depending on availability of the PSF, its appropriateness for use, and EPA's policies regarding feeds blending and disposal of the coarse fraction. A treatment facility other than the PSF would take considerable time to site, design, construct, permit, and start up, delaying the removal perhaps years.

CERCLA favors treatment options, and EPA will continue to monitor the progress and feasibility of treatment technologies.

4.1.6 Interim Storage

The excavated soil must be placed in either interim storage or shipped offsite for final disposal (see Section 4.1.7). Interim storage would be necessary only if final disposal becomes unavailable or is delayed for a prolonged period of time. Interim storage involves consolidating all of the excavated material and temporarily placing that material in one or more areas of a storage site until final disposition of the wastes is determined or becomes available. Options for interim storage include (1) placing the bulk material in piles and covering the piles or (2) containerizing the material and stacking the containers. Covering the piles or, to a greater degree, containerizing the material reduces the potential for leaching or for airborne contamination; however, storing additional radioactive material on a site does add to the total external gamma exposure emanating from the storage area. (Note: The total gamma exposure does not increase linearly with the amount of stored radioactive material because the material forming the outer layer of the pile/stack significantly attenuates radiation emitted from the pile/stack interior.)

The interim storage location could be the Rare Earths Facility or some other, as yet unidentified, offsite facility. Costs range from moderate, if the Rare Earths Facility becomes licensed by IDNS to receive and temporarily store the soil from the Residential Areas site and portions of the Kress Creek site, to high, if other offsite locations must be identified, approved, purchased, secured (to prevent entry to the area), and licensed. The time frames for implementation of the two interim storage options also range from short to long, respectively; indeed, the time frame to engineer and license an offsite (i.e., non-Rare Earths Facility) interim storage facility may delay the removal action several years and would, therefore, disqualify the offsite facility as a valid option.

Storage of contaminated soils at the Rare Earths Facility was accomplished by Kerr-McGee during their excavation of residential properties in the mid-1980s. Interim storage has also been accomplished at other similarly contaminated U.S. sites. An option, therefore, is to place the contaminated soils from the Residential Areas site and portions of the Kress Creek site at the Rare Earths Facility, with the understanding that (1) the waste storage will be temporary and (2) EPA will probably require (for administrative rather than health physics reasons) that the soil from the Residential Areas site and portions of the Kress Creek site be kept segregated from other contaminated soils from the Rare Earths Facility or other Kerr-McGee sites. Though interim storage is technically feasible, it will only be considered in the event that disposal (as described below) is delayed (e.g., the disposal site is not ready to accept waste) or waste transport is delayed (e.g., the railspur at the Rare Earths Facility is not yet constructed).

4.1.7 Disposal

Disposal refers to the permanent offsite placement of contaminated waste in a manner that protects human health and the environment for the long term. Disposal costs, including transportation of the waste to the disposal facility, are high.

Given the time frame for the removal action, the only disposal option considered for further evaluation in this EE/CA is a licensed commercial disposal facility; disposal alternatives with lengthy time requirements (e.g., developing and siting a new facility) will not be considered for the removal action.

The contaminated soils at the Residential Areas site and portions of the Kress Creek site are classified as "by-product material," which, according to the AEA of 1954, as amended, means "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content" [AEA, Section 11, paragraph (e), number 2]. Under authority of the AEA, NRC has developed standards and regulations for disposal of these so-called 11(e)2 by-product wastes.

Disposal options for this category of waste are limited. A separate license is required for a facility to take this category of waste. While many disposal sites have at one time had a license for 11(e)2 material, most have had specific qualifications for acceptance. For example, many sites have obtained a license to accept a specific shipment of this type of waste. Others accept only from specific sites, usually a site that is owned by the owner of the disposal site. Still others have the capability of accepting this category of waste, but do not have a general license for acceptance; they obtain specific licenses as necessary.

One disposal site, the Envirocare Facility, currently possesses a general disposal license for 11(e)2 material. Any other active 11(e)2 disposal site would have a license with specific waste acceptance criteria and would need a license amendment to handle and dispose of Superfund 11(e)2 waste from West Chicago.

The Envirocare low-level waste (LLW) facility in Tooele County (near Clive, Utah) possesses a general license for 11(e)2 waste. This license was obtained in November 1993 and is probably the most complete license ever issued for disposal of 11(e)2 material. Disposal methods include the Super Sacks (1-yd^3 containers with drawstring closures), B-25 metal boxes, or bulk disposal. Kerr-McGee currently has a contract in place with Envirocare, and this waste would be covered by the provisions in the contract; charges for disposal at the Envirocare facility are established in the contract. Laboratory confirmation testing of the waste is required prior to acceptance at Envirocare.

Envirocare can accept 11(e)2 by-product material having an average concentration below 2,000 pCi/g for any radionuclide in the uranium series or below 6,000 pCi/g for any radionuclide in the thorium series in any truckload or railcar. The presence of elevated metals suspected to be commingled with the radionuclides in the soils should not hinder disposal of the soil as an 11(e)2 waste. Elevated metals are common co-contaminants in this type of waste and are taken into account by the licensing agency (e.g., NRC and the State of Utah) in granting an 11(e)2 waste disposal license. Envirocare has indicated that if it can be demonstrated that the elevated metals originated with ore or the ore processing, the metals are exempt from RCRA even if they were to exhibit the "characteristic of toxicity" based on TCLP results. The current groundwater quality discharge permit from the State of Utah for the facility places concentration limits on metals; however, Envirocare reports that the limits are higher than any of the maximum concentrations indicated in the RI report (EPA, 1986) for any of the Kerr-McGee sites.

Envirocare's license imposes various administrative conditions; radioactive material qualification requirements; operational controls; inspection, monitoring, and recording requirements; and reporting requirements that Envirocare must meet in order to accept the waste. The license states that 120 days advance notice of shipment should be allowed prior to the first 11(e)2 shipment to allow Envirocare to prepare for waste receipt and to comply with NRC pre-receipt requirements. However, because of ongoing efforts by Envirocare and Kerr-McGee with regard to disposal of the Rare Earths Facility wastes, much progress in waste receipt preparation and compliance has already been made. Envirocare started construction in May 1994 of an 11(e)2 waste "cell" at their facility and should, according to current schedules, be prepared to accept 11(e)2 waste from the Rare Earths Facility in September 1994. The ongoing preparation means that advance notice of shipment of 11(e)2 waste from other sites, such as the Residential Areas site, should be minimal.

Disposal is retained for further consideration.

4.1.8 Recontamination Prevention

This response action to flooding minimizes risks of recontamination to portions of the Kress Creek site (i.e., the floodplain soils on residential properties) after cleanup. If the stream water rises above the banks, it could deposit contaminated sediments. If these contaminants exceed EPA's action criteria (see Section 3.2), additional cleanup would be required. Because flooding is unpredictable, the frequency of flooding that could occur

between completion of the removal action for the floodplain soils and remediation of the rest of the Kress Creek site is indeterminate. To be effective as a recontamination preventative, this response action must be implemented before a flood occurs.

The alternative to prevention is to save the cost of implementation and accept the risk and possible additional cost of a second cleanup during the Kress Creek site remediation. Examples of "post-flooding" cleanup activities are excavation/restoration or high-pressure water rinsing (sediments deposited in residential areas would be rinsed back into the stream with fire hoses to removal action goals) with downstream sediment control barriers. Details of final costs, quantities, scheduling, and resident acceptability would be considered during the Kress Creek site RI/FS. The cost of a second cleanup would vary depending on the extent and frequency of flooding.

Several recontamination prevention technologies were screened and evaluated on a preliminary basis using engineering judgment and approximate costs based on experience. They are summarized as follows:

- Creek Diversion. This option reroutes creek flow using ditches or trenches to bypass residential areas. Because the creeks contain base groundwater flow at times, full diversion cannot occur. Additional difficulties with this option include securing property through which alternate channels could be constructed to bypass the residential areas, the high cost of construction, possible contamination of the new channels requiring subsequent remediation, and loss of aesthetics of the existing stream. The ecological and permitting issues would also be formidable. Diversion is not recommended for this response action.

- Berms or Dikes. Berms and dikes are compacted earthen ridges or ledges constructed along the creek banks to keep flood waters from reaching residential areas and depositing sediment. This option is technically feasible and effective, but it requires a lot of real estate for the berm slopes, and the berm construction would generate a lot of heavy equipment traffic during installation and later removal. Berms are not recommended for this response action.

- Sheet Piling. Though somewhat expensive, this option is attractive because it requires very little space, it can be removed when no longer needed with minimal disturbance, and it can probably be decontaminated for reuse. Some economy is realized by the recovery of the sheet piling. It would be considered aesthetically unpleasing by the residents, but may be acceptable as a temporary measure. This technology is retained for further consideration.

Implementation of this contingent technology is technically feasible, uses standard construction techniques and equipment, and assures that Alternative 2 remains protective of public health and the environment over the long term. In addition to protecting the cleaned

residential areas, it serves as a barrier between the stream and residents, reducing exposure of potential receptors to stream sediments. One disadvantage is that the time required to address data needs and administrative requirements may significantly delay implementation. Sheet piling is retained for further consideration.

4.2 Identification of Preliminary Alternatives

In this section, the general response actions that passed initial screening in Section 4.1 are combined into preliminary alternatives. The general response actions considered potentially applicable to the Residential Areas site and portions of the Kress Creek site include the following:

- Indoor radon and thoron reduction (considered only for special removal situations where other actions are delayed or are not cost-effective)
- Institutional controls (considered only for special removal situations where more active actions are inappropriate)
- Excavation/restoration (to fully comply with EPA's action criteria)
- Interim storage (at the Rare Earths Facility)
- Disposal (at a licensed commercial facility)
- Recontamination prevention (using steel sheet piling)

Based on consideration of the various benefits and liabilities from the range of possible response actions, as well as the potential for impedances to implementation, the response actions were combined to form the following preliminary removal action alternatives:

- **Alternative 1—No Action.** This alternative postpones action at the Residential Areas site and portions of the Kress Creek site until their respective RI/FS has been completed and the Records of Decision (RODs) have been issued.
- **Alternative 2—Source Removal.** This alternative consists of expedited excavation of the contaminated soil from properties (both the Residential Areas site and portions of the Kress Creek site), backfill and restoration of the properties, packaging of the waste (if needed), transportation to the disposal site, and final disposal. Engineering controls to reduce radon and thoron concentrations, as well as specific institutional controls, may be used at a relatively small number of properties if excavation is inappropriate. Recontamination by flooding of floodplain soils on residential properties, if

any, will be cleaned up during the Kress Creek site RA. This alternative is described in more detail in Section 4.3.

- **Alternative 2, Contingent Action A—Interim Storage.** This contingent action consists of interim storage of the excavated soils at the Rare Earths Facility in the unlikely event that transportation or disposal is delayed. This contingent action is described in more detail in Section 4.3.5.

- **Alternative 2, Contingent Action B—Off-Rare Earths Facility Staging Area.** This second contingent action for Alternative 2 (discussed in Section 4.3.6) is not based on a review of the response actions but is instead a response to a possible situation where the Rare Earths Facility is unavailable for use as a staging area for excavated soil from the Residential Areas site or portions of the Kress Creek site. A description of this alternative is postponed in the EE/CA until waste transportation for the base alternative (Alternative 2) has been described (Section 4.3.2).

- **Alternative 2, Contingent Action C—Recontamination Prevention.** This contingent action is a temporary measure to prevent/reduce recontamination of floodplain soils on residential properties. It consists of installing steel sheet piling between Kress Creek and the residential properties in Zone 2 (this zone is shown in Figure 1-2) and between the West Branch DuPage River and the residential properties in Zone 3. This contingent action is described in more detail in Section 4.3.7.

4.3 Conceptual-Level Description of Source Removal Alternative

This section describes at the conceptual level how the source removal (Alternative 2) might occur. The specific implementation of the general process described here is not unique and does not preclude the removal action contractor from altering implementation techniques as needed. The purpose of the description is to provide a basis for the alternatives evaluation in Section 5. Some of the quantity/volume assumptions made in the description are subject to relatively high uncertainty but are necessary for cost estimating purposes.

4.3.1 Excavation and Restoration

Contaminated soil in excess of the action level (i.e., 5 pCi/g total radium above background) will be excavated. The amount of excavation at a property could vary from removal of a small hotspot to removal of most of the surficial soil. The boundaries of the excavation would be determined from existing radiological data and then monitored with supplemented surveys during the removal. An access agreement between the property owner and the contractor (or other responsible party) would be obtained prior to start of the excavation. An emergency safety plan would be coordinated with local police, fire, utility, and emergency personnel.

Excavation in open areas will be performed with conventional earthmoving equipment (e.g., backhoes, bulldozers, scrapers, small bobcats, and front end loaders). Those areas with limited access for conventional equipment, such as immediately next to or underneath structures, will be excavated using procedures that support and maintain the integrity of the structures and utilities. In some cases, the excavation will be manual. It is assumed that the excavation (and backfill) near structures or utilities (confined areas) is 2-1/2 times more costly than open-area excavation, and that 10 percent of the total quantity excavated for the site has near-structure ramifications (90 percent is from open-area excavation). In many instances, it is expected that the excavation and restoration could be performed without temporary relocation of residents.

In some situations where contamination is found underneath a structure, it may be necessary to move the structure (trenching methods as an alternative to moving the structure may also be used), provide underpinning, or break up and remove the basement slab. Utilities (e.g., gas, water, and sewer) would need to be removed and replaced if house moving, underpinning, or deep excavation in the front yard of a property were necessary. If utilities are interrupted, a household would have to be temporarily relocated for an assumed average period of 60 days.

Upon receipt of data indicating that the property has been cleaned to appropriate levels, excavated areas will be replaced with clean fill and the properties restored, to the extent possible, to the same condition that existed prior to the excavation and in accordance with property owner's agreements.

Special operating procedures during the excavation will increase the excavation cost and duration over that expected from standard construction scenarios; these procedures include decontaminating equipment, minimizing dust and dust inhalation, controlling runoff, and monitoring radiation exposure. Verification tests by IDNS after the excavation, as well as after restoration, will also be necessary for the removal action to meet the verification criteria (see Section 3.2). The property owners will receive documentation giving results of data collection and removal implementation on their property.

4.3.2 Packaging and Transportation

As the contaminated soil is excavated, it will be readied for shipment at the property. Bulk (unpackaged) shipment of the soils is allowable under transportation regulations and is a viable option for the removal contractor, but is not required because soils treatment is not currently an option for the removal action. Soils packaging does increase the handling cost slightly, but also permits inspection of waste quantities of consistent size. Both bulk and packaged shipments have been performed at other sites in the U.S.

Although bulk shipment is not precluded from consideration at the Residential Areas site or portions of the Kress Creek site, the packaging option is assumed for the source removal alternative and the contingent actions to provide a consistent basis for estimating costs. Use of the packaging option (1) avoids the licensing requirement for using an off-Rare

Earths Facility staging location if the Rare Earths Facility were unavailable for staging (see Section 4.3.6) and (2) reduces the number of controls/measures needed to prevent contaminant transport during interim storage (see Section 4.3.5), if needed.

The excavated soils from a property would be fed into the top of a hopper located on the same property. The hopper diverts the soil through chutes into 1-yd^3 durable polypropylene bags, which are then tied off by laborers. The bags are then pushed along a roller conveyor to a location where health physics personnel scan the bags so that the activity concentrations are below 2,000 pCi/g, the lower limit established by the U.S. Department of Transportation (DOT) for defining radioactive materials. Identification tags containing survey data and location references are attached to the bag for tracking purposes.

A loader or crane then picks up the bag and places it into a lined dump truck. When the truck is full, the load is covered and secured, the truck is radiologically surveyed prior to leaving the property, and then the truck hauls the soil to a Rare Earths Facility staging area or transloading site next to a railroad spur that runs along the western side of the Rare Earths Facility. All of the study area is within a radius of approximately 2 miles from the Rare Earths Facility. Transportation routes would be established to minimize impact on the community. When sufficient quantities of material have been collected at the staging area, the railcars are loaded (each "gondola" railcar holds approximately 75 bags or 75 yd^3) and the material is shipped. Because of the range of waste volumes possible for the Residential Areas site and portions of the Kress Creek site, truck transport to the disposal site would be more expensive than rail transport.

4.3.3 Final Disposal

The waste will be transported to a licensed offsite disposal facility. For purposes of this EE/CA, it was assumed that waste would be transported approximately 1,300 miles via rail to the Envirocare facility near Clive, Utah, for final disposal. Samples will be taken of the waste periodically during the removal action to verify to Envirocare that the waste meets their waste acceptance criteria for 11(e)2 by-product material.

4.3.4 Waste Volumes

Because comprehensive characterization of the Residential Areas site and portions of the Kress Creek site will occur subsequent to the submittal of this EE/CA, the extent and depth of contamination cannot be estimated for the EE/CA with any reasonable degree of certainty. To provide a basis for the alternatives evaluation, and specifically the cost estimate for the source removal alternative (Alternative 2), four volumes have been selected to represent a potential range of soil excavation; these four volumes (labeled as waste volume scenarios 1 through 4) and their rationale are presented in Table 4-2.

Table 4-2
Waste Volume Scenarios for Source Removal Alternative

Scenario	Contaminated Properties[a] (number)	Contaminated Properties[b] (as percent of total)	Excavated Volume[c] (yd^3)
1	50	3.5	15,000
2	100	7	30,000
3	200	14	60,000
4	400	28	120,000

[a]A range for the number of contaminated properties (50 to 400) was selected for cost estimating and alternatives evaluation purposes. The actual number of contaminated properties will not be determined until discovery and characterization are complete. Current site information is incomplete; however, a database printout (dated October 26, 1993) of West Chicago properties surveyed by IDNS and Kerr-McGee lists 87 "contaminated" properties without excavation dates. These are properties that are likely to exceed EPA's action criteria but were not excavated by Kerr-McGee in the mid-1980s. Survey data indicate exposure rates above Kerr-McGee criteria for 57 of the 87 properties and below the criteria for the remaining 30.

[b]The percentage of contaminated properties is determined by dividing the number of contaminated properties (second column) by the total number of properties (approximately 1,434 properties) within the boundary of elevated gamma readings (see Section 1.3). The range of percentages shown (3.5 to 28 percent) reflects (1) the percentage of properties identified by Kerr-McGee in the mid-1980s with survey data exceeding the excavation criteria (i.e., 117 contaminated properties out of 2,726 properties surveyed, or 4.3 percent), and (2) the percentage of above-background properties identified by IDNS in the time interval 1989 through 1993 (i.e., 48 contaminated properties out of 160 surveyed, or 30 percent).

[c]The excavated volume may be calculated one of two ways (both ways provide the same answers):
(1) Multiply the number of contaminated properties (in Column 2) by 300 yd^3 of excavated soil per property. This figure of 300 yd^3/property is the approximate average volume excavated per property by Kerr-McGee in the mid-1980s (Denny, 1986): 34,868 yd^3/115 completed excavations = 303.2 yd^3/excavation.
(2) The following assumptions are used for this calculation:

- The average property size is 13,000 ft^2. Most of the residential properties range in size from 10,000 to 17,000 ft^2. The average value of 13,000 ft^2 was determined by dividing the total area within the flyover contour (approximately 692 acres) by the number of properties within the contour (approximately 1,434 properties), and then multiplying by a factor of 0.6 to account for public areas such as streets and railroad lines.
- The average extent of contamination for each contaminated property is 25 percent of the surface area. The percentage of contaminated area within a property was estimated by analyzing 23 radiological survey maps produced in the mid-1980s during the Kerr-McGee excavation.
- The average contamination depth is 2 ft.
- Soil in the ground increases in volume or swells by a factor of 1.25 when excavated due to loss of compaction.

Calculation: Number of properties (in Column 2) $\times$ 13,000 ft^2/property $\times$ 0.25 $\times$ 2 ft depth $\times$ 1.25 $\times$ 1 yd^3/27 ft^3 = volume (yd^3).

4.3.5 Conceptual-Level Description of the Interim Storage Contingent Action

In the event that the proposed methods of rail transport or permanent disposal become temporarily unavailable or delayed, one possible contingent action is to place the excavated soil from the Residential Areas site and portions of the Kress Creek site in interim storage at the Rare Earths Facility. For the purposes of the EE/CA, the contingent action assumes that:

- Kerr-McGee is licensed by IDNS (Illinois is an Agreement State for NRC) to receive and store soil from the Residential Areas site and portions of the Kress Creek site at the Rare Earths Facility. The licensing agreement will stipulate waste management protocols and indicate that the waste will be shipped from the Rare Earths Facility within a prescribed period of time. An additional stipulation may prohibit consolidation of the waste with other waste at the Rare Earths Facility. (If the waste were stored in bulk form, measures to mitigate surface water runoff would be implemented.)

- The duration of interim storage is for 1 year only.

- The excavated waste volume that accumulates in storage during the 1-year duration is 50 percent of the total projected excavation volume.

- Storage fees are levied by the State of Illinois on Kerr-McGee for the excavated soil in accordance with Public Act 87-1024, the Uranium and Thorium Mill Tailings Control Act, which was passed by the Illinois Legislature and became effective September 6, 1992. This act specifies that "beginning January 1, 1994, an annual fee shall be imposed on the owner or operator of any property [...] being used for the storage or disposal of by-product material, equal to $2 per cubic foot of by-product material." Although the annual fee is levied only once a year, the contingent action cost estimate assumes that 50 percent of the total projected excavation volume is on the Rare Earths Facility in interim storage when the fee is imposed.

- After the year of storage, transportation and disposal become available, at which time the soils are loaded onto trucks and taken to the staging facility at the Rare Earths Facility for transloading and shipment to Envirocare.

4.3.6 Conceptual-Level Description of the Off-Rare Earths Facility Staging Area Contingent Action

To decommission the Rare Earths Facility, Rare Earths Facility wastes will be excavated and transported via the existing EJ&E railroad system to the Envirocare disposal facility. Current plans are to build a railspur in the EJ&E right-of-way (to the east of the existing EJ&E rail line) and then extend the railspur onto the Rare Earths Facility. A staging or

loading facility will also be built next to the railspur to facilitate loading railcars for shipment. The loading facility will probably be equipped with front-end loaders, hopper-fed conveyors, and cranes to handle bulk and packaged soils, as well as metal scrap and concrete debris. Kerr-McGee would be the licensee for the transloading operation at the Rare Earths Facility.

The source removal alternative assumes that the excavated soils are transported by truck to the Rare Earths Facility loading facility where it is loaded onto railcars for transport to Envirocare. In the event that the railspur and loading facility at the Rare Earths Facility are unavailable for use (e.g., because of licensing delays, or because Kerr-McGee does not conduct the excavation/restoration work and the work is conducted instead by EPA), the excavated soils can be transported to a different railspur and staging area in or near West Chicago.

For the purposes of this EE/CA, the off-Rare Earths Facility staging area contingent action to the base alternative assumes that the off-Rare Earths Facility railspur and staging area are located an average of 12 miles (one-way) from the site properties; this is approximately 10 miles farther than the assumed 2-mile maximum trip to the Rare Earths Facility from the site properties. A railroad company with presence in West Chicago indicates that multiple potential staging areas exist within the assumed 12-mile radius. The conservative 12-mile radius means that the associated incremental cost estimate for this contingency (Section 5.3) will be an upper limit. The contingent action also assumes that the waste is properly packaged, labeled, manifested, and otherwise ready for shipment when it is unloaded at the staging area. The packaging aspect is important for this contingent action because bulk shipments would require a licensee for the off-Rare Earths Facility staging area that would be responsible for transloading the bulk radioactive material.

4.3.7 Conceptual-Level Description of Recontamination Prevention Contingent Action

The floodplain soils in the residential areas may undergo removal before the current contamination source (Kress Creek site sediment) is removed. If a flood occurs and stream waters rise above the banks, contaminated sediments could be deposited on the cleaned areas. To prevent this, a barrier wall of steel sheet piling may be installed along the banks to an elevation that will protect against a 100-year recurrence flood. The 100-year flood water level at the property line between the residential area and Kress Creek in Zone 2 is at about 6 ft above the ground surface and in Zone 3 is at about 7 ft above the ground surface. The sheet piling will be installed to protect only the residential areas and will tie into high ground both upstream and downstream of these areas to provide an effective flood barrier. The action includes the following criteria:

- The sheet piles should be driven to 9 ft below ground surface and 8 ft above ground surface to allow a minimum of 1 ft of freeboard above the predicted flood elevation.

- Approximately 3,200 ft of sheet piling will be installed in Zone 2 parallel to the banks of the stream, on each side of the stream, throughout the residential area.

- Approximately 2,000 ft of sheet piling will be installed in Zone 3 along the west bank of the West Branch DuPage River.

- The sheet piling should be U. S. Steel PMA 22.

- Twelve-in.-diameter (one-way) check valves will be installed along the sheet piles at appropriate locations to provide stormwater drainage of the residential areas to the stream.

- Some landscaping will be required.

The following assumptions were made for this contingent action; the assumptions are conservative given the fact that flooding frequency, severity, and impacts cannot be predicted with any certainty.

- The residential property excavation/restoration will occur prior to remediation of the creek during the Kress Creek site RA.

- If flooding occurs subsequent to the removal action and before creek remediation, radioactive contaminants would be deposited at the residential property within the floodplain.

- Concentrations of contaminants in deposited sediments would exceed removal action goals.

- Non-residential floodplain areas will not be protected.

Section 5

Evaluation of Alternatives

The candidate removal actions evaluated in this section were introduced in Sections 4.2 and 4.3:

- Alternative 1—No action
- Alternative 2—Source removal
- Alternative 2, Contingent Action A—Interim storage
- Alternative 2, Contingent Action B—Off-Rare Earths Facility staging area
- Alternative 2, Contingent Action C—Recontamination Prevention

The three broad criteria (i.e., effectiveness, implementability, and cost) used to screen the response actions in Section 4 are expanded in this section into a more detailed evaluation according to EPA's EE/CA guidance (EPA, 1993b):

- The effectiveness of each alternative (Section 5.1) is evaluated with regard to overall protection of public health; protection of the environment; compliance with regulatory requirements; and the reduction of toxicity, mobility, or volume through treatment.

- The implementability of each alternative (Section 5.2) is evaluated with regard to technical feasibility, administrative feasibility, and availability of services and materials. State and community acceptance are also discussed because of their importance in future evaluations, but are not used as subcriteria for this EE/CA evaluation.

- The cost of each alternative (Section 5.3) is evaluated, as well as the sensitivity of the cost to various cost factors.

5.1 Effectiveness

5.1.1 Protection of Public Health

This subsection addresses whether the alternatives are protective of the health of the public (or community) and workers (during implementation). Assessments of both short-term effectiveness and long-term effectiveness and permanence are included.

5.1.1.1 Alternative 1

Under Alternative 1, no action would be taken for the Residential Areas site and portions of the Kress Creek site until RODs were issued outlining final RA decisions for the sites. For the short term, current exposures to elevated radioactivity levels would remain

essentially unchanged for residents. For the long term, exposure could increase in localized areas if below-surface contamination is brought to the surface. Situations in which this could occur include erosion of disturbed soil, property developments or improvements, and utility and street repairs or rebuilding. Localized exposure could also increase in the long term if future houses or other structures are built over areas of elevated radioactivity (hotspots) causing increased gamma and radon/thoron inhalation exposure. In a no-action alternative, activities that could bring contamination to the surface would not be monitored or controlled, and future locations of structures would not be screened for radiological impact during selection.

For the purposes of evaluating the potential health impact of Alternative 1, this EE/CA relies on EPA's conclusions about the current health risks posed on some of the Residential Areas site properties and portions of the Kress Creek site (refer also to Section 2.4.3). As a point of reference, EPA's Superfund program generally considers potential exposure resulting in excess lifetime cancer risks greater than 1 in 10,000 as needing reduction.

For the four residences evaluated in the preliminary focused risk assessment (SC&A et al., 1993), the excess lifetime cancer risk ranged from about 3 in 1,000 to 7 in 10,000. This calculation assumes residents will occupy those homes for 30 years and included contributions to risk from several different exposure pathways. At one of the four residences, the total risk is primarily due to inhalation and ingestion pathways. However, exposure to gamma radiation is the primary contributor to risk at the other residences. Although the risk calculations were conservative and based on minimal data, the results indicate that in the no-action alternative, by omission of any protective response, human health risks are not mitigated.

5.1.1.2 Alternative 2

Under Alternative 2, soils contaminated above EPA's action criteria would be excavated and then transported to an offsite disposal facility. Contaminant toxicity or volume is not affected by the excavation, but contaminant mobility is minimized by relocating the soil to an engineered facility designed for containment. Because contamination would be removed from site properties, radon/thoron decay product levels, gamma radiation levels, and radionuclide soil concentrations would be reduced to near background levels, and potential risks to human health should be correspondingly reduced. Calculations of long-term health risk that would remain after removal will be performed during the RI/FS in a focused residual risk assessment. Data will be collected during the verification phase of the removal to confirm reduction of contamination levels and to support this risk assessment.

Short-term risks may be posed to workers during implementation of Alternative 2. These risks result from temporarily elevated external gamma radiation levels, airborne (resuspended) contamination, and soil radionuclide concentrations potentially occurring during excavation of large volumes of contaminated soil.

An estimate of the radiation dose that could be potentially incurred by workers implementing the source removal alternative was calculated using the RESRAD model (Gilbert et al., 1989). A volume-weighted average concentration of 35 pCi/g for Th-232 and progeny was calculated on the basis of characterization data in the preliminary focused risk assessment (SC&A et al., 1993). During a 1-year period, a maximally exposed worker likely would spend 40 hr per week and 8 months per year in contaminated areas. Pathways considered for the calculation included external gamma exposure and contaminated dust inhalation. Inhalation of outdoor radon or thoron, ingestion of contaminated soil, and dermal exposure were considered negligible for the worker scenario and were not included in this scoping calculation. The estimated maximum annual radiation dose to the worker is 98 mrem/yr. The contribution to the total is 83 mrem/yr from gamma exposure and 15 mrem/yr from dust inhalation. These values are below the regulatory limits of 5,000 mrem/yr for a radiation worker (10 CFR 20).

The above estimate is based on conservative exposure assumptions without recourse to worker protective measures. Actual exposures to workers conducting the removal action are expected to be significantly less than those calculated because of the implementation of safety measures throughout the removal action. These measures include protective clothing, respiratory protection, dust suppression techniques, "on-the-job" and equipment training, as well as instruction to workers about potential safety and health hazards and compliance with applicable state and federal regulations and orders. The potential radiation doses to workers would be kept ALARA. A Health and Safety Plan (HSP) will be instituted that outlines the concepts and methodologies to be followed by the workers.

Short-term risks may also be posed to the general public during implementation of Alternative 2; specifically, a resident living near the property being excavated could potentially receive some incremental dose due to inhalation of airborne contaminants. However, appropriate mitigating measures (e.g., dust suppression) and health physics practices will be employed to minimize the airborne contamination and eliminate the particulate inhalation pathway for the public. An upper limit to the inhalation dose received by a nearby resident is that annual inhalation dose calculated for the worker divided by the fraction of the worker's time (1 year) that an individual resident would be exposed. Assuming an excavation period of 10 days for a single property and therefore a 10-day exposure period for the resident (which is 6 percent of the worker's duration of exposure in a year), the general public would receive a dose of less than 1 mrem. This dose is much less than the dose limit of 100 mrem/yr for the general public and the pathway-specific limit of 10 mrem/yr for airborne releases (40 CFR 61).

Risks to the general public from other exposure pathways are also likely to be negligible: (1) structural interferences (attenuators) and the naturally rapid decrease of dose with distance will limit external gamma radiation exposure, (2) proper security and safeguards at a property being excavated will prevent access to the site and possible direct contact and ingestion of soil contaminants, and (3) the short time frame for material transport minimizes the transient exposures from loaded trucks. In addition, any spillage from the truck should be minimal if packaged or covered properly and, in the event spillage occurs, it could be easily cleaned up and reloaded on the truck. The primary risk from material

transport is from vehicular accidents rather than from radiation exposure. A waste transportation plan including routes, spill prevention, and cleanup will be prepared prior to removal implementation.

5.1.1.3 Alternative 2, Contingent Action A – Interim Storage

This contingent action considers 1-year storage of the excavated soil at the Kerr-McGee (Rare Earths Facility) factory site in the event that either transportation or disposal become temporarily unavailable during removal implementation. EPA has performed some calculations (SC&A et al., 1993) to evaluate the additional risk and exposure due to gamma radiation from a Rare Earths Facility storage pile for two hypothetical scenarios: (1) an individual standing at the Rare Earths Facility fenceline closest to the pile (50 to 100 ft away) and (2) a resident living closest to the interim storage pile (approximately 400 ft away). EPA assumed for the calculations an 8,400-yd^3 interim storage pile at the Rare Earths Facility, positioned so that its edge would be approximately 50 ft from the west property line. The 8,400-yd^3 volume is only slightly more than would be expected from Volume Scenario 1 of Alternative 2. Inhalation is not a pathway because the soil is assumed to be packaged or the pile covered during storage. (If it is assumed that waste materials will not be packaged or adequately covered, measures must be taken so that windblown contamination is not released from the Rare Earths Facility. Airborne effluence may be controlled using appropriate dust control methods in conjunction with dust monitoring around the perimeter of the Rare Earths Facility. Sufficient dust controls can keep inhalation from becoming an exposure pathway.)

Current levels of radiation at the factory site near the "calculation-proposed" location of the storage pile are greater than natural background because of the existing contaminated piles that remain from past processing and cleanups. IDNS data show that actual current radiation levels at the closest fenceline west of the proposed location of the storage pile range from 38 to 110 μR/hr. EPA calculated that for a person standing at the fenceline, the interim storage pile would increase that person's level of radiation exposure by 1 to 4 μR/hr, an increase of 2 to 10 percent from current levels.

The increase in exposure rate to the nearest resident (because of the pile) is approximately 0.1 μR/hr (an increase of about 1 percent), which would be hard to distinguish from any existing levels. Based on this hourly rate, EPA estimated that the incremental annual dose would be approximately 0.53 mrem for the 8,400-yd^3 interim storage pile.

The largest soil volume considered for the interim storage contingent action is 60,000 yd^3 (Volume Scenario 4 of Alternative 2). This soil volume in interim storage, a volume 7 times larger than the volume used by EPA for their calculations, would increase annual dose levels (and corresponding health risks) for the nearest resident by a factor of less than 2 to 4 mrem. (The volume/dose relationship is not linear because of self-shielding effects.) Based on these preliminary calculations, the incremental dose levels from the interim storage pile do not cause the regulatory limit of 50 mrem/yr to be exceeded, and the

corresponding health risks are much lower for temporary storage than if the contaminated soils are allowed to remain in place at residences.

5.1.1.4 Alternative 2, Contingent Action B—Off-Rare Earths Facility Staging Area

This contingent action considers the option of shipping the excavated soil, in packaged or containerized form, from a railroad spur separate from the one planned at the Rare Earths Facility. No incremental exposures are expected for the worker in this contingent action; incremental exposures to the public should be significantly less than in the interim storage contingency because of the smaller time periods and soil accumulations associated with this off-Rare Earths Facility staging contingency.

5.1.1.5 Alternative 2, Contingent Action C—Recontamination Prevention

Given the conservative assumption that flooding occurs with significant contamination impacts, this contingent action provides dual protection. It protects cleaned residential areas from being recontaminated by flood deposits and provides a barrier between pedestrians and the stream until the stream is remediated. Worker exposure is expected to be less than that incurred during excavation.

5.1.2 Protection of the Environment

This subsection addresses whether the alternatives are protective of air quality, water resources, and the ecology. Assessments of both short-term effectiveness and long-term effectiveness and permanence are included.

5.1.2.1 Air

Under Alternative 1 (No Action), contaminated surface soils will be subject to wind erosion, and subsurface soils will continue to release gaseous radon and thoron. This will impact air quality for the long term. In addition, disturbance of the soil through such actions as property developments or underground utility work increases the opportunity for resuspension and dispersion of contaminants. The dispersion will be temporary and localized, but is an incremental threat to air quality.

Under Alternative 2, the threat to air quality during excavation is similar to that for soil disturbances under Alternative 1 (i.e., the impact is temporary and localized). However, in the Source Removal Alternative, the incremental radiological threat to air quality is recognized and plans are implemented to minimize these threats. During the removal action, various engineering practices and dust suppression techniques could be implemented: (1) concentrations of airborne particulates may be monitored; (2) excavated soil may be packaged (containerized), covered, or wetted on the surface using water sprays; (3) exposed surfaces (without vegetation) could be covered, wetted, and/or

backfilled as soon as possible after excavation has occurred; and (4) workers could use respiratory protection as appropriate.

Neither Contingency A or B of Alternative 2 contribute additional threat to air quality if properly packaged and/or covered at the Rare Earths Facility to mitigate wind erosion. Contingency C does not contribute to a threat of air quality.

5.1.2.2 Water

Evidence gathered from investigations at the Rare Earths Facility, Reed-Keppler Park, and Sewage Treatment Plant indicates that leachability of the thorium residuals is relatively small and that no significant groundwater pollution problems are related to the thorium residuals at those sites. However, runoff from these sites may have had impacts in the past on surface water and storm sewer conveyance facilities. Unlike the other Kerr-McGee sites, water resources are not a target of data acquisition for the Residential Areas site and relevant portions of the Kress Creek site because contaminated soil deposits are not as concentrated nor exposed. However, the potential for contamination of surface water may still exist over the long term from contaminant release via runoff from any disturbed, contaminated soil. Under Alternative 1, such potential for contaminant release may continue unabated.

Under Alternative 2, long-term impacts to water resources are negligible, but minor impact over the short term may occur without mitigating measures. This is because the potential for runoff (from water erosion) or leaching increases over the short term due to temporary disturbance of overlying sod and vegetative cover and exposure of the contaminated soils to the elements. Various erosion control measures and practices will be implemented during excavation to mitigate potential releases; these include placing covers over soil piles, installing containment or physical barriers to control runoff, and minimizing delays in backfilling and restoring excavated areas.

Neither Contingency A or B of Alternative 2 contribute additional threat to surface water quality if properly packaged and/or covered at the Rare Earths Facility to mitigate runoff. Contingency C does not contribute to a threat of surface water quality.

5.1.2.3 Ecological

Under Alternative 1, no disturbance or trauma to the terrestrial environment, with its existing habitats and associated biota, would occur. However, as mentioned previously, the potential for (1) exposure to biota and (2) releases to the environment (either through leaching of contaminants or the cyclical resuspension and deposition mechanisms that occur during wind and water transport) would continue.

Under Alternative 2, both excavation and restoration activities could disturb existing habitats and affect the associated biota in the same manner that standard construction

activities (e.g., building a house or road) would affect them. The affected habitats would not necessarily have to be located on the properties where the excavation is performed.

Within the project boundaries, land use is predominantly residential. As a result, potential wildlife habitat (terrestrial environment) is limited. Wildlife within these areas is expected to be composed of common edge species with a lower abundance and diversity than less developed lands. Habitat factors within residential areas, such as the maintenance of grassy lawns, abrupt edges, pets, and human disturbances, are expected to limit wildlife presence. These factors are also expected to limit the potential for exposure to wildlife that are present by lessening the possibility for direct exposure to gamma radiation. Direct exposure to some ground-feeding species, as well as the potential for exposure through the food chain, may exist for some wildlife. However, the total number of species potentially affected is considered small. Effects to aquatic environments are being addressed under another site, the Kress Creek site.

Federally designated "critical" habitat for a threatened and endangered species is not known to be present in DuPage County or West Chicago. Other areas that could be considered as sensitive may include state or federal parks and preserves, as well as other important community types such as wetlands. Several state preserves are located in DuPage County (e.g., the Blackwell Forest Preserve, which contains state-listed threatened and endangered species, is located downstream of Kress Creek along the West Branch DuPage River); however, portions of state preserves are located within some of the boundaries of elevated gamma readings for the study area. If individual site properties within the forest preserves are "discovered" according to EPA's action criteria, the forest preserve officials will be contacted and consulted to determine how best to implement the removal while minimizing damage to the environment that may be caused by the implementation. Wetlands are present along Kress Creek and therefore may border residential areas; however, the excavations will not be performed directly in wetlands.

Neither Contingency A or B of Alternative 2 (interim storage at the Rare Earths Facility or off-Rare Earths Facility staging area) contribute additional ecological threat. Contingency C does not contribute significantly to a threat of the ecology. Potentially, some minor disturbance to wetlands and natural drainage within the floodplain may occur in the short term. Long-term effects will be overscored by the stream remediation.

5.1.3 Compliance with ARARs

A description of the ARARs for the Residential Areas site and portions of the Kress Creek site can be found in Appendix B.

Under Alternative 1, because the concentration of radioactive contaminants would remain unaltered, the contaminant-specific ARARs (radon/thoron decay product concentrations, gamma radiation levels, and total radium concentrations in soil) will not be met.

Under Alternative 2, because soil excavation would proceed in accordance with EPA's action criteria and because the action criteria are based on those portions of the regulations judged to be relevant and appropriate, the contaminant-specific ARARs would be satisfied. Alternative 2 complies with all action- and location-specific ARARs, including ALARA. Alternative 2 would also comply during implementation with appropriate Occupational Safety and Health Administration (OSHA) standards, workers safety guidelines, and other federal and state regulations dealing with protection of human health and the environment [e.g., Clean Air Act (CAA), RCRA, Clean Water Act (CWA)].

DOT regulations will govern the packing, handling, labeling, marking, placarding, and routing of material to the transloading and disposal sites. Key definitions that properly guide the selection of DOT regulations for the purposes of this EE/CA are as follows:

- Radioactive material—defined as any material that spontaneously emits ionizing radiation and has a specific activity greater than 2,000 pCi/g

- Low specific activity (LSA) material—defined as uranium or thorium ores and physical or chemical concentrations of those ores

Alternative 2 will comply with the transportation ARAR whether the 11(e)2 waste is classified for transportation purposes as radioactive or LSA material.

With regard to disposal of the 11(e)2 waste, the NRC license held by a commercial disposal facility, such as Envirocare, stipulates those federal ARARs specific to the disposal. The licensed commercial facility accepting the waste will comply with NRC requirements outlined in the license and with host state requirements.

At least two properties on the list of National Register of Historic Places are located within the study area boundary. Whether they will be "discovered" during the site investigation is unknown at this time. If the investigation shows that removal implementation may in some way potentially impact the properties, appropriate mitigating measures will be undertaken.

No unique ARARs compliance issues have been identified for Contingencies A and B.

Contingency C, if implemented, must satisfy a number of location- and action-specific regulations that deal with flow obstruction or alteration of waterways. ARARs dealing with wetlands are also relevant.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

At the present time, no treatment technology has been shown to be more than marginally effective at achieving the desired reduction levels for the types and quantities of soil contamination found at the Residential Areas site. Because some technologies show promise, EPA will continue to monitor and study them for possible future application at the Kerr-McGee sites.

The principal threats at the Residential Areas site are gamma exposure and the generation of radioactive gas and associated decay products indoors, which are subsequently inhaled by the residents of those houses. Because no treatment is available that destroys the radioactive source of these threats, neither alternative satisfies the CERCLA statutory preference for treatment as the principal element.

5.2 Implementation

5.2.1 Technical Feasibility

Technical feasibility does not apply to Alternative 1.

Technical feasibility for Alternative 2, Source Removal, has been demonstrated at other locations around the country. Excavation and restoration use standard construction techniques and good engineering practices to reduce runoff and dispersal. Mature construction techniques exist for excavating in open areas and in confined space conditions in a manner that will protect the structural integrity of buildings. Because the soil contains radioactive contaminants, the excavation techniques are integrated with occupational health physics programs and other safety regimen that are also well established.

Monitoring and sampling after excavation and restoration will determine and confirm the degree to which property has been cleaned up.

Packaging and transport of the waste presents no insurmountable difficulties. Comprehensive soils data have not been collected to accurately predict the range of radionuclide concentrations for the Residential Areas site soils, but based on the limited data available, a reasonable expectation is that the soils content will not exceed the 2,000 pCi/g limit specified for shipment of LSA bulk soils. If the limit is exceeded for some portion of the soils, then based on experience reported at other sites, it is anticipated that blending of soils could be used to lower the concentration. Otherwise, containerization will be necessary, accompanied by the necessary modifications in handling and permitting arrangements for "radioactive material." A rail spur and loading facility will also need to be built at the Rare Earths Facility prior to waste shipment for Alternative 2.

Commercial disposal of 11(e)2 by-product material at Envirocare is technically feasible based on disposal of 11(e)2 waste at other sites and commercial disposal of similarly contaminated soils that are classified as LLW rather than by-product material. Commercial disposal is available at Envirocare (see Section 5.2.2, Administrative Feasibility, for additional comments) with ample capacity for the range of volumes currently predicted. Envirocare is required under their NRC license to adequately contain the waste and provide comprehensive environmental monitoring.

Assembling, staffing, and operating the alternative within the time frames of the removal schedule (see Section 3.3) are feasible given adequate resources for the number of

contaminated properties that will be identified during discovery and characterization. The weather may hinder construction work during winter months. All the properties are easily accessible (with regard to terrain and location).

The interim storage contingency (Alternative 2A) is technically feasible based on past storing of excavated materials at the Rare Earths Facility. The off-Rare Earths Facility staging contingency (Alternative 2B) is also technically feasible based on similar actions reported from other U.S. sites with similar soil contamination. The recontamination prevention contingency (Alternative 2C) is technically feasible; the sheets of piling are relatively short and they can be installed with readily available equipment. Disturbance to residential landscaping, fencing, and utilities will be a minor obstacle.

5.2.2 Administrative Feasibility

Under Alternative 1, action would be postponed until a ROD was issued. Administrative feasibility concerns arising from Alternative 1 would include the impact of the delay on perceived health risks, reduced property values and marketability, and potentially restricted land use.

Under Alternative 2, excavation, backfill, and restoration would be conducted in accordance with the terms and conditions of the access agreements to be signed by each property owner. During Kerr-McGee's cleanup action in the mid-1980s, almost all of the property owners cooperated with Kerr-McGee in the cleanup and gave permission for access. Property values and certification of completed surveys and cleanup, as well as other health and environmental advantages, are strong incentives for cooperation of current property owners in this follow-on removal action.

Transportation permits for the short haul via truck to the Rare Earths Facility, and the long haul via rail to the disposal sites should be obtained as required. Approvals for use of a small portion of the Rare Earths Facility as a transloading site for waste shipment would also be needed from the city authorities and other local government and state authorities and from Kerr-McGee. For example, if the excavated wastes are in bulk form rather than in DOT-approved packaging, Kerr-McGee would be required to obtain a license or license amendment from IDNS to receive and stage the wastes at the Rare Earths Facility for shipment.

Commercial disposal of 11(e)2 waste is administratively feasible. Though licensed, Envirocare has not yet received any 11(e)2 waste; however, it is in the process of complying with all the preconditions and stipulated financial obligations of the license. Based on information from Envirocare, the facility will be ready to receive waste from the Rare Earths Facility in September 1994.

Under the interim storage contingency, Kerr-McGee would be required to obtain a license or license amendment from IDNS to receive and store waste from the Residential Areas site and portions of the Kress Creek site (and other Kerr-McGee sites). The license will

address any EPA or state issues with regard to definition of roles and responsibilities for participants, waste segregation, monitoring, maximum storage period, and waste management [e.g., packaging or bulk soil covers, National Pollutant Discharge Elimination System (NPDES) permits to monitor runoff (if needed)].

Under the off-Rare Earths Facility staging contingency, no additional permits or administrative requirements have been identified.

The administrative feasibility for the recontamination prevention contingency is impacted by the following regulations:

- Section 10 of the Rivers and Harbors Act of 1899 prohibits the obstruction or alteration of navigable waters of the U.S. without a permit from the U.S. Army Corps of Engineers (USACE). These permits are primarily informational, and stream protection during pile installation will be the primary requirement. A general permit or letter permit may be sufficient because the steel pilings are temporary structures. This procedure could be expected to take 3 to 6 months after design.

- The Rivers, Lakes, and Streams Act; the Federal Water Pollution Control Act of 1972, as amended; and the CWA of 1977 apply when wetlands are disturbed during sheet pile installation, or when the installation affects the flow of the waterway. Compliance with these requirements would be concurrent with the Section 10 USACE permitting process, taking approximately 3 to 6 months after design to complete.

- The Federal Emergency and Management Association (FEMA), Illinois Department of Transportation (IDOT) Department of Water Resources (DWR), and DuPage County all have location- and action-specific requirements. Most applicable are floodplain volume mitigation requirements. These require the design capacity of channels subject to temporary and permanent stream channel impacts to be at least equal to the capacity of the unmodified stream channel immediately upstream and downstream from the diversion. This typically requires flood volume mitigation; when an existing floodway is restricted, additional volume must be provided to mitigate the impact of flooding. The county requirements would typically be the most restrictive, and the federal requirements would be the least. This process would require extensive study and design involving detailed and complex models, and expensive construction of new flood storage volume.

Access agreements with owners of properties where the sheet pilings would be installed would likely be difficult to obtain given the displeasing aesthetics of the sheet pilings and the barrier to the stream that the pilings create.

5.2.3 Availability of Services and Materials

Availability of services and materials does not apply to Alternative 1.

All of the services and materials required to implement Alternative 2 are available. As mentioned, advance planning for scheduling the services and obtaining the materials are critical, especially for scheduling final disposal and for preparing a railroad spur and nearby area for waste transloading. Advance planning will also be needed for obtaining transportation permits and for scheduling work with property owners.

The loading facility and rail spur at the Rare Earths Facility will be servicing transport of Rare Earths Facility wastes during the same time period that soils from the Residential Areas site and portions of the Kress Creek site are to be shipped. Wastes from other Kerr-McGee sites (e.g., Sewage Treatment Plant, Reed-Keppler Park) may also require shipment. Some coordination and even prioritization of wastes from different sites will be necessary to minimize potential for scheduling interferences.

Services and materials are readily available to install sheet piling in a metropolitan area.

5.2.4 State Acceptance

State acceptance refers to the concern and degree of support that the state government may express regarding the proposed removal alternative. The opinions of the State of Illinois cannot be predicted at this time. The state will have opportunity to review and comment on the EE/CA prior to release of the Action Memorandum documenting the final decision.

5.2.5 Community Acceptance

As with state acceptance, community acceptance of an alternative will be considered in the final selection of the alternative. Sections 300.415(m) and 300.820 of the NCP specify two forms of community interaction for all removal actions:

- Community relations activities that are designed to integrate the information needs of the community into the Community Relations Plan (CRP) for the site.

- Administrative record activities that are designed to chronicle the basis for the response action and serve as a vehicle for public participation in the removal action. This EE/CA will be part of the public record.

These forms of community interaction will help ensure that the proposed action satisfies local or community concerns. The community will have opportunity to review and comment on the EE/CA prior to the release of the Action Memorandum.

5.3 Estimated Cost

Cost estimates are presented here to allow a comparison of alternatives based on relative cost. The cost estimates are intended to provide an accuracy between +50 and -30 percent for the scope of work described. EPA guidance allows the use of Order of Magnitude estimation for the purposes of assessing the relative expense of a given alternative as compared with any other option or with a base option. At this stage, detailed costs such as those based on a completed design are not expected to be available.

Cost estimates generally include the following:

- Direct capital costs (e.g., construction, equipment and material, relocation, transport and disposal, laboratory analysis, insurance, contingency)
- Indirect capital costs (e.g, engineering, legal services and administration, licensing and permitting)
- Post-removal site control (PRSC) costs (e.g., operation and maintenance, auxiliary materials and energy, monitoring, support)

Direct and indirect costs are included in this EE/CA, but PRSC costs are excluded because (1) the nature of the source removal alternative is such that it is generally not a repetitive action (i.e., with very few exceptions, additional post-verification work on a particular property are not expected to be necessary), (2) if a second cleanup is required, as might be required for portions of the Kress Creek site (e.g., if flooding occurs), costs for the second cleanup are incurred under the RA and not the removal action, and (3) the RI/FS and ROD will immediately follow the completion of the removal action thereby negating the necessity of the CERCLA-required 5-year cyclical reevaluation of any interim action. In addition, present worth is not considered for the two alternatives in this EE/CA. Although the project duration will exceed 12 months, the proposed aggressive schedule for the removal is less than 24 months. Thus, present worth considerations would not appreciably impact alternatives comparison.

Under Alternative 1, no removal actions would be implemented; therefore, the estimated cost would be zero.

For Alternative 2, Source Removal, total estimated costs are presented in Table 5-1 and Figure 5-1. Additional detail is provided in Appendix C. The basis and primary assumptions for the cost estimates are itemized below.

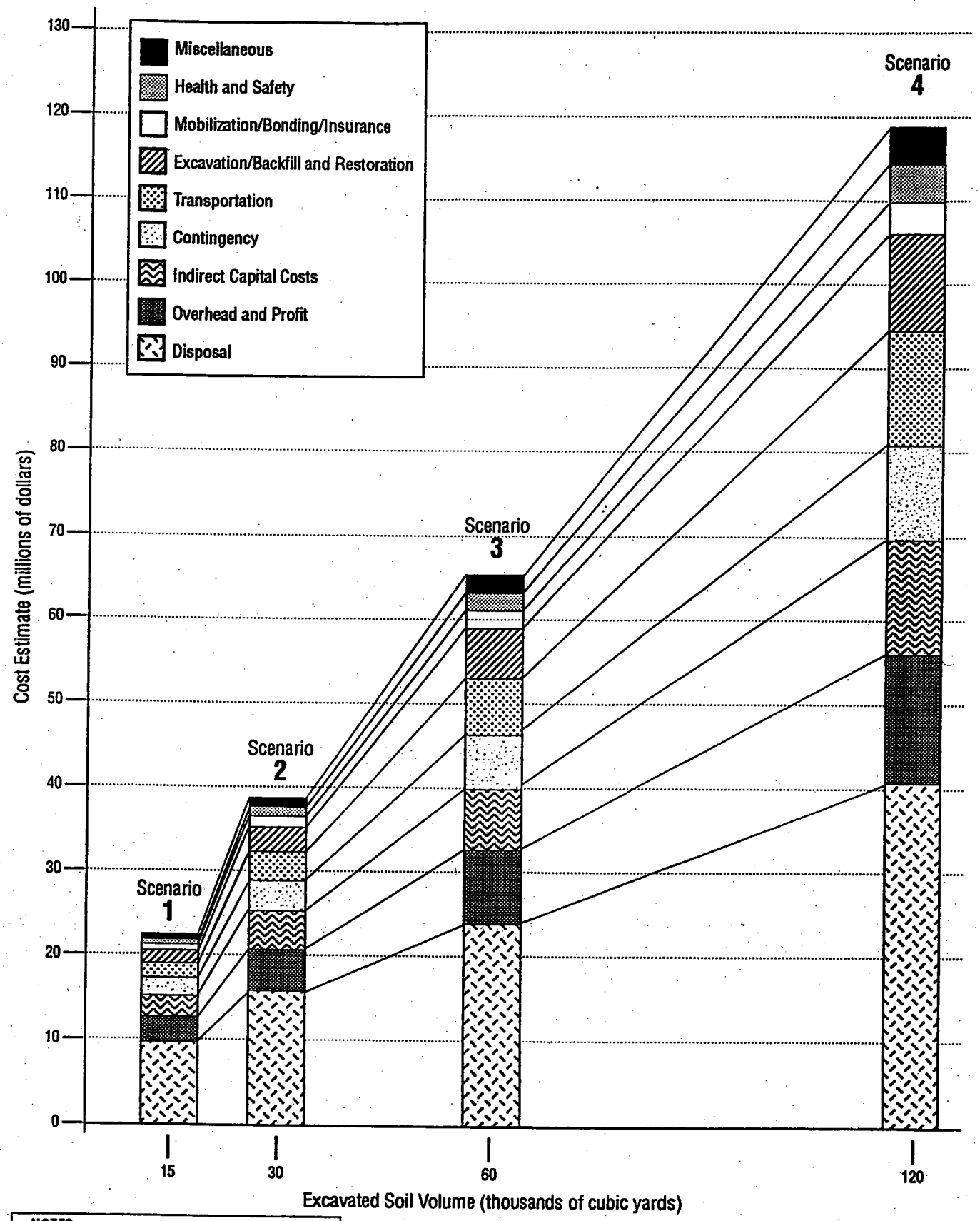
- Estimates of the excavated soil volume and the corresponding number of affected properties are based on the range discussed in Table 4-1.

Table 5-1
Cost Estimates for Alternative 2, Source Removal

Item	Soil Volume Scenario 1[a]	Soil Volume Scenario 2[a]	Soil Volume Scenario 3[a]	Soil Volume Scenario 4[a]
Volume (yd^3)	15,000	30,000	60,000	120,000
Number of Properties	50	100	200	400
Direct Capital Cost Items				
Health and Safety	$615,200	$1,161,900	$2,264,500	$4,478,900
Transportation	1,708,500	3,417,000	6,834,000	13,668,000
Excavation, Backfill, and Restoration	1,445,500	2,891,000	5,782,000	11,564,000
Disposal	9,750,000	15,750,000	24,000,000	40,500,000
Miscellaneous[b]	589,005	1,142,010	2,248,020	4,460,040
Subtotal Direct Capital Cost	**$14,108,205**	**$24,361,910**	**$41,128,520**	**$74,670,940**
Overhead and Profit	$2,927,453	$5,055,096	$8,534,168	$15,494,220
MOB[c]/Bond/Insurance (5% of subtotal)	705,410	1,218,096	2,056,426	3,733,547
Contingency (15% of subtotal)	2,116,231	3,654,287	6,169,278	11,200,641
Total Direct Capital Cost (rounded off)	**$19,857,000**	**$34,289,000**	**$57,888,000**	**$105,099,000**
Indirect Capital Cost Items				
Engineering and Design (8% of total)	$1,588,560	$2,743,120	$4,631,040	$8,407,920
Legal and Administrative (3% of total)	595,710	1,028,670	1,736,640	3,152,970
Licensing and Permitting (2% of total)	397,140	685,780	1,157,760	2,101,980
Subtotal Indirect Capital Cost	**$2,581,410**	**$4,457,570**	**$7,525,440**	**$13,662,870**
Grand Total (rounded off)	**$22,400,000**	**$38,700,000**	**$65,400,000**	**$118,800,000**

[a]Basis for volume scenarios is discussed in Table 4-2.
[b]Miscellaneous costs include loading, packaging, and sampling the waste material; verification sampling; and temporary family relocation.
[c]MOB = Mobilization.

Note: Costs are order of magnitude estimates with an expected accuracy of +50 to -30 percent. Detail for direct capital costs is in Appendix C. The order of magnitude costs have been prepared for the purpose of assessing the relative expense of a given alternative as compared with any other alternative and should not be considered as final estimates for negotiation. They are based on information available at the time of the estimate, information gathered from suppliers, and, to a large extent, on the experience and judgment of the study team. The final costs of the project will depend on actual labor and material costs, actual site conditions, final project scope, implementation schedule, and other variable factors.



NOTES:

1 Costs are order of magnitude estimates with an expected accuracy of +50 to -30 percent.

2 This figure is based on Table 5-1 data. Detail for direct capital costs is in Appendix C.

Figure 5-1
Cost Estimates for Alternative 2, Source Removal
Residential Areas Site and Portions of the Kress Creek Site

- Cost accrual begins after the properties have been discovered and characterized (i.e., work to perform discovery and characterization is not reflected in the cost estimates).

- Health and safety costs are based on a lump-sum amount that includes costs for planning, training, monitoring, Personal Protective Equipment (PPE), decontamination stations, and equipment rental.

- Transportation costs include the costs for hauling the contaminated material by truck from the property to the rail spur and loading facility at the Rare Earths Facility, and then transporting by rail to the disposal site.

- Excavation, backfill, and restoration costs include the costs for removing the contaminated soils, backfilling with clean fill material, and restoring the property to its original condition.

- Kerr-McGee currently has a contract with Envirocare of Utah for the disposal of the wastes from this site. Contracted disposal fees are considered privileged information; however, for the purposes of this EE/CA, the cost estimate assumes that the base disposal fee is \$650/yd^3 for volumes up to 20,000 yd^3 and \$275/yd^3 for volumes above 20,000 yd^3.

- Construction of Rare Earths Facility staging facilities such as the rail spur, loading facility, and decontamination pad are considered part of Rare Earths Facility decommissioning and are not reflected in the EE/CA cost estimate.

- Miscellaneous costs include loading, packaging, and sampling the waste by-product prior to shipment. Also included is the cost of temporary family relocations (10 percent of the properties only) and verification sampling.

- Add-on direct capital costs include overhead, profit, contingency, mobilization, bonding, and insurance.

- Add-on indirect capital costs include engineering and design, legal and administrative requirements, and licensing and permitting.

The total cost of Scenario 1 is \$22,400,000 and is based on 50 property sites (15,000 yd^3) for a total of \$448,000 per property (\$1,490/yd^3). The total cost of Scenario 2 is \$38,700,000 and is based on 100 property sites (30,000 yd^3) for a total of \$387,000 per property (\$1,290/yd^3). The total cost of Scenario 3 is \$65,400,000 and is based on 200 property sites (60,000 yd^3) for a total of \$327,000 per property (\$1,090/yd^3). The total cost of Scenario 4 is \$118,800,000 and is based on 400 property sites (120,000 yd^3) for a total of \$297,000 per property (\$990/yd^3). Disposal costs account for 34 to 44 percent of the total estimated costs, transportation costs account for 8 to 12 percent of the total, health and safety costs account for 3 to 4 percent of the total, and excavation/ backfill/restoration costs account for 6 to 10 percent of the total costs. Contingency costs

account for 9 percent of the total, overhead/profit costs account for 13 percent of the total, and mobilization/insurance/bonding costs account for 3 percent of the total costs. Indirect capital cost items account for approximately 12 percent of the total estimated costs.

It is expected that most of the site contamination is limited to shallow depths (e.g., no more than 2 ft) and to areas around, rather than underneath, structures. Therefore, the above cost estimates include source removal to shallow depths in both open and confined areas (e.g., next to a structural foundation). However, because the comprehensive site investigation has not yet been performed, it is unknown whether and to what extent contamination may exist under structures necessitating more arduous and expensive source removal tasks. The above cost estimates (e.g., Table 5-1) do not include major cost items resulting from source removal under structures. A sensitivity analysis has been performed on the cost estimates to determine the impact of those additional, but probably infrequent, major cost items resulting from locating significant contamination deposits under structures.

For the purposes of the sensitivity analysis, it is assumed that 10 percent of the "discovered" properties in each scenario would have major cost items performed at the same time as the basic removal action. These major cost items include basement slab removal and replacement, replacement of home mechanical systems, deep excavation that requires shoring and underpinning of the structure, garage removal and replacement, moving of a house, and installation of engineering controls for radon/thoron reduction. The radon/thoron reduction would be an allowed cost only for those properties where (1) the radon/thoron originated from Rare Earths Facility-produced materials and not from naturally occurring situations, (2) excavation was delayed and could not occur in a timely fashion, (3) excavation was not cost-effective or appropriate, and (4) owner permission to excavate under a structure could not be obtained. These major cost items, detailed in Appendix C, are estimated to increase the total costs in each scenario by 5 to 7 percent.

Table 5-2a gives estimates of the incremental total capital costs to implement Contingent Actions A and B of Alternative 2. For Contingent Action A, interim storage at the Rare Earths Facility, the incremental cost estimates are $577,000; $1,150,000; $2,310,000; and $4,620,000 for Scenarios 1 through 4, respectively. These costs represent increases over the Alternative 2 base cost estimates of 3 to 4 percent. Included in the costs are the annual state tax for 11(e)2 waste, the additional work of unloading and stockpiling the filled bags of soil at the Rare Earths Facility, and when the waste can be shipped, loading the waste onto a flatbed truck for transport to the loading facility and rail spur. For Contingent Action B, off-Rare Earths Facility staging area, the incremental cost estimates are $179,000; $357,000; $714,000; and $1,430,000 for Scenarios 1 through 4, respectively. These costs represent increases over the Alternative 2 base cost estimates of 0.8 to 1.2 percent. The incremental cost covers the additional mileage to haul the packaged soil to a rail spur elsewhere in the West Chicago area.

Table 5.2b gives estimates of the incremental capital costs to implement Contingent Action C of Alternative 2. For Contingent Action C, Recontamination Prevention, the incremental costs are $928,000 for Zone 2 and $616,000 for Zone 3, for a total of

Table 5-2a
Estimates of Incremental Costs[a] for Alternative 2 Contingent Actions A and B

Item	Soil Volume Scenario 1[b]	Soil Volume Scenario 2[b]	Soil Volume Scenario 3[b]	Soil Volume Scenario 4[b]
Volume (yd^3)	15,000	30,000	60,000	120,000
Number of Properties	50	100	200	400
Contingent Action A:				
Interim Storage (rounded off)	$577,000	$1,150,000	$2,310,000	$4,620,000
Contingent Action B:				
Off-Rare Earths Facility Staging Area (rounded off)	$179,000	$357,000	$714,000	$1,430,000

[a]Costs include direct capital add-ons of approximately 40 percent to cover overhead, profit, mobilization, bonding, insurance, and contingency. Direct capital cost detail is provided in Appendix C. The costs also include indirect capital add-ons of 13 percent of the total direct capital cost to account for engineering and design, legal and administrative needs, and licensing and permitting requirements.
[b]Basis for volume scenarios is discussed in Table 4-2.

Note: These estimates are order of magnitude estimates with an expected accuracy of +50 to -30 percent. The order of magnitude costs have been prepared for the purpose of assessing the relative expense of a given alternative as compared with any other alternative, and should not be considered as final estimates for negotiation.

Table 5-2b
Estimates of Incremental Cost[a] for Alternative 2 Contingent Action C

Item	Zone 2 Protection	Zone 3 Protection
Subtotal Direct Capital Cost	595,872	395,540
Total Direct Capital Cost (includes add-ons of overhead and profit, MOB/bond/insurance, and contingency)	821,000	545,000
Indirect Capital Cost (13%) (includes add-ons of engineering and design, legal and administrative, and licensing and permitting)	106,730	70,850
Grand Total (rounded off)	928,000	616,000

[a]Not included are any incremental costs for floodplain volume mitigation; additional design and investigation would be required to determine the mitigation requirements and to quantify these costs.

Note: These estimates are order of magnitude estimates with an expected accuracy of +50 to -30 percent. The order of magnitude costs have been prepared for the purpose of assessing the relative expense of a given alternative as compared with any other alternative, and should not be considered as final estimates for negotiation.

$1,544,000. This cost represents an increase over the Alternative 2 base cost of 1 to 7 percent. It is valuable to compare the above cost for the sheet pilings, which would prevent recontamination of the floodplain, with the cost of repeating the cleanup of the floodplain in the event that a flood recontaminated it. This repeat cleanup for the floodplain would occur concurrently with the Kress Creek site remediation. The floodplains of interest are those portions of the Kress Creek site that extend from the streambank to the 100-year flood contour and that lie in the residential areas in Zones 2 and 3 (see Figure 1-2). The area of these floodplains is approximately 376,000 ft^2. Assuming conservatively that *all* of this area becomes recontaminated by a flood to levels *greater* than EPA's action criteria, and assuming that an excavation depth of 2-1/2 to 3 in. is sufficient to remove the thin layer of contamination deposited by the flood, the expected maximum volume of excavated soil would be approximately 4,000 yd^3. Multiplying this volume by the unit cost of approximately $1,000/$yd^3$ (rounded off) presented earlier for Alternative 2 gives a total repeat cleanup cost for the floodplain soils of $4 million. This *upper limit* cost is less than 3 times greater than the $1.5 million (rounded off) for the sheet pilings.

5.4 Comparative Analysis for Alternatives

The purpose of the comparative analysis is to identify the relative advantages and disadvantages of each alternative so that key tradeoffs that would affect the remedy selection can be identified. Table 5-3 summarizes the comparison for the two base alternatives for the Kerr-McGee Residential Areas site and portions of the Kress Creek site. The summary table outlines important conclusions regarding effectiveness, implementation, and cost. Table 5-4 highlights key issues with regard to the contingent actions.

5.5 Preferred Alternative

The preferred action is Alternative 2, Source Removal, for both the Residential Areas site and for portions of the Kress Creek site. The preferred action includes the following components:

- Remove contaminated materials above removal action levels from the site properties to minimize potential hazards to human health and the environment associated with the contamination.

- Provide interim measures (e.g., indoor engineering controls) for those limited and exceptional situations where excavation is delayed or inappropriate to reduce the risks attributable to the contaminated material.

- Limit the potential health hazards to onsite workers performing the removal action.

Table 5-3
Comparative Analysis of Removal Action Alternatives
Residential Areas Site and Portions of the Kress Creek Site

Criteria	Alternative 1 – No Action	Alternative 2 – Source Removal
Effectiveness	No protection provided; no immediate change in human health and environmental impacts.	Short-term impacts on human health and the environment during the removal can be mitigated.
	Exposure could potentially increase in localized areas if below-surface contamination is inadvertently disturbed.	Protective of public health and the environment over the long term for the Residential Areas site; additional (post-removal) remediation of the properties will likely not be necessary. Overall effectiveness of removal action for portions of the Kress Creek site is dependent on the probability of recontamination.
	Does not comply with ARARs.	Complies with ARARs.
	No reduction in toxicity, mobility, or volume.	No reduction in toxicity, mobility, or volume, but waste is contained at disposal facility.
Implementability	Technical feasibility not applicable.	Alternative is technically feasible since excavation, restoration, transportation, disposal, and health physics aspects use standard techniques and readily available equipment.
	Alternative is administratively infeasible given state and local concerns about perceived and actual risks, reduced property values, marketability, and potentially restricted land use.	Alternative is administratively feasible, but advance planning is critical for EPA's aggressive schedule. Time will be needed to obtain agreements with property owners, obtain permits from state and local authorities, and provide for a waste transloading facility and rail shipment. A license amendment may be needed for Kerr-McGee to receive material at the Rare Earths Facility from the Superfund sites.
	Availability of services and materials not applicable.	All services and materials needed for implementation are obtainable.
Cost	Zero cost.	Total costs are estimated as follows: - \$22 million for 15,000 yd^3 (50 properties) - \$39 million for 30,000 yd^3 (100 properties) - \$65 million for 60,000 yd^3 (200 properties) - \$119 million for 120,000 yd^3 (400 properties) Costs will increase in rough proportion to the number of properties with contamination found under structural foundations.

Table 5-4
Key Issues Analyses of Alternative 2 Contingent Actions

Criteria	Contingent Actions		
	A: Interim Storage	**B: Off-Rare Earths Facility Staging Area**	**C: Recontamination Prevention**
Effectiveness[a]	Action decreases exposure at the properties by not delaying removal. Incremental increases of exposure around the Rare Earths Facility do not cause the regulatory limit to be exceeded.	Action decreases exposure at the residences by not delaying removal. No incremental exposures are expected for the worker. Incremental exposures to the public at the staging area are slight.	Action provides a temporary access barrier to contaminated stream sediments and a flood barrier to prevent recontamination for cleaned-up floodplain soils. The measure disturbs wetlands and natural drainage within the floodplain.
	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Implementability	Technically feasible.	Staging areas are available.	Installation can be performed with readily available equipment.
	A license amendment for storage is required from IDNS.	Administratively feasible.	Regulatory requirements are exacting and may delay installation. The barrier impacts aesthetics of and access to the stream.
	All services and materials needed for implementation are obtainable.	All services and materials needed for implementation are obtainable.	All services and materials needed for implementation are obtainable.
Cost[b]	3 to 4%	0.8 to 1.2%	1 to 7%[c]

[a]The contingent actions are all temporary responses, and so some of the effectiveness criteria, such as long-term protectiveness of public health and the environment, as well as reduction of toxicity, mobility, or volume through treatment, do not apply.
[b]The costs are incremental costs above the base cost of Alternative 2, shown as percentages of the base cost.
[c]The incremental cost does not include potential flood volume mitigation expenses.

- Restore those site properties where removals occurred according to agreements established with each property owner.

- Using appropriate environmental monitoring during and after removal, verify the remedy's effectiveness for each affected property (i.e., verify that the removal action successfully minimized potential hazards to human health and the environment).

- Ultimately dispose of the removed soils in a timely fashion at a licensed offsite facility. The Rare Earths Facility may be used as a staging or transloading area for waste shipment to the disposal facility given that a railspur and loading facility will be built at the Rare Earths Facility as part of Rare Earths Facility closure.

Alternative 2 best satisfies the removal action objectives and the evaluation criteria of effectiveness, implementability, and cost. Two of the contingent actions for Alternative 2, interim storage and off-Rare Earths Facility staging, are also allowed in the event that temporary impediments to transport or disposal occur.

Once implemented, and assuming regulatory bodies do not change the contaminant-specific ARARs after removals have been completed, the source removal alternative is effective and long-term (i.e., the solution for the Residential Areas site is permanent, and dispersal of contaminated soil could not occur in future property development or community infrastructure improvements). Over the long term, the source removal alternative protects human health and the environment. Short-term impacts to health and the environment due to soil disturbance during the removal can be mitigated with good engineering practices and appropriate health and safety measures. This alternative also complies with ARARs and EPA's action criteria, strong incentives to initiate the removal action in a timely fashion.

The implementability of Alternative 2, as well as Contingent Actions A and B, has been demonstrated at other locations around the country. Excavation and restoration use standard construction techniques and good engineering practices to reduce runoff and dispersal. Mature techniques also exist for packaging, transport, and disposal of the wastes. Because the soil contains radioactive contaminants, the removal action techniques are integrated with occupational health physics programs and other safety regimens that also are well established. Services and materials are also available or can be obtained without undue difficulty. However, some major project requirements will need to be carefully considered in planning to prevent them from later becoming major obstacles to implementation; examples include establishing a railroad spur and transloading site for transferring the waste from trucks to rail cars and obtaining the necessary permits (e.g., construction, interstate transport) from local and state authorities and agreements with property owners.

The volumes of contaminated soil to be excavated from the Residential Areas site and portions of the Kress Creek site are unknown. Therefore, a range of excavation volumes and associated total costs were presented for Alternative 2. This alternative is cost

effective because it provides the highest degree of overall effectiveness (protection of public health and the environment) relative to its range of costs. Opportunities for the removal action contractor to improve the cost efficiency for this alternative will occur as the work progresses through value engineering and application of lessons learned.

The source removal option is preferred for the relevant portions of the Kress Creek site for many of the same reasons it is preferred for the Residential Areas site (see Table 5-3). One advantage of cleaning up both floodplain and non-floodplain soils in a residential area is that it provides complete rather than partial protection of human health (i.e., a significant portion of a property does not remain contaminated). Other advantages are that concurrent rather than separate source removals on a property are more efficient (logistically and economically) and reduce disruption for the property owner. A potential disadvantage would arise if the cleaned-up floodplain soils became recontaminated as a result of flooding. In this situation, the long-term protectiveness afforded by the initial cleanup decreases in proportion to the extent and level of recontamination, and costs for a second cleanup may be incurred when the Kress Creek site is remediated.

Contingent Action C, Recontamination Prevention, is a temporary option evaluated in this EE/CA for minimizing flood impact on floodplain soils in residential areas that have undergone a removal action. This contingent action is protective of human health because it prevents recontamination of residential properties that lie in the floodplain, and it limits access to contaminated stream sediments. The contingency is also technically feasible and can be implemented with available services and materials. The contingency was shown earlier to be less expensive than cleaning up the floodplain's soils a second time for a hypothetical situation where a significant fraction of the floodplains was recontaminated to levels above the action criteria. Nevertheless, full cost effectiveness can only be demonstrated under the assumption that the probability is high that (1) a severe flood will occur prior to the Kress Creek site remediation and (2) the flood will recontaminate a significant fraction of the floodplain to levels above the action criteria. However, the contingency is disallowed because the administrative hurdles and construction schedule will likely delay significantly the initial cleanup of portions of the Kress Creek site. In addition, it is anticipated that the sheet pilings will generate community concerns because of the impact of the barrier on the stream aesthetics and access.

The preference then for source removal for portions of the Kress Creek site is a (non-quantified) risk management preference that assumes that floods causing significant recontamination (such as a 100-year flood) will not occur prior to the Kress Creek site remediation (anticipated to occur in 2 to 3 years). Initial cleanup of portions of the Kress Creek site will proceed in parallel with Residential Areas site efforts. If flooding recontaminates the cleaned-up portions of the Kress Creek site, a second cleanup effort will occur during the Kress Creek site RA.

Section 6
Applications of ALARA

As low as reasonably achievable (ALARA) is a phrase (acronym) used to describe an approach to radiation protection to manage exposures and releases of radioactivity to the environment to levels as low as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit, but an approach or philosophy with a goal to attain dose levels as far below regulatory limits as reasonably achievable.

The action criteria document (Appendix A) for removal actions at the Kerr-McGee Residential Areas site and portions of the Kress Creek site established a criteria for assuring that cleanups are conducted to levels that are ALARA. The criteria document further states that "every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are ALARA." The precedent and basis for using ALARA is well established; the approach is integrated into 10 CFR 20 (*Standards for Protection Against Radiation*), Department of Energy (DOE) Order 5400.5 (*Radiation Protection of the Public and the Environment*), the NRC's Regulatory Guide 8.37, and Section 340.1000(b) of the Illinois Administrative Code. Each of the aforementioned promulgated regulations or guidances have been identified by EPA as TBC material for the Residential Areas site and portions of the Kress Creek site removal action.

ALARA considerations generally involve activities affecting environmental protection, worker protection, and waste management and transport. EPA action criteria and cleanup guidelines are used to identify the activities and precautions involved in cleanup operations. Technical and economic considerations include engineering controls, waste volumes, and waste removal options. Conservative operating methods and controls are selected so that dose levels resulting from residual contamination after cleanup are commensurate with the goals of ALARA.

The ALARA approach is integrated into the Residential Areas site and portions of the Kress Creek site removal action. Evaluations have been qualitative in nature; no cost-benefit analyses have been performed. Reasonable efforts will be made to maintain radiation exposures and the amount of radioactive materials in unrestricted areas to levels that are ALARA.

The following ALARA topics are discussed in this section:

- Administrative requirements (Section 6.1)
- Worker protection (Section 6.2)
- Protection of the general public and the environment (Section 6.3)
- Waste management and transportation (Section 6.4)

6.1 Administration of ALARA

6.1.1 Reporting of Regulatory Compliance Violations

ALARA planning should provide a system for reporting to appropriate agencies when hazardous material exposure limits, both radiological and nonradiological, are exceeded. For the Residential Areas site and portions of the Kress Creek site, the primary compliance concern is meeting the removal criteria of 5 pCi/g total radium above background. For those situations, if any, where this criteria may be exceeded as a result of extraordinary costs or impacts associated with meeting the criteria, a hazards analysis will be conducted and documented in a memorandum to EPA.

Other potential exceedances of regulatory criteria (personnel radiation exposures, releases of contaminated dusts, etc.) will also be handled through notification of EPA. Notification of other regulatory (state or federal) authorities will be made by EPA.

6.1.2 Documenting ALARA

Specific documentation methods for recording implementation of the ALARA process are not provided. Because ALARA is a major factor in each facet of site actions, its specific documentation would involve considerable redundancy. Each removal and RA requires the generation of specific documents. ALARA considerations are incorporated within these documents. Example documents include those that report investigative findings (RI/FS and EE/CA reports), define potential risks (residual risk assessment), identify engineering approaches (design documents), compare alternative costs (FS and EE/CA reports), identify planned work (work plan), direct RAs (procedures), control project safety (project HSP), and record operational efforts (permits and audits).

Summary (RI/FS and EE/CA) reports and risk assessments document the technical findings and evaluate this information as it pertains to potential hazards and liabilities. While these documents are primarily intended to identify and evaluate site conditions, they are valuable in highlighting potential hazardous conditions that may be factored into remedial planning and implementation of the ALARA process. Design documents and project work plans identify the tasks to be performed and, to some degree, the methods by which work efforts are to be performed. Again, the ALARA process must be factored into this planning for the safety of workers and the general public. The work instructions, procedures, permits, and HSP instruct workers on how to perform each task and incorporate concerns for hazardous conditions. ALARA concerns are included in the development of these documents so that hazards are dealt with on a routine basis. The various assay reports (dosimetry and bioassay reports) document exposures encountered and permits evaluation of ALARA controls. Internal audits are performed that permit evaluation of the ALARA process and provide an opportunity to incorporate improved safety approaches [Bechtel National, Inc. (BNI), 1992].

6.1.3 ALARA Decisionmaking Process

Evaluations of the ALARA approach for a particular process may be either quantitative or qualitative. In addition, the ALARA evaluations may be used to justify action below EPA limits.

A wide range of approaches and tools are permitted for meeting ALARA goals. These tools range from cost-benefit formal analyses to more rudimentary analyses based on fundamental understanding and commitment to the ALARA process. In many cases, common sense and sound judgment in making decisions—rather than formal quantitative techniques—may be all that is required (DOE Order 5400.5). Regardless of the techniques employed in making an ALARA decision, the specific factors that should be considered include the following:

- Maximum dose to any member of the public
- Collective effective dose commitment to the nearby population
- Alternative processes (e.g., treatments, methods, or controls)
- Individual and collective doses for each process alternative
- Costs associated with each process alternative
- Differences in costs and impacts among process alternatives
- Anticipated changes in doses to workers
- Nonradiological impacts

Additionally, it is important that the level of effort, the significance of support information, and the magnitude of documentation be commensurate with the magnitude of the potential doses and costs. For instance, an activity resulting in low personnel exposures is more likely to be implemented based on a judgmental decision. However, an activity involving significant personnel exposures or environmental insult potential would require in-depth study in the decisionmaking process.

In most instances, the amounts of radioactive contaminants at the Residential Areas site and portions of the Kress Creek site are relatively small, and the support efforts for ALARA decisions are rudimentary. In these instances, the associated analyses are not rigorous, the differences in doses and cost are generally small, and a detailed ALARA review is not warranted.

In the few instances where the amounts of radioactive contaminants may be relatively large, a more rigorous analysis is involved in the ALARA decision process. These instances require a cost-benefit study of site-specific environmental and population risks for various radiation exposure scenarios. This study would involve a broad range of social, public policy, demographic, and practical considerations. However, the parameters needed to evaluate the cost-benefit analyses are often difficult to quantify and the evaluations can be expensive. Furthermore, the evaluations may include many additional assumptions, judgments, and limitations that are of themselves difficult to substantiate. Modeling and

use of assumptions, particularly for the nonqualified factors, would be necessary for conducting a rigorous analysis (BNI, 1992).

Special situations, which are as yet unidentified, may arise during the course of the removal action that are unusually difficult and cost-prohibitive to clean up the action criteria. DOE Order 5400.5, considered to be a TBC for the Residential Areas site and portions of the Kress Creek site, states that if special specific property circumstances indicate that the authorized limits are not appropriate for any portion of that property, then supplemental limits or an exception may be applied. The decision must be justified and documented that the authorized limits are not appropriate and that the alternative action selected will provide adequate protection. Such situations, if any, will be judged on a case-by-case basis.

6.2 Worker Protection

ALARA is implemented in worker training and in daily operations for worker protection.

6.2.1 Worker Training and Preparation

Preplanning of field operations identifies the efforts to be performed and the ALARA considerations that must be integrated into the operations. From this effort, personnel with appropriate technical capabilities are assigned to support each project function, and a staff of qualified workers is obtained. In most instances, specific training of a site staff is required to prepare for specific work efforts and to acquaint the workers with ALARA considerations. This training is documented on a form that lists the title or subject of training, the trainer, the date, and the employee's signature. The form is placed in the employee's personnel file as a permanent record. Once work begins, meetings are held at the work site as necessary. During these meetings, specific health and safety concerns are discussed and training is performed.

This training is provided in three different categories depending on the duties of the workers. These categories are discussed below.

- **OSHA (Occupational Safety and Health Administration) Training.** This training includes 40 hr of safety information prescribed by OSHA, followed by 8 hr of annual refresher training. This training prepares workers to respond to any hazardous situation that may be encountered. The requirements for the performance of this training will be monitored by the Site Safety Coordinator (SSC).

- **Indoctrination in Relevant Project Instructions and Plans.** This training is provided to each worker to develop a consistent and effective approach to project tasks. This training includes orientation and quality assurance (QA) indoctrination for all project staff, as well as a review of relevant project

instructions and procedures. Each individual will be required to read the HSP. The site manager is responsible for determining the required instructions and procedures for each worker and to maintain the quality of project work.

- **Site Briefing.** Each individual will attend a site briefing given by the SSC or equivalent. The purpose of the site briefing is to provide orientation to and additional knowledge of project work. All individuals working or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or radiation in the area. They shall be educated on safety problems associated with exposure to such materials or radiation and on the precautions and devices to minimize exposure.

6.2.2 Field Implementation

When feasible and practicable, the use of administrative and engineering controls is preferred over the use of protective equipment to minimize exposure to hazardous materials. Work plans and subcontractors' specifications identify the controls and specify the actions needed to reduce potential exposure levels to permissible limits. When these measures are found to be inadequate, worker protection is accomplished by using specific equipment. This equipment includes, but is not limited to, protective body clothing (coveralls), gloves, boots, headgear, and respiratory protective devices and the proper use of shielding, distance, and mockup training if justified. Standard posting protocols, dosimetry programs, and decontamination procedures are also implemented. Worker protection may also include monitoring ambient air before workers enter a work area. A health physicist is available to assess the level of protection necessary to meet the ALARA objectives.

The SSC is responsible for assessing the potential dangers for daily activities that occur in radiation areas. Before work begins, the SSC assesses the area and determines specific ALARA practices (if applicable) for each job task. If this assessment indicates a significant potential hazard, appropriate radiation protection procedures are instituted.

Calculations that are required for the determination of proper ALARA practices are checked, reviewed, and approved by the project health physicist or designee and are then recorded in the health and safety project files.

6.3 Protection of the General Public and the Environment

To protect the general public and the environment, EPA has established action criteria (Table 3-1 and Appendix A). The principal action criterion is that the outdoor soil concentration should not exceed 5 pCi/g radium above background. This is the maximum concentration that is allowed to remain. In addition, EPA is committed to an aggressive ALARA program during the removal action, which will generally include removal of

contaminated soils as far below target cleanup criteria as reasonably achievable (e.g., in situations where implementation costs are reasonable and incremental risks to removal action personnel are low). This ALARA concept could be restated as follows:

> *Limit the maximum (total radium) residual concentration at individual locations to 5 pCi/g above background, while striving to reduce to levels nearer background the residual concentration at the greatest number of locations possible.*

The basic objectives behind this concept are to (1) reduce the exposure risks to as large a population as possible to levels approaching background, (2) control the maximum individual risk by limiting the maximum concentration of total radium to that allowed and considered acceptable by EPA, and (3) minimize the possibility that additional site remediation would be necessary in the event that contaminant-specific ARARs change in the future.

This ALARA concept for the Residential Areas site and portions of the Kress Creek site is parallel in some respects to the goals outlined by EPA in the National Emission Standards for Hazardous Air Pollutants (NESHAPS) policy considerations for radionuclides (FR 54, No. 240). The radionuclide NESHAPS were geared toward controlling the maximum individual risk to 10^{-4}, while striving to provide protection to the greatest number of persons possible to a risk level no higher than 10^{-6}. A similar philosophy is expressed in recommendations from the International Commission on Radiation Protection (ICRP) in that radiation exposures should be justified, protection from exposures should be optimized, and individual risk limits should be applied to control maximum exposures (ICRP Report 60). The ALARA concept specified for this site provides a mechanism for complying with the concepts outlined in these guidance documents.

For the Residential Areas site and portions of the Kress Creek site, the ALARA concept is stated in terms of EPA's verification criterion for the outdoor soil concentration rather than risk; however, concentration and risk are directly related. The verification criterion for soil concentration is the primary criterion by which removals will be evaluated, and it provides a practical measuring tool for ALARA.

In practice, it is expected that the actual cleanup levels achieved during the Residential Areas site and portions of the Kress Creek site removal action will be generally well below the soil concentration criterion of 5 pCi/g. Because of the imprecise nature of field excavation equipment relative to the typical configuration of contaminated materials in discrete layers or pockets, and to allow for uncertainties in field measurements, excavation of contaminated soils will continue until concentrations clearly below the target levels are achieved. Such practices reduce the need for remobilization to excavate additional soils at a later time. Historical cleanup activities conducted by various parties (which have generally targeted the 5/15 pCi/g federal standard) have resulted in residual concentrations well below predetermined criteria and, in many cases, near background levels.

ALARA is implemented in daily operations to protect the public from excessive radiation exposures and to reduce the possibility of radioactivity release to the environment.

Examples of mitigating actions to protect the public and the environment are discussed in Section 5.1. Measures taken to protect the worker will also protect the general public during the removal action. These measures include standard posting protocol, dust suppression, and health physics coverage. Site access control will be maintained through access agreements and verbal communication with property owners/occupants and the general public. Protection of the environment during the removal action can be obtained through measures such as surface wetting to control dust, placing covers over soil piles, installing containment or physical barriers to minimize runoff, and minimizing delays in backfilling and restoring excavated areas.

6.4 Waste Management and Transportation

The ALARA process is also applied when determining how to manage and transport waste generated by the removal activity.

6.4.1 Management of Waste Material

Waste management will involve construction and monitoring of a temporary staging or transloading area for waste prior to shipment for final disposal (base action), construction and monitoring of an interim storage facility (contingent action), or use of special containers, such as for investigation-derived waste (IDW).

In an effort to meet ALARA objectives, the completed transloading area or interim storage facility will be inspected periodically. In addition, specific security measures such as access gates, fences, and warning signs will be inspected regularly. Spills will be promptly cleaned up and contained. The interim storage facility, if constructed, will be engineered to control exposures to the public and the environment.

Investigation-derived waste material from removal activities may be temporarily stored in a secured area to be identified by EPA in drums or appropriate containers such as LSA boxes. Specific guidelines will be followed for inspecting, loading, labeling, and storing the containers so that exposure levels from waste material placed in such containers meet ALARA objectives.

As containers arrive onsite, they will be inspected to verify that they meet the specifications of a DOT 17H specification drum or a DOT Type B-25 strong tight container. Inspections of drums include a visual examination for defects such as dents, punctures, major rust, or deterioration. LSA boxes will be visually inspected for weld deficiencies, dents, paint condition, lid size, clip hooks, skids, and interior deformity (e.g., excess weld material, excess paint, or rust). Certification of approved containers will be recorded on a container inventory sheet; unapproved containers will be sent back to the manufacturer.

Before waste material is loaded, a plastic liner will be placed in each container. The thickness of the liner is based on the proposed disposal or storage site criteria. Radioactive, hazardous, and mixed wastes are segregated and appropriately packaged and labeled in lined containers. While a container is being filled, a record will be maintained of the contents (e.g., type and volume of material). When a container is left unattended, the lid will be replaced and secured to prevent addition of unauthorized material.

Containers of radioactive, hazardous, and mixed wastes will be stored separately on pallets in sheltered areas. Stored containers will be inspected monthly for any signs of deterioration.

6.4.2 Transportation of Waste Material

Written instructions will provide necessary information to appropriate site personnel so that ALARA objectives are met during transport of waste material from the excavation sites to the holding/storage area and from the holding/storage area to final disposal. These instructions will establish requirements to minimize the potential for exposure and release to the environment during handling and transportation so that transport regulations and qualifications are met. For example, each container or bag of waste may be visually inspected and checked for tags/labels prior to loading. During loading, any damaged container or bag (e.g., punctured or crushed) will be removed and the contents placed in a container or bag in good condition. After loading, the exterior surface of the rail car or vehicle will be scanned for the presence of radioactivity and an external radiation field.

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Appendix A

Action Criteria for Superfund Removal Actions at the Kerr-McGee Residential Areas Site West Chicago, Illinois

Prepared by
U.S. Environmental Protection Agency, Region 5

November 1993

ACTION CRITERIA
FOR SUPERFUND REMOVAL ACTIONS
AT THE KERR-McGEE RESIDENTIAL AREAS SITE
WEST CHICAGO, ILLINOIS

Introduction

Under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (commonly known as Superfund), as amended by the Superfund Amendments and Reauthorization Act of 1986, the United States Environmental Protection Agency (U.S. EPA) is authorized, among other things, to take response actions whenever there is a release or threat of a release of a hazardous substance into the environment. The National Priorities List (NPL) is a list of hazardous waste sites across the country that are eligible for U.S. EPA response actions under Superfund.

The U.S. EPA has listed four sites in the vicinity of the City of West Chicago, Illinois, on the NPL. The primary contaminants of concern at these sites are radioactive thorium and its decay products derived from ore processing operations at a factory in West Chicago, now known as the Kerr-McGee Chemical Corporation West Chicago Rare Earths Facility ("factory site"). Three of the NPL sites became contaminated when the processing wastes (thorium mill tailings) were removed from the factory and used primarily as fill material in and around the City of West Chicago. These sites are known as:

(1) Kerr-McGee (Residential Areas) site,
(2) Kerr-McGee (Sewage Treatment Plant) site, and
(3) Kerr-McGee (Reed-Keppler Park) site.

The fourth site became contaminated when discharges and runoff from the factory site traveled via a storm sewer into nearby Kress Creek and downstream to the West Branch of the DuPage River. This site is known as:

(4) Kerr-McGee (Kress Creek/West Branch of DuPage River) site.

It is important to note that the Residential Areas site may encompass not only residential properties, but also institutional, commercial and municipal properties. Although primarily contaminated because thorium mill tailings were used as fill, some of the properties may have become contaminated due to windblown material from the factory site.

The Kerr-McGee factory site from which the contamination originated has not been listed on the NPL; it is regulated under the licensing authority of the Illinois Department of Nuclear Safety (IDNS). Decommissioning, clean-up and closure of the factory site currently is being addressed under that authority.

Purpose and Intent

The purpose of this document is to establish criteria for U.S. EPA's response actions at contaminated properties ("Residential Areas") that are not part of the Sewage Treatment Plant, Reed-Keppler Park or Kress Creek/West Branch of DuPage River sites. Those three NPL sites will be addressed by U.S. EPA in separate actions.

It is the intent of the U.S. EPA to address the contamination problems at the Residential Areas by removal actions wherever practicable. Removal actions generally provide more immediate protection than do long-term remedial actions, and are consistent with the movement in the Superfund program to accelerate site cleanups.

U.S. EPA's actions under Superfund will be limited to those properties where the contamination is attributed to process wastes (thorium mill tailings) from the factory site. When naturally occurring radioactive materials not associated with process wastes cause U.S. EPA's action criteria to be exceeded, any corrective actions will have to take place through a separate mechanism, because Superfund generally does not give U.S. EPA the authority to remediate threats from naturally occurring substances.

This document contains the criteria that U.S. EPA will use to designate properties for removal actions and to verify that cleanup to levels protective of human health and the environment has been achieved. The U.S. EPA does not have standardized criteria for removal actions of this type. Consequently, site-specific criteria have been developed by the U.S. EPA in consultation with the IDNS for use at the Residential Areas. The criteria specified in this document will be used during three separate phases of the cleanup action: the **discovery phase**, the **characterization phase**, and the **verification phase.** Each of these phases and the criteria for each are described in detail later in this document. This document also contains release criteria for releasing equipment from work sites for unrestricted use.

Applicable or Relevant and Appropriate Requirements

Under Superfund, long-term remedial actions must attain Federal and more stringent State "applicable or relevant and appropriate requirements" (ARARs) during and at the completion of the remedial action. Removal actions (such as the type planned at the Residential Areas) must attain ARARs to the extent practicable. Therefore, U.S. EPA relied upon Federal and State ARARs to the extent practicable to establish the criteria in this document.

"Applicable requirements" are cleanup standards or other environmental protection requirements that specifically apply to the substances or activities at the site. In other words, an applicable requirement is one that a private party would have to comply with by law if the same action was being taken apart from Superfund authority.

If a requirement is not applicable, it still may be relevant and appropriate. "Relevant and appropriate requirements" are those cleanup standards that address problems or situations sufficiently similar to those at the Superfund site that their use is well suited to the particular site. A relevant and appropriate requirement must be both relevant to the conditions at the site and appropriate for use at the site, given the circumstances.

If a Federal or State requirement is neither applicable nor relevant and appropriate (and thus not an ARAR), it still may be useful to U.S. EPA when determining the necessary level of cleanup for protection of human health and the environment. Such "to-be-considered" material (TBCs) can include

promulgated regulations that do not qualify as ARARs, and non-promulgated advisories or guidance issued by Federal or State government. Superfund actions are not required to meet TBCs.

Only requirements that are duly promulgated under Federal or State law can be ARARs. Additionally, only substantive requirements of regulations, not procedural requirements, can be ARARs for on-site actions.

The U.S. EPA has identified the following major sources of ARARs and TBCs for the cleanup actions at the Residential Areas:

Title 40, Part 192 of the Code of Federal Regulations (40 CFR 192), entitled "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" - 40 CFR 192 contains U.S. EPA's standards for cleanup of lands contaminated by uranium and thorium mill wastes. The standards apply only to the sites specifically designated under the Uranium Mill Tailings Radiation Control Act of 1978, but they often have been used as criteria at uranium, thorium and radium sites because of the similarity of the problems. They are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate.

Title 32, Chapter II, Subchapter b, Part 332 of the Illinois Administrative Code, entitled "Licensing Requirements for Source Material Milling Facilities" - These regulations deal with licensing requirements for source material milling facilities in Illinois and apply to the Kerr-McGee factory site in West Chicago. They are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate and portions to be TBCs.

Title 32, Chapter II, Subchapter b, Part 340 of the Illinois Administrative Code, entitled "Standards for Protection Against Radiation" - These regulations establish standards for protection against radiation hazards, primarily in an occupational setting; they control the possession, use and transfer of sources of radiation by "licensees and registrants" so that the total dose to an individual does not exceed specified standards. They also contain decontamination guides for the release of equipment for unrestricted use. These regulations are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate.

DOE Order 5400.5, entitled "Radiation Protection of the Public and the Environment" - This Order establishes standards and requirements for Department of Energy (DOE) operations with respect to protection of members of the public against undue risk from radiation, and contains a discussion of DOE's "ALARA" (As Low As Reasonably Achievable) approach. The Order is not a promulgated Federal or State regulation, and thus cannot be an ARAR, but U.S. EPA considers portions of the Order to be TBCs.

Title 10, Part 20 of the Code of Federal Regulations (10 CFR 20), entitled "Standards for Protection Against Radiation" - These regulations contain the Nuclear Regulatory Commission's standards for protection against radiation, and contain an "ALARA" approach. They are not applicable or relevant and appropriate to the Residential Areas, but U.S. EPA considers portions to be TBCs.

U.S. Nuclear Regulatory Commission's Regulatory Guide 8.37 - This regulatory guide contains, among other things, a discussion of the NRC's "ALARA" approach. The regulatory guide is not a promulgated regulation, and thus cannot be an ARAR, but U.S. EPA considers a portion of the guide to be a TBC.

U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86 - This regulatory guide contains, among other things, decontamination guides for the release of equipment for unrestricted use. The regulatory guide is not a promulgated regulation, and thus cannot be an ARAR, but U.S. EPA considers a portion of the guide to be a TBC.

The Action Criteria

The remainder of this document describes the different phases of the cleanup action, the specific Federal and State requirements that U.S. EPA considers to be ARARs or TBCs, and the resulting action criteria for each phase of the cleanup action.

DISCOVERY AND CHARACTERIZATION PHASES

The first phase of the cleanup action is the **discovery** phase. During this phase, properties in and around the City of West Chicago will be surveyed and sampled to discover and designate those that require cleanup. If a property clearly exceeds the discovery criteria, and if it is clear that the exceedance is due to thorium mill tailings from the factory site, the property will be designated for removal action. If it is not clear whether a property exceeds the discovery criteria (i.e., borderline results), or if it is not clear whether exceedance of the criteria is due to thorium mill tailings, then further investigation will be needed before a decision can be made to designate that property for response action. Such properties will move into the **characterization** phase.

Because the objective of both discovery and characterization is the same (i.e., to find contaminated properties), the action criteria during these two phases are identical. Properties deemed not to exceed the action criteria during either discovery or characterization will be excluded from further consideration.

Due to the nature of the radiological contamination at the Residential Areas, survey efforts during the discovery phase will consist of measuring and/or sampling the following four parameters: outdoor soil concentration, outdoor

gamma exposure rate, indoor gamma exposure rate and indoor radon/thoron air concentration.

The primary criterion that will be used to designate a property for response action is outdoor soil concentration. The other three parameters (outdoor gamma exposure rate, indoor gamma exposure rate and indoor radon/thoron air concentration) will be used as indicators or "finding tools" to help locate contaminated areas; elevated readings for any of these three parameters alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

The U.S. EPA has taken a conservative approach with the discovery and characterization criteria in order to minimize the chances of not discovering properties where contamination actually is present. As a result, the discovery criteria may be more stringent than the verification criteria (e.g., for outdoor soil concentrations, the results will not be averaged over 100 square meters during discovery and characterization, but averaging over 100 m^2 may be conducted during the verification phase).

For indoor radon/thoron, the necessity for expeditious surveillance argues for measurements on a shorter time frame than the annual average (or equivalent) associated with the wording of the relevant and appropriate requirement. In order to not unduly delay assessments, discovery and characterization measurement periods may be on the order of 2 days to 3 months. Since weather, seasons and home usage all influence indoor radon/thoron levels, these shorter measurements may not fully characterize the annual average but should be adequate to serve as "finding tools." Also, many homes may have elevated levels of naturally occurring radon that are not associated with the presence of thorium mill tailings on the property. For these reasons, an elevated reading of indoor radon/thoron will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Discussed below are the criteria that will be used during the discovery and characterization phases of the response action:

- **Outdoor Soil Concentration**

  Soil standards for mill tailings of the type present at the Residential Areas are found in 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," and at Section 332.150(b) of the Illinois Administrative Code. None of the standards are applicable to the Residential Areas, but portions are relevant and appropriate. Because the State standard is more stringent than the Federal standard (by specifying that the concentration limit is for dry soil), the State regulation is considered as the ARAR.

  The State regulation at Section 332.150(b) of the Illinois Administrative Code specifies that the licensed site shall be decontaminated to the following limits prior to termination of the license:

"Concentrations of radionuclides in soil above background concentrations for total radium, averaged over areas 100 square meters, shall not exceed:

A) 5 picocuries per gram of dry soil, averaged over the first 15 centimeters below the surface; and

B) 15 picocuries per gram of dry soil, averaged over layers of 15 centimeters thickness more than 15 centimeters below the surface."

The State requirements in Section 332.150(b) of the Illinois Administrative Code were based on the federal standards in 40 CFR 192.12(a). When the federal standards in 40 CFR 192 were developed over a decade ago, the 5 picocuries per gram (pCi/g) standard was a health based standard, but the 15 pCi/g standard for subsurface soil was technology based, reflecting instrument limitations in locating subsurface deposits. The 15 pCi/g limit is not a health-based standard, and should not be applied to situations in which a health-based standard is appropriate, or to situations that differ substantively from those for which it was derived.

The 15 pCi/g limit was developed as a practical measurement tool for use in locating discrete caches of high activity tailings (typically 300-1000 pCi/g) that were deposited in subsurface locations at mill sites or at nearby properties. The subsurface soil standard in 40 CFR 192 was originally proposed as 5 pCi/g. The final standard was changed, not because the health basis was relaxed, but rather in order to reduce the cost to DOE of locating buried tailings - under the assumption that this would result in essentially the same degree of cleanup at the DOE sites as originally proposed under the 5 pCi/g criterion. The use of a 15 pCi/g subsurface criterion allowed the DOE to use field measurements rather than laboratory analysis to determine when buried tailings had been detected. It is only appropriate for use as a cost-effective tool to locate radioactive waste in situations where contaminated subsurface materials are of high activity and are not expected to be significantly admixed with clean soil. The 15 pCi/g subsurface criterion was not developed for situations where significant quantities of moderate or low activity materials are involved, such as at the Residential Areas site. Therefore, the 15 pCi/g subsurface criterion is not appropriate for use at the Residential Areas site, and thus is not an ARAR. The 5 pCi/g standard, on the other hand, was developed as a health-based standard and is appropriate for use at the Residential Areas site.

Although the soil concentration standard in the regulation is written in terms of an average over an area of 100 square meters, areal averaging will not be conducted during discovery and characterization. This approach is conservative and should minimize the chances of not identifying contamination during the discovery and characterization surveys.

Therefore,

> **The Discovery and Characterization Criterion for outdoor soil concentrations will be exceedance of 5 picocuries per gram total radium (radium-226 plus radium-228), dry soil, above background in any 15 centimeter depth based upon Section 332.150(b) of the Illinois Administrative Code.**

- <u>Outdoor Gamma Exposure Rates</u>

Section 332.150(b)(2) of the Illinois Administrative Code, "Termination of Source Material Milling Facility License," deals with a site licensed by IDNS that is to be decontaminated for license termination. It states that the licensed site shall be decontaminated to the following limits prior to termination of the license:

> "The level of gamma radiation measured at a distance of 100 centimeters from the surface shall not exceed background."

This regulation applies only to a licensed site, but the requirements are relevant to the Residential Areas since the intent of the standards is to limit public exposure from site-related radioactive materials.

The variability and distribution of naturally-occurring radioactive materials results in a range of normal background levels, even within a small region such as a few mile radius around West Chicago. In part, this originates from variable geological constituents and in part from human actions (such as phosphate fertilization which can add additional radium to the soil). Consequently, there is not a single number that can be said to be "background" for the entire West Chicago region. While not represented by a single number, the normal background levels of gamma exposure rate will fall within a range and in a fairly predictable statistical pattern. Consequently, a statistical method will be applied to both establish background and what is distinctly above background.

Because there are sources unrelated to thorium mill tailings (such as phosphate fertilizers) that could cause elevated gamma readings at the Residential Areas, it is not appropriate to use the background gamma standard during the discovery phase as a strict, single criterion that, in and of itself, triggers cleanup. However, U.S. EPA will use measurements of outdoor gamma exposure rate as a "finding tool" to locate those areas that are statistically distinct from background. Gamma readings found to be statistically distinct from background at a property will be an indication of possible thorium mill tailings contamination. Such areas will, at a minimum, be investigated further. Elevated gamma readings alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Because the background gamma standard will be used extensively as a "finding tool" and not as a strict criterion, exposure rates may be measured at varying heights from the ground surface (typically, 0 to 1 meter), depending on detection sensitivities, practicality, and other conditions encountered in the field.

Therefore,

> **The Discovery and Characterization Criterion for outdoor gamma exposure rate will be the statistical exceedance of background based upon the Illinois Administrative Code, Section 332.150(b)(2).**

- <u>Indoor Gamma Exposure Rates</u>

The only promulgated standard that specifically deals with indoor gamma exposure rate is 40 CFR 192.12(b)(2), which states that the objective of remedial action shall be that

> "In any occupied or habitable building--...The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour."

Gamma ray exposure to 20 microroentgens per hour for a substantial portion of the year could result in an annual dose exceeding 100 millirem, due solely to external exposure to gamma rays. Recommendations by eminent bodies of radiation scientists, and regulations and policies of federal agencies such as the Nuclear Regulatory Commission and the Department of Energy, are to limit doses to members of the general public to less than 100 millirem per year, including both external exposure (from gamma rays) and internal exposure (from inhalation and ingestion). In addition, NRC's regulations at 10 CFR 20, DOE Order 5400.5 and NRC Regulatory Guide 8.37 contain an "ALARA" (As Low As Reasonably Achievable) approach, which sets forth an objective to attain dose levels as far below the dose limits as practicable. Moreover, EPA believes that individual sources of contamination should be kept to a small fraction of the primary limit of 100 millirem per year, and generally sets annual dose standards below a couple of tens of millirems.

As a result of the above considerations, 40 CFR 192.12(b)(2) is not appropriate for use at the Residential Areas site, and thus is not an ARAR.

Although meant to apply to outdoor situations, the gamma exposure rate standard found at Section 332.150(b)(2) of the Illinois Administrative Code is a TBC for indoor gamma exposure rate, since the intent is to limit public exposure to site-related radioactive materials, and since periods of occupancy are higher indoors than outdoors.

As with outdoor gamma exposure rate, normal background values for indoor gamma exposure rate will fall within a range and in a fairly predictable statistical pattern; background is not a single value and must be treated statistically. In addition, different building materials (such as bricks, concrete blocks and granite hearths) that contain naturally occurring radiological materials could cause elevated indoor gamma readings that are unrelated to thorium mill tailings. For these reasons, U.S. EPA will use measurements of indoor gamma exposure rate as a "finding tool" to locate contaminated areas that may be below or alongside the foundations of buildings. Elevated indoor gamma readings alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Therefore,

> **The Discovery and Characterization Criterion for indoor gamma exposure rate will be the statistical exceedance of background, based upon the Illinois Administrative Code, Section 332.150(b)(2).**

As with outdoor gamma exposure rate, a statistical method will be applied to both establish background and what is distinctly above background.

- <u>Indoor Radon/Thoron Decay Product Concentrations</u>

Standards dealing with indoor radon decay product concentrations are found at 40 CFR 192.12(b)(1), which states that:

> "In any occupied or habitable building-- The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL..." (WL, or working levels, is a measure of the concentration of radon decay products.)

While radon-222 (commonly known just as radon) is produced from the Uranium Decay Series, radon-220 (commonly known as thoron) is the Thorium Decay Series form of radon. 40 CFR 192.40(b) states that the provisions of the standard applicable to radon also apply to thoron. U.S. EPA interprets the radon decay product concentration of 0.02 WL at 40 CFR 192.12(b)(1) to represent the combined (total) concentration of decay products from both radon and thoron.

In the absence of the thorium mill tailings, naturally-occurring decay product concentrations consist primarily of radon, with thoron decay product levels at about 25% to 50% of those of radon. However, since the thorium decay series radionuclides dominated in the ores used at the factory site, it is reasonable to assume that contaminated properties may show elevated levels of thoron if tailings are located below or

alongside the foundation of a building. However, because of different half lives in the thoron decay series, and depending on the location of the tailings, not every contaminated property will show elevated levels of thoron.

Due to the need for expeditious surveillance, measurements during the discovery and characterization phases will occur over a shorter time frame than the annual average (or equivalent) associated with the wording of the relevant and appropriate requirement. In order to not unduly delay assessments, discovery and characterization measurement periods may be on the order of 2 days to 3 months. Since weather, seasons and home usage all influence indoor radon/thoron levels, these shorter measurements may not fully characterize the annual average but should be adequate to serve as "finding tools."

As with outdoor and indoor gamma exposure rate, there is a natural variability in the range of indoor radon/thoron decay product concentrations. Some areas of West Chicago, as in other parts of the country, may have naturally high levels of indoor radon that are totally unrelated to thorium mill tailings. For these reasons, U.S. EPA will use measurements of indoor radon/thoron decay product concentrations as a "finding tool" to help locate contaminated areas that may be below or alongside the foundations of buildings. Elevated indoor radon/thoron decay product readings alone will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Therefore,

> **The Discovery and Characterization Criterion for indoor radon/ thoron decay product concentrations is 0.02 WL combined radon and thoron decay products (including background) based upon 40 CFR 192.12(b)(1).**

If a property exceeds this criterion due to naturally-occurring radon, and there is no other indication of thorium mill tailings on the property, the property will not be remediated as part of this Superfund action.

- **<u>"As Low As Reasonably Achievable" (ALARA)</u>**

As discussed above, NRC's regulations at 10 CFR 20, DOE Order 5400.5 and NRC Regulatory Guide 8.37 all contain an ALARA approach which sets forth the objective to attain dose levels as far below the dose limits as practicable. These requirements are TBCs for the removal actions at the Residential Areas.

In addition, Section 340.1000(b) of the Illinois Administrative Code is a TBC for the removal actions at the Residential Areas. Section 340.1000(b), which applies to "licensees and registrants," states,

> "In addition to complying with the requirements set forth in this Part, every reasonable effort should be made to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable. The term 'as low as is reasonably achievable' means as low as is reasonably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of ionizing radiation in the public interest."

The NRC regulations at 10 CFR 20 contain similar language.

As a result, during discovery and characterization, the following ALARA approach will be used for the Residential Areas site:

> **Every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are as low as is reasonably achievable.**

VERIFICATION PHASE

Once a property has been designated for a removal action, the success of the operation must be verified during and at the completion of the removal action. During the verification phase, properties will be surveyed and sampled to ensure that cleanup to levels protective of human health and the environment has been achieved.

As indicated below, some of the verification criteria will be applied during and immediately following the removal action, with surveys and samples collected before the open excavation is backfilled with clean material. Some of the verification criteria will be applied later, with surveys and samples collected after the excavation is backfilled.

The criteria to be used during the verification phase are as follows:

- Outdoor Soil Concentrations

> **The Verification Criterion for this parameter will be soil concentrations that do not exceed 5 picocuries per gram total radium (radium-226 plus radium-228), dry soil, above background, averaged over areas up to 100 square meters, in any 15 centimeter depth based upon Section 332.150(b) of the Illinois Administrative Code.**

Samples for outdoor soil concentrations will be collected before backfilling.

- <u>Outdoor Gamma Exposure Rates</u>

During cleanup of a property, as during the discovery and characterization phases, outdoor gamma exposure rates will be used as a "finding tool" to help determine where additional excavation may be needed. The main criterion to determine when excavation can cease, however, is the outdoor soil concentration criterion.

However, Section 332.150(b)(2) of the Illinois Administrative Code (which requires that, prior to termination of the license, the licensed site be decontaminated so that "The level of gamma radiation measured at a distance of 100 centimeters from the surface shall not exceed background") is relevant to the Residential Areas, and is appropriate for application at the completion of a cleanup action at a property.

Therefore,

> **The Verification Criterion for this parameter will be outdoor gamma exposure rates that do not statistically exceed background at a distance of 100 centimeters from the surface, based upon the Illinois Administrative Code, Section 332.150(b)(2).**

Outdoor gamma exposure rate surveys to verify that this criterion has been met will be conducted after backfilling. A statistical method will be applied to both establish background and what is distinctly above background.

- <u>Indoor Gamma Exposure Rates</u>

For properties that require cleanup and that were found, during discovery and characterization, to have elevated levels of indoor gamma exposure rate due to thorium mill tailings contamination on the property, indoor gamma exposure rate surveys will be used during the cleanup action as a "finding tool" to help determine if additional excavation is necessary.

> **The Verification Criterion for this parameter will be indoor gamma exposure rates that do not statistically exceed background based upon the Illinois Administrative Code, Section 332.170(c).**

For properties that require cleanup, but for which no elevated indoor gamma readings were found during discovery and characterization, indoor gamma surveys will not be conducted during the verification phase.

- <u>Indoor Radon/Thoron Decay Product Concentrations</u>

For properties that require cleanup and that were found, during discovery and characterization, to have elevated levels of indoor radon/thoron decay product concentrations due to thorium mill tailings contamination on the property, additional surveys will be conducted at the completion of the cleanup action to determine if the following verification criterion has been met:

In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) combined radon and thoron decay product concentration (including background) not to exceed 0.02 WL. In any case, the combined radon and thoron decay product concentration (including background) shall not exceed 0.03 WL. (Based on 40 CFR 192.12(b)(1).)

For properties that require cleanup, but for which no elevated indoor radon/thoron decay product concentrations due to thorium mill tailings were found during discovery and characterization, indoor radon/thoron testing will not be required during the verification phase.

- **"As Low As Reasonably Achievable" (ALARA)**

In addition to meeting the verification criteria described above, the following ALARA approach will be used during cleanup actions:

Every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are as low as is reasonably achievable.

RELEASE CRITERIA

In addition to the above criteria for discovery, characterization and verification, it will be necessary throughout the project to release equipment from work sites and it may be necessary to assess whether materials or surfaces are suitable for unrestricted use. Requirements for such situations are found in the Illinois Administrative Code, Section 340, Appendix C(a); these requirements are relevant and appropriate for use at the Residential Areas. Similar requirements also are found in the U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86, Table 1; these guidelines are not ARARs (since only promulgated regulations can be ARARs), but the U.S. EPA does consider them to be TBCs.

Both sets of requirements are shown below. Since the requirements are set up with differing units, the most restrictive part for a given situation would be used.

- **Illinois Administrative Code, Section 340, Appendix C(a)**

DECONTAMINATION GUIDES

a) Surface Contamination Guide

Alpha Emitters

Removable	15 pCi per 100 cm^2 = 33 dpm per 100 cm^2	average over any one surface
	45 pCi per 100 cm^2 = 100 dpm per 100 cm^2	maximum
Total (fixed)	450 pCi per 100 cm^2 = 1,000 dpm per 100 cm^2	average over any one surface
	2,250 pCi per 100 cm^2 5,000 dpm per 100 cm^2	maximum
	0.25 mRem per hour at 1 cm	

Beta-Gamma Emitters

Removable (all beta-gamma emitters except Hydrogen 3)	100 pCi per 100 cm^2	average over any one surface
	500 pCi per 100 cm^2	maximum
Removable (Hydrogen 3)	1,000 pCi per 100 cm^2	average over any one surface
	5,000 pCi per 100 cm^2	maximum
Total (fixed)	0.25 mRem per hour at 1 cm from surface	

- **U.S. Nuclear Regulatory Commission, Regulatory Guide 1.86, Table 1**

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE [a]	AVERAGE [b,c]	MAXIMUM [b,d]	REMOVABLE [b,e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α per 100 cm^2	15,000 dpm α per 100 cm^2	1,000 dpm α per 100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm per 100 cm^2	300 dpm per 100 cm^2	20 dpm per 100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm per 100 cm^2	3000 dpm per 100 cm^2	200 dpm per 100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm ß-γ per 100 cm^2	15,000 dpm ß-γ per 100 cm^2	1000 dpm ß-γ per 100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Criteria Not Chosen for Discovery, Characterization or Verification

Discussed below are other parameters and their associated regulations and standards that were reviewed by U.S. EPA to determine whether they were ARARs and should be used as discovery, characterization and/or verification criteria. None of these standards is applicable to the removal action and, as explained below, none is relevant and appropriate.

- **Outdoor Radon Concentrations**

  Outdoor radon (radon-222) and thoron (radon-220) are regulated in Section 332.170(b) of the Illinois Administrative Code:

  > "During the operating life and facility decommissioning, the combined concentration of radon and thoron at the boundary of the licensed site, measured at a height of one meter from the surface, averaged annually, shall not exceed three picocuries per liter above the background concentration at the licensed site."

  Even though on its terms the regulation applies only to a licensed facility, the intent of the regulation is to control radon and thoron in off-site areas, since the point of compliance is at the boundary of the licensed site. Therefore, the U.S. EPA considers the regulation to be relevant to the Residential Areas.

  However, there are practical reasons why measurements for radon and thoron outdoors will not aid in the identification of contaminated properties not otherwise identified by outdoor gamma exposure rate surveys and outdoor soil concentration samples. These reasons are as follows: (1) Reliable radon and thoron measurements are not immediate, but can take days or weeks to measure good averages. Gamma surveys, on the other hand, can provide instantaneous measurements; (2) Unless the emissions are extremely large, radon and thoron emitted from the ground surface will rapidly mix in the open air, making them indistinguishable from naturally occurring radon and thoron. Large radon and thoron emissions would be associated with large contaminant deposits easily identifiable by gamma survey instruments; (3) Because radon and thoron are gases that can be transported by the wind, it would be much harder to pinpoint the emission site.

  Therefore, for the reasons stated above, outdoor radon concentrations (radon and thoron), though relevant, are not appropriate to these circumstances and will not be one of the criteria for this response action.

- **Radon Release Rates from Soil**

  The emission of radon (radon-222) and thoron (radon-220) from soils is regulated in Section 332.170(c) of the Illinois Administrative Code, which states:

> "The disposal area shall be designed so that after reclamation and stabilization, the annual total radon release rate through the cover from the byproduct material shall not exceed two picocuries per square meter per second."

This regulation only applies to the disposal area at a licensed facility, but the intent of the regulation is to control the total radon emission to the environment and to protect the general population.

However, Section 332.240(a) of the Illinois Administrative Code states:

> "Monitoring for total radon after installation of an appropriately designed cover is not required. Total radon emissions from cover material shall be estimated as part of developing a closure plan."

Since it appears that the State never intended that actual measurements be made to show compliance with the regulation, the U.S. EPA does not consider this regulation to be relevant and appropriate for use at the Residential Areas. In addition, there are other, practical reasons why measurements of radon and thoron emissions from soil would not be an appropriate indicator of contaminants. At the Residential Areas, thoron is the dominant radon isotope of concern. If thoron is produced at a depth of more than a few inches below the ground surface, it will radioactively decay to a solid element and cease moving through the soil before reaching the surface. Soil sampling, on the other hand, will find contaminants at much greater depth, as would gamma exposure rate measurements which penetrate soil depths on the order of several feet.

Consequently, measurements for radon and thoron emission rates will not be conducted during this response action.

- <u>Doses in the General Environment</u>

Thorium-related doses in the general environment are regulated in 40 CFR 192.41(d), which states:

> "Operations...shall be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive materials, radon-220 and its daughters excepted, to the general environment."

Doses in the general environment also are regulated in Section 332.170(a) of the Illinois Administrative Code, which states:

> "At all times, concentrations of radioactive material, excluding radon, thoron, and their progeny, which may be released to the general environment in groundwater, surface water, air, soil, or other means shall not result in a committed effective dose in excess of 25 millirem (0.25 mSv) to the whole body, and a

committed dose equivalent in excess of 75 millirem (0.75 mSv) to the thyroid, and 25 millirem (0.25 mSv) to any other organ of any member of the public."

* mSv designates milliSieverts, a dose unit equal to 100 millirem.

Neither of the above regulations is applicable to the Residential Areas, but the U.S. EPA considers both to be relevant.

Even though the dose requirements of 40 CFR 192.41(d) and Section 332.170(a) of the Illinois Administrative Code are relevant to the Residential Areas, there are practical reasons why performing dose assessment calculations will not aid in the identification of contaminated properties not otherwise detected by the other discovery criteria. An operational assumption for this response action is that where site parameters such as indoor or outdoor gamma exposure rate, outdoor soil concentrations, or indoor radon and thoron are elevated, dose is elevated proportionally. Therefore, having specific dose calculations is not appropriate as it will not provide useful information not already provided by other parameters. Consequently, no separate dose assessment calculations will be required for this response action.

Appendix B
Potential Applicable or Relevant and Appropriate Requirements

Appendix B
Potential Applicable or Relevant and Appropriate Requirements

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) specifies that removal actions for cleanup of hazardous substances must comply to the extent practicable with requirements or standards under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site. Inherent in the interpretation of applicable or relevant and appropriate requirements (ARARs) is the assumption that protection of human health and the environment is provided. ARARs apply to those federal and state regulations that are designed to protect the environment and do not generally apply to occupational safety regulations. Therefore, the Occupational Safety and Health Administration (OSHA) regulations are not addressed as ARARs unless they specifically apply to removal action goals.

The purpose of this appendix is to supply a preliminary list of available federal and state contaminant- and location-specific ARARs for the Residential Areas site and portions of the Kress Creek site. The process of ARAR identification is an iterative one that is continually changing as the removal action progresses. Therefore, this list of ARARs represents a compilation of potential ARARs, of which subsets will be used or additional ARARs added as site-specific contamination at the Residential Areas site is further characterized.

The contaminants of concern at the Residential Areas site and portions of the Kress Creek site are metals (e.g., lead, barium, chromium) and radionuclides from the mill tailings. The probable radionuclides of concern include thorium-232, uranium-238, and the products in the decay chain.

The following is a definition of terms used throughout this appendix:

Applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically addresses a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance at a CERCLA site" (52 FR 32496, August 27, 1987).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (52 FR 32496).

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, requirements must be

both relevant and appropriate for compliance to be required. In the case where a federal and a state ARAR are available, or where there are two potential ARARs addressing the same issue, the more stringent regulation must be selected.

CERCLA onsite response actions must only comply with the substantive requirements of a regulation and not the administrative requirements to obtain federal, state, or local permits [CERCLA §121(e)]. To proceed with CERCLA response actions as rapidly as possible, the Environmental Protection Agency (EPA) has reaffirmed this position in the final National Contingency Plan (NCP) (55 FR 8756, March 8, 1990). Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements facilitate their implementation. Response actions implemented offsite need to comply with both administrative as well as substantive regulatory requirements.

In the absence of federal- or state-promulgated regulations, there are other criteria, advisories, guidance values, and proposed standards that are not legally binding, but may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs, but are "to-be-considered" (TBC) guidance.

Contaminant-Specific ARARs

Contaminant-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants (52 FR 32496). These requirements generally set protective cleanup levels for the contaminants of concern in the designated media, or else indicate a safe level of discharge that may be incorporated when considering a specific removal activity. Little legislation or guidance is available governing cleanup criteria for contaminated soils at CERCLA sites.

Table B-1 summarizes the potential contaminant-specific requirements; specific information included in the table is the title and citation for the potential ARAR, a description of the requirements, a preliminary determination as to relevance (e.g., applicable, relevant and appropriate, or TBC), and any explanatory comments.

Radiation Protection Standards and Other Action-Specific ARARs

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (52 FR 32496). Selection of a particular removal action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

Table B-1
Potential Contaminant-Specific Requirements for the Residential Areas Site

Potential ARAR	Requirements	Preliminary Determination	Comments
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)	Specifies that concentrations of radium-226 and radium-228 in soil averaged over any 100 m^2 area may not exceed background by more than 5 pCi/g in the top 15 cm of soil or 15 pCi/g in any 15-cm layer below the surface layer. Specifies that within any habitable structure. gamma radiation exposure may not exceed 20 μR/hr above background, and radon decay product concentrations may not exceed 0.03 WL and should not exceed 0.02 WL where reasonably achievable.	Portions are relevant and appropriate (see Appendix A for application to the action criteria)	The standards apply only to the sites specifically designated under the Uranium Mill Tailings Radiation Control Act of 1978. but they have often been used as criteria at uranium, thorium and radium sites because of the similarity of problems.
Licensing Requirements for Source Material Milling Facilities (Title 32, Chapter II, Subchapter b, Part 332 of the Illinois Administrative Code)	Prior to termination of the license: Concentrations of radionuclides in soil above background concentrations for total radium, averaged over areas of 100 m^2, shall not exceed: (A) 5 pCi/g of dry soil, averaged over the first 15 cm below the surface; and (B) 15 pCi/g of dry soil. averaged over layers of 15 cm thickness more than 15 cm below the surface. The level of gamma radiation measured at a distance of 100 cm from the surface shall not exceed background.	Portions are relevant and appropriate. and portions are TBCs (see Appendix A for application to the action criteria)	Establishes procedures, criteria, and conditions upon which IDNS issues specific licenses for source material milling and disposal of the byproduct material.
Standards for Protection Against Radiation (Title 32, Chapter II, Subchapter b. Part 332 of the Illinois Administrative Code) Radiation Protection of the Public and the Environment (DOE Order 5400.5) Standards for Protection Against Radiation (10 CFR 20) U. S. Nuclear Regulatory Guide 8.37	Every reasonable effort should be made to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable (ALARA). ALARA means taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety. and other societal and socioeconomic considerations, and in relation to the utilization of ionizing radiation in the public interest.	Portions are relevant and appropriate (see Appendix A for application to the action criteria) Portions are TBC Portion is TBC Portion is TBC	some of the verification criteria are applications of ALARA on the standards.

Table B-1
Potential Contaminant-Specific Requirements for the Residential Areas Site

Potential ARAR	Requirements	Preliminary Determination	Comments
Clean Air Act, as amended; National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Establishes National Primary and Secondary Ambient Air Quality Standards for certain pollutants. including total particulate matter	Potentially applicable	Excavation equipment exhaust and fugitive dust could potentially contribute to air quality deterioration.
Federal Water Pollution Control Act, Clean Water Act: Water Quality Standards (40 CFR 131). National Pollutant Discharge Elimination System (40 CFR 122-125)	Establishes water quality standards for surface waters and pretreatment standards for waste waters released to publicly-owned treatment works	Potentially applicable	Any wastewater resulting from the proposed action will be managed in accordance with the NPDES process.
Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (EPA/540/R-93/081; February 1994)	Establishes an interim soil cleanup level for total lead at 400 ppm. which EPA considers protective for direct contact at residential settings.	TBC	This directive provides a strong scientific basis for choosing a soil lead cleanup level for a specific CERCLA (residential) site based on EPA's Uptake Biokinetic (UBK) model

The Atomic Energy Act (AEA) of 1954 and its amendments delegated authority for control of nuclear energy to the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and EPA. In addition, certain states have regulatory authority and programs for radioactive materials; Illinois is an agreement state with the NRC. EPA's regulations are derived from several other statutes as well and cover many types of activities and radioactive materials. The NRC licenses the possession and use of various types of radioactive materials at certain types of facilities. Table B-2 lists the State of Illinois, EPA, and NRC radiation protection standards that are described below.

EPA Regulations

Subparts T and I of 40 CFR 61, the National Emission Standards for Hazardous Air Pollutants (NESHAPs), addresses atmospheric radionuclide emissions, and may be applicable to airborne emissions during site cleanup. Subpart I limits radionuclide emissions to the ambient air so as not to exceed those amounts that would cause an effective dose equivalent of 10 mrem/year to any member of the public (40 CFR 61.102). EPA has issued a final rule (54 *FR* 51654, December 15, 1989) that limits emissions of radon-222 to the ambient air from uranium mill tailing piles at levels not exceeding 20 $pCi/m^2/s$ (40 CFR 61.222).

The provisions of the Uranium Mill Tailings Radiation Control Act (40 CFR 192) are designed to regulate the stabilization, disposal, and control of uranium and thorium mill tailings. However, these regulations may be relevant and appropriate to cleanup of the Residential Areas site since it contains tailings.

NRC Regulations

The standards for protection against radiation (10 CFR 20) are designed to limit radiation exposures from NRC-licensed activities. They provide permissible worker exposure limits for restricted areas of 5 rem/year (10 CFR 20.1201) and lower radiation exposure limits to the general public in unrestricted areas of 100 mrem/year (10 CFR 20.1301). More specifically, dose limits to the public are as follows:

- 50 mrem/year committed effective dose equivalent (CEDE) as a result of the inhalation of effluent radionuclides (10 CFR 20.1302)
- 50 mrem/year CEDE as a result of the ingestion of effluent radionuclides (10 CFR 20.1302)
- 50 mrem/year effective dose equivalent (EDE) as a result of external gamma radiation (10 CFR 20.1302)
- 100 mrem/year total effective dose equivalent (TEDE) by any combination of inhalation, ingestion, or external doses (10 CFR 20.1301)

Table B-2
Potential Radiation Protection Standards for the Residential Areas Site

Regulation	Applicability	Exposure Conditions	Standard
40 CFR 61	NESHAPs for radionuclides.	Radon release Radionuclide emissions to ambient air	20 pCi/m²-s Ra-222 from tailing piles 10 mrem/yr effective dose equivalent
40 CFR 192	Uranium and thorium mill tailings. Portions of 40 CFR 192 are considered relevant and appropriate (see Appendix A for application to the action criteria).	Radon (222) emissions Indoor radon (220 and 222) decay products Radium-226 in soil Indoor gamma radiation	20 pCi/m²/s release over entire site or 0.5 pCi/L air outside site 0.02 working level (WL) as practical. Not lo exceed 0.03 WL (includes background). 5 pCi/g over background in top 15 cm averaged 100 m² 15 pCi/g in 15-cm layers, > 15 cm deep over background, averaged 100 m² 20 μR/hr above background
10 CFR 20	Radiation from NRC-licensed facilities.	Worker exposure limits in unrestricted areas Public exposure, unrestricted areas	5 rem/year[a] 100 mrem/year[a]
10 CFR 61	Licensing requirements for land disposal of radioactive waste.	Public exposure, all sources	25 mremlyear (total body) 75 mrem/year (thyroid)
IDNS, Radiation Protection. Part 332	Disposal of source material milling by-product. Portions arc considered relevant and appropriate (see Appendix A for application to the action criteria).	Total radium in soil avegged over 100 m² Gamma radiation Annual radon emissions through cover	5 pCi/g over background in top 15 cm 15 pCi/g in 15-cm layers. > 15 cm deep Below background at 100 cm from surface 2 pCi/m²/s

[a]Final rule of May 22.1991 (56 FR 23360). effective January 1, 1993.

The NRC has promulgated licensing requirements for land disposal of radioactive waste (10 CFR 61). Part 61 contains procedural requirements and performance standards applicable to land disposal, with specific technical requirements for near-surface disposal of radioactive waste. 10 CFR 61.41 states that concentrations of radioactive materials released to the environment in all media must not result in an annual dose exceeding 75 mrem to the thyroid and 25 mrem to total body or all other organs of any member of the public. In addition, reasonable effort must be made to maintain releases of radioactive materials to "as low as reasonably achievable" (ALARA). 10 CFR 61.43 states that inadvertent intruders must be protected following cessation of active institutional controls, and 10 CFR 61.43 provides that operations at land disposal facilities must be carried out in compliance with 10 CFR 20.

State Regulations

The provisions of Illinois Department of Nuclear Safety (IDNS) Part 332, Licensing Requirements for Source Material Milling Facilities, are designed to regulate source material milling and disposal of the byproduct material. The decontamination requirements influence the cleanup levels for a removal alternative. The requirements concerning the final disposal area may be considered relevant and appropriate for source removal alternatives.

TBC Guidance for Radiological Contaminants

The EPA Office of Radiation Programs has derived slope and unit risk factors for radionuclides of concern at removal sites for each of three major exposure pathways (inhalation, ingestion, and external exposure to contaminated soil). These are available in the EPA Health Effects Assessment Summary Tables (HEAST).

Section 50.51, "Duration of License, Renewal," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that each license to operate a production and utilization facility be issued for a specific duration. Upon expiration of the specified period, the license may either be renewed or terminated by the Commission. Section 50.82, "Applications for Terminations of Licenses," specifies the requirements that must be satisfied to terminate an operating license, including the requirement that the dismantlement of the facility and disposal of the component parts not be inimical to the common defense and security or the health and safety of the public. Regulatory Guide 1.86 describes methods and procedures considered acceptable by the regulatory staff for the termination of operating licenses for nuclear reactors. Table B-3 shows radioactive surface contamination levels considered acceptable for release of a licensed facility for unrestricted use by the NRC. These standards may be used to assess the acceptable levels of contamination remaining on solid items.

Table B-3
Acceptable Surface Contamination Levels

Nuclide[a]	Average[b,c]	Maximum[b,d]	Removable[b,e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute (cpm) observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
[c]Measurements of average contaminant should not be average over more than 1 m^2. For objects of less surface area, the average should be derived for each such object.
[d]The maximum contamination level applies to an area of not more than 100 cm^2.
[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Information from Table 6-6 and Table 7-7 of "Risk Assessments Methodology, Environmental Impact Statement, NESHAPs for Radionuclides, Background Information Document" (Volume 1) may also be considered as TBC.

Transportation

The Hazardous Materials Transportation Act, as amended by the Hazardous Materials Transportation Uniform Safety Act (49 CFR 171-177) establishes the requirements for transportation of hazardous (including radioactive) materials, including classification, packaging, labeling, marking, shipping, and placarding requirements. This standard is considered potentially applicable as an ARAR, specifically with regard to transportation of radioactive materials offsite. It is anticipated that all wastes generated during the proposed removal action will contain radioactivity concentrations below 2,000 pCi/g, the threshold subject to classification as radioactive material under these transportation regulations.

Location-Specific ARARs

Location-specific requirements "set restrictions upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 FR 51394). Table B-4 lists the major federal location-specific ARARs that might be pertinent to removal actions at the Residential Areas site and portions of the Kress Creek site. These will be considered further as site-specific removal alternatives are selected for cleanup.

Caves, Salt-Dome Formations, Salt-Bed Formations, and Underground Mines

There are no indications of caves, salt-dome formations, salt-bed formations, or underground mines on or near the Residential Areas site or portions of the Kress Creek site.

Faults

There are no known faults near the Residential Areas site or portions of the Kress Creek site. The possibility of fault movement is considered unlikely.

Wilderness Areas, Wildlife Refuges, and Scenic Rivers

Two forest preserves are located within a portion of the Residential Areas site or portions of the Kress Creek site. In the event that a removal action could impact the forest preserve, consultation with the managing agency would be needed. The Residential Areas site and portions of the Kress Creek site do not contain either wild and scenic rivers or designated wildlife refuges, based on the current site information.

Table B-4
Tentative Location-Specific ARARs for the Residential Areas Site

Location	Requirement	Prerequisite(s)	Citation
Wetland	Must take action to avoid adverse impact, minimize potential harm, and to preserve and enhance wetlands to the extent possible.	Wetland as defined in 40 CFR 6. Appendix A. Part 4; action of federal agencies involving construction of facilities or management of property in wetland areas.	Executive Order 11990; Protection of Wetlands (40 CFR 6, Appendix A); 40 CFR 6.302(a) .
	Federal agencies shall incorporate floodplain management goals and wetlands protection considerations in its planning, regulatory, and decisionmaking process.		40 CFR 6. Appendix A
	Federal agencies should avoid new construction in wetlands areas.		40 CFR 6, Appendix A
	Prohibits discharge of dredge or fill material into wetlands without permit.	Wetlands as defined in 40 CFR 6, Appendix A, Part 4, and the U.S. Amy Corps of Engineers regulations	CWA Part 404; 40 CFR 230.10; 33 CFR 320-330
	Provides for the enhancement, restoration. or creation of alternate wetlands.	Unavoidable adverse impacts on wetlands	CWA Part 404(b)(1)
Withii 100-year floodplain	Facility must be designed, constructed. operated, and maintained to avoid washout by a 100-year flood.	RCRA hazardous waste: treatment. storage, or disposal	40 CFR 264.18(b)
Withii floodplain	Must take action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values. and minimize impact of floods on human safety, health. and welfare.	Action of federal agencies pertaining to: acquiring, managing. and disposing of lands and facilities: construction or improvements; and conducting activities and programs affecting land uses in flood-prone areas.	Executive Order 11988; Floodplain Management (40 CFR 6. Appendix A); 40 CFR 6.302(b)
	Federal agencies must evaluate the potential effects of any action it may take in a floodplain, ensuring that planning programs and budget reflect considerations of flood hazards.		Executive Order 11988

Table B-4
Tentative Location-Specific ARARs for the Residential Areas Site

Location	Requirement	Prerequisite(s)	Citation
Within area affecting stream or river	Must take action to protect affected fish or wildlife resources; prohibits diversion, channelling, or other activity that modifies a stream or river and affects fish or wildlife. Federal agencies should consult with the Fish and Wildlife Service and state personnel to develop protective measures for affected wildlife.	Presence of fish and wildlife resources; action by federal agencies resulting in the control or structural modification of a natural stream or body of water. Offsite response actions.	Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302(g)
Critical habitat upon which endangered or threatened species depends	Action to conserve endangered or threatened species, including consultation with the Department of the Interior.	Determination of endangered or threatened species.	Endangered Species Act of 1973 (16USC 1531 et seq.); 50 CFR. Part 200; 50 CFR, Part 402
Historic Sites and Archaeological Findings	Must take action to avoid adverse impact, and to preserve historic sites and archeological findings.	Identification of historic sites and archaeological findings that could potentially be affected by remediation actions	National Historic Preservation Act (36 CFR m Part 800) and National Archaeological and Historic Preservation Act (36CFR Part 65)

Wetlands and Floodplains

Because the Residential Areas site is adjacent to the Kress Creek site, individual properties may contains both wetlands and floodplains. As a result, the requirements found in the Resource Conservation and Recovery Act (RCRA) 40 CFR 264.18(b), 40 CFR 6 (Appendix A), 40 CFR 230.10, 33 CFR 320-330, and in Executive Orders 11988 and 11990, along with Section 404 of CWA (Table B-2), may be ARARs.

Historic Sites and Archaeological Findings

Northeastern Illinois contains records of prehistoric and historic settlements. Although the Illinois Historic Preservation Agency does not report any archaeological sites at or in close proximity to the Kerr-McGee Rare Earths Facility, field surveys and test excavations at the nearby Fermi National Accelerator Laboratory uncovered numerous prehistoric remains (NRC, 1989).

DuPage County possesses a large number of historic structures (e.g., houses, churches, mills, and taverns), twenty of which are listed in the *National Register of Historic Places*. In addition to two *National Register* properties (McAuley School District No. 27 and Turner Town Hall), the West Chicago area contains a number of nineteen-century buildings (private and public), some of which are currently listed in the state register (NRC, 1989). If historic sites or archeological findings are revealed at the Residential Areas site or portions of the Kress Creek site during the removal investigation, the National Historic Preservation Act (36 CFR Part 800) and the National Archaeological and Historic Preservation Act (36 CFR Part 65) may be applicable.

Rare, Threatened, or Endangered Species

Rare, threatened, and endangered species in the area of the Residential Areas site and portions of the Kress Creek site have been preliminarily identified in the Blackwell Forest Preserve. State-listed endangered species include the following:

- Yellow-Headed Blackbird
- Black Tern
- Common Moorhen
- Black-Crowned Night Heron

Federally listed endangered species include the following:

- Indiana Bat
- Eastern Prairie Fringed Orchid
- Prairie Bush Clover

Therefore, the Endangered Species Act of 1973 (50 CFR 200,402) may be applicable. Currently, critical habitats for these species have not been identified at the Residential Areas site or portions of the Kress Creek site.

Fish and Wildlife

The Kress Creek passing through some portions of the Residential Areas site provides a fish and wildlife habitat. As a result, the Fish and Wildlife Coordination Act [16 U.S.C. 661, 40 CFR 6.302(g)] that prohibits activities that may modify streams and rivers and potentially impact fish or wildlife is a potential ARAR.

Additional ARARS for Portions of the Kress Creek Site

Contingency C, Recontamination Prevention, of Alternative 2, Source Removal, considers installing a barrier wall of steel sheet piling along the creek banks to an elevation that will protect the floodplains from a 100-year recurrence flood. Potential ARARs dealing with this recontamination prevention measure are as follows:

- Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits the obstruction or alteration of navigable waters of the U.S. without a permit from the U.S. Army Corps of Engineers (USACE). These permits are primarily informational, and stream protection during pile installation will be the primary requirement. Contingency C will likely require compliance with (action-specific ARAR) Section 10 USACE permit process.

- For installation of the piling within the 100-year floodplain, 40 CFR 264.18(b) (RCRA) is not directly applicable because the Contingency C activity is not intended to prevent contamination from entering a stream during a flood.

- The Rivers, Lakes, and Streams Act (Ill. Rev. Stat. 1991, ch. 19, pars. 52-79) [615 ILCS 5], Section 404 of the Federal Water Pollution Control Act of 1972, as amended (30 U.S.C. 1344), and the Clean Water Act of 1977, Section 404 (40 CFR Parts 230 and 231) would apply if wetlands were disturbed by filling during sheet pile installation, or if the installation affected the flow of the waterway.

- Federal Emergency and Management Association (FEMA), Illinois Department of Transportation (IDOT) Department of Water Resources (DWR), and DuPage County all have (location- and action-specific ARAR) requirements. Most applicable are floodplain volume mitigation requirements. These require the design capacity of channels subject to temporary and permanent stream channel impacts to be at least equal to the capacity of the unmodified stream channel immediately upstream and

downstream from the diversion. This typically requires flood volume mitigation; when an existing floodway is restricted, additional volume must be provided to mitigate the impact of flooding.

State ARARs for Environmental Protection

Title 35 of the Illinois Administrative Code is the Environmental Protection Act, administered by the Illinois Environmental Protection Agency. Table B-5 lists the potential contaminant-specific ARARs from Title 35, and Table B-6 lists the potential action-specific ARARs.

Table B-5
Contaminant-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 212	Visual and Particulate Matter Emissions. This part addresses standards and limitations for visual and particulate matter from stationary sources. Subpart A (212.100 through 212.113) dictates the measurement methods for opacity and particulate matter. Subpan K (212.301 through 212.324) addresses the regulation of fugitive particulate matter emissions from any process, including any material handling or storage activity. that is visible by an observer looking generally toward the zenith at a point beyond the property line of the emission source.	Portions are applicable.	This applies to material excavation and storage pile management activities.
Part 243	Illinois Air Quality Standards. This part addresses the limits on atmospheric concentrations of air contaminants established for the purpose of protecting public health and welfare. Subpart A (243.104 through 243.108) establishes that if the existing ambient air quality is better than established ambient air quality standards, the existing air shall be maintained at its present high quality. The remainder of this subpart discusses monitoring requirements and reference conditions for all measurements of air quality. Subpart B (243.121 through 243.126) establishes the standards and measurement methods for monitoring the following contaminants: sulfur oxides (as sulfur dioxide), carbon monoxide, nitrogen dioxide, ozone, and lead.	Portions are relevant and appropriate.	This rule sets the air quality standards for the state with which everyone must comply.
Part 302	Water Quality Standards. This part contains schedules of water quality standards that are applicable throughout the state. Subpart B (302.208 and 302.210) contains general use water quality standards for specific chemical constituents and other toxic substances. Subpart C (302.304) contains public and food processing water supply standards for specific chemical constituents.	Portions may be relevant and appropriate.	This rule establishes the general water quality standards of the state.

Table B-5
Contaminant-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 304	Effluent Standards. This part prescribes the maximum concentrations of various contaminants that may be discharged to the waters of the state. Subpart A (304.102 through 304.141) contains general effluent limitations. Subpart C (304.301)) ains ten r r effluent standards.	Portions may be applicable.	This rule sets the minimum standards for effluent discharged into the waters of the state. This rule may apply to stormwater discharges from the project site.
Part 721	fi and Listing of I aste. This pan identifies those) wastes t are j to u as hazardous wastes under Parts) 7 th ug 725, an Subpart A (721.101 through 721.108) contains definitions, identifies wastes that are excluded from regulation under Parts 702, 703, 705, 722 through 726. and 728, and addresses requirements for small quantity generators. Subpart B (721.110 through 721.111) sets forth the criteria used to identify characteristics of hazardous waste and lists particular hazardous wastes. Subpart C (721.120 through 720.124) identifies characteristics of hazardous wastes. Subpart D (721.130 through 721.133) lists particular hazardous wastes.	Portions may be relevant and appropriate.	

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 201	Illinois Permits and General Air Pollution Regulations. This part addresses the general air pollution control regulations and requirements for permitting emission sources. Subpart C (201.141 through 201.151) discusses prohibitions and required permits for emission sources. Subpart D (201.152 through 210.165) discusses permit application requirements and the review process. Subpart F (201.207 through 201.210) discusses the procedures for permit renewal, revocation, revision, and appeal. Subpart J (201.282 through 201.283) discusses the requirements for monitoring and testing of any emission source for determining the nature and quantities of specified air contaminant emissions. Subpart K (201.301 through 201.302) discusses recordkeeping and report submittal requirements for any emission source.	Portions are relevant and appropriate.	These are the general rules and guidelines for operating permits for any air emission source.
Part 240	Illinois Mobile Sources Standards. This pan addresses the rules and regulations regarding the control of emissions from motor vehicles. Subpart A (240.103 and 240.104) addresses the prohibitions on tampering with the air pollution control equipment and the inspection requirements for the exhaust systems of all motor vehicles. Subpart B (240.121) addresses opacity limits for smoke emissions from motor vehicles.	Portions are relevant and appropriate	This project will utilize internal combustion vehicles that will each have an air pollution control device that is regulated under this part.
Part 305	Monitoring and Reporting. This part describes requirements for monitoring. reporting. and measuring contaminant discharges.	Portions are relevant and appropriate.	This rule establishes the monitoring. reporting. and measuring procedures.

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 309	Permits. This part addresses permits that may be required Subpart A (309.101 through 309.185) contains the requirements for which an NPDES permit is necessary. Subpart B (309.201 through 309.282) contains the requirements for other permits that may be required where an NPDES permit is not.	Portions may be relevant and appropriate.	A permit for stormwater discharge from the project site may be required due to the potential of contaminants being present in the excavated material that could be transported offsite during a storm event.
Part 700	Outline of Waste Disposal Regulations. This part sets forth rules that determine which provisions of Parts 700 through 749 are applicable to various persons and facilities. Subchapter A (700.101 through 700.109) contains general provisions for this part. Subchapter B (700.201 through 700.265) contains definitions applicable only to this part. Subchapter C (700.301 through 700.404) contains rules that apply to generators of hazardous waste. Subchapter D (700.401 through 700.404) contains rules that apply to transporters of hazardous waste. Subchapter E (700.501 through 700.504) contains rules that apply to owners or operators of HWM facilities.		These are general rules that apply to anyone who generates or transports hazardous waste or owns or operates a HWM facility.
Part 702	RCRA and UIC Permit Programs. These permit regulations include provisions for two permit programs: The RCRA permit program under Title V and Title X of the Environmental Protection Act and The UIC permit program under Title III and Title X of the Environmental Protection Act. (Not applicable.)	Portions may be relevant and appropriate.	The UIC rules do not apply; only the RCRA rules may apply.

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 702 (cont.)	Subpart A (702.101 through 702.110) contains general provisions and definitions that apply to Parts 702, 703, 704, and 705. Subpart B (702.120 through 702.126) contains permit application requirements for both permit programs. Subpart C (702.140 through 702.164) contains permit conditions for both permit programs. Subpart D (702.181 through 702.187) contains conditions for issued permits for both programs.		
Part 703	RCRA Permit Program. This part requires RCRA permits for HWMs, which may include one or more treatment, storage, or disposal units, pursuant to Section 21(f) of the Environmental Protection Act. Subpart A (703.100 through 703.110) contains general provisions for this pan. Subpart B (703.120 through 703.160) contains prohibitions to this pan. Subpart C (703.140 through 703.211) contains guidelines for authorization of permits by rule and by interim status. Subpart D (703.180 through 703.211) contains requirements for applications for facilities or activities seeking RCRA permits. Subpart E (703.221 through 703.231) contains guidelines for the issuance of short-term or phased permits. Subpart F (703.240 through 703.271) contains guidelines for permit conditions or denials.	Portions may be relevant and appropriate.	This part will apply only to the storage of hazardous waste by the generators.

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 720	HWM System: General. This part provides definitions of terms. general standards, and overview information applicable to Pans 720 through 725 and 728. Subpart A (720.101 through 720.103) addresses general information and guidelines. Subpart B (720.110 through 720.11 1) contains definitions and references. Subpart C (720.120 through 720.122) contains procedures for petitions for rulemaking, getting approvals for alternative testing methods. and for waste delisting.	Portions may be. relevant and appropriate.	These rules apply specifically to owners or operators of HWM systems that either treat, store, or dispose of hazardous waste.
Part 722	Standards Applicable to Generators of Hazardous Waste. This part establishes standards for generators who treat, store, or dispose of hazardous waste onsite. Subpart A (722.110 through 722.1 12) contains general requirements for generators of hazardous wastes. Subpart B (722.120 through 722.131) discusses manifesting requirements for generators of hazardous waste who transport the hazardous waste for offsite treatment. storage. or disposal.	Portions may be relevant and appropriate.	
Part 724	Standards for Owners or Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. This part establishes minimum standards that define the acceptable management of hazardous waste. Subpart A (724.101 through 724.103) discusses general requirements and who is subject to these regulations. Subpart B (724.1 10 through 724.1 18) contains general facility standards. Subpart C (724.130 through 724.137) addresses preparedness and prevention requirements of owners and operators of all HWMs for the potential release of hazardous waste into the environment.	Portions may be relevant and appropriate.	

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 724 (cont.)	Subpart D (724.150 through 724.155) addresses contingency plan and emergency requirements. Subpart E (724.170 through 724.177) discusses the manifest system recordkeeping and recording requirements. Subpart F (724.190 through 724.201) addresses required compliance monitoring and corrective action requirements when a release from an HWM unit is detected. Subpart G (724.210 through 724.220) addresses closure and post-closure program requirements. Subpart H (724.240 through 724.251) contains financial requirement for the HWM unit owner or operator. Subpart L (724.350 through 724.359) applies to owners or operators of facilities that store or heat hazardous waste in piles.		
Part 725	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment. Storage. and Disposal Facilities. This part establishes minimum standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or until post-closure responsibilities are fulfilled. Subpart A (725.101 through 725.104) contains general provisions for this part. Subpart B (725.110 through 725.118) addresses general facility standards. Subpart C (725.130 through 725.137) contains release preparedness and prevention requirements for owners and operators of HWM facilities. Subpart D (725.150 through 725.156) contains contingency plan and emergency procedures requirements.	Portions may be relevant and appropriate.	

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Part 725 (cont.)	Subpart E (725.170 through 725.176) contains the requirements for the manifest system's recordkeeping and reporting. Subpart G (725.210 through 725.220) addresses the closure and post-closure plan requirements. Subpart H (725.240 through 725.277) addresses financial requirements for owners and operators of HWM facilities. Subpart L (725.350 through 725.358) applies to owners and operators that treat or store hazardous waste in piles.		
Part 809	Special Waste Hauling. This part prescribes procedures for issuance of permits to special waste haulers and related activities. Subpart A (809.101 through 809.103) contains general requirements and definitions. Subpart B (809.201 through 809.211) addresses general permit requirements for special waste haulers. Subpart C (809.301 through 809.302) pertains to delivery and acceptance requirements for special waste haulers. Subpart D (809.401 through 809.402) address requirements for vehicle numbers and symbols. Subpart E (809.501) addresses manifest, record, and reporting requirements for special waste haulers. Subpart G (809.701) pertains to emergency contingencies for spills.	Portions may be relevant and appropriate	Depends if the waste is recognized as a special waste and not a hazardous waste.

Table B-6
Action-Specific ARARs from the Illinois Administrative Code, Title 35

Potential ARAR	Requirements	Preliminary Determination	Comments
Act 220	Hazardous Waste Equipment Operators and Laborers Act. This act makes it unlawful for any person to operate or assist in the operation of a crane or hoist driven by any power when used in lowering of hoisting personnel or materials involving the disposal. cleanup, or handling of hazardous waste at a facility without first obtaining an operator's license from the agency.	Portions may be relevant and appropriate.	This project will require licensed hazardous waste equipment operators and laborers.

Appendix C

Direct Capital Cost Estimates for the Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site

Appendix C
Direct Capital Cost Estimates for the Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site

1. Remediation crews of 15 people will be used throughout the remediation process.

2. Volumes of material for removal were supplied by the Environmental Protection Agency (EPA). (See Table 4-2 for a discussion of the range of volumes used and their rationale.)

3. It is assumed that each property is 13,000 ft^2 in area.

4. No shoring will be required for normal remediation work because the average depth to be excavated is 2 ft.

5. No cost reduction for using multiple crews for remediation work is assumed.

6. Excavation costs were developed based on a typical crew and productivities for work in confined and open areas.

7. Level-of-protection costs are based on price sheets from O.H. Materials.

8. The removal implementation contractor will be a local firm with a staging area convenient to all properties.

9. Ten days will be required to excavate a property. Backfill and restoration time is additional, but is assumed to be within the time needed to remediate other properties.

10. Major additional cost items are costs that will occur to some degree at each site. For this analysis, 10 percent of all sites was assumed to require additional major costs. The actual number cannot be determined without additional investigation data.

CREW & UNIT COST DEVELOPMENT

PROJECT :KERR-McGEE RESIDENTIAL
CREW :EXCAVATION
RESOURCE :VARIOUS
PROJ.NO :SAE65658.FS.10
BY :CULPEPPER / GNV
FILE :JMC.190/EXC

CREW DEVELOPMENT

CREW DESCRIPTION	NO.	$/HR.	TOTAL $/HR.
1. FOREMAN	1	$26.00	$26.00
2. EQUIPMENT OPERATORS	2	$30.20	$60.40
3. EQUIP. OILER	1	$22.15	$22.15
4. HOPPER OPERATORS	2	$24.39	$48.78
5. LABORERS	4	$22.39	$89.56
6.			
7.			
8.			
9.			
##			

EQUIPMENT DESCRIPTION	NO.	$/HR. (W/OPER$)	TOTAL $/HR
1. CAT 225 BACKHOE (CAT 225D - 1.25 CY)	1.0	$62.59	$62.59
2. 2 CY LOADER (CASE W20C)	1.0	$23.11	$23.11
3. HOPPER EQUIP. (ALLOWANCE)	1.0	$15.00	$15.00
4. ROLLER TRACK (REF. POWERED CONVEYOR)	1.0	$10.28	$10.28
5. SMALL TOOLS (ALLOWANCE)	1.0	$5.00	$5.00
6.			

A TOTAL CREW SIZE	10	(HRS/MHR)	
B SUBTOTAL LABOR $			$246.89
C % INDIRECTS	55.00%		$135.79
D SUBTOTAL LABOR $			$382.68
E % LABOR PROFIT			
F LABOR $/CREW-HOUR			$382.68
G LABOR $/MANHOUR			$38.27
H TOTAL LABOR & EQUIPMENT $/CREWHOUR =			$498.66

A SUBTOTAL EQUIP. $		$115.98
B % EQUIP. PROFIT		
C EQUIP. $/CREW-HOUR		$115.98
D EQUIP. $/MANHOUR		$11.60
E TOTAL LABOR & EQUIPMENT $/MANHR =		$49.87

UNIT COST DEVELOPMENT

WORK ITEM	PRODUCT. UN/HOUR	UNIT	MATERIAL UNIT$	LABOR MHR/UNIT	LABOR UNIT$	EQUIP. UNIT$	TOTAL UNIT$
1. EXCAVATE & LOAD TO HOPPER (50 CY/DY) USE IN CONFINED AREA	6.25	CY/HR		1.60	$61.23	$18.56	$80.00
2. EXCAVATE & LOAD TO HOPPER (100 CY/DY) USE IN OPEN AREA	12.5	CY/HR		0.80	$30.61	$9.28	$40.00
3. EXCAVATE & LOAD TO HOPPER (150 CY/DAY)	18.75	CY/HR		0.53	$20.41	$6.19	$27.00
4. EXCAVATE & LOAD TO HOPPER (200 CY/DAY)	25	CY/HR		0.40	$15.31	$4.64	$20.00
5. EXCAVATE & LOAD TO HOPPER (250 CY/DAY)	31.25	CY/HR		0.32	$12.25	$3.71	$16.00

KERR-McGEE RESIDENTIAL AREAS
WEST CHICAGO, ILL.

(file name: KMASS.xls) BASIS for ADDITIONAL MAJOR COST FACTORS

A	B	C	D	E	F	G	H	I	J	K
SCENARIO	VOLUME REMOVED	NO of PROPERTIES AFFECTED	TEMP. RELO.	REPLACE MECH. SYSTEMS	BASEMENT REMOVE / REPLACE	MOVE HOUSE	GARAGE REMOVE / REPLACE	VOLUME INVOLVING HAND LABOR	DEEP EXCAVATION REQUIRING SHORING	RADON REDUCTION
			(% of "C")	(% of "C")	(% of "C")	(% of "C")	(% of "C")	(% of "B")	(% of "C")	(% of "C")
			10%	10%	10%	10%	10%	10%	10%	10%
1.	15,000	50	5	5	5	5	5	1500	5	5
2.	30,000	100	10	10	10	10	10	3000	10	10
3.	60,000	200	20	20	20	20	20	6000	20	20
4.	120,000	400	40	40	40	40	40	12000	40	40

ASSUMPTIONS:

1. FAMILY RELOCATIONS INCLUDE 3 PEOPLE / FAMILY. RELOCATION IS 60 DAYS.
2. BASEMENT REPLACEMENT WILL BE BASEMENT SLAB ONLY.
3. GARAGES WILL BE DETACHED UNITS THAT DO NOT AFFECT THE HOUSE STRUCTURE.
4. DEEP EXCAVATION REQUIRING SHORING IS FOR A 10' DEEP x 5' WIDE x 40' LONG EXCAVATION REQUIRING 900 SF OF SHEETING:
5. THE ABOVE ITEMS WILL OCCUR AT THE SAME TIME AS THE BASIC REMEDIATION EFFORT. NO ADDITIONAL HEALTH & SAFETY COSTS WILL BE REQUIRED.

SENSITIVITY:

THE BASIC COSTS HAVE BEEN CALCULATED BASED ON A SCOPE OF WORK THAT IS ASSUMED WILL TAKE PLACE ON EACH PROPERTY. BECAUSE IT CANNOT BE DETERMINED WITH REASONABLE ACCURACY THAT THE SCOPE AS ASSUMED WILL ACTUALLY BE THE COMPLETE SCOPE OF WORK AT EACH PROPERTY, ADDITIONAL MAJOR COST ITEMS THAT MAY OCCUR HAVE ALSO BEEN CALCULATED. IT SHOULD BE ASSUMED THAT A PORTION OF, ALL OF, OR MORE THAN THE SCOPE OF WORK FOR THESE ADDITIONAL ITEMS WILL BE NEEDED TO COMPLETE THE REMEDIATION. THESE FACTORS SHOULD BE CONSIDERED WHEN USING THESE ESTIMATES FOR BUDGET PLANNING.

7/14/94 9:29 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 1 - 115.000 CY. 50 SITES

FILE NAME JMC.190/KM1

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY QTY	UNIT UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	EQUIP. UNIT $	EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS													
1.	EXCAVATION IN OPEN AREAS (90% OF IN-PIACE VOLUME)	10800	CY				531.00	$334,800	$9.00	$97,200			$432,000	EXCAVATION UNIT COST DEVELOPMENT
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-RACE VOLUME)	1200	CY				$61.00	$73,200	519.00	$22,800			$96,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	13.500	CY				54.65	$62,775	51.35	$18,225			$81,000	15% OF EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	1500	CY				59.15	$13,725	52.85	$4.275			$18,000	15% OF EXCAVATION COST. M022-250-9024 - 25% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	15,000	CY	$13.75	$206,25	.17	538.27	$95,675	51.97	$29,580			$331,505	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	15,000	C.Y.				50.82	$12,300	52.58	$38,700			$51,000	M 22-266-1100, M = 10.0%. L = 10.0%. E = 10.0% - 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	25.600	TON								565.00	$1,657,500	$1,657,500	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	536.000	$36,000	3 EVENTS @ 4 SAMPLES EVENT
9.	DISPOSAL AT ENVIROCARE	16.000	CY								5650.00	09,750,000	$9,750,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
10.	PROPERTY RESTORATION (13.000 SF / PROPERTY)	162,500	SF								95.00	5812.500	$812,500	REPLACE ALL DISTURBED SU/ AREAS & SLABS, WALLS, DB C.
11.	VERIFICATION SAMPLING COSTS	200	EA								5350.00	570,000	$70,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1	LPSM								5615,200.00	$615.200	$615,200	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	5	E4								$10,500.00	552.500	$52,500	60-DAY AVE. @ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	15.000	CY	55.00	$75,00		51.50	$22,500	$0.50	$7,500			$105,000	IMPORTED FILL DIRT AVAILABLE LOCALLY.
	SUBTOTAL				$281,250			5614.07		5218,280		$12,993,700	$14,108,205	
B	OVERHEAD & PROFIT	(A*ohd) + ((A+ohd)*p)			$581359			$127,60.		$45,293		$2,696,193	$2,927,453	
C	**MOB / BOND / INSUR.**	(% of A)			$14,063			$30,749		$10,914		$649,685	$705,410	
D	**CONTINGENCY**	(% of A)			$42,188			$92,246		$32,742		$1,949,055	$2,116,231	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$395,859			$865,577		$307,229		$18,288,633	$19,857,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 1 - 15,000 CY 50 SITES
FILE NAME: JMC.190/KM1H&S

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE 15
PROJECT DURATION (MO's.) 18 (50 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY:													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	$35.00	$5,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,1(					$2,100	4 HOURSIWORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								9800.00	$18,000	$18,00 0	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4	EACH								$600.00	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
6.	DECONTAMINATION STATION	2	EACH								$3,500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	50	DAYS			24.00	835.00	$42,0(					$42,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY:													
1.	**HEALTH & SAFETY PERSONNEL**	54	MONS				93.000.00	5162.00					$162,000	3 H&S PEOPLE
2.	HANDWASH. LUNCH, CHANGE ACCOMMODATIONS	18	MONS								*$300.00*	$5,400	$5,400	
3.	HEAT/COLD STRESS MONITORING	180	DAYS				$100.00	$18.00					$18,000	
4.	SAFETY INSPECTIONS	180	DAYS				$50.00	$9.00					$9,000	
5.	MISC. EQUIPMENT RENTAL	18	MONS						$2,000	$36,00(			$36,000	
6.	MISC. CONTRACTUAL DUTIES	18	MONS			40.00	535.00	$25,2(					$25,200	LOGS, REPORTS, MEETINGS, ETC. $25/P
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	6500	MDAY								$25.00	5162,500	$162,500	$25/PERSON/DAY/SITE CREW SIZE
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	1000	MDAY								$110.00	$110.000	$110,000	MATERIALS PRICE SHEET $110/PERSON/DAY x CREW SIZE @ 1(DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$263,900		$36,000		$315,300	$615,200	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 1 - ADDITIONAL MAJOR COST ITEMS

FILE NAME JMC.190/KM1A

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ .NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONOIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	TEMPORARY RELOCATIONS	5	EA								$ 10,500.00	$52,500	$52,500	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	5	EA											
	• DEMOLISH EXISTING SYSTEM	5	EA			8.00	$260.00	$10.000					$10,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	• INSTALL NEW UNIT	5	EA	$3,400.00	817.000		$2,800.00	$14.000					$31,000	M 155-115-2180 - LABOR x 2
	• INSTALL NEW DUCT WORK	5	EA	$1,000.00	86.000		$1,000.00	85,000					$10,000	ALLOWANCE
3.	BASEMENT REMOVE / REPLACE	5	EA											
	• DEMOLISH BASEMENT FLOOR	5	EA			6.00	$260.00	*$20,000*					$20,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• REPLACE FLOOR (40' x 40' x6")	148	CY								*$200.00*	$29,630	$29,630	HIGHER UNIT COST DUE TO RESTRICTED AREA
	• MISC. BASEMENT IMPROVEMENTS	5	EA								*$2.000.00*	$10,000	$10,000	ALLOWANCE
4.	MOVE HOUSE • (INCLUDES NEW BASEMENT, PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION - average 1500 inground area of house)	5	EA								$64,350.00	$321,750	$321,750	M 021-204-0300 x 2
5.	GARAGE REMOVE / REPLACE	5	EA											
	• DEMOLISH EXISTING GARAGE	5	EA			*6.00*	*$250.00*	*$20.000*					$20,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• CONCTRUCT NEW GARAGE ASSUME 22' x 22')	2420	SF								$15.00	$36,300	$36,300	M 131-204-0400 & 0450
6.	RADON REDUCTION SYSTEM	5	EA.								$3,000.00	$15,000	$15,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	1600	CY				$49.50	$74,260					$74,250	M 022-250-0500
8.	SHORING (900 SF/SITE)	4600	SF								$15.00	$67,500	$67,500	
A	SUBTOTAL				$22,000			8143,260				$532,680	$697,930	
B	OVERHEAD& **PROFIT**	(A*ohd)+((A+ohd)*p)			84,565			$29,724				$110,531	$144,820	
C	MOB / BOND / INSUR.	(% of A)			81.100			87.1 63				$26,634	$34,896	
D	**CONTINGENCY**	(% of A)			$3,300			$21,488				$79,902	$104,689	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$30,965			$201,624				$749,747	$982,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS
FACILITY :SCENARIO NO. 1 - CONTINGENT ACTION COST ITEMS
FILE NAME: JMC.190/KM1CA

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	15000	C.Y.				$1.81	$27,150	$5.67	$85,050			$112,200	M 22-266-1130, M=10.0%, L=10.0%, E=10.0% (COSTS INCREMENTAL ABOVE BASE CO ASSUMPTION)
A	SUBTOTAL							$27,150		$85,050			$112,200	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$5,634		$17,648			$23,282	
C	MOB / BOND / INSUR.	(% of A)						$1,358		$4,253			$5,610	
D	CONTINGENCY	(% of A)						$4,073		$12,758			$16,830	
E	TOTAL ESTIMATED CONSTRUCTION COST							$38,214		$119,708			$158,000	
2.	INTERIM STORAGE AT REF													
	- UNLOAD BAGS TO STOCKPILE	7500	C.Y.				$0.17	$1,275	$1.97	$14,775			$16,050	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	- LOAD BAGS ONTO FLATBED TRUCK	7500	C.Y.				$0.17	$1,275	$1.97	$14,775			$16,050	
	- STATE TAX	7500	C.Y.								$54.00	8406.000	$405,000	TAX = $2.00/C.F.
A	SUBTOTAL							$2,550		$29,550		$405,000	$437,100	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$529		$6,132			$6,661	
C	MOB / BOND / INSUR.	(% of A)						$128		$1,478			$1,605	
D	CONTINGENCY	(% of A)						$383		$4,433		$60,750	$65,565	
E	TOTAL ESTIMATED CONSTRUCTION COST							$3,589		$41,592		$465,750	$511,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY : SCENARIO NO. 2 - **30,000 C.Y. | 100 SITES**

FILE NAME JMC.190/KM2

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DEPOSAL COSTS													
1.	EXCAVATION IN OPEN AREAS (90% OF IN-PLACE VOLUME)	21600 CY					$31.00	$669.60	$9.00	$194,401			$864,000	EXCAVATION UNIT COST DEVELOPMENT
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-PLACE VOLUME)	2400 CY					$61.00	$146.40	$19.00	$45,600			$192,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	27,000 CY					$4.65	S'125.65	$1.35	$36,450			$162,000	15% OF EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	3000 CY					59.15	$27,45	$2.85	$8,550			$36,000	15% OF EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	30.000 CY		$13.75	$412,501	.17	$38.27	$191,351	51.97	$59,160			$663,010	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	30.000 CY.					$0.82	$24,60	$2.58	$77,400			$102,000	M 22-266-1100, M=10.0%, L=10.0%, E=10.0% - 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	51,000 TON									$65.00	$3,315,000	$3,315,000	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12 EA									$3,000.00	$36.000	$36,000	3 EVENTS @ 4 SAMPLES /EVENT
9.	DISPOSAL AT ENVIROCARE TO 20,000 CY	20,000 CY									$650.00	$13.000.000	$13,000,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20,000 CY	10,000 CY									$275.00	$2,750,000	$2,750,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
10.	PROPERTY RESTORATION (13,000 SF / PROPERTY]	325.000 SF									$5.00	$1,625,000	$1,625,000	REPLACE ALL DISTURBED SURFACE AREAS & SLABS, WALLS, DECKS, ETC.
11.	VERIFICATION SAMPLING COSTS	400 EA									$350.00	8140,000	$140,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1 LPSM									$1,161,900	$1,161,900	$1,161,900	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	10 EA									$10,500.00	$105,000	$105,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W I CLEAN FILL	30,000 CY		$5.00	$150.001		$1.50	$45,00	$0.50	$15,000			$210,000	IMPORTED FILL DIRT AVAILABLE LOCALLY
A	SUBTOTAL				$562.500			$1,229,950		$436.560		$22,132,900	$24,361,910	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			8116.719			$255,215		$90.586		$4,592,577	$5,055,096	
C	MOB / BOND / INSUR.	(% of A)			$28.1 25			$61,498		$21,828		$1,106,645	$1,218,096	
D	CONTINGENCY	(% of A)			$84,375			$184,493		$65,484		$3,319,935	$3,654,287	
E	TOTAL ESTIMATED CONSTRUCTION COST				$791,719			$1,731,155		$614,458		$31,152,057	$34,289,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE REISDENTIAL AREAS
FACILITY : SCENARIO NO. 2 - 30,000 CY | 100 SITES
FILE NAME JMC.190/KM2H&S

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FUUTIME WORKERS ONSITE: 15
PROJECT DURATION (MO's.): 34 (100 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY:													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	535.00	$5,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				535.00	$2,100					$2,100	4 HOURS/WORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								*$600.00*	$18,000	$18,000	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4	EACH								*$600.00*	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$10,000.00	$10,000	$10,000	
6.	DECONTAMINATION STATION	2	EACH								$3.500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	100	DAYS			214.00	$35.00	$84.000					$84,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY:													
1.	**HEALTH & SAFETY PERSONNEL**	102	MONS				$3,000.00	$306,000					$306,000	3 H&S PEOPLE
2.	HANDWASH, LUNCH, CHANGE ACCOMMODATIONS	34	MONS								$300.00	$10,200	$10,200	
3.	HEAT/COLD STRESS MONITORING	340	DAYS				5100.00	$34,000					$34,000	
4.	SAFETY INSPECTIONS	340	DAYS				550.00	517.000					$17,000	
5.	MISC. EQUIPMENT RENTAL	34	MONS						*$2,000*	$68,000			$68,000	
6.	MISC. CONTRACTUAL DUTIES	34	MONS			*40.00*	535.00	$47,600					$47,600	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	13000	MDA'I'								*$25.00*	$325,000	$325,000	$25/PERSON/DAY x CREW SIZE DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	2000	MDA'I'								$1 10.00	$220,000	$220,000	$110/PERSON/DAY x CREW SIZE @ 10 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$496,300		$68,000		$597,600	$1,161,900	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 2 - (ADDITIONAL MAJOR COST ITEMS
FILENAME: JMC.190/KM2A

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL.	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1	**TEMPORARY RELOCATIONS**	10	EA								$10,500.00	$105,000	$105,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	10	EA											
	• DEMOLISH EXISTING SYSTEM	10	EA			8.00	$250.00	120,000					$20,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	• INSTALL NEW UNIT	10	EA	$3,400.00	134,000		$2,800.00	$28,000					$62,000	M 155-115-2180 - LABOR x 2
	• INSTALL NEW DUCT WORK	10	EA	$1,000.00	$10.000		$1,000.00	810,000					$20,000	ALLOWANCE
3.	EASEMENT REMOVE / REPLACE	10	EA											
	• DEMOLISH EASEMENT FLOOR	10	EA			16.00	$250.00	$40,000					$40,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• REPLACE FLOOR (40'x 40' x6")	296	CY								$200.00	$59,259	$59,259	HIGHER UNIT COST DUE TO RESTRICTED AREA
	• MISC. EASEMENT IMPROVEMENTS	10	EA								$2,000.00	$20,000	$20,000	ALLOWANCE
4.	MOVEHOUSE • (INCLUDES NEW EASEMENT. PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION • average 1500 sf ground area of house)	10	EA								$64,350.00	$643.600	$643,500	M 021-204-0300 x 2
5.	GARAGE REMOVE / REPLACE	10	EA											
	• DEMOLISH EXISTING GARAGE	10	EA			18.00	$250.00	340,000					$40,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	4840	SF								$15.00	$72,600	$72,600	M 131-204-0400 & 0450
6.	RADON REDUCTION SYSTEM	10	EA.								$3,000.00	$30,000	$30,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	3000	CY				$49.50	$148,500					$148,500	M 022-250-0600
8.	**SHORING (900 SF/SITE)**	9000	SF								$16.00	$135,000	$135,000	
A	SUBTOTAL				$44,000			$286,500				$1,065,359	$1,395,859	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			$9,130			859,449				$221,062	$289,641	
C	MOB / BOND / INSUR.	(% of A)			82,200			$14,326				$53,268	$69,793	
D	**CONTINGENCY**	(% of A)			$6,600			$42,975				$159,804	$209,379	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$61,930			$403,249				$1,499,493	$1,965,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY : SCENARIO NO. 2 · CONTINGENT ACTION COST ITEMS

FILE NAME JMC.190/KM2CA

ESTIMATOR CULPEPPEWGNV

PROJ. MANAGER: DANSLOAN/ORO

PROJ.NO.: SAE65658.FS.10

MARK-UPS.

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	**HAUL TO RAIL SIDING AN ADDITIONAL** 10 MILES **FROM** SITE	30000 C.Y.					$1.81	$54,300	$5.67	$170,100			$224,400	M 22-266-1130, M = 10.0%. **L = 10.0%, E = 10.0%** (COST INCREMENTALABOVE **BASE** **ASSUMPTION)**
A	**SUBTOTAL**							$54,300		$170,100			$224,400	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$11,267		535.298			$46,563	
C	MOB I BOND INSUR.	(% of A)						$2,715		58.605			$11,220	
D	CONTINGENCY	(% of A)						$8,145		825.515			$33,660	
E	TOTAL ESTIMATED CONSTRUCTION COST							(76,427		$239,416			$316,000	
2.	NTERIM STORAGE AT REF													
	· UNLOAD **BAGS** TO STOCKPILE	15000 C.Y.					$0.17	$2.550	$1.97	$29.550			$32,100	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	· LOAD BAGS ONTO FLATBED TRUCK	16000 C.Y.					$0.17	$2,560	91.97	'529,550			$32,100	
	· STATE TAX	15000 C.Y.									$64.00	$810,000	$810,000	TAX = $2.00/C.F.
A	**SUBTOTAL**							$5,100		$59,100		$810,000	$874,200	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$1,058		512.263			$13,322	
C	MOB I BOND I INSUR.	(% of A)						9255		52,955			$3,210	
D	**CONTINGENCY**	**(% of A)**						$765		$8,865		$121,500	$131,130	
E	**TOTAL ESTIMATED CONSTRUCTION COST**							$7,178		$83,183		$931,500	$1,022,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. **3** - | 80,000 CY. | 200 SITES

FILE NAME **JMC.190/KM3**

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS													
1.	**EXCAVATION IN OPEN AREAS (90%** OF IN-PLACE VOLUME)	43200	CY				$31.00	$1,339,200	$9.00	$388.800			$1,728,000	EXCAVATION UNIT COST **DEVELOPMENT**
2	EXCAVATION IN CONFINED AREAS (10% OF IN-PLACE VOLUME)	4800	CY				$61.00	5292.800	$19.00	591.200			$384,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	54.000	CY				$4.65	$251,100	$1.35	$72,900			$324,000	15% OF EXCAVATION COST - M022-260-9024 - 25% SWELL FACTOR
4.	**LOAD** INTO HOPPERS FROM CONFINED AREAS	6000	CY				$9.15	$54.900	$2.85	$17.100			$72,000	15% OF EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
5.	**CONT**AIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	60,000	CY	$13.75	$825.000	.17	$38.27	$382,700	51.97	$118.320			$1,326,020	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	60.000	C.Y.				*50.82*	$49,200	$2.58	$154,800			$204,000	M 22-266-1100, **M=10.0%, L=10.0%, E=10.0% - 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK**
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	102,000	TON								**$65.00**	**$6,630,000**	**$6,630,000**	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	**$36,000**	**$36,000**	3 EVENTS @ 4 SAMPLES / EVENT
9.	DISPOSAL AT ENVIROCARE TO **20,000** CY	20,000	CY								$650.00	**$13,000,000**	**$13,000,000**	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20,000 CY	40,000	CY								5275.00	**$11,000,000**	**$11,000,000**	**ENVIROCARE QUOTE FOR MATERIAL LESS** THAN 20,000 CY
10.	PROPERTY RESTORATION (13.000 SF / PROPERTY)	650.000	SF								$5.00	53,250,000	**$3,250,000**	**REPLACE** ALL DISTURBED SUR . . . **AREAS & SLABS.** WALLS. DECKS, ETC.
11.	VERIFICATION SAMPLING COSTS	800	EA								5350.00	**$280,000**	**$280,000**	**ASSUME** 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1	LPSM								52,264,500	**$2,264,500**	**$2,264,500**	**SEE** H&S COST DEVELOPMENT **SPREADSHEET**
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	20	EA								$10,500.00	**$210,000**	**$210,000**	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W1 CLEAN FILL	60.000	CY	$5.00	$300,000		$1.50	990.000	50.50	$30,000			**$420,000**	IMPORTED FILL DIRT AVAILABLE **LOCALLY**
A	SUBTOTAL				**$1,125,000**			**$2,459,900**		**$873,120**		**$36,670,500**	**$41,128,520**	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			**$233,438**			**$510,429**		**$181,172**		**$7,609,129**	**$8,534,168**	
C	**MOB / BOND / INSUR.**	(% of A)			**$56,250**			**$122,995**		**$43,656**		**$1,833,525**	**$2,056,426**	
D	**CONTINGENCY**	(% of A)			**$168,750**			**$368,985**		**$130,968**		**$5,500,575**	**$6,169,278**	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				**$1,583,438**			**$3,462,309**		**$1,228,916**		**$51,613,729**	**$57,888,000**	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY :SCENARIO NO. 3 - | 60,000 CY | 200 SITES | 1

FILE NAME: JMC.190/KM3H&S

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DANSLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MAW-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS.	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE: 15
PROJECT DURATION (MO's.): 67 (200 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	535.00	$5,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,100					$2,100	4 HOURS/WORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								$600.00	$18,000	$18,000	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4	EACH								5600.00	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$15,000.00	$15,000	$15,000	
6.	DECONTAMINATIONSTATION	2	EACH								53.500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	200	DAYS			24.00	$35.00	$168,000					$168,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY													
1.	**HEALTH & SAFETY PERSONNEL**	201	MONS				$3,000.00	$603,000					$603,000	3 H&S PEOPLE
2.	HANDWASH. LUNCH, CHANGE ACCOMMODATIONS	67	MONS								$300.00	$20,100	$20,100	
3.	HEAT/COLD STRESS MONITORING	870	DAYS				$100.00	$67,000					$67,000	
4.	SAFETY INSPECTIONS	670	DAYS				$50.00	$33,500					$33,500	
5.	MISC. EQUIPMENT RENTAL	67	MONS						$2,000	$134.000			$134,000	
6.	MISC. CONTRACTUAL DUTIES	67	MONS			10.00	$35.00	$93,800					$93,800	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	26000	MDAY								*$25.00*	$650,000	$650,000	$25/PERSON/DAY x CREW SIZE DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	4000	MDAY								$110.00	$440,000	$440,000	$110/PERSON/DAY x CREW SIZE @ 10 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	SUBTOTAL							5973,000		$134,000		61,167,600	$2,264,500	

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ESTIMATE SUMMARY

PROJECT : **KERR-McGEE** RESIDENTIAL AREAS.
FACILITY : SCENARIO NO. **3** -
FILE NAME **JMC.190/KM3A**
MARK-UPS:

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

ADDITIONAL MAJOR COST ITEMS

	MATL	LABOR	EQUIP	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
mom =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	15.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	TEMPORARY RELOCATIONS	20	EA								#########	$210,000	$210,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	20	EA											
	• DEMOUSH EXISTING SYSTEM	20	EA			8.00	$250.00	540.000					$40,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	• INSTALL NEW UNIT	20	EA	$3,400.00	$68,000		########	$56.000					$124,000	M 155-115-2180 - LABOR x 2
	• INSTALL NEW DUCT WORK	20	EA	$1,000.00	$20.000		########	*020,000*					$40,000	ALLOWANCE
3.	BASEMENT REMOVE / REPLACE	20	EA											
	• DEMOUSH BASEMENT FLOOR	20	EA			16.00	$250.00	*$80.000*					$80,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• REPLACE FLOOR (40'x 40' x6")	693	CY								$200.00	$118,519	$118,519	HIGHER UNIT COST DUE TO RESTRICTED AREA
	• MISC. BASEMENT IMPROVEMENTS	20	EA								$2,000.00	$40,000	$40,000	ALLOWANCE
4.	MOVE HOUSE • (INCLUDES NEW BASEMENT, PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION • average 1500 sif ground area of house)	20	EA								#########	$1,287,000	$1,287,000	M 021-204-0300 x 2
5.	GARAGE REMOVE REPLACE	20	EA											
	• DEMOLISH EXISTING GARAGE	20	EA			16.00	$250.00	*$80,000*					$80,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	9680	SF								$15.00	$145,200	$145,200	M 131-204-0400 & 0450
6.	RADON REDUCTION SYSTEM	20	EA								*$3,000.00*	$60,000	$60,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	6000	CY				$49.50	8297,000					$297,000	M 022-250-0500
8.	SHORING (900 SF/SITE)	18000	SF								815.00	$270,000	$270,000	
A	SUBTOTAL				*$88.000*			$573,000				$2,130,719	$2,791,719	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			$18,260			$118,898				$442,124	$579,282	
C	MOB / BOND / INSUR.	(% of A)			84.400			$28,650				$106,536	$139,586	
D	CONTINGENCY	(% of A)			$13,200			$85,950				$319,608	$418,758	
E	TOTAL ESTIMATED CONSTRUCTION COST				$123,860			$806,498				$2,998,986	$3,929,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 3 - CONTINGENT ACTION COST ITEMS 1

FILE NAME: JMC.190/KM3CA

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	60000 C.Y.					$1.81	$108,600	$5.67	$340,200			$448,800	M 22-266-1130, M = 10.0%. L = 10.0%, E = 10.0% (COSTS / INCREMENTALABOVE BASE CO. ASSUMPTION)
A	**SUBTOTAL**							$108,600		$340,200			$448,800	
B	**OVERHEAD & PROFIT**	(A*ohd) + ((A + ohd)*p)						$22,535		$70,591			$93,126	
C	MOB BOND INSUR.	1% of A)						85.430		$17.010			$22,440	
D	CONTINGENCY	(% of A)						$16,290		$51,030			$67,320	
E	TOTAL ESTIMATED CONSTRUCTION COST							$152,855		$478,832			$632,000	
2.	INTERIM STORAGE AT REF													
	• UNLOAD BAGS TO STOCKPILE	30000 C.Y.					90.17	$5,100	81.97	$59,100			$64,200	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	• LOAD BAGS ONTO FLATBED TRUCK	30000 C.Y.					$0.17	$5,100	81.97	$59.100			$64,200	
	• STATE TAX	30000 C.Y.									(54.00	$1,620,000	$1,620,000	TAX = $2.00/C.F.
A	SUBTOTAL							810,200		$1 18.200		$1,620,000	$1,748,400	
B	OVERHEAD & PROFIT	(A*ohd) + ((A + ohd)*p)						82,117		$24,527			$26,643	
C	MOB BOND INSUR.	(% of A)						$510		$5,910			$6,420	
D	**CONTINGENCY**	(% of A)						$1,630		$17,730		$243,000	$262,260	
E	**TOTAL ESTIMATED CONSTRUCTION COST**							$14,357		$166,367		$1,863,000	$2,044,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 4 - 120,000 C.Y. | 400 SITES
FILE NAME: JMC.190/KM4

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS													
1.	EXCAVATION IN OPEN AREAS (90% OF IN-PIACE VOLUME)	86400	CY				$31.00	$2,678,400	$9.00	$777,600			$3,456,00	EXCAVATION UNIT COST DEVELOPMENT
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-RACE VOLUME)	9600	CY				$61.00	$585,600	$19.00	$182,400			$768,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	108.000	CY				$4.65	$502,200	$1.35	$145,800			$648,000	15% OF EXCAVATION COST - M022-250.9024 - 26% SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	12000	CY				$9.15	9109.800	52.85	$34,200			$144,000	15% OF EXCAVATION COST - M022-250-9024 - 26% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	120,000	CY	$13.75	$1,650,000	.17	938.27	$765.400	$1.97	$236,640			$2,652,040	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	120,000	C.Y.				$0.82	598.400	$2.58	$309,600			$408,000	M 22-266-1100, M = 10.0%, L = 10.0%. E = 10.0% - 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	204.000	TON								$65.00	$13,260,000	$13,260,000	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	$36,000	$36,000	3 EVENTS @ 4 SAMPLES I EVENT
9.	DISPOSAL AT ENVIROCARE TO 20,000 CY	20,000	CY								$650.00	$13,000,000	$13,000,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20.000 CY	100,000	CY								$275.00	$27,500,000	$27,500,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20.000 CY
10.	PROPERTY RESTORATION 113.000 SF / PROPERTY)	1,300,000	SF								$5.00	$6,500,000	$6,500,000	REPLACE ALL DISTURBED SURFACE AREAS & SLABS, WALLS, DECKS, ETC.
11.	VERIFICATION SAMPLING COSTS	1,600	EA								$350.00	$560,000	$560,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1	LPSM								$4,478,900	$4,478,900	$4,478,900	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	40	EA								$10,500.00	$420,000	$420,000	60-DAY AVE. @ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	120,000	CY	$5.00	$600,000		$1.50	$180,000	$0.50	$60.000			$840,000	IMPORTED FILL DIRT AVAILABLE LOCALLY
A	SUBTOTAL				$2,250,000			$4,919,800		$1,746,240		$65,754,900	$74,670,940	
B	OVERHEAD & PROFIT	(A*ohd) + ((A + ohd)*p)			$466.875			$1,020,859		$362.346		$13,644,142	$15,494,220	
C	MOB / BOND / INSUR.	(% of A)			$112,500			$245.990		$87,312		$3,287,745	$3,733,547	
D	CONTINGENCY	(% of A)			$337,500			$737,970		$261,936		$9,863,235	$11,200,641	
E	TOTAL ESTIMATED CONSTRUCTION COST				$3,166,875			$6,924,619		$2,457,833		$92,550,022	$105,099,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 4 - 120,000 CY | 400 SITES

FILE NAME: **JMC.190/KM4H&S**

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN **SLOAN/ORO**
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
mom =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE: 15
PROJECT DURATION (MO's.): 134 (400 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY													
1.	**PREPARE HEALTH & SAFETY PLANS**	20 DAYS				8.00	$35.00	55.600					$5,600	
2.	SITE-SPECIFIC TRAINING	80 MHRS					$35.00	52,100					$2,100	4 HOURS/WORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30 EACH									$800.00	$18,000	$18,000	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4 EACH									$600.00	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1 LPSM									$20,000.00	$20,000	$20,000	
8.	DECONTAMINATIONSTATION	2 EACH									$3,500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	400 DAYS				24.00	$35.00	$336,000					$336,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1 LPSM									$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY													
1.	**HEALTH & SAFETY PERSONNEL**	402 MONS					$3,000.00	$1,206,000					$1,206,000	3 H&S PEOPLE
2.	HANDWASH, LUNCH, CHANGE ACCOMMODATIONS	134 MONS									5300.00	$40,200	$40,200	
3.	HEAT/COLD STRESS MONITORING	1340 DAYS					$100.00	$134,000					$134,000	
4.	SAFETY INSPECTIONS	1340 DAYS					550.00	587.000					$67,000	
5.	MISC. EQUIPMENT RENTAL	134 MONS							82.000	$268,000			$268,000	
6.	MISC. CONTRACTUAL DUTIES	134 MONS				410.00	535.00	$187.800					$187,600	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	52000 MDAY									525.00	$1,300,000	$1,300,000	$25/PERSON/DAY x CREW S DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	8000 MDAY									$110.00	$880,000	$880,000	$110/PERSON/DAY x CREW SIZE @ 10 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$1,938,300		$268,000		$2,272,600	$4,478,900	

7/14/94 2:10 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 4 - ADDITIONAL MAJOR COST ITEMS

FILE NAME JMC.190/KM4A

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DANSLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL.	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	[illegible]	40	EA								#########	$420,000	$420,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	40	EA											
	- DEMOUSH EXISTING SYSTEM	40	EA			8.00	$260.00	$80.000					$80,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	- INSTALL NEW UNIT	40	EA	$3,400.00	$136,000		#######	$112,000					$248,000	M 155-115-2180 - LABOR x 2
	- INSTALL NEW DUCT WORK	40	EA	$1,000.00	$40,000		#######	$40,000					$80,000	ALLOWANCE
3.	BASEMENT REMOVE / REPLACE	40	EA											
	- DEMOUSH BASEMENT FLOOR	40	EA			16.00	$250.00	$160,000					$160,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	- REPLACE FLOOR (40'x 40' x6")	1185	CY								8200.00	$237,037	$237,037	HIGHER UNIT COST DUE TO RESTRICTED AREA
	- MISC. BASEMENT IMPROVEMENTS	40	EA								$2,000.00	$80,000	$80,000	ALLOWANCE
4.	MOVE HOUSE - (INCLUDES NEW BASEMENT. PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION - average 1500 sf ground area of house)	40	EA								########	$2,574,000	$2,574,000	M 021-204-0300 x 2
5.	GARAGE REMOVE / REPLACE	40	EA											
	- DEMOUSH EXISTING GARAGE	40	EA			16.00	$250.00	$160.000					$160,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	- CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	19360	SF								$15.00	$290,400	$290,400	M 131-204-0400 & 0450
6.	RADON REDUCTION SYSTEM	40	EA.								$3.000.00	$120,000	$120,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	12000	CY				$49.50	$594,000					$594,000	M 022-250-0500
8.	SHORING (900 SF/SITE)	36000	SF								$15.00	$540,000	$540,000	
A	SUBTOTAL				$176,000			$1,148,000				$4,261,437	$5,583,437	
B	OVERHEAD & PROFIT	(A*ohd) + ((A+ohd)*p)			$36,520			$237.795				$884,248	$1,158,563	
C	MOB / BOND / INSUR.	(% of A)			88,600			$57,300				$213,072	$279,172	
D	CONTINGENCY	(% of A)			$26,400			$171,900				$639,216	$837,516	
E	TOTAL ESTIMATED CONSTRUCTION COST				$247,720			$1,612,995				$5,997,973	$7,859,000	

7/14/94 2:14 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS
FACILITY : SCENARIO NO. 4 - CONTINGENT ACTION COST ITEMS
FILE NAME JMC.190/KM4CA

ESTIMATOR:. CULPEPPWGNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS.

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL. or S/C UNIT $	INSTL. or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	120000	C.Y.				$1.81	$217,200	$5.67	$680,400			$897,600	M22-266-1130, M=10.0%. L=10.0%. E=10.0% (COST INCREMENTAL ABOVE BASE ASSUMPTION)
A	SUBTOTAL							$217,200		$680,400			$897,600	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$45,069		$141,183			$186,252	
C	MOB / BOND / INSUR.	(% of A)						$10,860		$34,020			$44,880	
D	CONTINGENCY	(% of A)						$32,580		$102,060			$134,640	
E	TOTAL ESTIMATED CONSTRUCTION COST							$305,709		$957,663			$1,263,000	
2.	INTERIM STORAGE AT REF													
	- UNLOAD BAGS TO STOCKPILE	60000	C.Y.				$0.17	$10,200	$1.97	$118,200			$128,400	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	- LOAD BAGS ONTO FLATBED TRUCK	60000	C.Y.				$0.17	$10,200	$1.97	$118,200			$128,400	
	- STATE TAX	60000	C.Y.								$54.00	$3,240,000	$3,240,000	TAX = $2.00/C.F.
A	SUBTOTAL							$20,400		$236,400		$3,240,000	$3,496,800	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$4,233		$49,053			$53,286	
C	MOB / BOND / INSUR.	(% of A)						$1,020		$11,820			$12,840	
D	CONTINGENCY	(% of A)						$3,060		$35,460		$486,000	$524,520	
E	TOTAL ESTIMATED CONSTRUCTION COST							$28,713		$332,733		$3,726,000	$4,087,000	

7/8/84 9:20 AM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : RESIDENTIAL FLOOD PROTECTION
FILE NAME JMC.190/FLOOD

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVWHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
BOND/INS. =	2.00%	2.00%	2.00%	2.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ZONE 2 PROTECTION													
1.	**MOBILIZATION**	1	LS								$20,000.00	$20,000	$20,000	AVERAGE MOB. COST
2.	ACCESS ROAD ALONG SHEET PILE LENGTH	3200	LF								$10.00	$32,000	$32,000	TEMPORARY GRAVEL ROAD
3.	STEEL SHEET PILING, 22PSF, NO WATER, FOR 16' WCAV, PULL & SALVAGE	61,200	SF.	$2.09	$107.008		$2.80	$133,120	$3.12	$168.744			$399,872	M 21-614-1300, M = 10.0% L = 10.0%, E = 10.0%
4.	SITE RESTORATION	3200	LF								$3,605.00	$88,000	$48,000	ALLOWANCE
6.	12' DIAMETER CHECK VALVES @ 100' O.C.	32	EA										$96,000	PRATT VALVE & CH2M HILL
A	SUBTOTAL				$107,008			$133.1 20		$168,744		$196,000	$595,872	
B	OVERHEAD & PROFIT	A*ohd) + ((A + ohd)*p)			522.204			$27.622		$33.147		$40,670	$123,643	
C	MOB I BOND / INSUR.	% of At			$2,140			$2.662		$3,186		$3,920	$11,917	
D	**CONTINGENCY**	% of A)			$18.061			$19,968		$23,882		$28,400	$90,331	
E	TOTAL ESTIMATED CONSTRUCTION C	3T			$147,404			$183.373		$220.047		$269,990	$921,000	
	ZONE 3 PROTECTION													
1.	**MOBILIZATION**	1	LS								$20,000.00	$20,000	$20,000	AVERAGE MOB. COST
2.	ACCESS ROAD ALONG SHEET PILE LENGTH	2000	LF								$10.00	$20.000	$20,000	TEMPORARY GRAVEL ROAD
3.	STEEL SHEET PILING. 22PSF, NO WATER, FOR 16' WCAV, PULL & SALVAGE	34,000	SF.	$2.09	$71,060		$2.80	$88.400	$3.12	$108.080			$266,540	M 21-614-1300, M = 10.0%, L = 10.0%. E – 10.0%
	SITE RESTORATION	2000	LF								$16.00	$30,000	$30,000	ALLOWANCE
	12' DIAMETER CHECK VALVES @ 100' O.C.	20	EA								$3,000.00	$60,000	$60,000	PRATT VALVE & CH2M HILL
A	SUBTOTAL				$71,060			$88,400		$108,080		$130,000	$395,540	
B	OVWHEAD 6 PROFIT	(A*ohd) + ((A + ohd)*p)			$14,745			$18,343		$22,012		$26,975	$82,075	
C	**MOB / BOND / INSUR.**	(% of A)			$1,421			$1,768		$2,122		$2,600	$7,911	
D	**CONTINGENCY**	(% of A)			$10,659			$13,260		$15,912		$19,500	$59,331	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$97,885			$121,771		$146,125		$179,075	$545,000	

CREW & UNIT COST DEVELOPMENT

PROJECT :KERR-McGEE RESIDENTIAL
CREW :EXCAVATION
RESOURCE :VARIOUS
PROJ.NO :SAE65658.FS.10
BY :CULPEPPER / GNV
FILE :JMC.190/EXC

CREW DEVELOPMENT

CREW DESCRIPTION	NO.	$/HR.	TOTAL $/HR.
1. FOREMAN	1	$26.00	$26.00
2. EQUIPMENT OPERATORS	2	$30.20	$60.40
3. EQUIP. OILER	1	$22.15	$22.15
4. HOPPER OPERATORS	2	$24.39	$48.78
5. LABORERS	4	$22.39	$89.56
6.			
7.			
8.			
9.			
##			

EQUIPMENT DESCRIPTION	NO.	$/HR. (W/OPER$)	TOTAL $/HR
1. CAT 225 BACKHOE (CAT 225D - 1.25 CY)	1.0	$62.59	$62.59
2. 2 CY LOADER (CASE W20C)	1.0	$23.11	$23.11
3. HOPPER EQUIP. (ALLOWANCE)	1.0	$15.00	$15.00
4. ROLLER TRACK (REF. POWERED CONVEYOR)	1.0	$10.28	$10.28
5. SMALL TOOLS (ALLOWANCE)	1.0	$5.00	$5.00
6.			

A	TOTAL CREW SIZE	10	(HRS/MHR)	
B	SUBTOTAL LABOR $			$246.89
C	% INDIRECTS	55.00%		$135.79
D	SUBTOTAL LABOR $			$382.68
E	% LABOR PROFIT			
F	LABOR $/CREW-HOUR			$382.68
G	LABOR $/MANHOUR			$38.27
H	TOTAL LABOR & EQUIPMENT $/CREWHOUR =			$498.66

A	SUBTOTAL EQUIP. $		$115.98
B	% EQUIP. PROFIT		
C	EQUIP. $/CREW-HOUR		$115.98
D	EQUIP. $/MANHOUR		$11.60
E	TOTAL LABOR & EQUIPMENT $/MANHR =		$49.87

UNIT COST DEVELOPMENT

WORK ITEM	PRODUCT. UN/HOUR	UNIT	MATERIAL UNIT$	LABOR MHR/UNIT	LABOR UNIT$	EQUIP. UNIT$	TOTAL UNIT$
1. EXCAVATE & LOAD TO HOPPER (50 CY/DY) USE IN CONFINED AREA	6.25	CY/HR		1.60	$61.23	$18.56	$80.00
2. EXCAVATE & LOAD TO HOPPER (100 CY/DY) USE IN OPEN AREA	12.5	CY/HR		0.80	$30.61	$9.28	$40.00
3. EXCAVATE & LOAD TO HOPPER (150 CY/DAY)	18.75	CY/HR		0.53	$20.41	$6.19	$27.00
4. EXCAVATE & LOAD TO HOPPER (200 CY/DAY)	25	CY/HR		0.40	$15.31	$4.64	$20.00
5. EXCAVATE & LOAD TO HOPPER (250 CY/DAY)	31.25	CY/HR		0.32	$12.25	$3.71	$16.00

KERR-McGEE RESIDENTIAL AREAS
WEST CHICAGO, ILL.

(file name: KMASS.xls)BASIS for ADDITIONAL MAJOR COST FACTORS

A	B	C	D	E	F	G	H	I	J	K
SCENARIO	VOLUME REMOVED	NO. of PROPERTIES AFFECTED	TEMP. RELO.	REPLACE MECH. SYSTEMS	BASEMENT REMOVE / REPLACE	MOVE HOUSE	GARAGE REMOVE / REPLACE	VOLUME INVOLVING HAND LABOR	DEEP EXCAVATION REQUIRING SHORING	RADON REDUCTION
			(% of "C")	(% of "C")	(% of "C")	(% of "C")	(% of "C")	(% of "B")	(% of "C")	(% of "C")
			10%	10%	10%	10%	10%	10%	10%	10%
1.	15,000	50	5	5	5	5	5	1500	5	5
2.	30,000	100	10	10	10	10	10	3000	10	10
3.	60,000	200	20	20	20	20	20	'6000	20	20
4.	120,000	400	40	40	40	40	40	12000	40	40

ASSUMPTIONS

1. FAMILY RELOCATIONS INCLUDE 3 PEOPLE / FAMILY. RELOCATION IS 60 DAYS.
2. BASEMENT REPLACEMENT WILL BE BASEMENT SLAB ONLY.
3. GARAGES WILL BE DETACHED UNITS THAT DO NOT AFFECT THE HOUSE STRUCTURE,
4. DEEP EXCAVATION REQUIRING SHORING IS FOR A 10' DEEP x 5' WIDE x 40' LONG EXCAVATION REQUIRING 900 SF OF SHEETING.
5. THE ABOVE ITEMS WILL OCCUR AT THE SAME TIME AS THE BASIC REMEDIATION EFFORT. NO ADDITIONAL HEALTH & SAFETY COSTS WILL BE REQUIRED.

SENSITIVITY:

THE BASIC COSTS HAVE BEEN CALCULATED BASED ON A SCOPE OF WORK THAT IS ASSUMED WILL TAKE PLACE ON EACH PROPERTY. BECAUSE IT CANNOT BE DETERMINED WITH REASONABLE ACCURACY THAT THE SCOPE AS ASSUMED WILL ACTUALLY BE THE COMPLETE SCOPE OF WORK AT EACH PROPERTY, ADDITIONAL MAJOR COST ITEMS THAT MAY OCCUR HAVE ALSO BEEN CALCULATED. IT SHOULD BE ASSUMED THAT A PORTION OF, ALL OF, OR MORE THAN THE SCOPE OF WORK FOR THESE ADDITIONAL ITEMS WILL BE NEEDED TO COMPLETE THE REMEDIATION. THESE FACTORS SHOULD BE CONSIDERED WHEN USING THESE ESTIMATES FOR BUDGET PLANNING.

7/14/94 9:29 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 1 • 15,000 C.Y. | 50 SITES

FILE NAME JMC.190/KM1

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

		QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	OF IN-PLACE VOLUME)	10800	CY				$31.00	$334,80(	$9.00	$97,20(			$432,000	EXCAVATION UNIT COST DEVELOPMENT
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-PIACE VOLUME1	1200	CY				$61.00	$73,20(	$19.00	$22,80(			$96,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	13,500	CY				$4.65	$62,771	$1.35	$18.22(			$81,000	15% OF EXCAVATION COST • M022-250-9024 • 25% SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	1500	CY				$9.15	$13,72(	$2.85	$4,27(			$18,000	15% OF EXCAVATION COST • M022-250.9024 • 26% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	15,000	CY	613.75	$206,251	.17	$38.27	$95,67(	$1.97	$29,581			$331,505	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	15,000	C.Y.				$0.82	$12,30(	82.58	$38,70(			$51,000	M 22-266-1100, M=10.0%, L=10.0%, E=10.0% • 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	25.500	TON								865.00	$1,657,500	$1,657,500	QUOTE FROM RAILROAD
3.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	$36.000	$36,000	3 EVENTS @ 4 SAMPLES / EVENT
3.	DISPOSAL AT ENVIROCARE	15,000	CY								$650.00	$9,750,000	$9,750,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20.000 CY
10.	PROPERTY RESTORATION (13.000 SF / PROPERTY)	162.500	SF								$5.00	$812.500	$812,500	REPLACE ALL DISTURBED SURFACE AREAS & SLABS. WALLS, D TC
11.	VERIFICATION SAMPLING COSTS	200	EA								5350.00	$70.000	$70,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1	LPSM								$615,200.00	5615.200	$615,200	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	5	EA								$10,500.00	552.500	$52,500	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	15,000	CY	$5.00	$75,001		51.50	$22,50(	$0.50	$7.50(			$105,000	IMPORTED FILL DIRT AVAILABLE LOCALLY
A	**SUBTOTAL**				$281,250			$614,975		$218.280		$12,993,700	$14,108,205	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			$58,359			$127.807		$45.293		$2,696,193	$2,927,453	
C	**MOB / BOND / INSUR.**	(% of A)			$14,063			630.749		$10.914		$649,685	$705,410	
D	**CONTINGENCY**	(% of A)			$42,188			$92,246		$32,742		$1,949,055	$2,116,231	
E	TOTAL ESTIMATED CONSTRUCTION COST				$395.859			$865,577		$307,229		$18,288,633	$19,857,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE REISDENTIAL AREAS
FACILITY : SCENARIO NO. 1 - | 15,000 CY | 50 SITES |
FILE NAME: JMC.190/KM1H&S
MARK-UPS:

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER. DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE: 15
PROJECTDURATION (MO's.): 18 (150 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY:													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	$35.00	$5,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,100					$2,100	4 HOURSMJORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								5600.00	$18,000	$18,000	2 EXAMSMJORKER
4.	EMERGENCY EXAMS	4	EACH								$600.00	$2,400	$2,400	
5.	NON-DISWSABLE PROTECTIVE EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
6.	DECONTAMINATION STATION	2	EACH								$3,500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	50	DAYS			14.00	$35.00	$42,000					$42,000	**1-DAY/SITE**
8.	SAFETY & COMMUNICATION EQUIPMENT	**1**	**LPSM**								**$5,000.00**	**$5,000**	**$5,000**	
	CONTINUED HEALTH & SAFETY:													
1.	**HEALTH & SAFETY PERSONNEL**	64	MONS				$3,000.00	$162,000					$162,000	3 H&S PEOPLE
2.	HANDWASH. LUNCH, CHANGE ACCOMMODATIONS	18	MONS								$300.00	$5,400	$5,400	
3.	HEAT/COLD STRESS MONITORING	180	DAYS				$100.00	$18.000					$18,000	
4.	SAFETY INSPECTIONS	180	DAYS				$50.00	$9,000					$9,000	
5.	MISC. EQUIPMENT RENTAL	18	MONS						$2.000	$36,000			$36,000	
6.	MISC. CONTRACTUAL DUTIES	18	MONS			10.00	*$35.00*	$25,200					$25,200	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	6500	MDAY								525.00	$162,500	$162,500	$25/PERSON/DAY x CREW SIZE: DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	1000	MDAY								5110.00	$110,000	$110,000	$110/PERSON/DAY x CREW SIZE @ 1 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$263,900		$36,000		$315,300	$615,200	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 1 -

FILE NAME JMC.190/KM1A

ADDITIONAL MAJORCOST ITEMS

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	TEMPORARY RELOCATIONS	5	EA								$10,500.00	$52,500	$52,500	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	5	EA											
	- DEMOLISH EXISTING SYSTEM	5	EA			8.00	$250.00	$10,000					$10,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	- INSTALL NEW UNIT	5	EA	$3,400.00	$17,000		$2,800.00	$14,000					$31,000	M 155-115-2180 - LABOR x 2
	- INSTALL NEW DUCT WORK	6	EA	$1,000.00	$5,000		$1,000.00	$5,000					$10,000	ALLOWANCE
3.	BASEMENT REMOVE REPLACE	5	E 4											
	- DEMOLISH BASEMENT FLOOR	5	EA			16.00	$250.00	$20,000					$20,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	- REPLACE FLOOR (40'x 40' x6")	140	CY								$200.00	$29,630	$29,630	HIGHER UNIT COST DUE TO RESTRICTED AREA
	- MISC. BASEMENT IMPROVEMENTS	5	EA								$2,000.00	$10,000	$10,000	ALLOWANCE
4.	MOVE HOUSE - [INCLUDES NEW BASEMENT, PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION - average 1600 sf ground area of house)	5	E A								$64,350.00	$321,750	$321,750	M 021-204-0300 x 2
5.	GARAGE REMOVE REPLACE	6	EA											
	- DEMOLISH EXISTING GARAGE	5	EA			16.00	$250.00	920.000)					$20,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	. CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	2420	SF								$15.00	$36,300	$36,300	M 131-204-0400& 0460
6.	RADON REDUCTION SYSTEM	5	EA								$3,000.00	$15,000	$15,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	1600	CY				$49.50	074.250)					$74,250	M 022-250-0500
8.	SHORING (900 SFISITE)	4500	SF								915.00	$67,500	$67,500	
A	SUBTOTAL				$22,000			$143,250				$532,680	$697,930	
B	**OVERHEAD & PROFIT**	(A*ohd) + ((A + ohd) *p)			$4,565			$29,724				$110,531	$144,820	
C	**MOB / BOND / INSUR.**	(% of A)			$1,100			$7,163				$26,634	$34,896	
D	**CONTINGENCY**	(% of A)			$3,300			$21,488				$79,902	$104,689	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$30,965			$201,624				$749,747	$982,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY : SCENARIO NO. 1 - CONTINGENT ACTION COST ITEMS

FILE NAME : JMC.190/KM1CA

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	15000	C.Y.				$1.81	$27,150	$5.67	$85,050			$112,200	M 22-266-1130, M=10.0%, L=10.0%, E=10.0% (COSTS INCREMENTAL ABOVE BASE CO ASSUMPTION)
A	SUBTOTAL							$27,150		$85,050			$112,200	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$5,634		$17,648			$23,282	
C	MOB / BOND / INSUR.	(% of A)						$1,358		$4,253			$5,610	
D	CONTINGENCY	(% of A)						$4,073		$12,758			$16,830	
E	TOTAL ESTIMATED CONSTRUCTION COST							$38,214		$119,708			$158,000	
2.	INTERIM STORAGE AT REF													
	- UNLOAD BAGS TO STOCKPILE	7500	C.Y.				$0.17	$1,275	$1.97	$14,775			$16,050	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	- LOAD BAGS ONTO FLATBED TRUCK	7500	C.Y.				$0.17	$1,275	$1.97	$14,775			$16,050	
	- STATE TAX	7500	C.Y.								$54.00	$405.000	$405,000	TAX = $2.00/C.F.
A	SUBTOTAL							$2,550		$29,550		$405,000	$437,100	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$529		$6,132			$6,661	
C	MOB / BOND / INSUR.	(% of A)						$128		$1,478			$1,605	
D	CONTINGENCY	(% of A)						$383		$4,433		$60,750	$65,565	
E	TOTAL ESTIMATED CONSTRUCTION COST							$3,589		$41,592		$465,750	$511,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 2 - 30,000 CY. 100 SITES

FILE NAME JMC.190/KM2

HARK-UPS:

ESTIMATOR: CULPEPPEWGNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS:													
1.	**EXCAVATION IN OPEN AREAS (90%** OF IN-PIACE VOLUME)	21600 CY					$31.00	$669,600	$9.00	$194,400			$864,000	AVATION UNIT COST
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-PIACE VOLUME)	2400 CY					$61.00	$146,400	$19.00	$45,600			$192,000	DEVELOPMENT EXCAVATION UNIT COST
3.	LOAD INTO HOPPERS FROM OPEN AREAS	27,000 CY					$4.65	$125,550	$1.35	$36,450			$162,000	15% OF EXCAVATION COST • M022-250-9024 • 25% SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	3000 CY					$9.15	$27,450	$2.85	$8,550			$36,000	15% OF EXCAVATION COST • M022-250-9024 • 26% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	30,000 CY		$13.75	$412,501	.17	$38.27	$191,351	$1.97	$59,160			$663,010	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	30,000 CY.					$0.82	$24,600	$2.58	$77,400			$102,000	M 22-266-1100, M=10.0%, L=10.0%, E=10.0% • 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	51.000 TON									$65.00	$3,315,000	$3,315,000	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12 EA									53.000.00	*536,000*	$36,000	3 EVENTS @ 4 SAMPLES / EVENT
9.	DISPOSAL AT ENVIROCARE TO 20,000 CY	20,000 CY									$650.00	$13,000,000	$13,000,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20,000 CY	10,000 CY									5275.00	$2,750,000	$2,750,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20,000 CY
10.	PROPERTY RESTORATION (13,000 SF / PROPERTY)	325.000 SF									$5.00	$1,625,000	$1,625,000	REPLACE ALL DISTURBED SURFA AREAS & SLABS, WALLS, DECKS, ETC.
11.	VERIFICATION SAMPLING COSTS	400 EA									$350.00	8140.000	$140,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1 LPSM									51,161,900	$1,161,900	$1,161,900	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	10 EA									$10,500.00	$105.000	$105,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	30.000 CY		55.00	$150,000		$1.50	$45,000	*50.50*	$15,000			$210,000	IMPORTED FILL DIRT AVAILABLE LOCALLY
4	SUBTOTAL				$562,500			$1,229,950		$436.560		$22,132,900	$24,361,910	
3	OVERHEAD& PROFIT	(A*ohd)+((A+ohd)*p)			$116,719			$255,215		$90,586		$4,592,577	$5,055,096	
C	MOB / BOND / INSUR.	(% of A)			$28,125			861,498		$21,828		$1,106,645	$1,218,096	
D	CONTINGENCY	(% of A)			$84,375			$184,493		$65,484		$3,319,935	$3,654,287	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$791,719			$1,731,155		$614,458		$31,152,057	$34,289,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY : SCENARIO NO. 2 • 30,000 CY 100 SITES

FILE NAME: JMC.190/KM2H&S

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS.

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE 15
PROJECT DURATION (MO's.) 34 (100 SITES @ 10 DAYS EACH]

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	$35.00	$5,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,100					$2,100	4 HOURS/WORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								5800.00	$18,000	$18,000	2 EXAMSWORKER
4.	EMERGENCY EXAMS	4	EACH								5600.00	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$10,000.00	$10,000	$10,000	
6.	DECONTAMINATION STATION	2	'EACH								$3,500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	100	DAYS			24.00	$35.00	$84,000					$84,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY													
1.	**HEALTH & SAFETY PERSONNEL**	102	MONS				$3,000.00	$306,000					$306,000	3 H&S PEOPLE
2.	HANDWASH. LUNCH, CHANGE ACCOMMODATIONS	34	MONS								$300.00	$10,200	$10,200	
3.	HEAT/COLD STRESS MONITORING	340	DAYS				$100.00	$34,000					$34,000	
4.	SAFETY INSPECTIONS	340	DAYS				$50.00	$17,000					$17,000	
5.	MISC. EQUIPMENT RENTAL	34	MONS						$2,000	$68,00			$68,000	
6.	MISC. CONTRACTUAL DUTIES	34	MONS			410.00	$35.00	$47,600					$47,600	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	13000	MDAY								$25.00	$325,000	$325,000	$25/PERSON/DAY x CREW SIZE DAYS HAZ WORK/SITE • OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	2000	MDAY								$110.00	$220,000	$220,000	$110/PERSON/DAY x CREW SIZE @ 1(DAYS HAZ WORK/SITE • OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$496,300		$68,000		$597,600	$1,161,900	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 2 - ADDITIONAL MAJOR COST ITEMS
FILE NAME JMC.190/KM2A

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	**TEMPORARY RELOCATIONS**	10	EA								$10,500.00	$105,000	$105,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2	REPLACE HOME MECHANICAL SYSTEMS	10	EA											
	- DEMOLISH EXISTING SYSTEM	10	EA			8.00	$250.00	~20,000					$20,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	- INSTALL NEW UNIT	10	EA	S3.400.00	$34,000		$2,800.00	$28,000					$62,000	M 155-115-2180 - LABOR x 2
	- INSTALL NEW DUCT WORK	10	EA	$1,000.00	$10,000		$1,000.00	$10,000					$20,000	ALLOWANCE
3.	BASEMENT REMOVE / REPLACE	10	EA											
	- DEMOLISH BASEMENT FLOOR	10	EA			16.00	$260.00	$40,000					$40,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	- REPLACE FLOOR (40'x 40' x6")	296	CY								$200.00	$59,259	$59,259	HIGHER UNIT COST DUE TO RESTRICTED AREA
	- MISC. BASEMENT IMPROVEMENTS	10	EA								$2,000.00	$20,000	$20,000	ALLOWANCE
4.	MOVEHOUSE - (INCLUDES NEW BASEMENT, PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION - average 1500 of ground area of house)	10	EA								$64,350.00	8643.600	$643,500	M 021-204-0300 x 2
5.	GARAGE REMOVE / REPLACE	10	EA											
	- DEMOLISH EXISTING GARAGE	10	EA			16.00	$250.00	540,000					$40,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	- CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	4840	SF								$15.00	$72,600	$72,600	M 131-204-0400 & 0460
6.	RADON REDUCTION SYSTEM	10	EA								$3,000.00	$30,000	$30,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	3000	CY				549.50	$148,500					$148,500	M 022-250-0500
8.	SHORING (900 SF/SITE)	9000	SF								$15.00	$135,000	$135,000	
A	SUBTOTAL				$44,000			$286,600				$1,065,359	$1,395,859	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			$9,130			$59,449				$221,062	$289,641	
C	MOB / BOND / INSUR.	(% of A)			$2,200			$14,396				$53,268	$69,793	
D	CONTINGENCY	(% of A)			$6,600			$42,976				$159,804	$209,379	
E	TOTAL ESTIMATED **CONSTRUCTION** COST				$61,930			$403,249				$1,499,493	$1,965,000	

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ESTIMATE SUMMARY

PROJECT : **KERR-McGEE** RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 2 - CONTINGENT ACTION COST ITEMS
FILE NAME **JMC.190/KM2CA**

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DANSLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS.

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS.	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	30000 C.Y.					51.81	554,300	36.67	$170.100			**$224,400**	M 22-266-1 130, **M = 10.0%, L = 10.0%, E = 10.0%** icosr **INCREMENTAL ABOVE BASE ASSUMPTION)**
A	SUBTOTAL							$54,300		8170,100			**$224,400**	
B	OVERHEAD & PROFIT	**(A*ohd)+((A+ohd)*p)**						$11,267		135,298			**$46,563**	
C	MOB BOND **INSUR.**	**(%** of A)						92,716		$8,605			**$11,220**	
D	CONTINGENCY	1% of A)						$8.146		825.616			**$33,660**	
E	**TOTAL ESTIMATED CONSTRUCTION COST**							**$76,427**		**$239,416**			**$316,000**	
2.	**INTERIM STORAGE AT REF**													
	• UNLOAD BAGS TO STOCKPILE	**15000 C.Y.**					**$0.17**	**$2,550**	**$1.97**	**$29,550**			**$32,100**	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	• LOAD BAGS ONTO FLATBED TRUCK	15000 C.Y.					$0.17	52.550	$1.97	$29.550			**$32,100**	
	• STATE TAX	15000 C.Y.									$54.00	$810,000	**$810,000**	**TAX = $2.00/C.F.**
A	SUBTOTAL							$6.1 00		$69,100		$810.000	**$874,200**	
B	**OVERHEAD & PROFIT**	**(A*ohd)+((A+ohd)*p)**						**$1,058**		$12.283			**$13,322**	
C	MOB BOND INSUR.	(% of A)						$255		$2.955			**$3,210**	
O	**CONTINGENCY**	(% of A)						$765		$8,865		1121,600	**$131,130**	
E	TOTAL ESTIMATED CONSTRUCTION COST							**$7,178**		**$83,183**		**$931,500**	**$1,022,000**	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS

FACILITY : SCENARIO NO. 3 - 60,000 CY. 200 SITES

FILE NAME: JMC.190/KM3

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER. DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL.	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS													
1.	**EXCAVATION IN OPEN AREAS (90% OF IN-PLACE VOLUME)**	43200	CY				531.00	$1,339,200	$9.00	$388,800			$1,728,000	EXCAVATIONUNIT COST DEVELOPMENT
2	EXCAVATION IN CONFINED AREAS (10% OF IN-PIACE VOLUME)	4800	CY				561.00	$292,800	$19.00	$91,200			$384,000	EXCAVATIONUNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	54.000	CY				$4.65	$251.100	$1.35	$72,900			$324,000	15% OF EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
4.	**LOAD** INTO HOPPERS FROM CONFINED AREAS	6000	CY				$9.15	$54.900	$2.85	$17,100			$72,000	15% **OF** EXCAVATION COST - M022-250-9024 - 25% SWELL FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD ON TRUCK	60,000	CY	$13.75	$825.000	.17	$38.27	$382.700	$1.97	$118,320			$1,326,020	ASSUME 10 MINUTES TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	60,000	C.Y.				$0.82	$49.200	$2.58	$154,800			$204,000	M 22-266-1100, M= 10.0%. L=10.0%, E = 10.0%- 4 MILE ROUND TRIP W/ 16.5 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	102,000	TON								$65.00	$6,630,000	$6,630,000	QUOTE FROM RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	$36,000	$36,000	3 EVENTS @ 4 SAMPLES / EVENT
9.	DISPOSAL AT ENVIROCARE TO 20,000 CY	20,000	CY								$650.00	$13,000,000	$13,000,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20.000 CY
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20,000 CY	40,000	CY								$275.00	$11,000,000	$11,000,000	ENVIROCARE QUOTE FOR MATERIAL LESS THAN 20.000 CY
10.	PROPERTY RESTORATION (13,000 SF / PROPERTY)	650.000	SF								$5.00	$3,250,000	$3,250,000	REPLACE ALL DISTURBED SURF. AREAS & SLABS, WALLS, DECKS, ETC.
11.	VERIFICATION SAMPLING COSTS	800	EA								$350.00	$280,000	$280,000	ASSUME 4 SAMPLES/SITE
12.	HEALTH & SAFETY COSTS	1	LPSM								$2,264,500	$2,264,500	$2,264,500	SEE H&S COST DEVELOPMENT SPREADSHEET
13.	TEMPORARY FAMILY RELOCATION (10% of PROPERTIES)	20	EA								$10,500.00	$210,000	$210,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	60,000	CY	$5.00	$300.000		$1.50	$90,000	$0.50	$30,000			$420,000	IMPORTED FILL DIRT AVAILABLE LOCALLY
A	SUBTOTAL				$1,125,000			$2,459,900		$873,120		$36,670,500	$41,128,520	
B	**OVERHEAD & PROFIT**	(A*ohd)+((A+ohd)*p)			$233,438			$510,429		$181,172		$7,609,129	$8,534,168	
C	**MOB / BOND / INSUR.**	(% of A)			$56,250			$122,995		$43,656		$1,833,525	$2,056,426	
D	**CONTINGENCY**	(% of A)			$168,750			$368,985		$130,968		$5,500,575	$6,169,278	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$1,583,438			$3,462,309		$1,228,916		$51,613,729	$57,888,000	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE REISDENTIAL AREAS

FACILITY : SCENARIO NO. 3 - | 60,000 CY | 200 SITES

FILE NAME JMC.190/KM3H&S

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL.	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE: 15
PROJECT DURATION (MO's.): 67 (200 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY:													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	$35.00	55,600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,100					$2,100	4 HOURS/WORKER
3.	PRE & POST PROJECT MEDICAL EXAMS	30	EACH								$600.00	$18,000	$18,000	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4	EACH								$600.00,	$2,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$16,000.00	$15,000	$15,000	
6.	DECONTAMINATIONSTATION	2	EACH								$3,500.00	$7,000	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	200	DAYS			24.00	$35.00	$168,000					$168,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								$5,000.00	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY:													
1.	**HEALTH & SAFETY PERSONNEL**	201	MONS				$3,000.00	$603,000					$603,000	3 H&S PEOPLE
2.	HANDWASH, LUNCH, CHANGE ACCOMMODATIONS	67	MONS								$300.00	$20,100	$20,100	
3.	HEAT/COLD STRESS MONITORING	670	DAYS				$100.00	$67,000					$67,000	
4.	SAFETY INSPECTIONS	670	DAYS				$50.00	$33,500					$33,500	
5.	MISC. EQUIPMENT RENTAL	67	MONS						52,000	$134,000			$134,000	
6.	MISC. CONTRACTUAL DUTIES	67	MONS			40.00	$35.00	$93,800					$93,800	LOGS, REPORTS, MEETINGS, ETC.
7.	LEVEL "D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	26000	MDAY								$25.00	$650,000	$650,000	$25/PERSON/DAY x CREW SI) DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	4000	MDAY								$110.00	$440,000	$440,000	$110/PERSON/DAY x CREW SIZE @ 10 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$973,000		$134,000		$1,157,500	$2,264,500	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 3 -
FILE NAME JMC.190/KM3A

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DAN **SLOAN/ORO**
PROJ.NO.: SAE65658.FS.10

ADDITIONAL MAJOR COST ITEMS

MARK-UPS

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS		LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
1.	TEMPORARY RELOCATIONS	20	EA								#########	$210.000	$210,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
2.	REPLACE HOME MECHANICAL SYSTEMS	20	EA											
	• DEMOLISH EXISTING SYSTEM	20	EA			8.00	5250.00	540,000					$40,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	• INSTALL NEW UNIT	20	EA	$3,400.00	$68,000		########	$66,000					$124,000	M 155-116-2180 - LABOR x 2
	• INSTALL NEW DUCT WORK	20	EA	$1,000.00	$20.000		########	$20,000					$40,000	ALLOWANCE
3.	BASEMENT REMOVE / REPLACE	20	EA											
	• DEMOLISH EASEMENT FLOOR	20	EA			16.00	$250.00	~80,000					$80,000	2-DAYS DEMOLITION CREW O $250/CREW-HOUR
	• REPLACE FLOOR (40'x 40' x6")	693	CY								$200.00	$118,519	$118,519	HIGHER UNIT COST DUE TO RESTRICTED AREA
	• MISC. BASEMENT IMPROVEMENTS	20	EA								$2,000.00	$40,000	$40,000	ALLOWANCE
4.	MOVE HOUSE - (INCLUDES NEW BASEMENT, FATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION - average 1600 sif ground area of house)	20	EA								#########	$1,287,000	$1,287,000	M 021-204-0300 x 2
5.	GARAGE REMOVE / REPLACE	20	EA											
	• DEMOLISH EXISTING GARAGE	20	EA			16.00	5250.00	980,000					$80,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	9680	SF								$15.00	5146,200	$145,200	M 131-204-0400 & 0450
6.	RADON REDUCTION SYSTEM	20	EA								$3,000.00	$60,000	$60,000	ASSUME POSITIVE PRESSURE SYSTEM
7.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	6000	CY				549.50	$297,000					$297,000	M 022-250-0500
8.	SHORING (900 SF/SITE)	18000	SF								$15.00	$270,000	$270,000	
A	SUBTOTAL				$88,000			$573,000				$2,130,719	$2,791,719	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			018,260			8118,888				$442,124	$579,282	
C	MOB / BOND / INSUR.	(% of A)			84.400			$28,650				$106,536	$139,586	
D	CONTINGENCY	(% of A)			$13,200			$85,950				$319,608	$418,758	
E	TOTAL ESTIMATED CONSTRUCTION COST				$123,860			$806,498				$2,998,986	$3,929,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 3 -
FILE NAME **JMC.190/KM3CA**

ESTIMATOR: **CULPEPPER/GNV**
PROJ. MANAGER DAN **SLOAN/ORO**
PROJ.NO.: SAE65658.FS.10

CONTINGENT ACTION COST ITEMS:

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	60000	C.Y.				$1.81	$108,600	$5.67	$340,200			$448,800	M 22-266-1130, M=10.0%, L=10.0%, E=10.0% ICOSTS. INCREMENTAL ABOVE BASE CO ASSUMPTION)
A	SUBTOTAL							$108,600		$340,200			$448,800	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$22,535		$70,591			$93,126	
C	MOB / BOND / INSUR.	(% of A)						$5,430		$17,010			$22,440	
D	CONTINGENCY	(% of A)						$16,290		$51,030			$67,320	
E	TOTAL ESTIMATED CONSTRUCTION COST							$152,855		$478,832			$632,000	
2.	INTERIM STORAGE AT REF													
	- UNLOAD BAGS TO STOCKPILE	30000	C.Y.				$0.17	$5,100	$1.97	$59,100			$64,200	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	- LOAD BAGS ONTO FLATBED TRUCK	30000	C.Y.				$0.17	$5,100	$1.97	$59,100			$64,200	
	- STATE TAX	30000	C.Y.								854.00	$1,620,000	$1,620,000	TAX = $2.00/C.F.
A	SUBTOTAL							$10,200		$118,200		$1,620,000	$1,748,400	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$2,117		$24,527			$26,643	
C	MOB / BOND / INSUR.	(% of A)						$510		$5,910			$6,420	
D	CONTINGENCY	(% of A)						$1,530		$17,730		$243,000	$262,260	
E	TOTAL ESTIMATED CONSTRUCTION COST							$14,357		$166,367		$1,863,000	$2,044,000	

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ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 4 · 120,000 C.Y. | 400 SITES
FILE NAME: JMC.190/KM4

ESTIMATOR: CULPEPPER/GNV
PRW. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOB/BOND/INS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	EXCAVATION & DISPOSAL COSTS													
1.	**EXCAVATION IN OPEN AREAS (90% OF IN-PLACE VOLUME)**	86400	CY				$31.00	$2,678,400	$9.00	$777,600			$3,456,000	EXCAVATION [illegible] COST **DEVELOPMENT**
2.	EXCAVATION IN CONFINED AREAS (10% OF IN-PLACE VOLUME)	9600	CY				$61.00	$585,600	$19.00	$182,400			$768,000	EXCAVATION UNIT COST DEVELOPMENT
3.	LOAD INTO HOPPERS FROM OPEN AREAS	108.000	CY				$4.65	$502,200	$1.35	$145,800			$648,000	1 [illegible] EXCAVATIO COST - M022-260-9024- 5 SWELL FACTOR
4.	LOAD INTO HOPPERS FROM CONFINED AREAS	12000	CY				$9.15	$109,800	92.85	$34,200			$144,000	15% OF EXCAVATION COST - M022-2 [illegible] - 26% **SWELL** FACTOR
5.	CONTAIN WASTE IN POLYPROYPLENE BAGS & LOAD **ON** TRUCK	120,000	CY	$13.75	**$1,650,000**	.17	$38.27	$765,400	61.97	**$236,640**			$2,652,040	A [illegible] 10 MINU TO LOAD BAGS
6.	HAUL BAGS TO RAIL SITE	-120.000	C.Y.				$0.82	**$98,400**	$2.58	$309.600			$408,000	M 22-266-1 100, M= 10.0%. L= 10.0%. E = 10.0% - 4 MILE ROUND TRIP [illegible] 16.6 CY DUMP TRUCK
7.	RAIL TRANSPORTATION TO DISPOSAL SITE	204.000	TON								$85.00	**$13,260,000**	$13,260,000	O [illegible] RAILROAD
8.	WASTE CHARACTERIZATION SAMPLING	12	EA								$3,000.00	**$36,000**	$36,000	3 EVENTS @ 4 **SAMPI** [illegible] EVENT
9.	DISPOSAL AT ENVIROCARE TO 20.000 CY	20.000	CY								$850.00	**$13,000,000**	$13,000,000	E [illegible] QUOTE FOR MATERIAL LESS T [illegible]
9A.	DISPOSAL AT ENVIROCARE GREATER THAN 20,000 CY	100.000	CY								$275.00	**$27,500,000**	$27,500,000	E [illegible] TE FOR MATERIAL LESS T [illegible] CY
10.	PROPERTY RESTORATION (13.000 SF / PROPERTY)	1,300,000	SF								$5.00	**$6,500,000**	$6,500,000	REPLACE ALL [illegible] SLABS, [illegible]
11.	VERIFICATION SAMPLING COSTS	1.600	EA								$350.00	**$560,000**	$560,000	ASSUME [illegible]
12.	HEALTH & **SAFETY** COSTS	1	LPSM								$4,478,900	**$4,478,900**	$4,478,900	SEE [illegible] COST DEVELOPMENT
13.	TEMPORARY FAMILY RELOCATION (10% of **PROPERTIES**)	40	EA								$10,500.00	**$420,000**	$420,000	[illegible] $175/DAY **PER** DIEM PER 3-MEMBER FAMILY
14.	BACKFILL SITE W/ CLEAN FILL	120,000	CY	$5.00	$600,001		$1.50	$180.000	***$0.50***	**$60,000**			$840,000	[illegible] DIRT AVAILABLE **LOCALLY**
A	SUBTOTAL				92,250.000			$4,919,800		$1,746,240		**$65,754,900**	**$74,670,940**	
B	OVERHEAD & PROFIT	**(A*ohd) + ((A+ohd)*p)**			$468.876			$1,020,859		$362,345		**$13,644,142**	**$15,494,220**	
C	MOB BOND INSUR.	(% of A)			$112.500			$245.990		$87,312		**$3,287,745**	**$3,733,547**	
D	CONTINGENCY	(% of A)			$337.500			$737,970		6261.936		**$9,863,235**	**$11,200,641**	
E	TOTAL ESTIMATED CONSTRUCTION COST				**$3,166,875**			**$6,924,619**		**$2,457,833**		**$92,550,022**	**$105,099,000**	

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GENERAL HEALTH & SAFETY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 4 - 120,000 CY | 400 SITES
FILE NAME JMC.190/KM4H&S

ESTIMATOR **CULPEPPER/GNV**
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	20.00%	20.00%	20.00%	20.00%

FULLTIME WORKERS ONSITE 15
PROJECT DURATION (MO's.) 134 (400 SITES @ 10 DAYS EACH)

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	INITIAL HEALTH & SAFETY													
1.	**PREPARE HEALTH & SAFETY PLANS**	20	DAYS			8.00	$35.00	$5.600					$5,600	
2.	SITE-SPECIFIC TRAINING	60	MHRS				$35.00	$2,100					$2,100	4 HOURSNORKER
3.	PRE & WST PROJECT MEDICAL EXAMS	30	EACH								*$600.00*	$18,000	$18,000	2 EXAMS/WORKER
4.	EMERGENCY EXAMS	4	EACH								*$600.00*	92,400	$2,400	
5.	NON-DISPOSABLE PROTECTIVE EQUIPMENT	1	LPSM								$20.000.00	$20.000	$20,000	
6.	DECONTAMINATION STATION	2	EACH								$3,500.00	*$7.000*	$7,000	2-PORTABLES
7.	ESTABLISH SITE ZONES	400	DAYS			24.00	$35.00	8336,000					$336,000	1-DAY/SITE
8.	SAFETY & COMMUNICATION EQUIPMENT	1	LPSM								**$5,000.00**	$5,000	$5,000	
	CONTINUED HEALTH & SAFETY													
1.	**HEALTH & SAFETY PERSONNEL**	402	MONS				$3,000.00	$1,206,000					$1,206,000	3 H&S PEOPLE
2.	HANDWASH. LUNCH, CHANGE ACCOMMODATIONS	134	MONS								*$300.00*	$40.200	$40,200	
3.	HEAT/COLD STRESS MONITORING	1340	DAYS				5100.00	$134.000					$134,000	
4.	SAFETY INSPECTIONS	1340	DAYS				$50.00	**$67,000**					$67,000	
5.	MISC. EQUIPMENT RENTAL	134	MONS						82,000	$268,000			$268,000	
6.	MISC. CONTRACTUAL DUTIES	134	MONS			40.00	$35.00	$187,600					$187,600	LOGS, REPORTS, MEETINGS. ETC.
7.	LEVEL 'D" H&S CLOTHING & EQUIP. COSTS for 13 WORKERS	52000	MDAY								$26.00	$1,300,000	$1,300,000	$25/PERSON/DAY x CREW SIZE DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
8.	LEVEL "C" H&S CLOTHING & EQUIP. COSTS for 2 WORKERS	8000	MDAY								$110.00	*$880.000*	$880,000	$110/PERSON/DAY x CREW SIZE @ 10 DAYS HAZ WORK/SITE - OH MATERIALS PRICE SHEET
A	**SUBTOTAL**							$1,938,300		$268,000		$2,272,600	$4,478,900	

7/14/94 2:10 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : SCENARIO NO. 4 - ADDITIONAL MAJOR COST ITEMS
FILE NAME: JMC.190/KM4A

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER DAN SLOAN/ORO
PROJ.NO.: SAE85658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	15.00%
PROFIT =	5.00%	5.00%	5.00%	5.00%
MOBIBONDIINS. =	5.00%	5.00%	5.00%	5.00%
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

IO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	MH	RATE	AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ADDITIONAL MAJOR COST ITEMS													
.	**TEMPORARY RELOCATIONS**	40	EA								##I#I##I#	$420,000	$420,000	60-DAY AVE.@ $175/DAY PER DIEM PER 3-MEMBER FAMILY
.	REPLACE HOME MECHANICAL SYSTEMS	40	EA											
	• DEMOLISH EXISTING SYSTEM	40	EA			8.00	*$250.00*	$80,000					$80,000	1-DAY DEMOLITION CREW @ $250/CREW-HOUR
	.INSTALL NEW UNIT	40	EA	$3,400.00	$136,000		#######	$112,000					$248,000	M 155-115-2180 - LABOR x 2
	• INSTALL NEW DUCT WORK	40	EA	$1,000.00	$40,000		#######	$40,000					$80,000	ALLOWANCE
.	BASEMENT REMOVE REPLACE	40	EA											
	• DEMOLISH BASEMENT FLOOR	40	EA			16.00	*$250.00*	$160,000					$160,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• REPLACE FLOOR (40'x 40' x6")	1186	CY								*$200.00*	$237,037	$237,037	HIGHER UNIT COST DUE TO RESTRICTED AREA
	• MISC. BASEMENT IMPROVEMENTS	40	EA								*52,000.00*	$80,000	$80,000	ALLOWANCE
.	MOVEHOUSE • (INCLUDES NEW BASEMENT, PATCHING & HOOKUP. ASSUMES HOLDING HOUSE AT REMOTE SITE DURING REMEDIATION • average 1600 sf ground area of house)	40	EA								########	$2,574,000	$2,574,000	M 021-204-0300 x 2
.	GARAGE REMOVE/ REPLACE	40	EA											
	• DEMOLISH EXISTING GARAGE	40	EA			16.00	$250.00	$160,000					$160,000	2-DAYS DEMOLITION CREW @ $250/CREW-HOUR
	• CONCTRUCT NEW GARAGE (ASSUME 22'x 22')	19360	SF								$15.00	$290,400	$290,400	M 131-204-0400 & 0450
L	RADON REDUCTION SYSTEM	40	EA.								$3,000.00	$120,000	$120,000	ASSUME POSITIVE PRESSURE SYSTEM
.	ADDITIONAL COST OF HAND LABOR FOR EXCAVATION	12000	CY				$49.50	$594,000					$594,000	M 022-250-0500
L	SHORING (900 SF/SITE)	36000	SF								516.00	$540,000	$540,000	
A	SUBTOTAL				8176.000			$1,146,000				$4,261,437	$5,583,437	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)			636.520			6237.796				$884,248	$1,158,563	
C	MOB / BOND / INSUR.	(% of A)			*68.800*			667,390				$213,072	$279,172	
D	**CONTINGENCY**	(% of A)			826.400			$171,900				$639,216	$837,516	
E	TOTAL ESTIMATED CONSTRUCTION COST				$247,720			$1,612,995				$5,997,973	$7,859,000	

7/14/94 2:14 PM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE REISDENTIAL AREAS
FACILITY : SCENARIO NO. 4 - CONTINGENT ACTION COST ITEMS
FILE NAME JMC.190/KM4CA

ESTIMATOR: CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL	LABOR	EQUIP.	INSTL or S/C
OVERHEAD =	15.00%	15.00%	15.00%	
PROFIT =	5.00%	5.00%	5.00%	
MOB/BOND/INS. =	5.00%	5.00%	5.00%	
CONTINGENCY =	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	CONTINGENT ACTION COST ITEMS													
1.	HAUL TO RAIL SIDING AN ADDITIONAL 10 MILES FROM SITE	120000	C.Y.				$1.81	$217,200	$5.67	$680,400			$897,600	M 22-266-1130, M = 10.0%, L = 10.0%. E = 10.0% (COST INCREMENTAL ABOVE BASE ASSUMPTION)
A	SUBTOTAL							$217,200		$680,400			$897,600	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$45,069		$141,183			$186,252	
C	MOB / BOND / INSUR.	(% of A)						$10,860		$34,020			$44,880	
D	CONTINGENCY	(% of A)						$32,580		$102,060			$134,640	
E	TOTAL ESTIMATED CONSTRUCTION COST							$305,709		$957,663			$1,263,000	
2.	INTERIM STORAGE AT REF													
	- UNLOAD BAGS TO STOCKPILE	60000	C.Y.				$0.17	$10,200	$1.97	$118,200			$128,400	ASSUME ONE-HALF TOTAL VOLUME TO BE STOCKPILED
	- LOAD BAGS ONTO FLATBED TRUCK	60000	C.Y.				$0.17	$10,200	$1.97	$118,200			$128,400	
	- STATE TAX	60000	C.Y.								$54.00	$3,240,000	$3,240,000	TAX = $2.00/C.F.
A	SUBTOTAL							$20,400		$236,400		$3,240,000	$3,496,800	
B	OVERHEAD & PROFIT	(A*ohd)+((A+ohd)*p)						$4,233		$49,053			$53,286	
C	MOB / BOND / INSUR.	(% of A)						$1,020		$11,820			$12,840	
D	CONTINGENCY	(% of A)						$3,060		$35,460		$486,000	$524,520	
E	TOTAL ESTIMATED CONSTRUCTION COST							$28,713		$332,733		$3,726,000	$4,087,000	

7/8/94 9:20 AM

ESTIMATE SUMMARY

PROJECT : KERR-McGEE RESIDENTIAL AREAS
FACILITY : RESIDENTIAL FLOOD PROTECTION
FILE NAME **JMC.190/FLOOD**

ESTIMATOR CULPEPPER/GNV
PROJ. MANAGER: DAN SLOAN/ORO
PROJ.NO.: SAE65658.FS.10

MARK-UPS:

	MATL.	LABOR	EQUIP.	INSTL or S/C
OVERHEAD	15.00%	15.00%	15.00%	15.00%
PROFIT	5.00%	5.00%	5.00%	5.00%
BOND/INS.	2.00%	2.00%	2.00%	2.00%
CONTINGENCY	15.00%	15.00%	15.00%	15.00%

NO.	DESCRIPTION	QTY	UNIT	MATERIALS UNIT $	MATERIALS AMOUNT	LABOR MH	LABOR RATE	LABOR AMOUNT	CONST. EQUIP. UNIT $	CONST. EQUIP. AMOUNT	INSTL or S/C UNIT $	INSTL or S/C AMOUNT	TOTAL	RESOURCE
	ZONE 4 PROTECTION													
1.	**MOBILIZATION**	1	LS								*$20.000.00*	*$20,000*	$20.000	AVERAGE MOB. COST
2.	ACCESS ROAD ALONQ SHEET PILE LENGTH	3200	LF								$10.00	$32,000	$32.000	TEMPORARY GRAVEL ROAD
3.	STEEL SHEET PILINQ, 22PSF, NO WATER, FOR 16' EXCAV, PULL & SALVAQE	61,200	SF.	$2.08	$107.008		$2.80	$133,120	$3.12	$168,744			$399.872	M 21-614-1300, M = 10.0% L = 10.0%, E-10.0%
4.	**SITE** RESTORATION	3200	LF								916.00	$48.000	$48.000	ALLOWANCE
6.	12' DIAMETER CHECK VALVES @ 100' O.C.	32	EA								$3,000.00	$96,000	$96,000	PRATT VALVE & CH2M HILL
A	SUBTOTAL				$107,008			$133,120		$159,744		$196,000	$595,872	
B	OVERHEAD & PROFIT	(A*ohd) t ((A+ohd)*p)			$22,204			$27,822		$33,147		$40,670	$123,843	
C	MOB / BOND / INSUR.	(% of A)			$2,140			$2,882		$3,195		$3,920	$11,917	
D	CONTINGENCY	(% of A)			$18,061			$19,868		$23,962		$29,400	$89,381	
E	TOTAL ESTIMATED CONSTRUCTION C	IT			$147,404			$183.373		$220,047		$269,990	$821,000	
	ZONE 5 PROTECTION													
1.	**MOBILIZATION**	1	LS								$20,000.00	$20,000	$20.000	AVERAGE MOB. COST
2.	ACCESS ROAD ALONG SHEET PILE LENGTH	2000	LF								$10.00	$20,000	$20,000	TEMPORARY QRAVEL ROAD
3.	STEEL SHEET PILINQ, 22PSF, NO WATER, FOR 16' EXCAV, PULL & SALVAQE	34.000	SF.	$2.08	$71,060		$2.60	$88.400	$3.12	$106,080			$265,540	M 21-614-1300, M = 10.0%, L – 10.0%. E = 10.0%
	SITE RESTORATION	2000	LF								$16.00	$30,000	$30,000	ALLOWANCE
	12' DIAMETER CHECK VALVES @ 100' O.C.	20	EA								$3,000.00	$80.000	$60,000	PRATT VALVE & CH2M HILL
A	SUBTOTAL				$71.080			$88.400		$106,080		$130,000	$395,540	
B	OVERHEAD a PROFIT	(A*ohd) t ((A+ohd)*p)			$14.746			$18,343		$22.012		$26,975	$82,076	
C	MOB IBOND / INSUR.	(% of A)			$1.421			$1,768		$2,122		$2,600	$7,911	
D	CONTINGENCY	(% of A)			$10,659			$13,260		$15,912		$19,500	$59,331	
E	**TOTAL ESTIMATED CONSTRUCTION COST**				$97,885			$121,771		$146,126		$179,075	$545,000	

ATTACHMENT 9

WRITTEN RESPONSE TO SIGNIFICANT PUBLIC COMMENTS ON THE AUGUST 1994 ENGINEERING EVALUATION/COST ANALYSIS-- KERR-McGEE RESIDENTIAL AREAS SITE AND PORTIONS OF THE KRESS CREEK SITE IN AND NEAR WEST CHICAGO, ILLINOIS

November 1994

PURPOSE

This written response to significant public comments ("Responsiveness Summary") for the Engineering Evaluation/Cost Analysis (EE/CA) for the Kerr-McGee Residential Areas Site and Portions of the Kress Creek Site serves two vital functions: 1) it documents how significant comments have been considered during EPA's decision-making process for selecting a removal action at the Site and provides written responses to all significant comments on the proposed removal action; and 2) it provides EPA with information about the views of the public, government agencies, and potentially responsible parties (PRPs) regarding the proposed removal action and other alternatives that EPA considered in the EE/CA.

Comments received during the public comment period identified issues and concerns of the public, including the local community, the Illinois Department of Public Health (IDPH), the City of West Chicago, and Kerr-McGee Chemical Corporation (a PRP). Community comments are included in Section I below, IDPH comments are addressed in Section II, and City of West Chicago and Kerr-McGee comments are discussed in Sections III and IV, respectively. This document summarizes the public comments and provides general responses to them. Each individual comment is not specifically listed, but similar comments are grouped together and paraphrased. Lengthy comments also are not listed in their entirety, but are shortened and paraphrased to reflect the main intent of the comment. The complete text of comments received by EPA is contained in the administrative record for the Action Memorandum (or "Action Memo") to which this Responsiveness Summary is attached.

I. SUMMARY OF COMMENTS FROM THE LOCAL COMMUNITY

Comment: As residents on property that is on Kress Creek, it is our opinion that Alternative 2 - Source Removal be the route that the EPA take, except for Contingent Action C (recontamination prevention by installing steel sheet piling) which we would be completely adverse to. We would try to prevent the steel pilings from being installed. Our home is very near the Kress Creek bank. It is of utmost importance that as much of the contaminated soil be removed as early as possible. This will both protect us from further exposure to the radioactive material healthwise and help alleviate the financial strain of having the Thorium on our property. If the EPA chooses Contingent Action

C, and builds the steel barrier, that would cause an immense strain on the value of our property and our ability to enjoy that property. We believe the EPA will follow the action that is best suited for the people along the Kress Creek considering both health and ability to use the property in a way that will not cause financial or emotional strain.

Response: As described in the Action Memo, EPA has selected the source removal alternative (designated as Alternative 2 in the EE/CA) as the removal action that will be taken, and has NOT selected the recontamination prevention measures -- namely, steel sheet pilings -- that were evaluated in the EE/CA (Contingent Action C). As described in the Action Memo, however, EPA continues to evaluate other recontamination prevention measures (such as silt fences) against the criteria of effectiveness, implementability and cost, to determine if they are appropriate for this Site.

Comment: I support the plan proposed in the EE/CA. The plan satisfactorily addresses the concerns I have expressed over the years: (1) Begin the removal earlier than later. It is good that the plan calls for removal to begin before all contaminated locations have been identified. It is also good that contingencies for interim storage and an alternate staging area have been planned so that removal can proceed as quickly as all of the agreements have been approved. (2) Begin the removal from the residences along Kress Creek before a plan for the creek itself is in place. Owners need to have the freedom to use their property without fear to their health or economic well being. In addition, I support the plan for recontamination prevention: do nothing. The assumptions that there will not be significant flooding or that such flooding would significantly recontaminate the properties are consistent with my experience of living along the creek for 26 years and consistent with my understanding of how the thorium contamination would move. Trying to contain the creek in the Kress Creek site would only create larger problems downstream -- the water and perhaps contamination is going to go somewhere. Why send it further downstream?

Response: EPA appreciates the concern and support of the proposed removal action as expressed.

Comment: The EE/CA estimates the volume of contaminated soil from private properties at an average of 300 cubic yards per property. This estimate seems to be too excessive by a factor of 10. You would have to dig out the whole property eight foot deep to justify 300 cubic yards. What is the basis of that volume estimate? I know that some of the properties cleaned up in the mid-1980s didn't have anything close to that amount of material removed.

Response: The estimate of 300 cubic yards of material per property is based on the information from the Kerr-McGee residential cleanup effort in the mid-1980s. During that cleanup, Kerr-McGee removed 34,868 cubic yards of material from 116 properties, which averages out to about 300 cubic yards per property. This is not to say that each property had 300 cubic yards removed. Some properties probably had much less while others had much more.

Independent of the actual data from the previous cleanup effort, the following estimation method also results in the same volume estimate: Assume that the average property size is 13,000 square feet; assume that the average extent of contamination on each property is 25 percent of the surface area; assume that the average depth of contamination is 2 feet; and assume that the soil swells by a factor of 1.25 when excavated due to loss of compaction. 13,000 ft^2/property x 0.25 x 2 ft depth x 1.25 x 1 $yd^3/27\ ft^3$ = 301 yd^3 per property. Digging out a property to only 2 feet deep (not 8 feet) over only 25 percent of the property results in about 300 cubic yards.

Comment: Radon gas comes from the soil as a product of millions of tons of naturally-occurring radioactive ore. It is possible that the radon produced by these ores will seep into homes. To speak of thoron coming from the few tons of surface deposited spills of thorium by the Rare Earths Facility is scientifically unsupportable. All the printed material EPA handed out speaking about thoron is a total discredit. I am amazed how much it is stressed as if it was the major problem. The thoron gas cannot be a problem. I'm not saying that nothing is a problem -- if you eat thorium it is a serious problem to your health -- and I think the thorium should be removed. But don't confuse it with the thoron gas.

Response: Scientific literature and actual data indicate that thoron gas can be produced by the thorium mill tailings and seep into homes if there are significant deposits of mill tailings beneath or against the foundation of the home. During the Kerr-McGee cleanup effort in the mid-1980s, Kerr-McGee found at least one home that had significantly elevated levels of thoron due to mill tailings deposits beneath the home. Exposure to thoron is not expected to be the major problem at contaminated properties, however EPA believes that it is one possible route of exposure that must be considered.

Comment: In the 1980s, soil measurements and the removal of radioactive soil was performed, and properties declared clean knew where they stood. Now letters are being sent to people in areas indicated by fly-by airplane indications, producing fear and uncertainty about what will happen next. Why? The earlier measurements and removal of materials seems like a much more reliable technique than flying with an airplane and making some haphazard

judgment. I have more confidence in such, and would like to know the results of that measurement which was done in the 1980s.

Response: Access letters have been sent to approximately 1500 property owners located within EPA's study area for the Residential Areas Site. The study area is based on the results of a 1989 aerial radiological flyover conducted for the IDNS which shows, from the air, areas of elevated gamma radiation. The aerial flyover is being used only as an indication of where we should be looking for contamination, to define the boundaries of the study area. The only way to know which properties in the study area are contaminated is to test each one. EPA is in the process of testing each property by ground-level surveys, similar to what was done in the mid-1980s by Kerr-McGee, except EPA is using more stringent criteria to determine which properties get cleaned up. As a result, EPA may determine that some properties that were surveyed by Kerr-McGee in the mid-1980s and found not to need cleanup may now need some cleanup. EPA expects that the majority of properties in the study area will be found to be uncontaminated, but the only way to know for sure is to test each one.

Comment: Why is EPA looking at an alternative storage area? Most citizens had assumed that any storage from the community itself would be stored on the Kerr-McGee site. The Kerr-McGee site, which is already contaminated, is the most logical place to take the material.

Response: In the EE/CA EPA did not consider any other storage area besides the Kerr-McGee Rare Earths Facility. However, EPA developed another alternative in the EE/CA called "Off-Rare-Earths-Facility Staging Area" (Contingent Action B) in response to requests from the community that EPA have an alternative way, a "Plan B," to get the materials to the permanent disposal site, in case the Rare Earths Facility was not available. EPA listened to the community's concerns, and thus developed this option.

EPA agrees that the most logical place to take the materials is the Kerr-McGee facility. However, if Kerr-McGee for some reason does not conduct the cleanup of the residential areas and EPA conducts the cleanups, EPA may need another way to get the material to the permanent disposal facility. The "Off-Rare-Earths-Facility Staging Area" would NOT be a storage area, but rather would probably be an existing railyard where EPA could take properly packaged wastes for loading onto trains. EPA is not considering constructing a new waste storage area, nor is EPA currently considering constructing a new railspur.

Comment: If EPA decides to have off-site storage, can that be done as a unilateral decision by EPA on any piece of property in the community?

Response: As explained in the previous response, in the EE/CA EPA did not consider using any piece of property in the community to store excavated materials from contaminated residential properties. EPA is not considering storing material at any location besides the Kerr-McGee Facility. As discussed in the response to the previous comment, the "Off-Rare-Earths-Facility Staging Area" refers to an existing railyard where EPA could take properly packaged wastes to have them loaded onto trains. The extent to which EPA can unilaterally decide to use any property for a given use depends upon many, varied factors. As a general matter, EPA tries to obtain the voluntary permission of a property owner before using his/her property for activities related to a cleanup.

Comment: Will we still have thorium in our yards after the cleanup?

Response: There may be some small residual levels of thorium left after cleanup, but the cleanup criteria EPA has established for this Site in the November 1993 Action Criteria Document (Appendix A of the EE/CA) are very stringent. The cleanup criteria are protective of human health and the environment and set the maximum level of thorium that can remain after cleanup. In addition to the cleanup criteria numbers, EPA will be using the principle of cleaning to levels "As Low As Reasonably Achievable," such that cleanup will continue to levels even lower than the cleanup criteria when practicable.

Comment: The EE/CA document is kind of vague. Please explain this statement: "Under certain circumstances an alternative may be selected that does not meet all the regulatory requirements. However it must be protective of public health." (EE/CA, page 3-2.)

Response: The extent to which removal actions must comply with applicable or relevant and appropriate requirements (ARARs) under federal environmental or state environmental or facility siting laws is discussed in Section 3.4 of the EE/CA. Generally, the laws that govern the Superfund program state that removal actions are required to comply with all regulatory requirements to the extent practicable considering the exigencies of the situation, but that the action should be protective of human health and the environment. In order to be protective of human health, and to minimize the chance that further action would be needed in the future, any removal action at this Site must comply with the cleanup criteria in the Action Criteria Document, which are derived from federal and state environmental laws. As explained in Section 5.1.3 of the EE/CA, the recommended alternative is expected to comply with all ARARs.

Comment: Page ES-2 of the EE/CA says, "Radium specific activity in soil -- Dry soil concentrations of total radium must not exceed 5 picoCuries per gram above background levels averaged over areas of 100 meters square in any 15 centimeter depth." Can the average of 5 picoCuries over 100 square meters allow hot spots? If so, why?

Response: The federal and state regulations upon which the cleanup criteria for this Site were based specifically allow averaging the soil concentration over 100 square meters. Technically, this could allow small "hot spots" to exist. However, EPA has not included the averaging language in the discovery and characterization criteria, which are the criteria that EPA will use to identify contaminated areas for cleanup. EPA specifically excluded such averaging language from the discovery and characterization criteria in order to identify and cleanup such "hotspots." For the verification phase, which confirms that the cleanup (including cleanup of "hotspots") has been done properly, averaging over 100 square meters is allowed but not required. Even if averaging is used during the verification stage, EPA does not expect "hotspots" at levels of concern to remain at the Site after cleanup.

Comment: If Kerr-McGee agrees to do the off-site remediation, does Kerr-McGee need a permit to bring off-site material onto the Rare Earths Facility?

Response: Yes. Kerr-McGee needs a license amendment from IDNS and, possibly, the approval of other authorities to bring material to or store material on the Rare Earths Facility. Kerr-McGee already has applied for and obtained a license amendment from IDNS allowing Kerr-McGee to bring up to 15,000 cubic yards of material from the Residential Areas Site onto the Rare Earths Facility.

Comment: If Kerr-McGee obtains a license amendment to bring off-site material onto the Rare Earths Facility, then can material be brought onto the facility whether the cleanup is done by Kerr-McGee or EPA?

Response: The license amendment Kerr-McGee has obtained from IDNS allows only Kerr-McGee to bring material onto the facility. If EPA conducts the cleanup, EPA could not automatically use the Kerr-McGee facility. If EPA wanted to use the Kerr-McGee facility, EPA would need a separate approval from IDNS and any other applicable authority.

Comment: You already know of about 50 contaminated properties. Why can't EPA begin the remediation of those properties while it's identifying other properties?

Response: That is exactly the approach that EPA is taking. The cleanup of contaminated properties that already have been identified will begin before EPA has finished surveying all 1500 properties in the Site study area.

Comment: Page 4-3 of the EE/CA states, "There is no reason to believe that thoron reduction technologies will be substantially different from those of radon." I would like to see some data on that to prove it.

Response: There is not as much information available on thoron as there is on radon, because thoron has not been studied as much as radon. This is because naturally-occurring radon is a problem common to many homes across the country. Radon reduction technologies have been developed and are widely available because there is a large market for such technologies. Thoron, on the other hand, is not a common problem around the country. The reduction technologies discussed in the EE/CA have one of two purposes: they either (1) remove or dilute the gas from the air after the gas has entered the structure (e.g., ventilation in a crawlspace), or (2) prevent the gas from entering the structure (e.g., sealing interior/exterior cracks in foundation, or using soil gas ventilation outside the structure to divert the gas from entering the structure). Because of the nature of the radon reduction technologies and the physical similarities between radon and thoron, EPA believes, as stated in the EE/CA, that "there is no reason to believe that thoron reduction technologies will be substantially different from those of radon."

Comment: Page 6-4 of the EE/CA states, "Special situations which are not yet identified may arise during the course of the removal actions that are unusually difficult and cost prohibitive to reach the cleanup criteria." When these situations arise will there be public comment on it?

Response: Since the special situations referred to in the EE/CA are those which may arise at an individual property, not the Site as a whole, EPA does not believe that public comment would be appropriate. Such situations will be dealt with in the field as they are encountered, and EPA will make decisions on these situations in consultation with IDNS and, when appropriate, with the affected property owner. As explained in the EE/CA, the decision will be justified and documented, and the alternative action selected will provide adequate protection to human health and the environment.

Comment: I challenge EPA to come out with a first date of remediation of properties within the next thirty days. There is no reason at all that the EPA could not begin the remediation of properties simultaneously with the remediation of the factory site.

Response: Cleanups will begin in the Spring of 1995, and will continue concurrent with the remediation of the Kerr-McGee Rare Earths Facility.

Comment: If you were to use a spell-check with a computer on the EE/CA document, the most-used word would be "generally." There is nothing general about what is going on here. The EE/CA states, "In the previous removal, contaminated soil generally was limited to the top two feet of soil and often to the top one foot of soil." I would like to know then why so many properties were dug so deep to get this stuff out.

Response: The statement that the contamination "generally" was limited to the top two feet of soil in the previous removal is based on what was found, on the average, during the previous cleanup effort. This does not mean that no contamination was found deeper than two feet. In fact, there were several properties where the excavation was much deeper than two feet. Contamination may be found deeper than two feet in the upcoming cleanup effort. The main reason this statement is in the EE/CA is to serve as a basis for an estimate of the volume of material that might be encountered. It does not limit the depth of our excavations once the cleanup begins.

Comment: Page 6-7 of the EE/CA states, "Measures taken to protect the worker will also protect the general public during the removal action." I would like to ask either the EPA or Kerr-McGee where we can get our white suits.

Response: The referenced statement on page 6-7 of the EE/CA was not referring to protective clothing. Rather, as described in the sentence following that statement in the EE/CA, "These measures include standard posting protocol, dust suppression, and health physics coverage." EPA realizes that the general public will not be wearing "white suits." However, dust suppression techniques and the other measures mentioned will protect both workers and the general public.

Comment: I own some properties in the West Chicago area. If I want to sell them, would I be able to sell them now or not? I received a letter from EPA requesting access to my property. What does it mean?

Response: If a property owner received a letter from EPA requesting access to her or his property, it does NOT mean that the property is contaminated. It only means that the property is located in EPA's study area for the Site, along with approximately 1500 other properties, the majority of which probably are uncontaminated, and that EPA will be testing the property. If the EPA study indicates that the property is not contaminated at levels of concern, the owner may receive an EPA letter to that effect. If the property is contaminated at levels of concern, it will be cleaned to the levels indicated in the Action

Criteria Document and the owner may receive a letter from EPA confirming that fact. Some lending institutions may require that property be tested prior to their decision on whether to underwrite a loan, but this is not an EPA requirement.

Comment: The properties that I own are rental properties. What are my alternatives if my tenants decide to move out while you're testing and digging the property? Once you start digging on a property, how long will it take? How long will the property be affected?

Response: The testing of a property takes only several hours over the course of a few days, during which time different EPA workers will make measurements and take samples from the property. If EPA determines, based on the test results, that the property needs to be cleaned up, the time needed to do the cleanup at that property could be anywhere from a few days to a few weeks, depending on the amount of contamination. A small hotspot, for instance, would only take a day or two to clean up and restore, but a much larger excavation would take longer. Cleanups will begin in the Spring of 1995 on the most highly contaminated properties, and will continue throughout 1995 and possibly into 1996, depending on the number of contaminated properties that are found. The exact schedule for when specific properties will be cleaned up has not been set yet. EPA can assist property owners and tenants by providing information to them regarding the cleanup. The cleanup will be done in such a way as to be protective of all affected residents.

Comment: Is EPA headquarters or Department of Justice review and approval of the EE/CA document required before EPA can make a final cleanup decision?

Response: No. Neither EPA headquarters nor the Department of Justice is reviewing and/or approving the EE/CA document. The Action Memo is EPA's final removal action decision and does not require EPA headquarters or Department of Justice Review, either.

Comment: Kerr-McGee intends to be done with the factory site cleanup in three years. It is very conceivable that they're going to be cleaned up, their facility is going to be packed up, and they're going to be out of here before you ever get to square one with removal of these residential properties. And then your cost estimates show that in the event you have to build a whole new facility and go through all of this permitting and all of this time to duplicate what Kerr-McGee just spent all this time doing, it's only going to cost you 1% more? How did you arrive at these figures?

Response: The cleanup of the Residential Areas Site will begin in the Spring of 1995. How long the cleanup will take depends on the number of properties

that are found to be contaminated, but it is highly likely that the cleanup of the Residential Areas Site will be completed before the cleanup of the Kerr-McGee Rare Earths Facility is completed. The cost estimates in the EE/CA do not include the costs of building a whole new facility, because EPA would not build a whole new facility. The 1% figure is the additional cost, over and above source removal, of EPA having to haul the properly containerized material to an already existing railyard where the containers would be placed on trains for transport to the permanent disposal facility. This alternative, known as "Contingent Action B -- Off-Rare-Earths-Facility Staging Area," might be necessary in the event that Kerr-McGee does not conduct the cleanup and the cleanup is conducted instead by EPA. The alternative consists of simply using an already existing railyard, not constructing a new railspur and materials handling facilities (as Kerr-McGee is doing at its facility).

Comment: I would like to see a lot tighter breakdown on the cost estimates than just telling us that cleaning up fifty properties would cost $22 million.

Response: The cost breakdown information is contained in Section 5.3 of the EE/CA. Table 5-1 and Figure 5-1 (pages 5-14 and 5-15, respectively) in the EE/CA provide a breakdown of costs for each of the four different volume scenarios for the following categories: health & safety; transportation; excavation, backfill and restoration; disposal; miscellaneous; overhead and profit; mobilization, bonding and insurance; contingency; and indirect capital costs (i.e., engineering and design, legal and administrative, licensing and permitting). This information also is shown in Attachments 5 and 6 of the Action Memo.

Comment: It may be fruitful to have another community meeting prior to issuance of EPA's Action Memorandum.

Response: The vast majority of commenters on the EE/CA, while still wanting to discuss various issues related to the cleanup, appear to support the action that was proposed by EPA and selected in the Action Memo, namely, the Source Removal alternative. EPA will continue discussions with the public on many issues, but does not believe that another community meeting is necessary before issuance of the Action Memo.

Comment: EPA recently sent out access letters to people who own property. Do these people have the authority to refuse EPA access to their property for testing?

Response: Some property owners may deny EPA access to their property. However, EPA has some authority under the Superfund law to gain access to properties to implement the Superfund program. If a property owner refuses access, EPA would exercise that authority in appropriate circumstances. EPA

would prefer that property owners willingly give access for testing and cleanup of their properties.

Comment: I'm not sure whether I believe that property owners should be able to refuse EPA access or whether EPA should go out and make sure every property is tested. But does EPA know how it will deal with this issue? Will EPA make sure every property is tested, even if people refuse access? If people refuse access, does that mean that there's a chance that properties will be left un-cleaned up?

Response: EPA will make a decision on this issue if and when it arises. One factor that EPA must consider is that if a property is contaminated and not cleaned up, the contamination may affect many future generations in addition to the current property owner.

Comment: Does the EPA need some sort of a license from IDNS to bring material onto the Kerr-McGee factory site for shipment as a staging area?

Response: As owner of the facility, Kerr-McGee would be the one to apply for and obtain a license amendment to use the Kerr-McGee facility as a staging area for shipment of wastes no matter who sent the material to the facility.

Comment: If Kerr-McGee doesn't do the cleanup, does EPA need a license to use some other place as a staging area for shipment of the wastes? Would the material need to be packaged somehow?

Response: If EPA conducts the cleanup, EPA would most likely use a staging area for shipment of wastes other than the Rare Earths Facility (as described in the EE/CA as Contingent Action B -- Off-Rare-Earths-Facility Staging Area). If the wastes were handled in bulk form, the staging area might need to be licensed for such activities. However, if the wastes were properly packaged, a license would not be required according to IDNS. If EPA were to conduct the removal action, EPA probably would package the wastes immediately after removal and take the packaged wastes to a staging area where they would be loaded onto trains.

Comment: The people who live along Kress Creek are on well water. Is it possible that their well water could be contaminated? If so, where could they send samples to be analyzed?

Response: Because the thorium is very insoluble, contamination of water is not expected to be a problem. IDNS has tested many residential wells and has never seen a problem. If residents want their water tested, the IDNS will conduct such tests. Contact Dave Ed at IDNS at 217-786-6362.

Comment: For material that is removed from contaminated properties and stored somewhere, what plans will there be to catch rain water that could potentially become contaminated? What would happen to the rain water?

Response: Whoever conducts the removal action (whether Kerr-McGee or EPA) will prepare a Work Plan that describes all the details of how the removal action will be accomplished. Details such as this have not been worked out yet but will be provided in the Work Plan.

Comment: The conceptual-level description of interim storage on page 4-19 of the EE/CA states, "The excavated waste volume that accumulates in storage in one year duration is 50% of the total projected volume." What is the total excavation volume?

Response: The total excavation volume is unknown at this time, which is why the EE/CA estimated costs for four different volume scenarios. Therefore, the 50% figure represents a different volume for each scenario. For the purposes of estimating costs only, the EE/CA assumed that, because Illinois law imposes a storage fee on Kerr-McGee, 50% of the total projected volume would be in storage at the Kerr-McGee facility.

Comment: Who is going to address the contamination by the EJ&E railroad tracks?

Response: The contamination under the EJ&E railroad tracks on the west side of the Kerr-McGee facility, and any other contamination that leached away from the Kerr-McGee facility, will be dealt with by IDNS as part of the closure activities at the facility.

Comment: When the cleanup of all the off-site areas is finished, for how many years and specifically in what ways will you retest the area to make sure you haven't missed anything? Will there be something in place to protect us in the future in case you don't find all the contaminated areas, and someone, for example, has to dig a foundation and there's a hotspot there?

Response: EPA realizes that these are issues which must be addressed. Completion of all the off-site areas is still a few years away, so final decisions on what will be done afterwards have not yet been made. EPA and IDNS have discussed the possibility of conducting another aerial radiological flyover of the West Chicago area after all the cleanups are complete, as a final check to see if any contamination was missed. Mechanisms to identify contamination during future construction activities may also be put into place. EPA, in consultation with IDNS and other appropriate entities, will address these issues formally in a future document available for public comment.

Comment: The fact sheet that EPA passed out talks about different routes of exposure. Given the specific nature of the contaminants, have you done any prioritization of what the risk factors are from those different routes of exposure? It would appear that the greatest individual risk factor for any one person in a residential area would have to be ingestion of material.

Response: The fact sheet listed possible routes of exposure without prioritizing them. Based on a preliminary look at current Site conditions, EPA believes that direct exposure to gamma radiation presents the greatest likelihood of risk because we know that people currently are being exposed by this route. However, if any of the contaminated areas are not vegetated, ingestion of contaminated soils would be more likely to occur and would present a significant risk to those individuals.

Comment: To illustrate situations where hotspots might be left behind, EPA has given the example of a tree where there is a hotspot bound up in the roots. My concern is that this contamination will be with us for a very long time. What happens if someone later on decides to cut down the tree and dig up the area around the tree, and people can then be exposed to the contamination? I want to reiterate my concern about leaving any hot spots behind, because it will be with us forever.

Response: That is a valid concern. In determining whether any contamination may remain on-Site at levels of concern, EPA will take into account the fact that any contamination left behind may expose future generations. If a decision is made to leave any specific hotspots behind, EPA will require a deed restriction, lien or other legal instrument to notify future purchasers and the public that the contamination is still there. This instrument will include details about the location and amount of the contamination.

Comment: The EE/CA says something about remediation taking eighteen months. Since it will take you two years to complete the testing of all the residential properties, does this mean it will take two years plus another eighteen months? What is the total timeframe for the residential cleanups?

Response: The total timeframe for removals is unknown at this time because the number of contaminated properties is unknown. Page 3-5 of the EE/CA stated that "The estimated duration of the removal implementation is less than 19 months" and that "...this duration will be revised depending on the number of contaminated properties and volume of contaminated soils found at the site..." Earlier on the same page, the EE/CA provides that "...the completion of the removal implementation...is estimated to occur within several months of the completion of discovery activities, depending on the number of properties that are found to need removal action." Because the testing of some properties

and the cleanup of other properties will be going on at the same time, it will not take an additional 18 months after all the testing is done to complete cleanup of the entire Site. However, as stated above, an exact timeframe is impossible to give, because the size of the removal project is yet to be determined.

Comment: EPA sent me a letter saying it wants to test my yard. Fine, I will sign it, but I want it tested now. Don't make me wait two years to find out I have hot spots in my backyard with my children playing out there.

Response: Because of the large number of properties to be tested (approximately 1500), EPA believes it necessary to conduct testing activities over two "construction seasons." Approximately half of the properties will be tested in 1994, and the other half will be tested in 1995. EPA will attempt to contact property owners at least one week in advance of the testing. If residential property owners wish to have their properties tested before that time, IDNS has indicated that it will conduct a screening survey at the owner's request. To request an IDNS screening survey, contact Dave Ed at 217-786-6362.

Comment: I have a yard that is contaminated, and because I have four children I poured concrete over most of my yard. Now I received a letter from EPA saying you are going to come out and check my yard. Since the majority of it is covered with concrete now, how will the testing be able to detect the contamination that is underneath? How will you address that? IDNS originally tested my yard, and they have the data that shows it is contaminated.

Response: EPA probably will not be able to detect the contamination through the concrete. However, IDNS data is available from the property before it was covered with concrete and EPA will use the IDNS data in making cleanup decisions.

Comment: Regarding the "ALARA" concept (As Low As Reasonably Achievable), what in layman's terms is "easily achievable" so we can derive some understanding of what that means?

Response: In layman's terms, the concept of "As Low As Reasonably Achievable" means that excavation will not necessarily stop when the numerical cleanup criteria have been reached, but excavation will continue to lower levels if EPA determines that it is practicable. For example, if excavation has reached the numerical criteria and it would require excavation of only a few more shovelfuls of soil to remove the contamination to near background levels, EPA would consider removing the additional soils "reasonably achievable." EPA would not consider tearing down the

foundation of a house to remove an insignificant amount of contamination located below the foundation to be reasonably achievable.

Comment: How are the people doing the cleanup going to know when it's clean enough for them to stop digging?

Response: Cleanup levels were established by EPA in the Action Criteria Document. If Kerr-McGee conducts the cleanup, its contractors will be testing contamination levels in the open excavation, and when they think they have reached the cleanup criteria, will notify EPA. However, EPA will independently confirm Kerr-McGee's results. IDNS will be doing the final testing in the open excavation for EPA, and EPA will use the IDNS data to decide whether Kerr-McGee's contractors can stop digging or whether they will need to excavate more soil. Only after EPA tells Kerr-McGee's contractors that they have reached the cleanup criteria (based on IDNS data) can they backfill the excavation with clean soil and restore the property.

Comment: Is it true that the EE/CA determined that soil washing is not being considered for this site as a way to reduce the volume of contaminated soil because the process is not presently sufficient to reduce the contaminant concentration to levels below the cleanup criteria for a significant fraction of the waste?

Response: Page 4-10 of the EE/CA states that "Although soil washing may be proposed for the Rare Earths Facility materials, volume reduction of soils via soil washing from the Residential Areas site and portions of the Kress Creek site is not retained for further consideration because the process is not presently sufficient to reduce the contaminant concentration to levels below the soil concentration action criteria for a significant fraction of the waste." As stated on the same page in the EE/CA, additional pilot testing would need to be conducted before EPA would give serious consideration to soil washing for the materials from this Site. Based on current information, soil washing is not retained for further consideration at this time. However, EPA will continue to monitor the progress and feasibility of this and other treatment technologies.

Comment: I would like to know the status of my property. I have let both EPA and IDNS on the property several times to take readings, and have never heard anything regarding "hot spots" and/or contamination. I think it's about time I heard something from you.

Response: EPA has not yet sent the results of tests to the property owners, and hopes to do so by the end of 1994 for all properties that had complete testing done in 1994. In the future, EPA intends to provide test results to property owners as soon as possible after the results are verified.

Comment: I want to thank EPA for giving us a forum for our input. Not all agencies do that. I also want to encourage EPA to continue these efforts.

Response: Thank you for your comment and encouragement.

II. SUMMARY OF COMMENTS FROM ILLINOIS DEPARTMENT OF PUBLIC HEALTH (IDPH)

Comment: IDPH agrees with the USEPA that immediate removal is appropriate for the wastes in residential areas. In the Draft Public Health Assessment for the Kerr-McGee Radiation Areas, one of the recommendations was that actions be taken to reduce human exposure in residential areas.

Response: IDPH support of the removal action is noted. In fact, the findings of the Draft Public Health Assessment were cited in the Action Memo.

Comment: IDPH is pleased that the cleanup plans of USEPA include evaluating nonradioactive contamination, including lead. It is important that all chemicals of concern are addressed.

Response: In addition to lead, an EPA pilot study at the Site is evaluating other nonradioactive contaminants, namely barium and chromium.

Comment: Page 2-1 of the EE/CA incorrectly states that the Rare Earths Facility extracted thorium and/or other elements from fluorspar. Fluorspar is the primary source of hydrofluoric acid, which was one of the primary chemicals used to extract thorium and rare earth materials from the ore. Fluorspar also may have been a source of lead found in the wastes, so the levels of radionuclides and lead may not be well-correlated.

Page 2-1 of the EE/CA does not contain a complete description of the Rare Earths Facility operations. Other materials such as used mantle scraps and minor ores were also processed. Bastnasite ore, which contains rare earths but does not contain thorium over background levels, was first processed in 1954, after tailings were used for fill in the vicinity. Consequently, wastes from its processing should not be present in residential areas, unless they were carried by runoff through the storm sewer discharge to Kress Creek and deposited in floodplain soils.

Page 2-1 of the EE/CA should state that the percentages that are given are for the monazite ore, since bastnasite ore does not contain thorium above background levels.

Response: The description on page 2-1 of the EE/CA was not intended to be a complete description of the Rare Earths Facility operations, but rather just an overview. EPA does not disagree with any of these comments or clarifications. EPA does not believe that the EE/CA requires revision at this time, as none of these changes would affect our evaluation of the cleanup alternatives or result in a change in the selected removal action. These comments will be noted for future reference.

Comment: Page 2-2 of the EE/CA could be updated with more recent and accurate information on the glacial till geology of the Kerr-McGee Facility than the Law Engineering (1981) report, which was heavily criticized by USEPA and numerous state and local agencies. Other references include: IDPH Draft Public Health Assessment for the Kerr-McGee Radiation Areas (1993), the NRC Supplement to the Final Environmental Impact Statement (1989), and well logs available from the Illinois State Water Survey (ISWS), Champaign (for areas around the Kerr-McGee Facility). While the layers described in the EE/CA are generally present at the Kerr-McGee Facility, there are some exceptions and data gaps. [The comment then went on to give a detailed description of the exceptions and data gaps regarding the geology of the area.]

Response: The discussion on page 2-2 of the EE/CA was not intended to be a complete description of the geology of the Rare Earths Facility, but rather just an overview. EPA does not believe that the EE/CA requires revision at this time, as none of these changes would affect our evaluation of the cleanup alternatives or result in a change in the selected removal action. These comments will be noted for future reference.

Comment: Page 2-3 of the EE/CA misquotes Frame (1984) by saying that in the study area, the depth of the West Branch of the DuPage River is 2 to 5 feet deep. Frame (1984) did not give the depth of the West Branch of the DuPage River, but said it is only slightly deeper than Kress Creek (average depth 30 cm {about 1 foot} and rarely over 60 cm deep {about 2 feet}). The USEPA RI (1986) stated the depth of the West Branch of the DuPage River is about two to three feet by the West Chicago Regional Wastewater Treatment Plant. However, the depth of the river is variable and during periods of low flow (July into fall), it is frequently only a few inches deep in riffle areas. In fact, in late summer, canoeing on the river is usually difficult because of shallow water.

According to Frame (1984), which was again misquoted on page 2-3 of the EE/CA, the average depth of Kress Creek is 30 cm (about 1 foot), and it is rarely over 60 cm (about 2 feet) deep. Also, some of its banks are much higher than two feet, particularly about 900 to 1,250 meters south of the storm outfall.

Response: The discussion on page 2-3 of the EE/CA is a general description of the surface water hydrology of the area. The exact depths of the river and creek did not affect the selection of the removal action for this Site.

Comment: Regarding statements on page 2-6 and 2-7 of the EE/CA, the drilling of shallow wells has helped, but not solved the problem of radium in the deep groundwater used by the City of West Chicago. [The comment went on to give analytical results of water sampling from 1990-1992, which showed that there have been exceedances of regulatory limits for alpha activity and radium in water.] While this radium is natural and not related to the Kerr-McGee wastes, for users of the municipal water supply, it would add to the risks from any exposure to tailings.

Response: This information will be noted for future reference. However, please note that any risk assessments for this Site will account for only Site-related risks.

Comment: Page 2-18, 2-19 and 2-26 of the EE/CA list contaminant release mechanisms and exposure pathways. The ingestion of contaminated fish and frogs (one person told me that their family frequently ate the legs of frogs from Kress Creek) is another possible exposure pathway, although, because of limited water solubility and bioavailability, bioaccumulation of lead and radionuclides is probably not of concern. Furthermore lead, radium, thorium, and uranium tend to accumulate in bone, which is the last part of a fish anyone would wish to eat. Also, for this reason, it is very important to use the analyses of filets rather than whole fish for any human risk assessment of lead or these radionuclides in fish. Whole fish sampling would produce biased results which are not relevant to human consumption.

Response: The EE/CA document evaluates the Residential Areas Site and the portions of the Kress Creek Site that are in the floodplain and are residential properties. The EE/CA document does not address the actual creek or river. Ingestion of fish and frogs is therefore not relevant to the EE/CA document. EPA will address the Kress Creek contamination in a later action.

Comment: On page 2-22 of the EE/CA, please state that the genetic effects of radiation are important because the damage to DNA is what initiates radiation-induced cancer. In addition, the teratogenic effects of radiation can be quite serious, given a sufficient dose at the critical time of gestation (8 to 25 weeks for humans, with 8-15 weeks the most sensitive; the data also suggest a threshold between 20 and 40 rad; BEIR V, 1990). Instead, please say that teratogenic effects have been observed only at much higher doses than possible from exposure to the Kerr-McGee waste tailings.

Response: These comments are noted for future reference. Since teratogenic effects have been observed only at much higher doses than possible from exposure to the Kerr-McGee wastes, including more detailed information in the EE/CA was deemed unnecessary.

Comment: Regarding page 2-22 of the EE/CA, it is important to note that the radiological standards for uranium are based on its chemical toxicity to the kidney and not radiation-induced carcinogenicity, which poses a lower risk.

Response: This comment will be noted for future reference. EPA does not believe that the EE/CA requires revision at this time, as this change would not affect our evaluation of the cleanup alternatives or result in a change in the selected removal action.

Comment: On page 2-23 of the EE/CA, saying "...with the carcinogenicity being the limiting effect" is very ambiguous. I think you meant to say that in general, carcinogenic chemicals pose unacceptable cancer risks at lower concentrations than are associated with non-cancerous toxic effects. This is true only in general. For example, the radiological exposure standards for uranium are based on non-cancerous kidney toxicity rather than radiation-induced cancer.

Response: This interpretation of the sentence is correct.

Comment: Regarding page 2-23 of the EE/CA: In animals, cancers can occur less than two years after exposure. In general for humans, however, chemical- or radiation-induced cancers occur 10 or more years after exposure. In epidemiologic studies, when a cancer is observed only one or two years after exposure, the general conclusion is that it was not caused by the chemical or radiation being investigated.

Response: This comment is noted for future reference.

Comment: On page 2-24 of the EE/CA the sentence that reads "Generally, if an exposure to a chemical exceeds a chronic RfD, adverse toxic effects are likely to occur" is untrue and MUST be eliminated. As stated correctly earlier on the same page, a RfD is an estimate of the daily ingestion of a chemical that is likely to be without adverse non-cancerous health effects. The reverse, that anything over the RfD is likely to cause adverse health effects, is absolutely not true! A RfD is an extremely conservative value meant to protect sensitive members of the public. For example, if a no-observed adverse effect level (NOAEL) is reported for a rat (which may easily be over an order of magnitude less than the lowest observed adverse effect level {LOAEL}), this value is divided by ten to be conservative in extrapolating from animals to humans. It is then further divided by ten to allow for human variability. It can also be divided

by other uncertainty factors for various reasons, including uncertainty of the data, use of a LOAEL instead of a NOAEL (divide by 10), and route-to-route extrapolation (generally divide by 10). The result is a RfD with a large safety margin. To say otherwise, particularly for a case like Kerr-McGee where public concern is high, may lead to increased and unjustified fears.

Response: According to Superfund Risk Assessment Guidance, the RfD is the level of exposure below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level exceeds the RfD, there may be a concern for potential noncancer effects. EPA agrees that the sentence in question could have been worded slightly differently, but does not believe that this difference would affect our evaluation of the cleanup alternatives or result in a change in the selected removal action.

Comment: Regarding the discussion of lead on page 2-24 of the EE/CA: A common source of lead and the most common cause of lead poisoning is lead paint. In these homes, the inhalation of lead dust may be more important than the ingestion of paint chips. Soil along homes with exterior lead paint and along busy roadways often has high lead concentrations in the upper inch of soil. Lead is relatively immobile in the environment and tends to remain at the surface of the soil (or where it is deposited). Children 6 months to 6 years old are the most susceptible to lead because of greater absorption after ingestion, slower elimination, frequent hand-to-mouth activity, and greater sensitivity of their developing nervous systems. Lead absorption is increased by inadequate intakes of calcium, copper, iron, phosphorus, or zinc, as well as by fatty foods.

Response: This information will be noted for future reference.

Comment: Regarding page 2-27 of the EE/CA, the cancer slope factors for nonradioactive chemicals are 95 percent upper confidence limits, but those for radionuclides are actual risk estimates.

Response: The EE/CA intended to make a general statement that cancer risk factors are often (not always) upperbound confidence limits. The cancer slope factors for radionuclides are actual risk estimates.

Comment: Regarding page 2-27 of the EE/CA, the USEPA Focused Risk Assessment used slope factors from the HEAST tables, which were based on the BEIR III (1980) report. In 1986, the dose estimates for atomic bomb survivors were revised downward, which resulted in new risk estimates about four to eighteen times higher for various cancers. The USEPA has just released new cancer slope factors based on the newer information. The risk estimates for exposure

to the Kerr-McGee wastes should be re-calculated using the new slope factors, and the revised estimates should be used for clean-up decisions.

Response: The Focused Risk Assessment used the cancer slope factors from the HEAST tables that were current at the time the assessment was conducted. Since that time, EPA has released new cancer slope factors based on newer information. If and when EPA calculates or recalculates risks for this Site, the most current EPA slope factors would be used. Recalculating the risks for purposes of the EE/CA would not change EPA's evaluation of cleanup alternatives or selection of the removal action, therefore EPA is not recalculating the risk estimates at this time.

Comment: Regarding pages 3-3, 3-4 and 3-6 of the EE/CA, there can be significant differences in the non-cancerous health risks of chemicals to children and adults, and this must be considered in developing cleanup criteria. According to the ATSDR Public Health Assessment Guidelines, typical soil ingestion rates of children and adults differ considerably: children ingest 200 mg of soil per day (mg/d), a pica child ingests 5,000 mg/d, and an adult consumes 100 mg/d. Children also have lower body weights, so the same intake would result in a greater dose. Consequently, given the same contaminant concentrations, children receive significantly higher doses of soil pollutants than adults. For non-carcinogenic effects, the doses of both children and adults should be calculated to determine if either exceeds the RfD or any other health-based criterion. The level of a chemical may not exceed an acceptable intake for an adult, but it may be over that for a child. Furthermore, some chemicals (e.g., lead, mercury) are much more toxic to children than adults. These factors must be considered when establishing cleanup criteria.

Response: The pages in question deal with the development of Preliminary Removal Goals (PRGs) for nonradiological contaminants. PRGs are not cleanup criteria, but are used as a screening tool to identify chemicals and media of concern when the Site has not been fully characterized. The methods used to develop the PRGs, including the use of an age-adjusted soil ingestion rate, is entirely consistent with Superfund guidance for development of risk-based preliminary remediation goals. EPA currently is investigating whether nonradiological contaminants (such as metals) are present at the Site at levels of concern. The PRGs developed in the EE/CA will be used as preliminary numbers to evaluate whether the nonradiological contaminants should continue to be considered contaminants of concern. If the nonradiological contaminants are present at levels above the PRGs and a risk assessment is conducted to establish risk-based cleanup criteria for those contaminants, an assessment based on the actual Site data would be conducted. Such a risk assessment may include a separation of the risks to children and the risks to adults. However, such a separation is not necessary for the development of PRGs.

Comment: Regarding page 4-6 of the EE/CA, another reason for rejecting institutional controls as an alternative is that the half-life of thorium-232 is about 14 billion years and lead remains toxic forever. It is not reasonable that institutional controls would persist indefinitely.

Response: Although this was not specifically stated in the EE/CA, EPA has taken this into account while selecting the removal action.

Comment: Regarding page 16 of Appendix A of the EE/CA (the Action Criteria Document), which discusses outdoor radon concentrations: In 1982, Jensen et al. (1983) found that radon-220 and radon-222 were not elevated along Kress Creek, and radon levels were generally not elevated around the Kerr-McGee Facility. Radon-220 and radon-222 concentrations around the Kerr-McGee Facility should be even lower now, since the waste piles were covered with asphalt in 1983 to reduce radon progeny emissions. At Reed-Keppler Park, radon-220 and radon-222 levels were not elevated outside of the fenced area (Booth et al., 1982; Frigerio et al., 1978).

Response: EPA assumes from this comment that IDPH agrees with the decision that was made in the Action Criteria Document (which was finalized in November 1993) not to use outdoor radon/thoron as one of the criteria for the Site.

III. SUMMARY OF COMMENTS FROM THE CITY OF WEST CHICAGO

Comment: Initially, the City agrees with EPA's conclusion that source removal is the preferred alternative for both the Residential Site and the identified portions of the Kress Creek Site. However, the City does have serious concern with several issues (discussed in comments below).

Response: The City's support of the preferred alternative is noted.

Comment: In the EE/CA, EPA identifies the principal radioactive contaminants of concern as "thorium, uranium, and associated decay products such as radium, radon, and thoron." Yet EPA has structured its entire investigation and cleanup program on detecting certain *radium* (no thorium or uranium) values. By detecting total radium values for Radium 226 (Ra-226) and Radium 228 (Ra-228), EPA assumes it is also collecting accurate information on the quantity of Uranium 238 (U-238) and Thorium 232 (Th-232) that may be present. The basis for EPA's assumption is premised on the assumption that all of these radionuclides are in "secular equilibrium." This assumption means that if EPA detects Ra-228 at 5 pCi/g, EPA will assume that Th-232 is also at 5 pCi/g; similarly, if Ra-226 is detected at 5 pCi/g, EPA will assume that U-

238 is also at 5 pCi/g. Unfortunately, the available data (collected by Kerr-McGee) strongly suggests that Ra-228 is *not* in secular equilibrium with Th-232; nor is Ra-226 in secular equilibrium with U-238.

The consequences of failing to address this potential lack of secular equilibrium are serious. EPA is currently undertaking an expensive field survey of West Chicago residences based solely on radium values. EPA may declare a residence to be uncontaminated based on radium values -- when the investigation may have failed to examine and detect unacceptably high and dangerous levels of Th-232 and U-238 at that same home. Our citizens have already been through one flawed "clean-up" in the mid 1980s. We don't need another flawed clean-up based on non real-world assumptions which will leave the health and property values of our citizens significantly at risk. The City has raised this issue repeatedly with EPA. The City asks EPA to immediately develop and conduct an investigation to determine if highly reliable correlations (linking the measured value of Ra-228 with Th-232 and the measured value of Ra-226 with U-238) can be developed. In the absence of such correlations, we ask that EPA's residential site sampling program be revised -- and to the extent necessary redone -- to actually measure for these radionuclides.

EPA does acknowledge in the EE/CA that certain of the testing done for other NPL Sites in West Chicago will be pertinent to the question of whether secular equilibrium exists or not. However, that information may not be available until after locations within the Residential Site are investigated or remediated. Further, because during different time periods, different isotopes were being recovered at the Rare Earths Facility, the data on the other NPL sites may not be relevant to conditions in the Residential Site. The City believes that the assumption of secular equilibrium must be tested and verified before actual removals are undertaken.

Response: EPA is aware of the City's concerns on the issue of secular equilibrium and has made a commitment to investigate and resolve the issue. Originally, EPA intended to use data collected from the other 3 NPL Sites to address this issue, as the quick-turnaround lab analysis being performed by IDNS for EPA at the Residential Areas site provides values for Ra-228 and Ra-226 only. Samples from the other NPL Sites are being analyzed by EPA's National Air and Radiation Environmental Laboratory (NAREL), and the resulting data will include measured values of Th-232, U-238, Ra-228 and Ra-226. However, because of delays associated with the analysis of the samples from the other 3 sites and the question regarding whether data from the other NPL Sites is representative of the Residential Areas Site, EPA has decided to collect samples from the Residential Areas Site and analyze them for Th-232, U-238, Ra-228 and Ra-226. EPA will expedite the analysis of these samples

and will share this information with interested parties as soon as validated data becomes available. At that time EPA will initiate any necessary changes to the removal action investigations or other activities.

Comment: In oral presentations to the community, EPA has consistently stated that when contaminated property was discovered, the property would be cleaned to background. Such a practice would be consistent with Kerr-McGee's mid-1980s practice of cleaning to background at locations it determined to be contaminated. EPA has stated to the community that the basis of cleaning to background was based on the "ALARA" principle, and that the exceptions to not cleaning to background would be rare and only based on extreme physical impracticability. Finally, EPA has orally stated that the determination of whether an excavation was clean to background would be made *before* the excavation was backfilled. These oral representations appear to be inconsistent with written documents prepared by EPA including the EE/CA. Please confirm in a revision to the EE/CA or other formal documentation that our understanding of your oral commitments to the residents of the City are correct.

Response: In oral presentations to the community, EPA has endeavored to be consistent with its written position, i.e., that properties will be cleaned to meet, at a minimum, the soil concentration criterion (5 pCi/g above background for combined Ra-228 and Ra-226) that has been established for this Site, and in addition, that the "ALARA" principle will be applied. The intent in applying ALARA to cleanups is to go as far below the soil concentration criterion as is reasonably achievable, as explained in the Action Criteria Document (which contains the cleanup criteria for the Site), finalized by EPA in November 1993. The primary cleanup criterion for the Site is 5 pCi/g above background, with application of ALARA. Measurements to determine compliance with this criterion will be made by IDNS/EPA in the open excavation, prior to backfilling. (Another criterion in the Action Criteria Document requires that, after backfilling, gamma exposure rates must not exceed background as measured 1 meter above the ground.) While in practice the 5 pCi/g criterion in conjunction with the ALARA criterion may result in a cleanup at or near background at many locations, EPA will not require that all contamination be cleaned to background. The Superfund law does not require that cleanups be to background levels. EPA believes that the numerical and ALARA criteria described in the Action Criteria Document are protective of human health and the environment and comply with applicable laws.

Comment: Throughout the discussion of alternatives, EPA has ignored the question of the City's authority regarding shipments of so-called "off-site" material to the Rare Earths Facility. Neither Kerr-McGee nor EPA can bring off-site wastes to that Facility unless and until they receive explicit written permission from the

City. We emphasize that the City has agreed to allow such shipment -- but only after a formal application for zoning and other approvals have been received and acted upon by the City, and only after we have received enforceable written assurances that all the material will be moved within the six month deadline imposed by the City. As of this date (9/19/94), Kerr-McGee has not filed a complete and sufficient application for such approvals.

Response: All off-site activities must comply with all applicable federal, state and local laws, including City laws.

Comment: In EPA's discussion of ARARs, EPA consistently ignored a State statute which calls for complete cleanup of the off-site areas within four years after commencement of construction. That statute (420 ILCS 42/1 et seq.) is a binding substantive State law implementing authority transferred to the State under the federal Atomic Energy Act. EPA's schedule for completing the cleanup of the so-called Residential Site, as well as all the other NPL sites within West Chicago must incorporate this deadline. The commencement of the cleanup program took place in the Summer of 1994. Cleanup of all the areas should therefore be finished by 1998.

Response: The State of Illinois, which is responsible for identifying State applicable or relevant and appropriate requirements (ARARs) for EPA's consideration, has not identified the cited Illinois statute (Illinois Public Act 87-1024 or "the Karpiel Bill") to EPA as an ARAR and has indicated that it believes that the Act does not apply to residential properties. On its face, Illinois Public Act 87-1024 applies only to disposal facilities, licensed sites or property that has been used in whole or in part for the milling of source material. Even if the State of Illinois were to suggest that the Act apply to this Site, Superfund regulations provide that, in order to be considered "applicable," a requirement must be "substantive." EPA does not consider the requirements of Illinois Public Act 87-1024 to be substantive, since the requirements do not pertain directly to actions or conditions in the environment, as would health-, risk- or technology-based requirements. The requirements of Illinois Public Act 87-1024 are administrative in nature, i.e., they pertain to consultation and approval by local authorities, impose deadlines and assess storage fees. EPA does not consider administrative requirements to be "applicable". In fact, the Superfund statute specifically exempts on-site Superfund actions from Federal, State and local permits.

Comment: The EE/CA indicates it is presenting an evaluation of an array of remedial alternatives. The remedial elements considered are identified as "no action," source removal, source removal with interim storage, source removal with off-Rare Earths Facility staging area and source removal with recontamination prevention. The only real alternatives included are no action and source

removal; the other items are simply variations on source removal. Yet the discussion addresses the different versions of source removal as if they were real alternatives. The "no action" option is not accurately characterized either. Here no action really means addressing the Sites through the CERCLA remedial process, rather than the removal process, so that remediation would be delayed. The sections of the EE/CA dealing with the evaluations of alternatives should be re-drafted to reflect and clarify this fact.

Response: The EE/CA states that the two main alternatives are "Alternative 1 - No Action" and "Alternative 2 - Source Removal." The EE/CA also states that the other elements considered are variations of the source removal option, and names them accordingly: Alternative 2, Contingent Actions A, B and C. The EE/CA evaluated each of the contingent actions separately to weigh each against the criteria of effectiveness, implementability and cost. The EE/CA also characterizes the "no action" alternative as meaning that action would be postponed until a final remedial decision was made under the remedial process (as opposed to the removal process) (see, for example, EE/CA pages 4-14, 5-1, 5-10).

Comment: Table 1-1 on page 1-3 of the EE/CA implies that Kress Creek runs from the Rare Earths Facility. This is not accurate. Kress Creek does not flow from the Rare Earths Facility, but a point south of the Facility boundary. The table should be corrected.

Response: Table 1-1 is not meant to imply that Kress Creek runs from the Rare Earths Facility. It does mean, however, that the Kress Creek NPL Site has been defined as running from the Rare Earths Facility. The storm sewer that EPA believes carried contamination from the Rare Earths Facility to the creek is being investigated as part of the Kress Creek NPL Site RI/FS, and is included within the Kress Creek NPL Site boundary.

Comment: Table 1-1 on page 1-3 of the EE/CA states that the source of contamination to the creek is the storm sewer effluent from the Rare Earths Facility. Again, that may not be accurate. Kerr-McGee and EPA have both sampled the effluent from the storm sewer and Kerr-McGee has reported that the effluent is not contaminated with radiologic materials. In addition, the Frame report stated that there are ores visible in the creek bed. Assuming that is the case, the storm sewer should not be cited as the only possible source of contaminants to the creek.

Response: Even if data shows that current storm sewer effluent may not be contaminated with radiologic materials, EPA still believes that the storm sewer was the route by which contamination was transported from the Rare Earths Facility to the creek. This is consistent with statements in the Frame reports

(1981 and 1984), which reported that the contamination in the creek got there via a "storm sewer and drainage ditch." The purposes of sampling the contents of the storm sewer are to determine (1) whether contaminated sediments are still present in the storm sewer that may find their way to the creek, and (2) whether the Rare Earths Facility is a continuing source of contamination to the creek. The Frame report (1981) stated, "Accumulation of greyish-colored thorium-containing residues are visible in the sediments in slower moving sections of the Creek, particularly near the storm sewer outfall."

Comment: Page 1-4 of the EE/CA includes an extremely broad description of the Residential Site. As the City and EPA have discussed in the past, a definition of the Residential Site which purportedly includes any and all areas in and around the City that are potentially impacted does not comport with the NPL listing document or the Agency's more recent descriptions of the Site. According to the NPL Hazardous Ranking System document for this Site, 88 homes to the west of the Factory Facility make up the Site. Further, in our more recent discussions, the Residential Site has been defined by aerial survey boundaries generated based on an IDNS fly over of the area. That definition of the Residential Site is depicted at page 1-6 of the EE/CA. The City has made the EPA aware of the problems which stem from an overly broad view of the Residential Site. Residents and other property owners become understandably upset when they learn that their homes and properties may be in a Superfund Site even though no contamination has been identified at a given location. The EE/CA should be internally consistent and consistent with the Agency's current view of what constitutes the Residential Site.

Response: EPA has defined the Residential Areas Site study area as is depicted in the figure on page 1-6 of the EE/CA. The broad description on page 1-4 is under the heading "Location of Study Area," and the EE/CA clarifies on page 1-5 that the Site study area currently is defined as shown in the figure on page 1-6. The Residential Areas Site boundaries will not be identified until the completion of the Remedial Investigation.

Comment: Page 2-1 of the EE/CA describes the Rare Earths Facility as a <u>thorium</u> processing site. While it is true that thorium was processed, other materials were also produced at the site. It is important to note the production of these other products, since each process generated a waste stream with different radiologic and chemical make-up. These statements should be corrected to accurately reflect Facility operations as described by Kerr-McGee.

Response: This comment is noted. The description on page 2-1 of the EE/CA was not intended to be a complete description of the Rare Earths Facility operations, but rather just an overview.

Comment: On page 2-15 of the EE/CA, EPA discusses the finding of metals at the Rare Earths Facility, Reed-Keppler Park and the Sewage Treatment Plant. However, metals have not been detected at the Residential Sites or in Kress Creek. This fact should be mentioned so that the public is in an informed position to evaluate the likelihood of metals being present and any attendant risk. On page 3-1 of the EE/CA, EPA mentions that it will be testing for metals as part of the pilot study. That fact should be noted at page 2-15. In addition, the results of all the pilot study testing should be available to help define the appropriate scope of the removal actions before actual removals are undertaken.

Response: These facts already are mentioned on page 2-15. Page 2-15 of the EE/CA states, "Soils at the Residential Areas site and Kress Creek site have been analyzed in the laboratory for metals. However, the analytical results had not been evaluated prior to the publication and release of the EE/CA; thus the suspected metal contamination has not been confirmed. The metals data for the Residential Areas site soils will be evaluated as part of the ongoing pilot study...The metals data for the Kress Creek site...will be evaluated when the radiological analyses have been completed." The results of the pilot study will be available prior to the beginning of actual excavation work.

Comment: In discussing the alternative of interim storage of materials on page 4-10 of the EE/CA, no mention is made of the fact that the City did offer the use of some of its property as an alternative temporary storage location. If City property were used, purchase would not be required. The City believes that EPA should factor this option into its evaluation of temporary storage alternatives.

Response: Purchasing a property was mentioned as one possibility under the general response action of interim storage, but is not seriously considered as a valid option. Although the City did offer the use of some of its property, it is a moot point at this time, as the only interim storage option that would be used now is the Rare Earths Facility.

Comment: In the section of the EE/CA beginning on page 4-12, EPA is dealing with the possible means to prevent recontamination of Kress Creek properties should the creek flood. The City has a suggestion for a relatively low cost method that would prevent recontamination, and that does not have as many drawbacks as sheet piling. A geofabric filter approximately two feet high could be used along the creek. That fabric would allow water through, while sloughing sediments back into the Kress Creek bed. The City suggests that EPA evaluate the use of this fabric as an alternative to sheet piling.

The City also suggests that EPA evaluate vacuuming the creek as a quick, effective means of removing the source of contamination to the Residential

Sites. If the creek bed were vacuumed, the EPA could then monitor it as the RI/FS proceeded to see if additional remedial work were needed over time. After vacuuming, flooding of the Residential Sites in an interim period might not be as great a concern.

Response: EPA is taking a closer look at the option of using a geofabric filter, also known as a "silt fence," as a possible means of recontamination prevention for Kress Creek residential properties. If EPA decides that such an option should be implemented, the Action Memo would be amended if necessary. An initial look at this option, however, indicates that it could only handle floodwaters of 1 to 2 feet in height. The EE/CA evaluated the possibility of a 100-year flood event, where the flood waters would rise from 5 to 7 feet in height in the areas of concern. Flood waters higher than 1 to 2 feet in height would not be effectively handled by the silt fence, and might wash it down. The effect of heavy snow and chunks of ice during spring melt must also be considered.

Regarding the suggestion of vacuuming creek, such an option is beyond the scope of this EE/CA and Action Memo. Actions to address the majority of the contamination at the Kress Creek Site (including the contaminated sediments in the creek bed) will be evaluated as part of the RI/FS for the Kress Creek Site.

Comment: On page 4-19 of the EE/CA, under the first bullet point, it must be noted that the City of West Chicago has independent approval authority for the movement of materials to and from the Rare Earths Facility. Under the second bullet point, the State of Illinois and the City of West Chicago have already entered into a court-enforceable agreement specifying that the storage of offsite material at the Rare Earths Facility will not continue more than six months. That six month period should replace the one year period currently noted in the EE/CA.

Response: The bullet points on page 4-19 of the EE/CA describe assumptions that were made with respect to the option of interim storage at the Rare Earths Facility. Failure to make a statement about City authority in the EE/CA does not significantly affect that option or in any way affect any authority the City has. The one-year interim storage period noted in the EE/CA was included solely for the purposes of estimating costs and is not legally enforceable in any way.

Comment: In Section 4.3.6 of the EE/CA (page 4-20), EPA should add a statement that the City of West Chicago and/or DuPage County have independent approval authority over the activities described in this section (off-Rare-Earths-Facility staging area). The local governmental entity having such authority depends

upon the actual location of the activities. On page 5-11 of the EE/CA, EPA states that no additional permits or administrative requirements have been identified for the off-Rare Earths Facility staging contingency. Depending upon where the off-facility staging area is to be located, the City of West Chicago and/or DuPage County approvals would be necessary prior to the establishment of a staging area. The analysis of this alternative must take those independent local authorities into consideration.

Response: At this time, EPA does not believe that any permits or authorizations would be needed for Contingent Action C -- Off-Rare-Earths-Facility Staging Area. Such a staging area would NOT be a storage area, but rather would be an existing railyard where EPA could take properly packaged wastes for loading onto trains. EPA is not considering constructing a new waste storage area, nor is EPA considering constructing a new railspur. Wastes would not be handled in bulk, but would be properly packaged to meet all applicable Department of Transportation requirements. If the wastes are properly packaged, IDNS has informed EPA that no State approvals would be required in order to load the packages onto trains. EPA is not aware of any local approvals that would be required.

Comment: Page 5-6 of the EE/CA should be clarified to more accurately describe the source of contaminants to the residential soils along Kress Creek. As EPA has stated in other portions of the EE/CA, it is the surface water, i.e., Kress Creek flooding, which has apparently contaminated these residential soils. That relationship should be more clearly considered so that it does not appear as if the residential soils are the sole source of the contamination for that portion of the Kress Creek Site.

Response: This comment is not relevant to page 5-6 of the EE/CA, which discusses whether any of the removal alternatives would impact the quality of groundwater or surface water.

Comment: Page 5-7 of the EE/CA should be clarified to state that ARARs will not be met during the period of remedial delay. However, once a remedial decision is made and action undertaken, the ARARs would have to be met.

Response: The statement on page 5-7 should be interpreted to mean that ARARs will not be met under Alternative 1, which is no <u>removal</u> action. To the extent required by Superfund law, ARARs would be met for a final remedial action.

Comment: The comparison of alternatives on pages 5-20 and 5-21 of the EE/CA approaches the "no action" option as if no remediation would ever take place. However, according to EPA's initial description of the alternative, "no action"

really means delayed action. Therefore, this evaluation of alternatives should be modified to compare removals with action delayed for some period of years.

Response: As described in response to previous comments, the "no action" alternative in the EE/CA was identified to mean that action would be postponed until a final remedial decision was made, and was evaluated as such.

Comment: Page 5-21 of the EE/CA should indicate (under the category of "Implementability") that City of West Chicago and/or DuPage County approvals are required for all of the Alternative 2 variations.

Response: Failure to make a statement about City and/or County authority in the EE/CA does not in any way affect any authority the City and/or County has. EPA is not currently aware of any local approvals that would be required for Contingent Action B.

IV. SUMMARY OF COMMENTS FROM KERR-McGEE CHEMICAL CORPORATION

Comment: Page ES-1 of the EE/CA asserts that elevated indoor concentrations of thoron and radon and their daughters may be exhibited in some houses as a result of the presence of tailings. This is true only if a home were built on a substantial volume of tailings or if tailings were used, for example, as backfill around a substantial portion of a foundation. Kerr-McGee has had extensive experience with the off-site contamination in the West Chicago area as a result of the cleanup effort in the mid-1980s. Kerr-McGee rarely encountered properties where a home was built on a substantial volume of tailings or where tailings were used as backfill around a substantial portion of a foundation, and any such properties within the City have already been addressed. Any contamination that may remain at the residential areas within the City is expected to be found in small, isolated pockets that would be highly unlikely to have any consequences on indoor radon or thoron levels. It thus is extremely unlikely that indoor thoron levels will be found to be significantly different from that which would be expected for ordinary homes in uncontaminated areas.

Response: While Kerr-McGee "rarely" encountered properties where a home was built on a substantial volume of tailings or where tailings were used as backfill around a substantial portion of a foundation, such situations were encountered. Kerr-McGee found at least one property where the indoor thoron levels were significantly elevated as a result of tailings beneath the house.

While EPA agrees that the likelihood of finding such situations within the City are low (because of Kerr-McGee's previous cleanup effort within the City), the same cannot be said about properties outside of the City. It is quite possible that some homes outside the City were built on a substantial volume of tailings. Therefore, elevated indoor concentrations of thoron and radon and their daughters may be exhibited in some houses.

Comment: Region 5 continues to rely on its Focused Risk Assessment for West Chicago Vicinity Properties (Jan.1993) to justify its proposed removal program (EE/CA pages ES-2, 2-26 to 2-29, 5-2). The Focused Risk Assessment drew exaggerated conclusions with respect to risk from data collected from a few highly contaminated residential sites, and was subjected to strong criticisms by the State, the City of West Chicago, and other governmental representatives. In response to these criticisms, Region 5 has acknowledged that the Focused Risk Assessment and its findings are "preliminary" and that further data collection and discussion of assumptions would be appropriate. Yet, despite this fact, the preliminary Focused Risk Assessment remains Region 5's only analysis of the potential risks posed by thorium tailings at the residential areas.

In addition, in many places throughout the EE/CA the Agency improperly has used the data from the preliminary assessment to support decisions concerning the conduct of the removals at the residential areas site. For example, the EE/CA provides an estimate of the short-term risks to workers during implementation of the source removal alternative (Alternative 2) (EE/CA pages 5-2 to 5-4) based on the assumption that the volume-weighted average concentration for thorium-232 is 35 pCi/g. But that value has been derived from single samples taken from a few highly contaminated properties and does not reflect the circumstances at the residential areas site, and thus cannot be used to estimate the risks to workers from exposure to soils with significantly lower Th-232 concentrations.

Response: EPA guidance on conducting non-time-critical removal actions describes a "streamlined risk evaluation" which is intermediate in scope between the limited risk evaluation undertaken for emergency removal actions and the conventional baseline risk assessment normally conducted for remedial actions. The streamlined risk evaluation can help justify taking a removal action and identify what current or potential exposures should be prevented. The results of the streamlined risk evaluation help EPA decide whether to take a cleanup action at the site and what exposures need to be addressed by the action. For the EE/CA, the streamlined risk evaluation should focus on the particular problem the removal action is intended to address (e.g., soil contamination). According to the guidance, a risk evaluation that identifies only contaminants of concern in the affected media, contaminant concentrations, and the toxicity associated with the chemical can be sufficient

to justify taking a removal action. A full baseline risk assessment is neither required nor recommended.

The Preliminary Focused Risk Assessment conducted by EPA and discussed in the EE/CA fulfilled the objectives of the streamlined risk evaluation and is consistent with EPA guidance. It identified, based on limited IDNS data that was available at the time, contaminant concentrations at some Site properties, and identified current or potential exposures that are of concern at the Site. The streamlined risk evaluation discussion in the EE/CA added additional information on the toxicity/health effects of the contaminants of concern. The streamlined risk evaluation is not EPA's sole justification for taking a removal action at the Site, but does help justify taking an action. The Action Memo discusses additional factors upon which EPA relied for its decision.

As explained on page 5-3 of the EE/CA, EPA based worker exposure risk estimates on conservative assumptions, including data in the Preliminary Focused Risk Assessment. This was done to maximize worker protection, consistent with the ALARA principle.

Comment: In various places throughout the EE/CA, the screening and cleanup standards that EPA has decided should be applied to the residential areas site are referred to as "applicable or relevant and appropriate requirements (ARARs)" (EE/CA pages ES-2, 3-2 to 3-5, Appendix B). By definition, the term ARAR is limited to specific state or federal regulatory requirements that are legally "applicable" or that are "relevant and appropriate" under the circumstances. As demonstrated in Kerr-McGee's earlier comments (Mar.93) on the Action Criteria, the cleanup standards cannot properly be considered ARARs. In nearly every instance Region 5 has failed to understand the purpose of the regulations it has deemed to be ARARs and the circumstances in which they were intended to apply. Moreover, even for those regulations that could properly be viewed as ARARs, Region 5 has significantly and unjustifiably modified their requirements in establishing its criteria. The modifications are sufficiently significant that the criteria cannot be said to derive from the regulations.

Response: This comment has been addressed previously (see "Summary of Responses to Public Comments on March 1993 Review Draft of Action Criteria" [December 1993], which is included in the administrative record for this action). The Action Criteria Document discusses in detail EPA's determination of which federal or state regulatory requirements, or portions of federal or state regulatory requirements, are considered "relevant and appropriate." (None of the federal or state requirements are "applicable" to the Site.) The cleanup standards for this removal action were derived from ARARs to the extent practicable.

Comment: Region 5 should recast the statements in the EE/CA concerning the origin of the thorium materials in Kress Creek and associated areas (EE/CA pages ES-1, 1-4). It has never been demonstrated that Kress Creek and the properties along the creek have been contaminated by runoff from the West Chicago Rare Earths Facility. A storm sewer passes immediately adjacent both to the portion of the Facility at which processing occurred and to the Facility waste disposal area. The storm sewer discharges into Kress Creek at the point where elevated levels of thorium are first observed. This has led to speculation that materials from the Facility escaped into the storm sewer and that these materials are the source of the thorium contamination in the creek. But, no theory has ever been advanced that adequately explains the quantity of thorium-bearing materials in the creek, which far exceeds that which seemingly could be accounted for by discharge from the Facility's storm sewer. As a result, there remains substantial uncertainty as to the origins of the thorium materials in Kress Creek and associated areas.

Response: How thorium materials were deposited in Kress Creek is irrelevant to the threat presented by the materials and the actions necessary to address that threat. Whether or not the quantity of thorium-bearing materials in the creek has been adequately explained to date, EPA believes without reservation that the materials originated at the Rare Earths Facility and share the characteristics of materials at the facility. NRC records indicate that the most likely vehicle by which the contaminants were transported from the Rare Earths Facility to the creek is the storm sewer. The contamination entering the storm sewer may have been surface runoff from the Rare Earths Facility, or may even have been direct process waste discharges from the facility in the early years of operation, prior to any regulation of the facility, but there is no doubt that the materials came from the Rare Earths Facility.

Comment: Page 1-1 of the EE/CA correctly notes that the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, limits EPA's authority to take only those removal actions that are "appropriate" to address the threat of a release of hazardous substances. But, as explained in Kerr-McGee's previous comments (Mar.93) on the Action Criteria, the cleanup program of the residential areas within the City in the mid-1980s has already served to cleanup most properties in the West Chicago area to levels that pose no significant residual risks. As a result, the extensive removal program contemplated by EPA cannot be considered "appropriate" or otherwise justified by the need for prompt action to address threats to public health.

Response: While Kerr-McGee's previous cleanup effort addressed many contaminated properties within the City limits, many other properties (located both outside the City and within the City) remain contaminated. The Action

Memo establishes and documents the appropriateness of the selected removal action for this Site.

Comment: Page 1-4 of the EE/CA indicates that Region 5 intends to expand the scope of its removal program to address residential properties along the waterline in the floodplain (but not the channel sediments) of Kress Creek. None of EPA's previous documents indicated that such properties would be included in the EE/CA. Region 5 has not fully characterized the contamination in the area, has not conducted a risk assessment, and has not demonstrated that the cleanup criteria that were tailored for the residential area properties are appropriate for the Kress Creek properties. We question whether Region 5 has established a proper procedural predicate for inclusion of the Kress Creek properties under the current removal program. Despite its misgivings, Kerr-McGee does not object to a limited and focused program that seeks to cleanup the small localized areas of contamination that may be present at properties within the floodplain of Kress Creek. However, there is no justification for an extensive removal program in the Kress Creek floodplain area. [The comment went on to give detailed information on the findings of previous gamma surveys by NRC and Kerr-McGee.] To the extent Region 5 contemplates a removal program beyond that needed to address the few area "hotspots" that have been identified, we suggest that the Agency defer action until the RI/FS that is planned for the Kress Creek area is completed. Any plans to conduct excavations below the water table, for example, would require careful analysis and a full consideration of alternatives that can only be accomplished in the context of an RI/FS of the site.

Response: The removal action has been expanded, as described in the EE/CA, to include only those contaminated floodplain soils that are actual residential properties. The contamination at the residences along the creek is no different from the contamination at other residential properties except perhaps for the method by which the contamination came to be located there, so the risks at those residential properties would be similar to the risks at other residential properties. The cleanup criteria that were developed specifically for the Residential Areas Site are indeed appropriate for the Kress Creek floodplain soils that are residential properties, specifically because they are actual residential properties. An extensive removal action at the Kress Creek Site (e.g., excavations of creek sediments, extensive excavations of non-residential floodplain soils) is beyond the scope of the EE/CA and this action.

Comment: Region 5 proposes to undertake the cleanup of the West Chicago residential sites under the guise of a "non-time-critical removal action" (EE/CA pages 1-5 to 1-7). Removal actions are intended to be limited to short-term, relatively inexpensive activities. (Fund-financed removal actions are limited to $2 million or 12 months in duration). Yet, the costs of the residential cleanup

(estimated at between $22 million to $119 million, depending on the volume of material to be excavated), far exceed the costs incurred in any other removal program of which we are aware. Kerr-McGee previously has provided extensive comment on whether the proposed removal is consistent with EPA authority under the National Contingency Plan (NCP). (See Kerr-McGee comments on the Action Criteria.) The EE/CA provides no recognition of, or response to, the issues Kerr-McGee has raised on these matters. We justifiably expect that Region 5 will address these issues in the responsiveness document that is to be prepared in connection with the EE/CA.

Response: While fund-lead removal actions generally are limited to $2 million or 12 months in duration (these limits can be exceeded under certain circumstances), no such limitation exists for removal actions, such as this, conducted by PRPs. Non-time-critical removal actions and other early actions at sites are being encouraged and are consistent with the new Superfund Accelerated Cleanup Model (SACM). The Action Memo and supporting documentation in the administrative record addresses the issues raised by Kerr-McGee and establishes and documents that the selected removal action is consistent with EPA authority under the NCP.

Comment: The EE/CA reports that after the removal program has been completed, EPA intends to conduct a final RI/FS to determine whether further remediation of the off-site areas is warranted (EE/CA pages 1-7 and 3-1). The cleanup criteria that EPA has selected for the removal program already are significantly more stringent than the standards that have guided every other cleanup of similar sites of which we are aware (see Kerr-McGee comments on the Action Criteria). There thus can be no real prospect that any residual risks that may remain at the conclusion of the cleanups would warrant further action. Moreover, Kerr-McGee strenuously objects to any implication that the residential properties might be subject to further cleanups. Most of the contaminated properties were already subject to extensive remediation in the mid-1980s and the EPA removal program would be the second such cleanup program conducted in the area. There can be no conceivable justification for subjecting the residential areas to a third-round of cleanups, particularly if EPA plans to pass the costs on to others.

Response: It is EPA's intent that this removal action be the final action necessary at the Site, and that the RI/FS will lead to a decision that no further action is necessary. The cleanup criteria were based on ARARs, even though removal actions are not always required to comply with ARARs, to increase the likelihood that no further action would be necessary at the conclusion of the removal action. The application of ALARA will increase this likelihood even more. The effectiveness of implementation of the removal program, the conditions at the post-removal site (as determined by the verification phase

sampling) and the existing federal and state regulations at the time the final remedial action decision is made all have a bearing on whether additional action at the Site will be needed. Other sites that have similar cleanup criteria include the Ottawa Radiation Areas Site, Ottawa, Illinois, and the Maywood Chemical Company Site (residential portions), Maywood, New Jersey.

Comment: The EE/CA (page 1-8) explains that removal actions will be undertaken only where evidence of contamination related to thorium tailings exceeding the discovery criteria is found, and that elevated radiological readings that are attributable to conditions or other radioactive materials not related to the Rare Earths Facility are not subject to removal action. But, nowhere in the document does Region 5 explain how it will assure that only sites contaminated by tailings are remediated. The procedures to guide this important determination should be carefully thought through and presented for comment.

With respect to indoor radon levels, the EPA screening program may well result in a large number of false positives -- determinations that the radon limit is exceeded, but for which no response under CERCLA is appropriate. Data from IDNS show that 25-50 percent of the homes in DuPage County have levels of radon that exceed EPA action levels for reasons entirely unrelated to the presence of tailings. Once levels that exceed the screening level are found, Region 5 will have to undertake detailed further sampling to determine the cause of the readings. This may cause substantial anxiety to affected residents, many of whom have exaggerated fears of the hazards of the tailings, and who likely will be suspicious of any ultimate determination that tailings are not the cause of the elevated readings.

The ability to measure and distinguish between radon and thoron decay products becomes critical to a determination of the cause of elevated indoor radon/thoron measurements (tailings or natural materials). Region 5 has selected the R.A.D. M-1 Surveymeter radon progeny integrated sampling unit (RPISU) for use in the discovery phase of the removal program. But the Agency has not shared with the public the data which demonstrates that the RPISU is an appropriate methodology for accurately measuring and distinguishing between radon and thoron decay products. In addition, because only short term sampling (7-10 days) is contemplated, there is likely to be substantial unreliability in any such measurements.

Response: EPA's investigatory methods for the identification and characterization of contaminated properties are described in the Work Plan for the EE/CA and RI/FS (which is included in the administrative record for this action); it is not necessary for the EE/CA to repeat this information.

With respect to indoor radon levels, EPA acknowledges that false positives may be obtained. However, through an evaluation of the relative concentrations of radon and thoron, as well as an evaluation of the results of other testing (e.g., soil sampling, gamma surveys), EPA would determine whether the elevated indoor levels are caused by mill tailings or naturally-occurring conditions. Kerr-McGee is correct in stating that the ability to measure and distinguish between radon and thoron is critical to a determination of the cause of the elevated readings. As described in the Work Plan, EPA determined during the scoping of the site investigation work that the RPISU was the most appropriate device for measuring radon and thoron decay products at this Site. Upon request, EPA will share with interested parties the information upon which the decision to use RPISU's was based. Lastly, EPA acknowledged in the Action Criteria Document that the shorter-term measurements may not fully characterize the longer-term radon/thoron average concentrations, but determined that short-term measurements may still be useful as a "finding tool" during the discovery phase.

Comment: Page 2-1 of the EE/CA, which includes a history of the ownership of the Rare Earths Facility, fails to reflect the ownership of the Facility by the American Potash and Chemical Company during the period 1958 to 1967.

Response: The first paragraph under Section 2.1 on page 2-1 of the EE/CA reflects the ownership of the Facility by the American Potash and Chemical Company.

Comment: Page 2-9 of the EE/CA asserts that extensive deposits of contaminated materials may be present at the residential properties within the City. But, for the reasons discussed in Kerr-McGee's comments on the Action Criteria, extensive deposits of contaminated material are highly unlikely to be present at these properties. Some 2,726 properties in the City of West Chicago were surveyed in the mid-1980s and 116 of the 117 properties that exceeded the cleanup criteria (30 μR/hr) were remediated to approximate background levels. There thus is no reason to believe that any City properties with extensive contamination were not addressed during the earlier cleanup.

Response: Page 2-9 does not specifically identify the locations (i.e., within the City or outside the City) of the contaminated materials that may be present, nor does it discuss "extensive" deposits. As discussed in response to previous comments, EPA agrees that the likelihood of finding <u>extensive</u> deposits of contaminated materials within the City at levels which exceed the criteria used in the mid-1980s cleanups is low (because of Kerr-McGee's previous cleanup effort within the City), but the same cannot be said about properties outside of the City or about contamination within or outside the City at levels which exceed EPA's criteria. It is quite possible that some properties

outside the City have extensive deposits of tailings at levels which exceed even the cleanup levels of the 1980s. In addition, it is likely that properties exist within the City that have levels of contamination above the cleanup criteria that have been established for this Site.

Comment: Page 2-6 of the EE/CA estimates that background gamma levels for the West Chicago area range between 5 μR/hr and 13 μR/hr. In point of fact, the variability in natural background in the area is significantly higher. An Argonne National Laboratories study (the Frigerio Report, 1978) of the residential areas reports that background varies from 12 to 36 μR/hr, and attributes the high natural background to the fact that the soil in the area is higher in uranium, thorium and their daughters than many other soils in Illinois as a result of phosphate fertilization and the use of water with high natural radioactivity.

Response: Page 2-6 of the EE/CA provides general information and does not set the background levels that will be used during EPA's field investigation work. The reported background range took into account not only the 1978 Frigerio Report, but more recent information as well, particularly information recently collected by the IDNS. However, EPA is collecting more information on Site background conditions as part of its Site investigation work and will set background levels for use in implementation of the action criteria before excavation activities begin.

Comment: Page 3-4 of the EE/CA incorrectly estimates the background indoor thoron and radon decay product concentrations for the residential areas at 0.002 working levels (WL). Several studies have shown that radon concentrations in the West Chicago area are elevated for reasons unrelated to tailings and that as many as 50 percent of the homes in the area are likely to have decay product concentrations that are 10 times higher than the 0.002 WL estimate provided in the EE/CA.

Response: As stated on page 3-4 of the EE/CA, the estimated background level was based on data available at the time. The use of this data did not significantly affect EPA's evaluation of cleanup alternatives or selection of the removal action. The same page also states that additional background data will be obtained during EPA's Site investigation work.

Comment: The EE/CA has not provided an estimate of background indoor gamma levels (see page 3-4 of the EE/CA). We assume that the background level will be determined prior to the commencement of the discovery phase of the project and that the data supporting the estimate will be made available to the public. Any effort to determine background indoor gamma levels must recognize that

indoor gamma levels might be artificially raised by the use of construction materials that contain naturally occurring radiological material.

Response: Since indoor gamma exposure rates are being used during the site investigation work and verification phase as a "finding tool" only, it was not necessary to establish the background level for indoor gamma exposure rates prior to initiation of Site investigation work. EPA is collecting some background information on indoor gamma exposure rates as the Site investigation work progresses and will have that information before verification activities begin. EPA recognizes that construction materials that contain naturally-occurring radiological materials may influence indoor gamma levels, and will provide for this phenomenon during implementation of the verification activities.

Comment: Region 5 has not considered all of the data available on Kress Creek and has failed to carefully scrutinize the limited data on which the EE/CA has relied (EE/CA, pages 2-10 to 2-11). The EE/CA relies extensively on sampling conducted for the NRC by Oak Ridge Associated Universities (ORAU) as the source of information concerning the concentrations of thorium-containing materials in and along the creek. An NRC panel of administrative law judges has carefully reviewed the ORAU data and has concluded that there is considerable uncertainty surrounding the sampling results. The EE/CA also relies on the ORAU report for data on gamma exposure rates in the area (EE/CA, page 2-11). But, there are significant problems with that data as well. Finally, the EE/CA has ignored a comprehensive gamma survey of the properties in the vicinity of the creek that was undertaken by Kerr-McGee which revealed that regions with elevated exposure rates are small in areal extent and are infrequently encountered.

Response: Because the EE/CA addresses only a very small portion of the Kress Creek NPL Site and actual cleanups will be based on data collected during the discovery and characterization phase, it was not necessary to scrutinize in detail all of the data available on the Kress Creek Site. The section of the EE/CA on page 2-10 to 2-11 is merely giving a description of past investigations and response. It did, however, fail to mention the surveys of properties in the Kress Creek area previously conducted by Kerr-McGee, although EPA is aware of these surveys and their results. The issues regarding the alleged "problems" with the past data are not really relevant to the selection of the response action, as decisions regarding which properties will be remediated will be based on data that EPA currently is collecting (and not on past data). Section 2.3.2 of the EE/CA is not intended to identify specific properties for cleanup but to support inclusion of portions of the Kress Creek Site in the study area.

Comment: Region 5 plans to investigate the degree of equilibrium between Uranium-238 and its decay products in residential area soils by analyzing soil samples that are to be collected from Kress Creek, Reed-Keppler Park, and the Sewage Treatment Plant (EE/CA, page 2-12). However, no explanation is provided as to why samples will not be taken from the residential areas themselves. It would seem that analysis of soils from the residential areas would provide the most direct correlation between U-238 and daughter equilibrium concentrations in residential area soils.

Response: As discussed in response to previous comments, EPA has decided to collect samples from the Residential Areas Site and analyze them for Th-232, U-238, Ra-228 and Ra-226 to investigate the degree of their equilibrium. EPA will expedite the analysis of these samples and will share this information with interested parties as soon as validated data becomes available.

Comment: The EE/CA incorrectly reports that the Rare Earths Facility may have significant sources of metal contamination other than those generated from ore processing (EE/CA, page 2-15). The metals that are present in the tailings pile are at the levels that are typical of the natural ore from which the tailings were produced.. There thus is no reason to believe that the presence of metals in the Facility wastes are derived from sources other than the natural ore that was feed to the process.

Response: This comment may be correct and is duly noted, although whether metals contamination derives from "natural ore" byproducts or from other Rare Earths Facility sources does not affect the removal action.

Comment: With regard to the issue of possible metals contamination, and the fact that metals have been found at the Reed-Keppler Park Quarry NPL Site, the EE/CA correctly reports that Reed-Keppler Park was used as a landfill with multiple waste generators (EE/CA, page 2-15). Indeed, much of the waste disposal that may have occurred at Reed-Keppler Park has not been attributed to the Rare Earths Facility. Nonradiological contaminants identified in soil samples collected from within the fenced security area include semivolatile organic compounds and pesticides, compounds not identified in Facility soils or groundwater.

Response: This comment is noted and does not affect selection of the removal action.

Comment: Region 5 has not adequately explained why barium and chromium are considered potential contaminants of concern even though the data show that neither metal will exceed its respective risk-based concentration (EE/CA, page 2-16). The decision to include barium and chromium as potential contaminants

of concern appears to be based on EPA's incorrect decision to include barium and chromium in the hazard ranking score (HRS) for the off-site areas (EE/CA, page 2-21). But, the HRS is intended to provide a ranking of hazardous waste sites for the purpose of determining whether to include the sites on the NPL, and is not intended to guide the conduct of removal actions.

Response: As stated on page 2-16 of the EE/CA, barium and chromium are considered potential contaminants of concern because they were included in the HRS scoring package for both the Residential Areas and Kress Creek NPL Sites. EPA currently is investigating, as part of its Site investigation work, whether these metals should continue to be considered contaminants of concern. The results of this investigation, and not the HRS scoring information, will guide the conduct of the actual removal actions.

Comment: The EE/CA correctly notes that because of its extremely short half-life (55 sec.), the potential for migration of thoron into a home is low, and it goes on to note that once thoron enters a home through foundation cracks or sumps, its decay product, lead-212, may persist in the home for some time and may migrate from the entry point (EE/CA, page 2-20). The EE/CA has failed to note, however, that because of the relatively small diffusion rate for thoron, only the very near surface of contaminated soil can release thoron into the crawl space or basement of the home, so only an extremely small fraction of the thoron emitting from the tailings will enter the residence in the first instance. Moreover, much of the lead-212 that would be generated is likely to be removed from the air by mechanisms such as plate-out and thus becomes unavailable for exposure to the resident.

Response: EPA agrees that probably only the very near surface of contaminated soil can release thoron into the home because of the relatively small diffusion rate for thoron. Mechanisms such as plate-out are factors to be considered for thoron decay products, just as they are with radon decay products. However, EPA still believes that radon/thoron monitoring could serve as a useful "finding tool" to find material beneath or against the foundation of homes.

Comment: Region 5 has declined to endorse soil separation of excavated soils from the off-site areas as a treatment option (EE/CA, page 4-10). Although Kerr-McGee does not expect that soils from shallower excavations of off-site properties will be suitable for screening, soils from deeper excavations may contain sufficiently clean materials so as to justify soil separation. Soil separation may offer significant reductions in the volumes of the soils that would need to be transported off-site for disposal and should be retained as a treatment option. Indeed, Kerr-McGee's analysis of the feasibility of soil separation indicates that the separation of coarse soil fractions with

concentrations below 5 pCi/g total radium from more highly contaminated material is technologically feasible and economically attractive. Volume reduction achieved by soil separation provides substantial societal benefits as well -- space in waste depositories is increasingly scarce; no health or safety benefit is achieved by requiring material that can be separated from contaminants by soil separation to be disposed of in permanent depositories; and volume reduction reduces non-radiological risks resulting from transportation of large volumes of material to a distant repository. Volume reduction also lowers the expense of transportation and disposal. U.S. EPA itself has, in technical publications, endorsed the use of volume-reduction as an innovative technology for the cleanup of Superfund sites containing radiological material. Finally, it should be recognized that after the off-site materials are brought to the Rare Earths Facility, the materials will be governed by the IDNS, who will oversee and control all actions taken with respect to the manner in which the materials are processed, stored, and managed at the Facility.

Response: The decision was made in the EE/CA not to retain volume reduction techniques such as soil separation for further consideration on the Residential Areas Site because the information available to EPA indicated that the process is not presently sufficient to reduce the contaminant concentration to levels below the 5 pCi/g total radium criterion for a significant fraction of the waste from this Site and to be consistent with the ALARA principle. Because EPA did not believe that the technology was appropriate for use at the Residential Areas Site, EPA did not deem it necessary to endorse use of the technology for Residential Areas Site materials taken to the Rare Earths Facility. EPA is not aware of any facility in the country that is a licensed treatment facility for 11(e)(2) byproduct material within the meaning of EPA's Off-Site Rule. Accordingly, the Action Memo requires that all contaminated materials removed from affected properties be transported to a permanent off-site disposal facility. EPA does not believe that the Rare Earths Facility is currently licensed to accept 11(e)(2) byproduct material from outside the facility for treatment or disposal. EPA would need to review any treatment licenses and actual data from the physical separation facility demonstrating its ability to meet applicable standards before EPA would approve transportation of materials to such a facility for treatment.

Comment: Region 5's preferred removal alternative (Alternative 2 - Source Removal) seems to envision that the off-site materials are to be loaded onto railcars as soon as sufficient materials accumulate at the Facility staging area to fill a railcar (EE/CA, page 4-17). This approach is unreasonable. Off-site materials will need to be stockpiled at the Facility before the materials are shipped off-site for disposal. Kerr-McGee has committed to an aggressive schedule for the removal of the Facility tailings -- with removal of the most

highly contaminated materials first -- and cannot, consistent with its commitments, dedicate railcars to the priority removal of materials from the off-site properties, much of which is expected to consist of soils with contamination at levels slightly above background. Instead, the materials of lesser radioactivity will be transported as railcar space becomes available. Other contingencies such as inclement weather may necessitate that the off-site materials be stockpiled at the Facility before the materials can be shipped to the disposal site.

Although interim storage of off-site soils at the Rare Earths Facility has been retained as an alternative for further consideration, Region 5 has not yet endorsed interim storage for use in the removal program. We urge Region 5 to do so. Region 5 has imposed two conditions on the acceptability of the Facility for interim storage of off-site soils: the storage period must be temporary (up to one year) and the off-site soils must be segregated from the other Facility wastes (EE/CA, page 4-11). Both conditions are readily satisfied. As off-site soils arrive at the Facility, they will be placed in stockpiles, and each stockpile will be removed within six months from the date on which it was established. Kerr-McGee has no objection to segregating soils from the West Chicago Superfund sites from other Facility materials. However, Kerr-McGee does not intend to establish a separate stockpile for each load of off-site materials that is received at the Facility. It also should be understood that the off-site soils will likely be blended with other Facility soils prior to shipment to assure satisfaction of standards for acceptance by Envirocare (e.g., activity, moisture, pH).

Response: The discussion on page 4-17 of the EE/CA is a conceptual-level description of the source removal alternative. Although it stated, "When sufficient quantities of material have been collected at the staging area, the railcars are loaded...", the term "sufficient quantities" was not defined. In addition, this was a conceptual-level description only, and as clearly stated elsewhere in the EE/CA, some of the assumptions made in the EE/CA were for cost estimating purposes only, and were not meant to dictate the exact procedures to be used during the removal action; the Work Plan for the removal action, after approval by EPA, will detail how the work (including use of railcars) will be conducted. EPA acknowledges Kerr-McGee's aggressive schedule for shipping the Rare Earths Facility wastes. If Kerr-McGee wishes to stockpile wastes from the Residential Areas Removal Site at the Rare Earths Facility prior to shipment, those procedures should be included in the Work Plan Kerr-McGee will submit to EPA (if Kerr-McGee conducts the work) and must comply with standards and schedules contained in the IDNS license amendment and other applicable requirements.

EPA disagrees with the comment that EPA has not endorsed the interim storage option. Past EPA factsheets related to the Site endorsed this option, and the EE/CA concludes that "Contingent Action A -- Interim Storage" is allowed. EPA has stated that in order for interim storage to be acceptable, the storage must be temporary and the off-site soils must be segregated from other contaminated soils from the Rare Earths Facility. However, the one-year period for interim storage assumed in the EE/CA was an assumption for cost estimating purposes only. EPA does not expect Kerr-McGee to establish a separate stockpile for each load of material that is received at the Rare Earths Facility, and EPA has no objection to the blending of materials from this Site with other materials at the Rare Earths Facility for purposes of shipment of the materials to Envirocare.

Comment: The EE/CA refers to contaminated soils from the Rare Earths Facility and other "Kerr-McGee sites." Kerr-McGee strenuously objects to the designation of the off-site NPL-listed sites as "Kerr-McGee" sites. Kerr-McGee is not and has never been the owner of these off-site areas. Kerr-McGee is not a "responsible party" under CERCLA Section 107 with respect to these areas. Kerr-McGee became the owner of the Facility in 1967 as a result of a corporate acquisition. Kerr-McGee understands that the tailings were removed from the Facility by various residents, contractors, or others in the 1930s and 1940s -- apparently the Facility was viewed by the community as a source of fill material. The Kerr-McGee connection to the off-site contamination is too attenuated to provide a foundation for liability. The only conceivable theory by which Kerr-McGee might be deemed liable as a responsible party is that it somehow "by contract, agreement or otherwise arranged for disposal...or arranged with a transporter for disposal..." In circumstances in which tailings were placed on the off-site areas by third parties without involvement by Kerr-McGee, Kerr-McGee cannot be deemed to have arranged for disposal.

Response: The NPL Sites are referred to as the Kerr-McGee sites because that is how their name appears on the National Priorities List. The issue of Kerr-McGee's liability is not relevant to the analysis and selection of the removal action, but will be addressed at the appropriate time.

Comment: The discussion in the EE/CA concerning Envirocare's readiness to accept shipments of Section 11(e)(2) byproduct material is outdated (EE/CA, page 4-12). The first railcar of tailings destined for disposal at the Envirocare site left the Rare Earths Facility on September 9, 1994.

Response: This comment is noted and does not affect selection of the removal action. The discussion in the EE/CA was current at the time the EE/CA was prepared.

Comment: Region 5 has retained for further consideration the installation of a barrier wall of sheet piling along the banks of Kress Creek to prevent possible recontamination of Kress Creek properties during severe flooding events (EE/CA, pages 4-5, 4-13). We find this proposal to be extraordinarily impracticable and unnecessary. The EE/CA aptly demonstrates that sheet piling would add significant costs to the cleanup program, would divert time and effort in securing the necessary federal and State approvals, is likely to be extremely unpopular with the local community, and is largely unnecessary given the extremely low probability of a storm/flooding event of significant severity and magnitude to cause deposition of contaminated sediments onto the Kress Creek properties.

Response: Although sheet piling was evaluated in the EE/CA as a possible means of recontamination prevention, the EE/CA concluded that this option was not recommended.

Comment: Region 5 has proposed that excavated soils from residential properties be packaged in polypropylene bags for shipment to the Rare Earths Facility (EE/CA, page 4-17). Any requirement for packaging of excavated soils is unnecessary and impracticable. Bulk shipment of soils was employed during the West Chicago cleanup that was conducted in the mid-1980s with EPA oversight and NRC approval. In all, some 35,000 cubic yards of soil were safely transported to the Facility from the residential areas without a single mishap. The use of packaging for the soils would serve to increase costs, would prevent the maximum utilization of truck and railcar space, and can not be justified on the basis of health or safety. We thus urge Region 5 to drop any further consideration of packaging the soils in polypropylene bags.

Response: The EE/CA states (on page 4-16) that the packaging option was an assumption that was made solely for the purpose of having a consistent basis on which to estimate costs, and that bulk shipment of the materials from this Site is not precluded by this assumption. Packaging of the wastes is not a requirement. The actual procedures for conduct of the work will be governed by the EPA-approved Work Plan for the removal action.

Comment: The Illinois Uranium and Thorium Mill Tailings Control Act referenced on page 4-19 of the EE/CA has recently been amended.

Response: This comment is noted. The amendment does not affect the cost estimates in the EE/CA.

Comment: The EE/CA compares the potential dose to residents from removal activities to the 10 mrem/yr standard for airborne releases found in the National Emission Standard for Hazardous Air Pollutants (NESHAPs) at 40 CFR 61 (EE/CA,

page 5-3). The NESHAP by its terms applies to radionuclide emissions from NRC-licensed facilities only. The comparison to the NESHAP in the context of the residential site cleanup thus is improper; the NESHAP simply does not apply to residential sites.

Response: The EE/CA does not state nor imply that the NESHAP standard for airborne releases applies to the Residential Areas Site. The EE/CA was merely comparing estimated doses to the general public with established dose limits in other regulations to give readers some context for the dose estimates.

Comment: Kerr-McGee supports the use of the Rare Earths Facility as a site at which soils excavated during the removal program could be stored until they are shipped for disposal to Envirocare (EE/CA, pages 5-4 to 5-5). In our view, the only sensible approach is the use of the Rare Earths Facility for storage and shipment.

Response: EPA agrees that the most logical place to take the materials for staging or storage before they are shipped for disposal is currently the Kerr-McGee facility.

Comment: In the discussion of the incremental dose to the nearest resident from interim storage at the Rare Earths Facility reference is made to a regulatory limit of 50 mrem/yr (EE/CA, page 5-4). The reference appears to be in error. The relevant NRC limit is 100 mrem/yr (10 CFR 20.1301, 1993).

Response: This is correct. EPA does not believe that this comment requires revision of the EE/CA at this time because it would not result in a change in the selected removal action. The comment is noted for future reference, particularly if Contingent Action A (Interim Storage at the Rare Earths Facility) requires implementation.

Comment: Region 5 has retained as a contingent action the transportation of excavated soils to a railspur and staging area at some unidentified site other than the Rare Earths Facility (Alternative 2, Contingent Action B) (EE/CA, pages 4-15, 4-19 to 4-20, 5-5). This alternative is unnecessary. Kerr-McGee has received the necessary approvals from the IDNS to permit the interim storage of off-site soils at the Facility. Moreover, a railspur and loading facility has already been constructed at the Facility and shipments are now occurring.

Response: The development of the Off-Rare-Earths- Facility Staging Area contingent action was necessary in case Kerr-McGee, for some reason, does not conduct the removal action work at this Site and the work instead is conducted by EPA. Although Kerr-McGee has obtained approvals from IDNS to accept wastes at the Rare Earths Facility and has indicated a willingness to

conduct the work at this Site, Kerr-McGee is not currently under any legally enforceable requirement to conduct the work.

Comment: The EE/CA asserts that runoff from the Rare Earths Facility may have impacted surface water and storm sewer conveyance facilities (EE/CA, page 5-6). That assertion is misguided. All surface runoff from the Kerr-McGee Facility is contained within the Facility boundaries. There is no basis for believing that Facility runoff has impacted sewer conveyance facilities.

Response: Although all surface runoff from the Kerr-McGee Facility currently may be contained within the Facility boundaries, this was not necessarily the case during the entire history of Facility operations (from 1932 until now). As discussed in response to previous comments, EPA believes that contamination from the Facility was carried to Kress Creek via a storm sewer.

Comment: Inexplicably, the EE/CA has failed to identify the permits and regulatory requirements that must be secured before an off-Rare Earths Facility railspur and staging area can be established (EE/CA, page 5-11). Construction of the railspur and staging area would require, at a minimum, issuance of construction permits from local authorities and presumably would require licenses or approvals from IDNS and other State agencies.

Response: At this time, EPA does not believe that any permits or authorizations would be needed for Contingent Action C -- Off-Rare-Earths-Facility Staging Area. Such a staging area would not be a storage area, but rather would be an existing railyard where EPA could take properly packaged wastes for loading onto trains. EPA is not considering constructing a new waste storage area, nor is EPA considering constructing a new railspur. Wastes would not be handled in bulk, but would be properly packaged to meet all applicable Department of Transportation requirements. If the wastes are properly packaged, IDNS has informed EPA that no State approvals would be required in order to load the packages onto trains.

Comment: EPA Region 5 has added a new element to the cleanup criteria which now provide that, in addition to the specific numerical cleanup criteria, all cleanup activities must comply with the additional requirement that "every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are as low as reasonably achievable (ALARA)." Kerr-McGee objects to the addition of a significant new element to the cleanup criteria without any opportunity for affected parties to comment. EPA's addition of the ALARA criterion seems to undercut the whole purpose for the establishment of criteria -- the need for concrete and precise guidance for the conduct of sampling and cleanup. The 5 pCi/g standard now has been recast by Region 5 to require that "excavation of

contaminated soils continue until concentrations clearly below the target levels are achieved" (EE/CA, page 6-6). Such an approach is completely impractical, as it may require negotiation of the cleanup level on a residence-by-residence or perhaps shovel-by-shovel basis. In addition, EPA has misunderstood how the ALARA principle is to be applied. If EPA persists in considering an ALARA-based cleanup standard, it should at least apply the ALARA principle in the same fashion as IDNS has done in setting the cleanup standard for soils at the West Chicago Rare Earths Facility (the "Facility"). IDNS has applied ALARA in the context of developing specific soil cleanup standards -- namely to justify cleanup to the 5 pCi/g level -- and not to demand a non-specific and indefinite obligation for further cleanup.

Response: The addition of ALARA as an element of the cleanup criteria for this Site was not made in the EE/CA, but was made when the criteria were established in November 1993. Although this element was not in the draft version of the Action Criteria Document which underwent an informal public input period, it was included in the final version in order to provide an additional degree of protectiveness and to comply with the ALARA philosophy that EPA deemed to be an ARAR from federal and state requirements. The public was given the opportunity to comment on the ALARA principle during the comment period for the EE/CA. As described in the Action Criteria Document, the primary criterion that will be used to judge whether cleanups are performed properly is the soil concentration criterion of 5 pCi/g above background. The soil concentration criterion should be viewed as a "maximum allowable" number; the ALARA criterion simply states a preference to go as far below the soil concentration criterion as is reasonably achievable. The statement that Kerr-McGee quotes from page 6-6 of the EE/CA, that "excavation of contaminated soils continue until concentrations clearly below the target levels are achieved," has been taken out of context; that statement was made in the context of describing what, in actual practice, is likely to occur in the field due to the nature of excavation activities. Elsewhere on page 6-6, the EE/CA clearly states the ALARA concept as follows: "Limit the maximum...residual concentrations at individual locations to 5 pCi/g above background, while striving to reduce to levels nearer background the residual concentration at the greatest number of locations possible."

In previous comments, Kerr-McGee has expressed the concern, shared by some property owners as well, that there be no further cleanup required at the Site after completion of the removal action at the Site. One of the basic objectives of applying the ALARA concept at this Site (as stated on page 6-6 of the EE/CA) is to minimize the possibility that additional Site remediation would be necessary in the future, particularly in the event that contaminant-specific ARARs change in the future. When the RI/FS is conducted at this

Site and a final remedial decision made, EPA will have to consider the ARARs that exist at that time. In light of the fact that some ARARs may be changing to possibly more stringent levels, the application of ALARA now is additional insurance that the final remedial decision at this Site will be "no action." As stated in the EE/CA, historical data from cleanup activities at other sites demonstrates that residual concentrations remaining after cleanup typically are well below targeted cleanup criteria due to the way excavation activities are conducted. EPA believes it has properly and appropriately applied ALARA at this Site, and that stating it as an element of the criteria for this Site is simply putting into writing what already is done in actual practice at most cleanups. EPA is not bound to IDNS's interpretation of ALARA, which may differ from EPA's for several reasons, including different future use scenarios. The application of ALARA will not be negotiated at each property, but will be determined by EPA.

Comment: Kerr-McGee strongly supports the excavation of tailings from any highly contaminated properties in the West Chicago area and the return of that material to the West Chicago Rare Earths Facility for shipment to Envirocare. Because Kerr-McGee has previously been identified by EPA as a potentially responsible party in connection with the West Chicago Superfund Sites and has been engaged in discussions with EPA on the conduct of the removal program, Kerr-McGee has a strong interest in assuring that practical and technically sound cleanup strategies are developed and applied. To that end, over the past one and one-half years, Kerr-McGee has submitted extensive comments (listed below) to EPA in an effort to assist EPA in developing an appropriate cleanup program. We request that these earlier comments be incorporated as part of our comments on the Engineering Evaluation/Cost Analysis.

"Comments of Kerr-McGee Chemical Corporation on the Focused Risk Assessment for West Chicago Vicinity Properties and the Associated Fact Sheet" (February 25, 1993)

"Comments of Kerr-McGee Chemical Corporation on the Action Criteria for Superfund Removal Actions, West Chicago, Illinois and the Associated Fact Sheet" (March 29, 1993)

Letter from R.A. Meserve, Covington & Burling, to R. Frey and D.P. Seely, EPA, Region 5 (February 18, 1994)

Letter from R.A. Meserve to R. Frey and D.P. Seely (October 22, 1993)

Letter from R.A. Meserve to R. Frey and D.P. Seely (October 5, 1993)

Letter from R.A. Meserve to R. Frey and G.M. Schafer (June 2, 1993)

Letter from R.A. Meserve to R. Frey (May 5, 1993)

Letter from R.A. Meserve to R. Frey and M. Radell (April 28, 1993)

Response: EPA acknowledges receipt of Kerr-McGee's previous comments (listed above, dated from February 25, 1993, through February 18, 1994), in addition to Kerr-McGee's written comments dated September 16, 1994, on the EE/CA. EPA has added all Kerr-McGee comments to the administrative record for this action. Some of the issues raised in those submissions are not directly relevant to the EE/CA, but are, nonetheless, addressed below or have been addressed previously. Many of the issues were repeated in Kerr-McGee's comments on the EE/CA, which have been responded to above. Most of the issues raised were regarding the action criteria EPA has established for this site. To the extent responses have not already been provided, responses to these issues are provided below.

Comments from "Comments of Kerr-McGee Chemical Corporation on the Focused Risk Assessment for West Chicago Vicinity Properties and the Associated Fact Sheet" (February 25, 1993), as clarified by a letter from R.A. Meserve to R. Frey (March 1, 1993):

Comment: The risk assessment is only one of several studies of the risks associated with the off-site materials, and is inconsistent with the conclusions of the numerous studies that have preceded it. The Frigerio Report (1978) concluded that "there is no hazard to the public health and safety." Even EPA in the past has stated that the risks are insignificant; a 1983 letter from EPA to residents stated that "the data showed results that would be expected for ordinary homes in uncontaminated areas."

Response: The Frigerio Report's conclusion was apparently based solely on a comparison to the NRC regulatory limits at 10 CFR 20, which have since been made significantly more stringent. (For example, the report references a dose limit of 100 mrem per week, while the current limit is 100 mrem per year.) The report's conclusions also were based on the contaminated areas that had been identified and the data that had been collected at that time, and not necessarily the more recent data that was used in EPA's assessment of risks. In fact, the Frigerio Report failed to identify several of the most highly contaminated properties that Kerr-McGee found during it's cleanup effort in the mid-1980s. In addition, the Frigerio Report assumed that fenced-off areas were not accessible for exposure; Superfund does not consider such access restrictions when evaluating potential risks. EPA followed standard Superfund risk assessment procedures; the Frigerio Report did not conduct a risk assessment. Lastly, Kerr-McGee has taken the 1983 EPA letter completely

out of context. That letter conveyed only the results of indoor radon/thoron measurements at 10 homes in West Chicago. As stated on page 2-9 of the EE/CA, the results at those 10 homes was generally less than 0.02 Working Levels. The letter cannot be construed as if EPA has said there are no risks at the entire Site.

Comment: The data on which EPA relies are inadequate. The properties that were studied are not typical of other contaminated properties in the area, and cannot serve as reasonable examples of properties that have already been surveyed and cleaned up in the mid-1980s. Kerr-McGee did encounter two residential properties that had extensive deposits of undiluted tailings, but these properties were clearly unusual and cannot be expected to recur.

Response: EPA's risk assessment was based on limited IDNS data that was available at the time from several properties. EPA very clearly states in the risk assessment that its analysis is limited to the properties that were the focus of the assessment. However, the levels of contamination at the properties that were studied clearly do exist at those properties. As stated above in response to previous comments, the risk evaluation is not EPA's sole justification for taking a removal action at the Site, but does help justify taking an action.

Comment: The characterization of the properties was inadequate because, in most cases, the sole data on which EPA relied were the maximum gamma measurement and a single soil sample collected from the point of the maximum gamma measurement. The risk assessment was conducted by assuming that the single gamma measurement and soil analysis were characteristic of the entirety of the contaminated area at each site. These data are clearly too sparse to provide a reliable portrayal of the properties.

Response: EPA acknowledged in the risk assessment that the available data was very limited and some conservative assumptions had to be made, and that the estimated risks therefore could be overestimated. As stated in response to previous comments, the Preliminary Focused Risk Assessment conducted by EPA fulfills the objectives of the streamlined risk evaluation necessary for the EE/CA and is consistent with EPA guidance.

Comment: EPA has significantly exaggerated the risk associated with the properties because of (1) assumptions that were made that exaggerate the risk from current and future land-use scenarios, (2) the selection of an erroneously low background gamma level, (3) several erroneous assumptions regarding indoor thoron/radon (i.e., thoron daughter equilibrium rate, and indoor radon and thoron concentration in air that are different than those used by another EPA contractor in 1986), (4) inappropriate dose conversion factors (i.e., the appropriate roentgen to rem conversion factor should be .61 instead of 1), (5)

inappropriate thoron risk values (a more appropriate risk value for thoron daughters would be between 75 and 45 per million WLM of exposure, about one-third to one-fifth that of radon daughters, instead of 180 per million WLM of exposure), and (6) unrealistic exposure assumptions (e.g., exposure times, the gardening scenario, the soil ingestion scenario). [The comment provided many technical details concerning each of these points.]

Response: (1) EPA acknowledged and justified in the risk assessment document that it had to make some conservative assumptions that may cause the risks to be overestimated. (2) As stated in response to previous comments, the selection of the background gamma level was based on consideration of more than one study, and on more recent data than the 1978 Frigerio Report, and would not significantly affect the calculations. (3) The thoron daughter equilibrium rate was based on appropriate scientific literature as cited in the risk assessment document. Similarly, the derivation of the indoor radon and thoron concentration in air is shown in Appendix A of the risk assessment document, using appropriate assumptions based on the most current information. EPA believes that the current assumptions are more appropriate for use in this action than those contained in the 1986 document. (4) Regarding the roentgen to rem dose conversion factor, the statement in the risk assessment that "one roentgen equals one rad equals one rem for the purposes of this study" is based upon the fact that one roentgen corresponds to 87.8 ergs of energy absorbed per gram of air and leads to the absorption of 95 ergs per gram in tissue. With the rad defined as 100 ergs per gram, 95 ergs per gram is, to one significant digit, 1 rad. The quality factor for gamma radiation is 1 so that 1 rad corresponds to 1 rem (rem = QF x rad). Thus, the statement that one roentgen equals one rad equals one rem is justified. (5) With regard to the thoron risk value, the Science Advisory Board set a radon risk factor, but it has not set a thoron risk factor. It appears that Kerr-McGee correctly states that EPA should have selected a thoron risk factor of approximately 75, which is one-third the value for radon. However, in most cases the risks evaluated in the Focused Risk Assessment were dominated by gamma exposure risk, so adjustments to the radon/thoron risk calculations would not change the results significantly. (6) Lastly, the exposure assumptions in the risk assessment document were based on standard EPA risk assessment guidance and Site-specific assumptions that might reasonably be expected to occur for a maximally exposed individual. EPA believes the exposure times, while conservative, are not implausible and were appropriate for their intended use. In most cases, neither the gardening scenario nor the soil ingestion scenario contributed significantly to the estimated risk, which was dominated by gamma exposure risk.

Comment: The risk assessment is not related to the contemplated removal actions.

Response: The focused risk assessment (and the streamlined risk evaluation in the EE/CA) helps to justify taking an action at the Site but is not EPA's sole justification for taking an action. The complete justification for the removal action is contained in the Action Memo and its administrative record. Once the decision is made to take an action, it is the cleanup criteria that have been established for the Site, and not the risk assessment, that determine which properties require remediation.

Comments from "Comments of Kerr-McGee Chemical Corporation on the Action Criteria for Superfund Removal Actions, West Chicago, Illinois and the Associated Fact Sheet" (March 29, 1993): EPA previously provided responses to these comments (see "Summary of Responses to Public Comments on March 1993 Review Draft of Action Criteria for Superfund Removal Actions, West Chicago, Illinois," December 1993; this document is included in the administrative record for this action). EPA considered all of Kerr-McGee's comments on the draft action criteria before finalizing the criteria. In fact, Kerr-McGee's comments on the draft document resulted in several changes in the final document issued by EPA in November 1993. For those aspects of the action criteria that did not change, Kerr-McGee repeated some of the same comments in its comments on the EE/CA, and responses to those are provided above.

Comments from the letter from R.A. Meserve, Covington & Burling, to R. Frey and D.P. Seely (February 18, 1994): This letter contained comments on the final Action Criteria Document that was finalized in November 1993. The comments centered around the fact that EPA did not change the 5 pCi/g soil concentration criterion in the final Action Criteria Document, and the fact that EPA added the ALARA element to the final criteria document. Many of the concerns expressed in the letter are repeated in Kerr-McGee's comments on the EE/CA, which are responded to above. The comments in the letter that were not included in Kerr-McGee's comments on the EE/CA, however, are responded to below.

Comment: Region 5 has established a cleanup standard of 5 pCi/g above background for buried radium even though the relevant EPA and IDNS standards provide a limit of 15 pCi/g above background for buried radium. It appears that the foundation for the cleanup requirement is reflected in the letter from M.T. Oge, EPA Office of Radiation and Indoor Air, to R.A. Meserve (December 7, 1993), but that letter does not adequately address Kerr-McGee's concerns.

Kerr-McGee has stated a concern that radium-228, the predominant radium isotope of concern in thorium tailings, has very different properties than radium-226 and that the cleanup standard is based on the properties of radium-226. Ms. Oge states that the soil cleanup standard that was promulgated by EPA (40 CFR 192) reflected an analysis of the risks of radium-228. This is incorrect. The document, "Final Environmental Impact Statement for Standards for the Control of Byproduct Material from Uranium Ore Processing

(40 CFR 192)," EPA 520/1-83-008-1, September 1983, ("FEIS"), discusses thorium and acknowledges that the thorium decay series is different from the uranium decay series and that thoron decay products present lesser risk than radon decay products. The analysis presented, however, relates only to the adoption of the flux standard for a tailings pile and does not bear on the selection of a radium-in-soil cleanup standard for contaminated land. The only analysis of the soil cleanup standard in the FEIS concerns the risk to persons living in homes that might be built on contaminated land, and the analysis is limited to the risk from radium-226; EPA conducted no parallel analysis of soil cleanup standards for radium-228. The NRC has found, based on an analysis of the risks from thoron and its daughters, that a far less restrictive standard for radium-228 would be justified.

Response: As noted in Ms. Oge's December 7, 1993, letter, when the standards at 40 CFR 192 were promulgated, the 5 pCi/g limit for thorium or radium in surface soils was based on both the inhalation risk from radon and thoron and the risk from gamma radiation. This basis is reflected in the preamble to the final regulation at 48 FR 600. The 5 pCi/g limit is a health-based limit that EPA considers as relevant and appropriate for use at this Site. The 15 pCi/g subsurface limit, on the other hand, is not a health-based standard, but is rather a practical "finding tool" for use in locating discrete caches of high-activity tailings (typically 300-1000 pCi/g) that were deposited in subsurface locations at mill sites or at properties in the vicinity of such mills. It is only appropriate for use as a cost-effective tool to locate radioactive waste in situations where contaminated surface materials are of high activity and are not expected to be significantly admixed with clean soil. The 15 pCi/g subsurface soil standard was not developed for situations where significant quantities of moderate- or low-activity materials are involved, such as at the Residential Areas Site.

Kerr-McGee correctly notes that the analysis of the soil cleanup standard in the FEIS is based on an analysis of the risk from radium-226. The FEIS discusses risk from gamma radiation, but because the analysis focused on radium-226, and because the risk from radon was so large, the risk from gamma radiation was not discussed in great detail (although it is discussed). If an analysis were conducted that was based solely on thoron and its daughters, such an analysis may well conclude that a less restrictive standard for radium-228 is appropriate. However, thorium mill tailings differ from uranium tailings in that the thorium-232 decay chain contributes approximately 50% more effective dose equivalent from gamma radiation than the uranium decay chain. As Ms. Oge stated in her December 7th letter, thorium-contaminated soils actually pose a higher risk from gamma radiation than do radium-226 contaminated soils.

The analysis of thorium that is presented in Appendix G of the FEIS, as Kerr-McGee notes, was conducted to evaluate the flux standard from a tailings pile. However, information in the analysis DOES bear on the radium-in-soil cleanup standard. Table G-6 (page G-11) of the FEIS indicates that, for a tailings pile, an absorbed dose rate of 21.6 mrad/year (which for gamma is equivalent to 21.6 mrem/year) results from every 1 pCi/g of thorium and its decay products. The same would also hold true for land contaminated with thorium tailings. As a result, 5 pCi/g of thorium tailings could result in over 100 mrem/year absorbed dose rate, which is above the health-based regulatory limit of 100 mrem/year recommended by the National Council on Radiation Protection and Measurements (NCRP) and applied by the NRC in regulations at 10 CFR 20. (This is one of the reasons EPA has decided to apply the ALARA principle to the cleanup at this Site, as discussed in response to previous comments.) If subsurface soils were allowed to have greater than this amount of tailings and a home were built on top of the material, EPA believes that the gamma emissions would cause the health-based limit to be exceeded. Therefore, although the primary analysis of the radium-in-soil standard focused on radium-226, information exists to demonstrate that the standard of 5 pCi/g is also a health-based limit for thorium and its decay products (such as radium-228), albeit for different reasons.

In addition, although the background documents for the standards at 40 CFR 192 may not reflect a full analysis of thorium (and radium-228), EPA Headquarters clearly was aware of the differences between uranium-chain materials and thorium-chain materials and the much higher gamma exposure rates attributable to thorium-chain materials, as reflected in a memo (Ca.1980) from J. Russell, EPA Headquarters, to L. Jensen, EPA Region 5, which can be found in the administrative record for this action. This memo states that soil contaminated with 5 pCi/g of uranium mill tailings from the ground surface to an infinite depth will produce an external dose rate of about 70 mrem/year; the same amount of thorium mill tailings, however, produces about 108 mrem/year, which is over the current regulatory limit of 100 mrem/year.

Finally, the standards promulgated under 40 CFR 192 require the same degree of cleanup for thorium-chain materials as for uranium-chain materials. It is important to note that the ARAR that was cited in the Action Criteria Document was the State regulation at Section 332.150(b) of the Illinois Administrative Code. The State regulation was based on the federal standards at 40 CFR 192.12(a), and the State standards clearly specify that the standards apply to the combined quantities of radium-226 and radium-228. It should be noted that, although Section 332.150(b) of the Illinois Administrative Code is legally "applicable" to the Rare Earths Facility and contains a limit of 5 pCi/g for surface soils and 15 pCi/g for subsurface soils, IDNS has decided that the

cleanup of the Rare Earths Facility (which is to be released for unrestricted use after cleanup) should strive to meet the ALARA goal (as interpreted by IDNS) of 5 pCi/g above background at any depth in order to meet other regulatory requirements "to maintain doses to the public and releases to the general environment as low as is reasonably achievable." (Condition 33 to Amendment No. 23 to License No. STA-583 (Sept. 1, 1994) (Attachment to letter from R.A. Meserve to E. Deamer [Sept. 16, 1994]).) It appears that IDNS believes, as EPA definitely believes at a minimum, that the 5 pCi/g limit should be applied for subsurface soils as well as surface soils in order to be protective of public health.

Comments from the letter from R.A. Meserve to R. Frey and D.P. Seely (October 22, 1993): This letter provided additional comments to EPA on the draft Action Criteria, specifically the soil concentration criterion, prior to finalization of the criteria in November 1993. These comments were considered by EPA prior to finalization of the Action Criteria Document. Some of the comments in this letter already have been addressed because they were repeated in other Kerr-McGee comments, which are responded to above. The comments in the letter that were not included in other Kerr-McGee comments, however, are responded to below.

Comment: This comment is based on Kerr-McGee's presumption that Region 5 is inclined to establish a 5 pCi/g limit for buried material because of an analysis of the risks due to radon infiltration into homes. Such an analysis is largely inapplicable because the West Chicago tailings consist principally of radium-228, not radium-226. Based on a consideration of the comparative levels of radium-226 and radium-228 in the West Chicago tailings, Kerr-McGee suggests a possible risk-based standard that reflects the actual ratios of radium isotopes in the tailings. [The comment then went on to suggest a possible risk-based standard, based solely on a consideration of the risks from radon/thoron.]

Response: As stated in response to previous comments, Kerr-McGee's presumption is incorrect. EPA has established the 5 pCi/g standard as a criterion for subsurface soils in order to protect public health not only from radon and thoron but from the significant gamma emissions attributable to thorium-chain materials. Therefore, EPA believes that Kerr-McGee's suggested risk-based standard would not be protective of public health and is not appropriate for this Site.

Comments from the letter from R.A. Meserve to R. Frey and D.P. Seely (October 5, 1993): This letter provided additional Kerr-McGee comments on the draft Action Criteria, specifically the indoor radon criterion. Most of the comments in this letter were repeated in Kerr-McGee's comments on the EE/CA, which are responded to above. One comment that was not included in Kerr-McGee's comments on the EE/CA is responded to below.

Comment: With respect to indoor radon/thoron levels, we urge EPA to determine through a limited sampling program whether an indoor radon limit is necessary. For example, EPA might undertake a program in which it makes measurements of indoor radon at some of the properties at which tailings are known or determined to be present and, if elevated levels of radon are found, to assess the cause. We believe that such a program will demonstrate that the application of a radon limit is simply inappropriate in the West Chicago circumstance.

Response: EPA has decided to take just such an approach. During the time from January 1994 to April 1994, EPA conducted the first phase of indoor radon/thoron and indoor gamma surveys at less than 100 properties in the West Chicago area, some of which are known to have tailings contamination. Based on an evaluation of the results from this first phase of sampling, EPA will decide whether to continue such sampling at all properties within the study area or to scale-back on such sampling.

Comments from the letter from R.A. Meserve to R. Frey and G.M. Schafer (June 2, 1993): This letter provided documents related to cleanup standards at three other sites (i.e., Record of Decision for Montclair/West Orange Radium Site, N.J.; Record of Decision for Monticello Vicinity Properties Site, UT; Memo regarding removal action at Bluewater Uranium Mine Sites, N.M.).

Comment: Kerr-McGee urges EPA to consider the above documents before finalizing the Action Criteria for this Site.

Response: EPA was aware of this information, as well as information related to other sites around the country, and considered it prior to finalizing the Action Criteria Document in November 1993.

Comments from the letter from R.A. Meserve to R. Frey (May 5, 1993): This letter was in regards to an article that had been published in a local newspaper regarding the possibility of using Manville Oaks Park (owned by the West Chicago Park District) as an interim storage location. It is not relevant to the EE/CA or this action because EPA is no longer considering any interim storage location other than the Kerr-McGee Rare Earths Facility.

Comments from the letter from R.A. Meserve to R. Frey and M. Radell (April 28, 1993): This letter reiterated comments and concerns that Kerr-McGee had expressed to EPA during an April 1993 meeting between the two parties and in Kerr-McGee's written comments on the draft Action Criteria Document. EPA has responded to these comments and concerns in response to previous comments.

END

ATTACHMENT 3

ACTION CRITERIA
FOR SUPERFUND REMOVAL ACTIONS
AT THE KERR-McGEE RESIDENTIAL AREAS SITE
WEST CHICAGO, ILLINOIS

Prepared by
U.S. EPA Region 5

November 1993

ACTION CRITERIA
FOR SUPERFUND REMOVAL ACTIONS
AT THE KERR-McGEE RESIDENTIAL AREAS SITE
WEST CHICAGO, ILLINOIS

Introduction

Under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (commonly known as Superfund), as amended by the Superfund Amendments and Reauthorization Act of 1986, the United States Environmental Protection Agency (U.S. EPA) is authorized, among other things, to take response actions whenever there is a release or threat of a release of a hazardous substance into the environment. The National Priorities List (NPL) is a list of hazardous waste sites across the country that are eligible for U.S. EPA response actions under Superfund.

The U.S. EPA has listed four sites in the vicinity of the City of West Chicago, Illinois, on the NPL. The primary contaminants of concern at these sites are radioactive thorium and its decay products derived from ore processing operations at a factory in West Chicago, now known as the Kerr-McGee Chemical Corporation West Chicago Rare Earths Facility ("factory site"). Three of the NPL sites became contaminated when the processing wastes (thorium mill tailings) were removed from the factory and used primarily as fill material in and around the City of West Chicago. These sites are known as:

(1) Kerr-McGee (Residential Areas) site,
(2) Kerr-McGee (Sewage Treatment Plant) site, and
(3) Kerr-McGee (Reed-Keppler Park) site.

The fourth site became contaminated when discharges and runoff from the factory site traveled via a storm sewer into nearby Kress Creek and downstream to the West Branch of the DuPage River. This site is known as:

(4) Kerr-McGee (Kress Creek/West Branch of DuPage River) site.

It is important to note that the Residential Areas site may encompass not only residential properties, but also institutional, commercial and municipal properties. Although primarily contaminated because thorium mill tailings were used as fill, some of the properties may have become contaminated due to windblown material from the factory site.

The Kerr-McGee factory site from which the contamination originated has not been listed on the NPL; it is regulated under the licensing authority of the Illinois Department of Nuclear Safety (IDNS). Decommissioning, clean-up and closure of the factory site currently is being addressed under that authority.

Purpose and Intent

The purpose of this document is to establish criteria for U.S. EPA's response actions at contaminated properties ("Residential Areas") that are not part of the Sewage Treatment Plant, Reed-Keppler Park or Kress Creek/West Branch of DuPage River sites. Those three NPL sites will be addressed by U.S. EPA in separate actions.

It is the intent of the U.S. EPA to address the contamination problems at the Residential Areas by removal actions wherever practicable. Removal actions generally provide more immediate protection than do long-term remedial actions, and are consistent with the movement in the Superfund program to accelerate site cleanups.

U.S. EPA's actions under Superfund will be limited to those properties where the contamination is attributed to process wastes (thorium mill tailings) from the factory site. When naturally occurring radioactive materials not associated with process wastes cause U.S. EPA's action criteria to be exceeded, any corrective actions will have to take place through a separate mechanism, because Superfund generally does not give U.S. EPA the authority to remediate threats from naturally occurring substances.

This document contains the criteria that U.S. EPA will use to designate properties for removal actions and to verify that cleanup to levels protective of human health and the environment has been achieved. The U.S. EPA does not have standardized criteria for removal actions of this type. Consequently, site-specific criteria have been developed by the U.S. EPA in consultation with the IDNS for use at the Residential Areas. The criteria specified in this document will be used during three separate phases of the cleanup action: the **discovery phase**, the **characterization phase**, and the **verification phase**. Each of these phases and the criteria for each are described in detail later in this document. This document also contains release criteria for releasing equipment from work sites for unrestricted use.

Applicable or Relevant and Appropriate Requirements

Under Superfund, long-term remedial actions must attain Federal and more stringent State "applicable or relevant and appropriate requirements" (ARARs) during and at the completion of the remedial action. Removal actions (such as the type planned at the Residential Areas) must attain ARARs to the extent practicable. Therefore, U.S. EPA relied upon Federal and State ARARs to the extent practicable to establish the criteria in this document.

"Applicable requirements" are cleanup standards or other environmental protection requirements that specifically apply to the substances or activities at the site. In other words, an applicable requirement is one that a private party would have to comply with by law if the same action was being taken apart from Superfund authority.

If a requirement is not applicable, it still may be relevant and appropriate. "Relevant and appropriate requirements" are those cleanup standards that address problems or situations sufficiently similar to those at the Superfund site that their use is well suited to the particular site. A relevant and appropriate requirement must be both relevant to the conditions at the site and appropriate for use at the site, given the circumstances.

If a Federal or State requirement is neither applicable nor relevant and appropriate (and thus not an ARAR), it still may be useful to U.S. EPA when determining the necessary level of cleanup for protection of human health and the environment. Such "to-be-considered" material (TBCs) can include

promulgated regulations that do not qualify as ARARs, and non-promulgated advisories or guidance issued by Federal or State government. Superfund actions are not required to meet TBCs.

Only requirements that are duly promulgated under Federal or State law can be ARARs. Additionally, only substantive requirements of regulations, not procedural requirements, can be ARARs for on-site actions.

The U.S. EPA has identified the following major sources of ARARs and TBCs for the cleanup actions at the Residential Areas:

Title 40, Part 192 of the Code of Federal Regulations (40 CFR 192), entitled "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" - 40 CFR 192 contains U.S. EPA's standards for cleanup of lands contaminated by uranium and thorium mill wastes. The standards apply only to the sites specifically designated under the Uranium Mill Tailings Radiation Control Act of 1978, but they often have been used as criteria at uranium, thorium and radium sites because of the similarity of the problems. They are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate.

Title 32, Chapter II, Subchapter b, Part 332 of the Illinois Administrative Code, entitled "Licensing Requirements for Source Material Milling Facilities" - These regulations deal with licensing requirements for source material milling facilities in Illinois and apply to the Kerr-McGee factory site in West Chicago. They are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate and portions to be TBCs.

Title 32, Chapter II, Subchapter b, Part 340 of the Illinois Administrative Code, entitled "Standards for Protection Against Radiation" - These regulations establish standards for protection against radiation hazards, primarily in an occupational setting; they control the possession, use and transfer of sources of radiation by "licensees and registrants" so that the total dose to an individual does not exceed specified standards. They also contain decontamination guides for the release of equipment for unrestricted use. These regulations are not applicable to the Residential Areas, but U.S. EPA considers portions to be relevant and appropriate.

DOE Order 5400.5, entitled "Radiation Protection of the Public and the Environment" - This Order establishes standards and requirements for Department of Energy (DOE) operations with respect to protection of members of the public against undue risk from radiation, and contains a discussion of DOE's "ALARA" (As Low As Reasonably Achievable) approach. The Order is not a promulgated Federal or State regulation, and thus cannot be an ARAR, but U.S. EPA considers portions of the Order to be TBCs.

Title 10, Part 20 of the Code of Federal Regulations (10 CFR 20), entitled "Standards for Protection Against Radiation" - These regulations contain the Nuclear Regulatory Commission's standards for protection against radiation, and contain an "ALARA" approach. They are not applicable or relevant and appropriate to the Residential Areas, but U.S. EPA considers portions to be TBCs.

U.S. Nuclear Regulatory Commission's Regulatory Guide 8.37 - This regulatory guide contains, among other things, a discussion of the NRC's "ALARA" approach. The regulatory guide is not a promulgated regulation, and thus cannot be an ARAR, but U.S. EPA considers a portion of the guide to be a TBC.

U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86 - This regulatory guide contains, among other things, decontamination guides for the release of equipment for unrestricted use. The regulatory guide is not a promulgated regulation, and thus cannot be an ARAR, but U.S. EPA considers a portion of the guide to be a TBC.

The Action Criteria

The remainder of this document describes the different phases of the cleanup action, the specific Federal and State requirements that U.S. EPA considers to be ARARs or TBCs, and the resulting action criteria for each phase of the cleanup action.

DISCOVERY AND CHARACTERIZATION PHASES

The first phase of the cleanup action is the **discovery** phase. During this phase, properties in and around the City of West Chicago will be surveyed and sampled to discover and designate those that require cleanup. If a property clearly exceeds the discovery criteria, and if it is clear that the exceedance is due to thorium mill tailings from the factory site, the property will be designated for removal action. If it is not clear whether a property exceeds the discovery criteria (i.e., borderline results), or if it is not clear whether exceedance of the criteria is due to thorium mill tailings, then further investigation will be needed before a decision can be made to designate that property for response action. Such properties will move into the **characterization** phase.

Because the objective of both discovery and characterization is the same (i.e., to find contaminated properties), the action criteria during these two phases are identical. Properties deemed not to exceed the action criteria during either discovery or characterization will be excluded from further consideration.

Due to the nature of the radiological contamination at the Residential Areas, survey efforts during the discovery phase will consist of measuring and/or sampling the following four parameters: outdoor soil concentration, outdoor

gamma exposure rate, indoor gamma exposure rate and indoor radon/thoron air concentration.

The primary criterion that will be used to designate a property for response action is outdoor soil concentration. The other three parameters (outdoor gamma exposure rate, indoor gamma exposure rate and indoor radon/thoron air concentration) will be used as indicators or "finding tools" to help locate contaminated areas; elevated readings for any of these three parameters alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

The U.S. EPA has taken a conservative approach with the discovery and characterization criteria in order to minimize the chances of not discovering properties where contamination actually is present. As a result, the discovery criteria may be more stringent than the verification criteria (e.g., for outdoor soil concentrations, the results will not be averaged over 100 square meters during discovery and characterization, but averaging over 100 m^2 may be conducted during the verification phase).

For indoor radon/thoron, the necessity for expeditious surveillance argues for measurements on a shorter time frame than the annual average (or equivalent) associated with the wording of the relevant and appropriate requirement. In order to not unduly delay assessments, discovery and characterization measurement periods may be on the order of 2 days to 3 months. Since weather, seasons and home usage all influence indoor radon/thoron levels, these shorter measurements may not fully characterize the annual average but should be adequate to serve as "finding tools." Also, many homes may have elevated levels of naturally occurring radon that are not associated with the presence of thorium mill tailings on the property. For these reasons, an elevated reading of indoor radon/thoron will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Discussed below are the criteria that will be used during the discovery and characterization phases of the response action:

- <u>Outdoor Soil Concentration</u>

  Soil standards for mill tailings of the type present at the Residential Areas are found in 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," and at Section 332.150(b) of the Illinois Administrative Code. None of the standards are applicable to the Residential Areas, but portions are relevant and appropriate. Because the State standard is more stringent than the Federal standard (by specifying that the concentration limit is for dry soil), the State regulation is considered as the ARAR.

  The State regulation at Section 332.150(b) of the Illinois Administrative Code specifies that the licensed site shall be

decontaminated to the following limits prior to termination of the license:

> "Concentrations of radionuclides in soil above background concentrations for total radium, averaged over areas 100 square meters, shall not exceed:
>
> A) 5 picocuries per gram of dry soil, averaged over the first 15 centimeters below the surface; and
>
> B) 15 picocuries per gram of dry soil, averaged over layers of 15 centimeters thickness more than 15 centimeters below the surface."

The State requirements in Section 332.150(b) of the Illinois Administrative Code were based on the federal standards in 40 CFR 192.12(a). When the federal standards in 40 CFR 192 were developed over a decade ago, the 5 picocuries per gram (pCi/g) standard was a health based standard, but the 15 pCi/g standard for subsurface soil was technology based, reflecting instrument limitations in locating subsurface deposits. The 15 pCi/g limit is not a health-based standard, and should not be applied to situations in which a health-based standard is appropriate, or to situations that differ substantively from those for which it was derived.

The 15 pCi/g limit was developed as a practical measurement tool for use in locating discrete caches of high activity tailings (typically 300-1000 pCi/g) that were deposited in subsurface locations at mill sites or at nearby properties. The subsurface soil standard in 40 CFR 192 was originally proposed as 5 pCi/g. The final standard was changed, not because the health basis was relaxed, but rather in order to reduce the cost to DOE of locating buried tailings - under the assumption that this would result in essentially the same degree of cleanup at the DOE sites as originally proposed under the 5 pCi/g criterion. The use of a 15 pCi/g subsurface criterion allowed the DOE to use field measurements rather than laboratory analysis to determine when buried tailings had been detected. It is only appropriate for use as a cost-effective tool to locate radioactive waste in situations where contaminated subsurface materials are of high activity and are not expected to be significantly admixed with clean soil. The 15 pCi/g subsurface criterion was not developed for situations where significant quantities of moderate or low activity materials are involved, such as at the Residential Areas site. Therefore, the 15 pCi/g subsurface criterion is not appropriate for use at the Residential Areas site, and thus is not an ARAR. The 5 pCi/g standard, on the other hand, was developed as a health-based standard and is appropriate for use at the Residential Areas site.

Although the soil concentration standard in the regulation is written in terms of an average over an area of 100 square meters, areal averaging will not be conducted during discovery and characterization. This approach is conservative and should minimize the chances of not identifying contamination during the discovery and characterization surveys.

Therefore,

> **The Discovery and Characterization Criterion for outdoor soil concentrations will be exceedance of 5 picocuries per gram total radium (radium-226 plus radium-228), dry soil, above background in any 15 centimeter depth based upon Section 332.150(b) of the Illinois Administrative Code.**

- <u>Outdoor Gamma Exposure Rates</u>

Section 332.150(b)(2) of the Illinois Administrative Code, "Termination of Source Material Milling Facility License," deals with a site licensed by IDNS that is to be decontaminated for license termination. It states that the licensed site shall be decontaminated to the following limits prior to termination of the license:

> "The level of gamma radiation measured at a distance of 100 centimeters from the surface shall not exceed background."

This regulation applies only to a licensed site, but the requirements are relevant to the Residential Areas since the intent of the standards is to limit public exposure from site-related radioactive materials.

The variability and distribution of naturally-occurring radioactive materials results in a range of normal background levels, even within a small region such as a few mile radius around West Chicago. In part, this originates from variable geological constituents and in part from human actions (such as phosphate fertilization which can add additional radium to the soil). Consequently, there is not a single number that can be said to be "background" for the entire West Chicago region. While not represented by a single number, the normal background levels of gamma exposure rate will fall within a range and in a fairly predictable statistical pattern. Consequently, a statistical method will be applied to both establish background and what is distinctly above background.

Because there are sources unrelated to thorium mill tailings (such as phosphate fertilizers) that could cause elevated gamma readings at the Residential Areas, it is not appropriate to use the background gamma standard during the discovery phase as a strict, single criterion that, in and of itself, triggers cleanup. However, U.S. EPA will use measurements of outdoor gamma exposure rate as a "finding tool" to locate those areas that are statistically distinct from background. Gamma readings found to be statistically distinct from background at a property will be an indication of possible thorium mill tailings contamination. Such areas will, at a minimum, be investigated further. Elevated gamma readings alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Because the background gamma standard will be used extensively as a "finding tool" and not as a strict criterion, exposure rates may be measured at varying heights from the ground surface (typically, 0 to 1 meter), depending on detection sensitivities, practicality, and other conditions encountered in the field.

Therefore,

> **The Discovery and Characterization Criterion for outdoor gamma exposure rate will be the statistical exceedance of background based upon the Illinois Administrative Code, Section 332.150(b)(2).**

- Indoor Gamma Exposure Rates

The only promulgated standard that specifically deals with indoor gamma exposure rate is 40 CFR 192.12(b)(2), which states that the objective of remedial action shall be that

> "In any occupied or habitable building--...The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour."

Gamma ray exposure to 20 microroentgens per hour for a substantial portion of the year could result in an annual dose exceeding 100 millirem, due solely to external exposure to gamma rays. Recommendations by eminent bodies of radiation scientists, and regulations and policies of federal agencies such as the Nuclear Regulatory Commission and the Department of Energy, are to limit doses to members of the general public to less than 100 millirem per year, including both external exposure (from gamma rays) and internal exposure (from inhalation and ingestion). In addition, NRC's regulations at 10 CFR 20, DOE Order 5400.5 and NRC Regulatory Guide 8.37 contain an "ALARA" (As Low As Reasonably Achievable) approach, which sets forth an objective to attain dose levels as far below the dose limits as practicable. Moreover, EPA believes that individual sources of contamination should be kept to a small fraction of the primary limit of 100 millirem per year, and generally sets annual dose standards below a couple of tens of millirems.

As a result of the above considerations, 40 CFR 192.12(b)(2) is not appropriate for use at the Residential Areas site, and thus is not an ARAR.

Although meant to apply to outdoor situations, the gamma exposure rate standard found at Section 332.150(b)(2) of the Illinois Administrative Code is a TBC for indoor gamma exposure rate, since the intent is to limit public exposure to site-related radioactive materials, and since periods of occupancy are higher indoors than outdoors.

As with outdoor gamma exposure rate, normal background values for indoor gamma exposure rate will fall within a range and in a fairly predictable statistical pattern; background is not a single value and must be treated statistically. In addition, different building materials (such as bricks, concrete blocks and granite hearths) that contain naturally occurring radiological materials could cause elevated indoor gamma readings that are unrelated to thorium mill tailings. For these reasons, U.S. EPA will use measurements of indoor gamma exposure rate as a "finding tool" to locate contaminated areas that may be below or alongside the foundations of buildings. Elevated indoor gamma readings alone generally will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Therefore,

> **The Discovery and Characterization Criterion for indoor gamma exposure rate will be the statistical exceedance of background, based upon the Illinois Administrative Code, Section 332.150(b)(2).**

As with outdoor gamma exposure rate, a statistical method will be applied to both establish background and what is distinctly above background.

- **Indoor Radon/Thoron Decay Product Concentrations**

Standards dealing with indoor radon decay product concentrations are found at 40 CFR 192.12(b)(1), which states that:

> "In any occupied or habitable building-- The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL..." (WL, or working levels, is a measure of the concentration of radon decay products.)

While radon-222 (commonly known just as radon) is produced from the Uranium Decay Series, radon-220 (commonly known as thoron) is the Thorium Decay Series form of radon. 40 CFR 192.40(b) states that the provisions of the standard applicable to radon also apply to thoron. U.S. EPA interprets the radon decay product concentration of 0.02 WL at 40 CFR 192.12(b)(1) to represent the combined (total) concentration of decay products from both radon and thoron.

In the absence of the thorium mill tailings, naturally-occurring decay product concentrations consist primarily of radon, with thoron decay product levels at about 25% to 50% of those of radon. However, since the thorium decay series radionuclides dominated in the ores used at the factory site, it is reasonable to assume that contaminated properties may show elevated levels of thoron if tailings are located below or

alongside the foundation of a building. However, because of different half lives in the thoron decay series, and depending on the location of the tailings, not every contaminated property will show elevated levels of thoron.

Due to the need for expeditious surveillance, measurements during the discovery and characterization phases will occur over a shorter time frame than the annual average (or equivalent) associated with the wording of the relevant and appropriate requirement. In order to not unduly delay assessments, discovery and characterization measurement periods may be on the order of 2 days to 3 months. Since weather, seasons and home usage all influence indoor radon/thoron levels, these shorter measurements may not fully characterize the annual average but should be adequate to serve as "finding tools."

As with outdoor and indoor gamma exposure rate, there is a natural variability in the range of indoor radon/thoron decay product concentrations. Some areas of West Chicago, as in other parts of the country, may have naturally high levels of indoor radon that are totally unrelated to thorium mill tailings. For these reasons, U.S. EPA will use measurements of indoor radon/thoron decay product concentrations as a "finding tool" to help locate contaminated areas that may be below or alongside the foundations of buildings. Elevated indoor radon/thoron decay product readings alone will not trigger a cleanup action unless combined with soil sampling data that exceeds the soil concentration criterion and confirms the presence of thorium mill tailings.

Therefore,

> **The Discovery and Characterization Criterion for indoor radon/thoron decay product concentrations is 0.02 WL combined radon and thoron decay products (including background) based upon 40 CFR 192.12(b)(1).**

If a property exceeds this criterion due to naturally occurring radon, and there is no other indication of thorium mill tailings on the property, the property will not be remediated as part of this Superfund action.

- **"As Low As Reasonably Achievable" (ALARA)**

As discussed above, NRC's regulations at 10 CFR 20, DOE Order 5400.5, and NRC Regulatory Guide 8.37 all contain an ALARA approach which sets forth the objective to attain dose levels as far below the dose limits as practicable. These requirements are TBCs for the removal actions at the Residential Areas.

In addition, Section 340.1000(b) of the Illinois Administrative Code is a TBC for the removal actions at the Residential Areas. Section 340.1000(b), which applies to "licensees and registrants," states,

"In addition to complying with the requirements set forth in this Part, every reasonable effort should be made to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable. The term 'as low as is reasonably achievable' means as low as is reasonably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of ionizing radiation in the public interest."

The NRC regulations at 10 CFR 20 contain similar language.

As a result, during discovery and characterization, the following ALARA approach will be used for the Residential Areas site:

Every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are as low as is reasonably achievable.

VERIFICATION PHASE

Once a property has been designated for a removal action, the success of the operation must be verified during and at the completion of the removal action. During the verification phase, properties will be surveyed and sampled to ensure that cleanup to levels protective of human health and the environment has been achieved.

As indicated below, some of the verification criteria will be applied during and immediately following the removal action, with surveys and samples collected before the open excavation is backfilled with clean material. Some of the verification criteria will be applied later, with surveys and samples collected after the excavation is backfilled.

The criteria to be used during the verification phase are as follows:

- **Outdoor Soil Concentrations**

  The Verification Criterion for this parameter will be soil concentrations that do not exceed 5 picocuries per gram total radium (radium-226 plus radium-228), dry soil, above background, averaged over areas up to 100 square meters, in any 15 centimeter depth based upon Section 332.150(b) of the Illinois Administrative Code.

  Samples for outdoor soil concentrations will be collected before backfilling.

- Outdoor Gamma Exposure Rates

During cleanup of a property, as during the discovery and characterization phases, outdoor gamma exposure rates will be used as a "finding tool" to help determine where additional excavation may be needed. The main criterion to determine when excavation can cease, however, is the outdoor soil concentration criterion.

However, Section 332.150(b)(2) of the Illinois Administrative Code (which requires that, prior to termination of the license, the licensed site be decontaminated so that "The level of gamma radiation measured at a distance of 100 centimeters from the surface shall not exceed background") is relevant to the Residential Areas, and is appropriate for application at the completion of a cleanup action at a property.

Therefore,

> **The Verification Criterion for this parameter will be outdoor gamma exposure rates that do not statistically exceed background at a distance of 100 centimeters from the surface, based upon the Illinois Administrative Code, Section 332.150(b)(2).**

Outdoor gamma exposure rate surveys to verify that this criterion has been met will be conducted after backfilling. A statistical method will be applied to both establish background and what is distinctly above background.

- Indoor Gamma Exposure Rates

For properties that require cleanup and that were found, during discovery and characterization, to have elevated levels of indoor gamma exposure rate due to thorium mill tailings contamination on the property, indoor gamma exposure rate surveys will be used during the cleanup action as a "finding tool" to help determine if additional excavation is necessary.

> **The Verification Criterion for this parameter will be indoor gamma exposure rates that do not statistically exceed background based upon the Illinois Administrative Code, Section 332.170(c).**

For properties that require cleanup, but for which no elevated indoor gamma readings were found during discovery and characterization, indoor gamma surveys will not be conducted during the verification phase.

- Indoor Radon/Thoron Decay Product Concentrations

For properties that require cleanup and that were found, during discovery and characterization, to have elevated levels of indoor radon/thoron decay product concentrations due to thorium mill tailings contamination on the property, additional surveys will be conducted at the completion of the cleanup action to determine if the following verification criterion has been met:

> **In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) combined radon and thoron decay product concentration (including background) not to exceed 0.02 WL. In any case, the combined radon and thoron decay product concentration (including background) shall not exceed 0.03 WL. (Based on 40 CFR 192.12(b)(1).)**

For properties that require cleanup, but for which no elevated indoor radon/thoron decay product concentrations due to thorium mill tailings were found during discovery and characterization, indoor radon/thoron testing will not be required during the verification phase.

- **"As Low As Reasonably Achievable" (ALARA)**

In addition to meeting the verification criteria described above, the following ALARA approach will be used during cleanup actions:

> **Every reasonable effort should be made to maintain radiation exposures, and the amount of radioactive materials in unrestricted areas, to levels that are as low as is reasonably achievable.**

RELEASE CRITERIA

In addition to the above criteria for discovery, characterization and verification, it will be necessary throughout the project to release equipment from work sites and it may be necessary to assess whether materials or surfaces are suitable for unrestricted use. Requirements for such situations are found in the Illinois Administrative Code, Section 340, Appendix C(a); these requirements are relevant and appropriate for use at the Residential Areas. Similar requirements also are found in the U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86, Table 1; these guidelines are not ARARs (since only promulgated regulations can be ARARs), but the U.S. EPA does consider them to be TBCs.

Both sets of requirements are shown below. Since the requirements are set up with differing units, the most restrictive part for a given situation would be used.

- Illinois Administrative Code, Section 340, Appendix C(a)

DECONTAMINATION GUIDES

a) Surface Contamination Guide

Alpha Emitters

Removable	15 pCi per 100 cm^2 = 33 dpm per 100 cm^2	average over any one surface
	45 pCi per 100 cm^2 = 100 dpm per 100 cm^2	maximum
Total (fixed)	450 pCi per 100 cm^2 = 1,000 dpm per 100 cm^2	average over any one surface
	2,250 pCi per 100 cm^2 5,000 dpm per 100 cm^2	maximum
	0.25 mRem per hour at 1 cm	

Beta-Gamma Emitters

Removable (all beta-gamma emitters except Hydrogen 3)	100 pCi per 100 cm^2	average over any one surface
	500 pCi per 100 cm^2	maximum
Removable (Hydrogen 3)	1,000 pCi per 100 cm^2	average over any one surface
	5,000 pCi per 100 cm^2	maximum
Total (fixed)	0.25 mRem per hour at 1 cm from surface	

- U.S. Nuclear Regulatory Commission, Regulatory Guide 1.86, Table 1

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE [a]	AVERAGE [b,c]	MAXIMUM [b,d]	REMOVABLE [b,e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α per 100 cm^2	15,000 dpm α per 100 cm^2	1,000 dpm α per 100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm per 100 cm^2	300 dpm per 100 cm^2	20 dpm per 100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm per 100 cm^2	3000 dpm per 100 cm^2	200 dpm per 100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm ß-γ per 100 cm^2	15,000 dpm ß-γ per 100 cm^2	1000 dpm ß-γ per 100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Criteria Not Chosen for Discovery, Characterization or Verification

Discussed below are other parameters and their associated regulations and standards that were reviewed by U.S. EPA to determine whether they were ARARs and should be used as discovery, characterization and/or verification criteria. None of these standards is applicable to the removal action and, as explained below, none is relevant and appropriate.

- <u>Outdoor Radon Concentrations</u>

  Outdoor radon (radon-222) and thoron (radon-220) are regulated in Section 332.170(b) of the Illinois Administrative Code:

  > "During the operating life and facility decommissioning, the combined concentration of radon and thoron at the boundary of the licensed site, measured at a height of one meter from the surface, averaged annually, shall not exceed three picocuries per liter above the background concentration at the licensed site."

  Even though on its terms the regulation applies only to a licensed facility, the intent of the regulation is to control radon and thoron in off-site areas, since the point of compliance is at the boundary of the licensed site. Therefore, the U.S. EPA considers the regulation to be relevant to the Residential Areas.

  However, there are practical reasons why measurements for radon and thoron outdoors will not aid in the identification of contaminated properties not otherwise identified by outdoor gamma exposure rate surveys and outdoor soil concentration samples. These reasons are as follows: (1) Reliable radon and thoron measurements are not immediate, but can take days or weeks to measure good averages. Gamma surveys, on the other hand, can provide instantaneous measurements; (2) Unless the emissions are extremely large, radon and thoron emitted from the ground surface will rapidly mix in the open air, making them indistinguishable from naturally occurring radon and thoron. Large radon and thoron emissions would be associated with large contaminant deposits easily identifiable by gamma survey instruments; (3) Because radon and thoron are gases that can be transported by the wind, it would be much harder to pinpoint the emission site.

  Therefore, for the reasons stated above, outdoor radon concentrations (radon and thoron), though relevant, are not appropriate to these circumstances and will not be one of the criteria for this response action.

- <u>Radon Release Rates from Soil</u>

  The emission of radon (radon-222) and thoron (radon-220) from soils is regulated in Section 332.170(c) of the Illinois Administrative Code, which states:

"The disposal area shall be designed so that after reclamation and stabilization, the annual total radon release rate through the cover from the byproduct material shall not exceed two picocuries per square meter per second."

This regulation only applies to the disposal area at a licensed facility, but the intent of the regulation is to control the total radon emission to the environment and to protect the general population.

However, Section 332.240(a) of the Illinois Administrative Code states:

"Monitoring for total radon after installation of an appropriately designed cover is not required. Total radon emissions from cover material shall be estimated as part of developing a closure plan."

Since it appears that the State never intended that actual measurements be made to show compliance with the regulation, the U.S. EPA does not consider this regulation to be relevant and appropriate for use at the Residential Areas. In addition, there are other, practical reasons why measurements of radon and thoron emissions from soil would not be an appropriate indicator of contaminants. At the Residential Areas, thoron is the dominant radon isotope of concern. If thoron is produced at a depth of more than a few inches below the ground surface, it will radioactively decay to a solid element and cease moving through the soil before reaching the surface. Soil sampling, on the other hand, will find contaminants at much greater depth, as would gamma exposure rate measurements which penetrate soil depths on the order of several feet.

Consequently, measurements for radon and thoron emission rates will not be conducted during this response action.

- <u>Doses in the General Environment</u>

Thorium-related doses in the general environment are regulated in 40 CFR 192.41(d), which states:

"Operations...shall be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive materials, radon-220 and its daughters excepted, to the general environment."

Doses in the general environment also are regulated in Section 332.170(a) of the Illinois Administrative Code, which states:

"At all times, concentrations of radioactive material, excluding radon, thoron, and their progeny, which may be released to the general environment in groundwater, surface water, air, soil, or other means shall not result in a committed effective dose in excess of 25 millirem (0.25 mSv) to the whole body, and a

committed dose equivalent in excess of 75 millirem (0.75 mSv) to the thyroid, and 25 millirem (0.25 mSv) to any other organ of any member of the public."

* mSv designates milliSieverts, a dose unit equal to 100 millirem.

Neither of the above regulations is applicable to the Residential Areas, but the U.S. EPA considers both to be relevant.

Even though the dose requirements of 40 CFR 192.41(d) and Section 332.170(a) of the Illinois Administrative Code are relevant to the Residential Areas, there are practical reasons why performing dose assessment calculations will not aid in the identification of contaminated properties not otherwise detected by the other discovery criteria. An operational assumption for this response action is that where site parameters such as indoor or outdoor gamma exposure rate, outdoor soil concentrations, or indoor radon and thoron are elevated, dose is elevated proportionally. Therefore, having specific dose calculations is not appropriate as it will not provide useful information not already provided by other parameters. Consequently, no separate dose assessment calculations will be required for this response action.

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