

APPLICATION FOR UNITED STATES
NUCLEAR REGULATORY COMMISSION CERTIFICATION
PORTSMOUTH GASEOUS DIFFUSION PLANT
USEC-02

REMOVE/INSERT INSTRUCTIONS

Revision 23

Remove Pages	Insert Pages
VOLUME 1	
UPDATED LIST OF EFFECTIVE PAGES	
i / ii	i / ii
v / vi	v / vi
ix / x	ix / x
xiii / xiv	xiii / xiv
xxiii / xxiv	xxiii / xxiv
TABLE OF CONTENTS	
v / vi	v / vi
CHAPTER 1	
1-5 through 1-10	1-5 through 1-10
SECTION 3.1	
3.1-3 / 3.1-4	3.1-3 / 3.1-4
SECTION 3.2	
3.2-41 / 3.2-42	3.2-41 / 3.2-42
SECTION 3.7	
3.7-1 through 3.7-4	3.7-1 through 3.7-4
A-1 through A-10	A-1 / A-2

APPLICATION FOR UNITED STATES
NUCLEAR REGULATORY COMMISSION CERTIFICATION
PORTSMOUTH GASEOUS DIFFUSION PLANT
USEC 92

REMOVE/INSERT INSTRUCTIONS

Revision 23

Remove Pages	Insert Pages
VOLUME 2	
UPDATED LIST OF EFFECTIVE PAGES	
i / ii	i / ii
v / vi	v / vi
ix / x	ix / x
xiii / xiv	xiii / xiv
xxiii / xxiv	xxiii / xxiv
TABLE OF CONTENTS	
v / vi	v / vi
SECTION 5.2	
5.2-11 / 5.2-12	5.2-11 / 5.2-12
VOLUME 3	
EMERGENCY PLAN	
List of Effective Pages, pages i / ii	List of Effective Pages, pages i / ii
1-7 through 1-8b	1-7 through 1-8b
FUNDAMENTAL NUCLEAR MATERIALS CONTROL PLAN	
List of Effective Pages, pages i / ii	List of Effective Pages, pages i / ii
Table of Contents, pages vii / viii	Table of Contents, pages vii / viii
9-5 through 9-8	9-5 through 9-8

APPLICATION FOR UNITED STATES
NUCLEAR REGULATORY COMMISSION CERTIFICATION
PORTSMOUTH GASEOUS DIFFUSION PLANT
USEC-02

REMOVE/INSERT INSTRUCTIONS

Revision 23

Remove Pages	Insert Pages
TRANSPORTATION SECURITY PLAN	
List of Effective Pages, page 1	List of Effective Pages, page 1
6	6
9	9
19	19
PHYSICAL SECURITY PLAN	
2, 3	2, 3
7	7
11	11
14, 15, 15a	14, 15, 15a
26-30	26-30
32	32
CLASSIFIED MATTER PROTECTION PLAN	
2	2
15	15
19	19
53	53
67	67

LIST OF EFFECTIVE PAGES

List of Effective Pages - Volumes 1 & 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
i	23	xi	19	xxi	19
ii	23	xii	19	xxii	19
iii	19	xiii	19	xxiii	23
iv	19	xiv	23	xxiv	19
v	23	xv	19	xxv	22
vi	21	xvi	21	xxvi	19
vii	21	xvii	19	xxvii	19
viii	19	xviii	19	xxviii	19
ix	23	xix	19		
x	19	xx	19		

Introduction - Volume 1

<u>Page</u>	<u>Revision</u>
1	22
2	22
3	22
4	19

Table of Contents - Volumes 1 & 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
i	19	xiii	19	xxv	19
ii	19	xiv	19	xxvi	19
iii	19	xv	19	xxvii	19
iv	19	xvi	19	xxviii	19
v	19	xvii	19	xxix	19
vi	23	xviii	19	xxx	19
vii	19	xix	19	xxxi	19
viii	19	xx	19	xxxii	19
ix	19	xxi	19	xxxiii	19
x	19	xxii	19	xxxiv	19
xi	19	xxiii	19		
xii	19	xxiv	19		

LIST OF EFFECTIVE PAGES

Definitions - Volume 1

<u>Page</u>	<u>Revision</u>
1	11
2	19
3	11
4	1

Chapter 1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
1-1	2	1-10	4	A-5	8
1-2	19	1-11	4	A-6	8
1-3	3	1-12	4	A-7	19
1-4	2	A-1	19	A-8	8
1-5	2	A-1a	8	A-9	19
1-6	23	A-1b	8	A-10	19
1-7	23	A-2	8	A-11	8
1-8	4	A-3	19	A-12	8
1-9	23	A-4	8		

Section 2.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
2.1-1	1	2.1-10	1	2.1-19	8
2.1-2	19	2.1-11	8	2.1-20	8
2.1-3	19	2.1-12	1	2.1-20a	8
2.1-3a	3	2.1-13	8	2.1-20b	8
2.1-3b	2	2.1-14	8	2.1-21	1
2.1-4	1	2.1-15	8	2.1-22	1
2.1-5	1	2.1-15a	8	2.1-23	1
2.1-6	1	2.1-15b	8	2.1-24	1
2.1-7	2	2.1-16	8	2.1-25	1
2.1-8	1	2.1-17	8	2.1-26	1
2.1-9	1	2.1-18	8		

LIST OF EFFECTIVE PAGES

Section 3.0 - Volume 1

<u>Page</u>	<u>Revision</u>
3.0-1	1
3.0-2	1

Section 3.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.1-1	1	3.1-28	1	3.1-51	19
3.1-2	1	3.1-29	1	3.1-52	19
3.1-3	1	3.1-30	1	3.1-53	1
3.1-4	23	3.1-31	1	3.1-54	1
3.1-5	8	3.1-32	1	3.1-55	1
3.1-6	19	3.1-33	1	3.1-56	1
3.1-7	1	3.1-34	19	3.1-57	19
3.1-8	19	3.1-35	1	3.1-58	19
3.1-9	8	3.1-36	1	3.1-59	19
3.1-10	1	3.1-37	1	3.1-60	19
3.1-11	1	3.1-38	1	3.1-61	19
3.1-12	1	3.1-39	1	3.1-62	19
3.1-13	8	3.1-40	1	3.1-63	1
3.1-14	8	3.1-41	1	3.1-64	2
3.1-15	19	3.1-42	1	3.1-64a	2
3.1-16	1	3.1-43	1	3.1-64b	2
3.1-17	19	3.1-44	19	3.1-65	1
3.1-18	19	3.1-45	19	3.1-66	19
3.1-19	1	3.1-45a	1	3.1-67	1
3.1-20	8	3.1-45b	1	3.1-68	19
3.1-21	1	3.1-46	1	3.1-69	19
3.1-22	19	3.1-47	19	3.1-70	19
3.1-23	1	3.1-48	19	3.1-71	1
3.1-24	19	3.1-48a	2	3.1-72	2
3.1-25	19	3.1-48b	2	3.1-73	19
3.1-26	19	3.1-49	1	3.1-74	19
3.1-27	19	3.1-50	1	3.1-75	1

LIST OF EFFECTIVE PAGES

Section 3.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.1-76	1	3.1-103	19	3.1-132	3
3.1-77	19	3.1-104	19	3.1-133	19
3.1-78	2	3.1-105	19	3.1-134	19
3.1-79	19	3.1-106	1	3.1-135	2
3.1-80	1	3.1-107	19	3.1-136	2
3.1-80a	19	3.1-108	1	3.1-137	19
3.1-80b	19	3.1-109	1	3.1-138	1
3.1-81	1	3.1-110	1	3.1-139	19
3.1-82	1	3.1-111	1	3.1-140	19
3.1-83	1	3.1-112	19	3.1-141	19
3.1-84	1	3.1-112a	1	3.1-142	21
3.1-85	1	3.1-112b	1	3.1-143	19
3.1-86	3	3.1-113	19	3.1-144	1
3.1-87	1	3.1-114	1	3.1-145	1
3.1-88	1	3.1-115	1	3.1-146	19
3.1-89	19	3.1-116	1	3.1-147	19
3.1-90	2	3.1-117	1	3.1-147a	1
3.1-91	1	3.1-118	1	3.1-147b	1
3.1-92	1	3.1-119	1	3.1-148	1
3.1-93	1	3.1-120	19	3.1-149	3
3.1-94	1	3.1-121	1	3.1-150	3
3.1-94a	3	3.1-122	19	3.1-151	19
3.1-94b	3	3.1-123	1	3.1-152	19
3.1-95	19	3.1-124	1	3.1-153	1
3.1-96	19	3.1-125	19	3.1-154	1
3.1-97	1	3.1-126	19	3.1-155	1
3.1-98	19	3.1-127	1	3.1-156	1
3.1-99	19	3.1-128	1	3.1-157	1
3.1-100	1	3.1-129	3	3.1-158	1
3.1-101	19	3.1-130	1	3.1-159	1
3.1-102	1	3.1-131	19	3.1-160	1

LIST OF EFFECTIVE PAGES

Section 3.2 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.2-1	1	3.2-33	19	3.2-67	1
3.2-2	1	3.2-34	19	3.2-68	1
3.2-3	19	3.2-35	19	3.2-69	3
3.2-4	19	3.2-36	3	3.2-70	19
3.2-5	1	3.2-37	3	3.2-71	1
3.2-6	1	3.2-38	19	3.2-72	19
3.2-7	19	3.2-39	19	3.2-73	19
3.2-8	19	3.2-40	19	3.2-74	3
3.2-9	16	3.2-41	19	3.2-75	1
3.2-10	16	3.2-42	23	3.2-76	1
3.2-11	16	3.2-43	3	3.2-77	1
3.2-12	1	3.2-44	19	3.2-78	19
3.2-13	19	3.2-45	1	3.2-79	19
3.2-14	19	3.2-46	1	3.2-80	19
3.2-15	19	3.2-47	1	3.2-81	1
3.2-16	22	3.2-48	2	3.2-82	1
3.2-17	8	3.2-49	1	3.2-83	1
3.2-17a	8	3.2-50	1	3.2-84	19
3.2-17b	8	3.2-51	1	3.2-85	1
3.2-18	1	3.2-52	2	3.2-86	1
3.2-19	2	3.2-53	1	3.2-87	1
3.2-20	1	3.2-54	2	3.2-88	1
3.2-21	19	3.2-55	1	3.2-89	1
3.2-22	19	3.2-56	1	3.2-90	1
3.2-23	19	3.2-57	1	3.2-91	1
3.2-24	19	3.2-58	1	3.2-92	1
3.2-25	19	3.2-59	19	3.2-93	1
3.2-26	19	3.2-60	19	3.2-94	1
3.2-27	19	3.2-61	22	3.2-95	1
3.2-28	1	3.2-62	19	3.2-96	19
3.2-29	19	3.2-63	19	3.2-97	19
3.2-30	19	3.2-64	19	3.2-98	19
3.2-31	2	3.2-65	19	3.2-99	1
3.2-32	19	3.2-66	1	3.2-100	1

LIST OF EFFECTIVE PAGES

Section 3.2 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.2-101	1	3.2-111	1	3.2-121	1
3.2-102	1	3.2-112	1	3.2-122	1
3.2-103	1	3.2-113	1	3.2-123	1
3.2-104	1	3.2-114	1	3.2-124	1
3.2-105	1	3.2-115	1	3.2-125	1
3.2-106	1	3.2-116	1	3.2-126	1
3.2-107	1	3.2-117	1	3.2-127	1
3.2-108	1	3.2-118	1	3.2-128	1
3.2-109	1	3.2-119	1	3.2-129	19
3.2-110	1	3.2-120	1	3.2-130	1

Section 3.3 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.3-1	1	3.3-21	2	3.3-41	19
3.3-2	19	3.3-22	3	3.3-42	1
3.3-3	1	3.3-23	19	3.3-43	19
3.3-4	1	3.3-24	1	3.3-44	19
3.3-5	1	3.3-25	1	3.3-45	19
3.3-6	3	3.3-26	1	3.3-46	19
3.3-7	19	3.3-27	1	3.3-47	1
3.3-8	19	3.3-28	8	3.3-48	19
3.3-9	19	3.3-29	1	3.3-49	19
3.3-10	3	3.3-30	1	3.3-49a	19
3.3-11	19	3.3-31	1	3.3-49b	19
3.3-12	19	3.3-32	1	3.3-50	19
3.3-13	3	3.3-33	19	3.3-51	1
3.3-14	19	3.3-34	1	3.3-52	2
3.3-15	1	3.3-35	1	3.3-53	19
3.3-16	19	3.3-36	1	3.3-54	1
3.3-17	19	3.3-37	19	3.3-55	3
3.3-18	3	3.3-38	1	3.3-56	1
3.3-19	19	3.3-39	19	3.3-57	1
3.3-20	19	3.3-40	19	3.3-58	1

LIST OF EFFECTIVE PAGES

Section 3.4 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.4-106	1	3.4-111	1	3.4-116	1
3.4-107	1	3.4-112	1	3.4-117	1
3.4-108	1	3.4-113	8	3.4-118	1
3.4-109	1	3.4-114	1	3.4-119	1
3.4-110	1	3.4-115	1	3.4-120	1

Section 3.5 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.5-1	1	3.5-22	1	3.5-45	3
3.5-2	3	3.5-23	1	3.5-46	1
3.5-3	19	3.5-24	1	3.5-47	1
3.5-4	1	3.5-25	2	3.5-48	8
3.5-5	3	3.5-26	1	3.5-49	1
3.5-6	1	3.5-27	2	3.5-50	1
3.5-7	1	3.5-28	2	3.5-51	2
3.5-8	2	3.5-29	19	3.5-52	2
3.5-9	1	3.5-30	1	3.5-53	2
3.5-10	3	3.5-31	15	3.5-54	3
3.5-11	3	3.5-32	2	3.5-55	3
3.5-12	19	3.5-33	19	3.5-56	2
3.5-13	19	3.5-34	19	3.5-57	1
3.5-13a	19	3.5-34a	3	3.5-58	1
3.5-13b	19	3.5-34b	3	3.5-58a	3
3.5-13c	19	3.5-35	2	3.5-58b	3
3.5-13d	19	3.5-36	2	3.5-59	1
3.5-14	19	3.5-37	2	3.5-60	1
3.5-15	19	3.5-38	2	3.5-61	1
3.5-16	19	3.5-39	1	3.5-62	1
3.5-17	19	3.5-40	1	3.5-63	1
3.5-18	2	3.5-41	2	3.5-64	1
3.5-19	3	3.5-42	2	3.5-65	1
3.5-20	3	3.5-43	3	3.5-66	1
3.5-21	2	3.5-44	3		

LIST OF EFFECTIVE PAGES

Section 3.6 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.6-1	1	3.6-24	19	3.6-47	1
3.6-2	1	3.6-25	19	3.6-48	1
3.6-3	1	3.6-26	19	3.6-49	1
3.6-4	19	3.6-27	19	3.6-50	19
3.6-5	2	3.6-28	19	3.6-51	19
3.6-6	3	3.6-29	1	3.6-52	19
3.6-7	3	3.6-30	1	3.6-53	1
3.6-8	2	3.6-31	1	3.6-54	19
3.6-9	2	3.6-32	3	3.6-55	1
3.6-10	1	3.6-33	2	3.6-56	1
3.6-11	3	3.6-34	1	3.6-57	19
3.6-12	3	3.6-35	1	3.6-58	1
3.6-13	19	3.6-36	1	3.6-59	1
3.6-14	1	3.6-37	1	3.6-60	19
3.6-15	19	3.6-38	1	3.6-61	1
3.6-16	19	3.6-39	1	3.6-62	19
3.6-17	19	3.6-40	1	3.6-63	1
3.6-18	19	3.6-41	1	3.6-64	1
3.6-19	19	3.6-42	1	3.6-65	1
3.6-20	2	3.6-43	1	3.6-66	1
3.6-21	1	3.6-44	1	3.6-67	1
3.6-22	2	3.6-45	1	3.6-68	1
3.6-23	1	3.6-46	1		

Section 3.7 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.7-1	23	3.7-4	3
3.7-2	23	A-1	23
3.7-3	23	A-2	23

LIST OF EFFECTIVE PAGES

Section 5.1 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.1-1	2	5.1-22	1	5.1-43	1
5.1-2	2	5.1-23	3	5.1-44	1
5.1-3	2	5.1-24	1	5.1-45	1
5.1-4	2	5.1-25	1	5.1-46	1
5.1-5	19	5.1-26	1	5.1-47	1
5.1-6	19	5.1-27	1	5.1-48	1
5.1-7	19	5.1-28	1	5.1-49	1
5.1-8	2	5.1-29	1	5.1-50	1
5.1-9	19	5.1-30	1	5.1-51	1
5.1-10	19	5.1-31	19	5.1-52	1
5.1-11	19	5.1-32	1	5.1-53	1
5.1-12	19	5.1-33	1	5.1-54	1
5.1-13	19	5.1-34	1	5.1-55	1
5.1-14	1	5.1-35	1	5.1-56	1
5.1-15	1	5.1-36	1	5.1-57	1
5.1-16	1	5.1-37	1	5.1-58	1
5.1-17	1	5.1-38	1	5.1-59	1
5.1-18	1	5.1-39	1	5.1-60	1
5.1-19	1	5.1-40	1	5.1-61	1
5.1-20	1	5.1-41	1	5.1-62	1
5.1-21	1	5.1-42	1		

Section 5.2 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.2-1	2	5.2-7	2	5.2-13	3
5.2-2	2	5.2-8	2	5.2-14	4
5.2-3	2	5.2-9	4	5.2-15	4
5.2-4	3	5.2-10	4	5.2-16	3
5.2-5	3	5.2-11	2	5.2-17	19
5.2-6	3	5.2-12	23	5.2-18	19
5.2-6a	3				
5.2-6b	3				

LIST OF EFFECTIVE PAGES

Section 5.3 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.3-1	3	5.3-15	3	5.3-27	19
5.3-2	3	5.3-16	3	5.3-28	19
5.3-3	4	5.3-17	3	5.3-29	2
5.3-4	3	5.3-18	19	5.3-30	2
5.3-5	4	5.3-19	3	5.3-31	2
5.3-6	3	5.3-20	19	5.3-32	19
5.3-7	19	5.3-20a	8	5.3-33	2
5.3-8	3	5.3-20b	8	5.3-34	19
5.3-9	4	5.3-21	3	5.3-35	19
5.3-10	4	5.3-22	3	5.3-36	2
5.3-11	3	5.3-23	19	5.3-37	19
5.3-12	3	5.3-24	19	5.3-38	2
5.3-13	3	5.3-25	3	5.3-39	2
5.3-14	3	5.3-26	3	5.3-40	2

Sections 5.4 & 5.5 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.4-1	3	5.4-5	3	5.4-9	3
5.4-2	19	5.4-6	3	5.4-10	19
5.4-3	3	5.4-7	3	5.5-1	19
5.4-4	3	5.4-8	3	5.5-2	1

LIST OF FIGURES
Chapter 2 (Continued)

Figure	Page
2.6-7 "BLUME" PORTS Seismic Hazard Curves	2.6-22
2.6-8 Interpretation of the BLUME and Seismic Hazard Curve for PORTS	2.6-23
2.6-9 Estimated Peak Acceleration Return Periods, Dames and Moore - Seismic Hazard Curve	2.6-24
2.6-10 TERA - PORTS Seismic Hazard Curve	2.6-25
2.6-11 Superimposed Results for Fernald and PORTS	2.6-26
2.6-12 Recommended Fernald and PORTS Seismic Hazard Curve	2.6-27

TABLE OF CONTENTS
Chapter 3

	Page
3.0 FACILITY AND PROCESS DESCRIPTION	3.0-1
3.1 CASCADE SYSTEMS	3.1-1
3.1.1 Uranium Enrichment Cascade	3.1-1
3.1.2 Purge Cascade System	3.1-98
3.1.3 Freezer/Sublimers Systems	3.1-120
3.1.4 Cold Recovery System	3.1-129
3.1.5 Freon Degradation System	3.1-152
3.1.6 Cascade Systems Safety Systems, Design Features, and Administrative Controls	3.1-162
3.2 UF ₆ FEED, WITHDRAWAL, SAMPLING, HANDLING, AND CYLINDER STORAGE FACILITIES AND SYSTEMS	3.2-1
3.2.1 Cascade UF ₆ Feed and Sampling Systems	3.2-4
3.2.2 Tails and Product (ERP and LAW) Withdrawals	3.2-20
3.2.3 Top Product (PW) and Side Withdrawals	3.2-42
3.2.4 The High Assay Sampling Facilities (HASA)	3.2-44
3.2.5 UF ₆ Cylinder Shipping and Receiving	3.2-60
3.2.6 Cylinder Storage	3.2-62
3.2.7 UF ₆ Cylinder Transport	3.2-72
3.2.8 Safety Systems, Design Features for Safety, and Administrative Controls	3.2-74

TABLE OF CONTENTS
Chapter 3 (Continued)

	Page
3.3 URANIUM RECOVERY AND CHEMICAL SYSTEMS	3.3-1
3.3.1 X-705 Decontamination and Recovery Facility	3.3-1
3.3.2 X-705 Waste Water Treatment Facility	3.3-42
3.3.3 Contaminated Storage Facilities	3.3-52
3.3.4 Bionitrification Facilities	3.3-55
3.4 POWER AND UTILITY SYSTEMS	3.4-1
3.4.1 Electrical Systems	3.4-1
3.4.2 Plant Water System	3.4-7
3.4.3 Plant Nitrogen System	3.4-21
3.4.4 Plant Air System	3.4-27
3.4.5 Plant Steam and Condensate Systems	3.4-31
3.4.6 Plant Waste Systems and Facilities	3.4-33
3.4.7 HF/F ₂ Systems	3.4-38
3.5 GENERAL SUPPORT FACILITIES AND SYSTEMS	3.5-1
3.5.1 Maintenance Facilities	3.5-1
3.5.2 Laboratories and Pilot Plants	3.5-20
3.5.3 Receiving and Storage Facilities	3.5-29
3.5.4 Communications and Data Processing	3.5-34
3.5.5 Administration Facilities	3.5-43
3.5.6 Health Protection Facilities	3.5-46
3.6 FIRE PROTECTION AND RADIATION ALARM SYSTEMS AND ENVIRONMENTAL PROTECTION FACILITIES	3.6-1
3.6.1 Fire Protection Systems	3.6-1
3.6.2 Radiation Alarm Systems	3.6-12
3.6.3 Environmental Protection Facilities	3.6-22
3.7 HEU AND MEU ACTIVITIES	3.7-1
3.7.1 Description	3.7-1
3.7.2 Temporary Conversion of Leased Areas of the X-705 Facility from NRC to DOE Regulation	3.7-2
3.7.3 Organization and Responsibilities	3.7-3
APPENDIX A (Deleted)	A-1

Table 1-2. Table deleted.

Table 1-3 Possession Limits for NRC-Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
A. Source Material ^{1,2,3}	92	Solid, liquid, and gas	UF ₆ , UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	300,000 MTU ⁴	Uranium (including natural, depleted and recycled) and daughter products and process contaminants and wastes
					Laboratory chemicals Analysis of samples ⁵
B. Source Material	90	Solid and liquid	Soluble and insoluble chemicals, metal	10 Ci	Instrument calibration and check sources
					Laboratory chemicals, instrument calibration sources, plated metallic sources, instrument check sources Analysis of samples ⁵
C. Special Nuclear Material ^{1,2,3,4,5}	92	Solid, liquid, and gas	UF ₆ , UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	300,000 MTU	Uranium (including recycled) enriched in isotope 235 up to 10 percent by weight, uranium daughter products and process contaminants and wastes, to include: (1) laboratory chemicals, (2) analysis of samples ⁵ , (3) instrument calibration and check sources, or (4) material that may be held up in facilities and equipment from previous operations
					Uranium enriched in isotope 235 from 10 percent up to 20 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities, (2) laboratory chemicals, (3) analysis of samples ⁵ , or (4) instrument calibration and check sources.

Table 1-5 (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
Special Nuclear Material	92	Solid, liquid and gas	UF ₆ , UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	1,000 g ²³⁵ U*	Uranium enriched in isotope 235 to 20 percent and up to 98 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities, (2) laboratory chemicals, (3) analysis of samples*, or (4) instrument calibration and check sources.
	94	Sealed source		50 Ci	Instrument calibration sources, NDA
		Sealed glass ampules		3 Ci	Instrument calibration sources, NDA
		Unsealed sources		0.5 Ci	Laboratory chemicals Analysis of samples*
D. By-Product Material	94	Any	Any		Process contaminants and wastes, material held in equipment from previous operations
	3-89, 91	Sealed source		1 Ci with no single isotope to exceed 100 mCi, except as noted below	Calibration, instrument internal source
		Unsealed source		1 Ci with no single isotope to exceed 100 mCi, except as noted below	Instrument calibration and check sources Laboratory chemicals Analysis of samples*

Table 1-3. (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	27Co-57	Sealed Source		10 Ci	Calibration, internal instrument standard, NDA
	27 Co-60	Sealed Source		450 Ci	Calibration, NDA, Process sources
		Unsealed Source		0.5 Ci	Laboratory chemicals Analysis of samples*
	28 Ni-63	Sealed Source		10 Ci	Process sources, internal instrument standards
	38 Sr-90	Sealed Source		0.5 Ci	Calibration
		Unsealed Source		0.5 Ci	Laboratory chemicals, Analysis of samples*
	43 Tc-99	Sealed Source		10 Ci	Calibration
		Unsealed Source		5 Ci	Laboratory chemicals, Analysis of samples*
		Any	Any	That resulting from the feed of recycled or FSU* uranium	Process contaminants and wastes, material held in equipment from previous operations
	55 Cs-137	Sealed Source		2,000 Ci	Calibration, NDA, Process sources
		Unsealed Source		0.5 Ci	Laboratory chemicals Analysis of samples*
	61 Pr-147	Sealed Source		0.5 Ci	Calibration
	70 Yb-169	Sealed Source		5.0 Ci	Calibration, NDA
	81 Tl-207	Sealed Source		1.0 Ci	Calibration
	88 Ra-226	Sealed Source		15 Ci	Calibration

Table 1-3 (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	93, 96, 97, 99, 100	Sealed source Unsealed source		0.5 Ci 1.0 Ci	Calibration Laboratory chemicals Analysis of samples ^a
	93, 95-100	Any	Any	That resulting from the feed of recycled or FSU uranium ^c	Process contaminants and wastes, material held in equipment from previous operations
	95	Sealed source Unsealed source	Oxides, metals Oxides, metals, solutions	15 Ci 0.5 Ci	Calibration, process source Analysis of samples ^a Laboratory chemicals
	98	Sealed source Unsealed source	Oxides, metals Oxides, metals, solutions	10 Ci 0.5 Ci	Calibration, NDA Analysis of samples ^a Laboratory chemicals

a. MTU - Metric Tons Uranium

b. See 10 CFR Part 76 definitions: Special nuclear material means: (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of Section 51 of the act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched in any of the foregoing, but does not include source material.

c. FSU meets the ASTM Standard C996, Standard Specification for Uranium Hexafluoride Enriched to Less Than 5 percent ²³⁵U; UF₆ for enrichment meets the ASTM Standard C787, Standard Specification for Uranium Hexafluoride for Enrichment.d. Recycled uranium includes the feed and processing of Paducah Product and the "stockpile" UF₆ transferred from DOE to USEC for enrichment.

e. "Analysis of samples" refers to the analysis of samples (from USEC activities, DOE-PORTS and DOE-other sites, and offsite requestors) utilizing existing facilities and analytical techniques to process low-level radioactivity samples bounded by the possession limits stated in this table.

f. Except for Paducah Product and the "stockpile" UF₆ transferred from DOE to USEC for enrichment, uranium to be fed to the cascade will meet the requirements of ASTM Standard C996, "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ²³⁵U" or ASTM Standard C787, "Standard Specification for Uranium Hexafluoride for Enrichment" for reprocessed UF₆. All other uranium that does not meet the requirements of ASTM C996 or C787 for reprocessed UF₆ may be accepted for storage and subsequent dispositioning but will not be introduced to the cascade, with the exception of small amounts (e.g., 50 pounds UF₆) associated with sampling, subsampling, and analyses required to establish receiver's values.

g. These possession limits do not include material in USEC leased space from previous DOE operations to include retained inventory of uranium plated out on the inside surfaces of both shutdown and operating equipment in the X-326 facility; specific components in the X-326 cascade that need to be removed for maintenance or other operational purposes; material and equipment such as alumina traps, seal exhaust oil and GP containers from always-safe vacuums that are generated as part of ongoing operations in X-326; or material held up in X-705 equipment (some of which may have to be removed for maintenance).

FSU - Former Soviet Union

Table 1-4. Authorized uses of NRC-regulated materials.

Material Class	Authorized Use
A. Source Material, Element 92 ^{a, b}	1. Enrichment of uranium up to 10 percent enrichment by weight ^{235}U 2. Receipt, storage, inspection, and acceptance sampling of cylinders containing uranium 3. Filling and storage of cylinders of natural uranium and uranium depleted in ^{235}U 4. Cleaning and inspection of cylinders used for the storage and transport of process product and tails containing source or SNM 5. Storage of process wastes containing uranium, transuranic elements, and other contaminants and decay products 6. Process, characterize, package, ship, or store low-level radioactive and mixed wastes 7. Radiation protection, process control and environmental sample collection, analysis, instrument calibration, and operation checks 8. Maintenance, repair, and replacement of process equipment 9. Laboratory analysis and testing 10. Heating cylinders and feeding contents into the diffusion process 11. Controlled feeding of cylinders 12. Transfer between cylinders
B. Source Material, Element 90	1. Calibration and use of portable radiation protection and fixed laboratory equipment 2. Laboratory analysis and testing 3. Process, characterize, package, ship, or store low-level radioactive and mixed wastes

from the cascade for maintenance service. Each cell consists of a number of converters and the supporting equipment, primarily the compressors and heat exchangers. The cell volumes are listed, by size of equipment, below:

- a. X-33 equipment (8 stages, 26,000 to 28,000 ft.³).
- b. X-31 equipment (10 stages, 11,560 to 11,850 ft.³).
- c. X-29 equipment (10 stages, 8,960 to 11,080 ft.³).
- d. X-27 equipment (12 stages, 2,210 to 2,250 ft.³).
- e. X-25 equipment (6 or 12 stages, 940 to 1,630 ft.³).

For practical operation, cells are grouped together to form units. Each unit consists of cells containing the same equipment type and usually operate under the same conditions. This grouping also allows additional flexibility in providing auxiliary service (e.g., lube oil and hydraulic oil).

3.1.1.1.3 Cascade Shape, Flow and Taper

Three steel-framed, transite-covered, two-story buildings (X-326, X-330, and X-333) house the process equipment. The X-333 Building contains 640 stages (80 cells, 8 units) of X-33 (or 000) size equipment, which is inserted in the cascade flow between units 2 and 3 of X-31 (00) size equipment (located in the X-330 Building). The X-330 Building houses 500 stages (50 cells, 5 units) of X-31 size equipment, and 600 stages (60 cells, 6 units) of X-29 (0) size equipment. The X-326 Building houses 720 stages (60 cells, 3 units) of X-27 equipment, 1560 stages (130 cells, 6.5 units) of X-25 equipment, and 60 stages (10 cells, 0.5 unit) of purge cascade equipment. The location of any particular converter can be identified by specifying the equipment type, unit, cell, and stage. For example, the converter in stage one, cell five, unit three in the X-333 equipment would be specified by X-33-3-5.1.

Figure 3.1.1.1-3 presents a graphic representation of the cascade and provides a simplified process flow diagram. Diagrams of each type of cell are presented in Section 3.1.1.2 which provides a detailed description of the process flow in each building. Figure 3.1.1.1-4 provides a schematic of the cascade interplant flow.

The Portsmouth GDP has the capability of producing reactor grade (currently up to 5.0 % U-235 with a design capability to produce up to 10% U-235) product. In order to enrich uranium from a feed of 0.711 % U-235 to product material at 5.0% U-235, the number of diffusion stages between the feed point and the top product is about 2200. This section of the cascade is called the "enriching" section. Additional stages are required to strip the U-235 isotope from normal feed material so that the depleted material or tails will contain about 0.2 to 0.3 % U-235 (this depends upon power load and marketing considerations). This section of the cascade, called the "stripping" section, is made up of about 500 stages. The Portsmouth GDP consists of 2700 isotopic stages. The cascade also contains 60 purge stages that separate and purge the light gas contaminants that leak into the system.

There are several factors that influence the cascade "shape." A cascade producing at a high product rate must have higher flow rates between stages than one producing at a lower product rate. To utilize power efficiently, the stages in the middle (or near the feed point) must have higher flow rates than those at the ends. This is usually represented or drawn in a diamond shape to illustrate this flow

distribution. The Portsmouth cascade is tapered by appropriate sequencing of the five different equipment sizes and by reducing the pressures across each size equipment.

Tapering is accomplished as follows: The middle part of the cascade, where feed is introduced, contains the largest, highest pressure cells resulting in the maximum interstage flow rate near the feed point. The flow taper is achieved in units of the same equipment size by gradually decreasing the pressure from cell to cell and unit to unit. At approximately 320 stages away from the feed point, the equipment size is reduced (to X-31 size) and the pressure is raised to compensate for the smaller equipment. Pressure tapering is then resumed as the equipment size is further reduced; pressures would again be tapered down toward the cascade ends in order to achieve efficient flow distribution.

Fuel for light water reactors can be produced by diffusion cascades having only two, or possibly three equipment sizes, while a longer cascade, such as the Portsmouth GDP, is designed to produce a more highly enriched product for special reactors and, therefore, is made up of five equipment sizes (illustrated in Figure 3.1.1.1-5). As seen in this figure, cascade feed is made up of multiple feed streams (typically three and sometimes four streams), and are withdrawn for commercial reactor assay streams (currently 3.2 to 4.95% U-235, with a capability up to 10% U-235) and the tails stream. Average high-side pressures and assays are given on either side of the schematic.

Most of the plant load is consumed by the low-assay X-29, X-31, and X-33 size equipment. Each block shown in the schematic represents a unit, with the number of cells and stages shown in the right side of the block. The diamond represents the taper flow of an ideal cascade of this type. The sizes of electrical components which provide power to the stage compressors must also be tapered in accordance with the flow taper in the UF_6 system. The sizes of coolant condensers, and the recirculating cooling water flow rates, must also conform with the UF_6 flow taper. The assays and feed and withdrawal locations shown in Figure 3.1.1.1-5 are not precise, but are typical for current market conditions.

The product withdrawals from the Portsmouth cascade are usually made up of two different streams. They are removed at the Extended Range Product Withdrawal (ERP) and Low Assay Withdrawal (LAW) stations. The cascade feed is made up of two (sometimes three, including HEU Refeed) streams of different assays. The lower feed stream is usually normal assay material; the higher feed consists of slightly enriched product from the Paducah GDP. At every point where there is a feed or withdrawal, the flow taper required for the most efficient power utilization and assay control for withdrawal operations must take into account the sudden change in cascade flow conditions. A taper for projected typical operation of the Portsmouth cascade at full power is illustrated in Figure 3.1.1.1-5; the pressures and assays are approximate. A different taper would be required for other feed and withdrawal locations. The number of cells may vary as the lower product assay changes. Normally, cells are started and shut down and the cascade retapered to maintain high efficiency when the lower product assay is changed or as power availability dictates.

The major cascade feed streams are supplied through feed headers connected to the feed autoclaves in the X-342 and X-343 Feed Facility.

Power Failure

When a total power failure occurs, a diesel-driven generator supplies power to the withdrawal stations MOV's. Should the diesel generator fail to start or supply power, tie breakers can be closed to another generator to supply backup power for closing the MOV's.

The air-operated valves are designed to fail in the safe position; consequently the withdrawal cylinders, condensers, accumulators, and compression loops would isolate and the vent valve would open, when either an air or electrical failure occurs.

The electronic instrumentation on the LAW control panel in ACR-1 is supplied power from the backup generator. ERP and Tails instruments are pneumatic and therefore not affected by a power failure.

Plant Air Failure

Failure of the plant air system requires shutdown of the withdrawal facilities. During an air supply failure there would be time for an orderly shutdown and isolation. The compressor recycle valves would open protecting the compressors. The RCW control valves to the cooling condensers would close causing the compressors to trip on high coolant pressure or temperature, except in the Tails Area.

As described in Section 3.2.2.2, the air operated valves in the HPV system would fail in the safe position. The air operated pigtail valve has a reserve volume of air sufficient for valve closure.

Over a prolonged outage, the condensers and accumulators can be drained to a withdrawal cylinder and evacuated to surge drums.

3.2.2.10 Nuclear Criticality Control

The accumulator size is primarily the limiting factor when determining the maximum assay that may be withdrawn through a particular withdrawal loop. (Section 3.2.2.2) However, the 10-ton and 14-ton cylinders that are used at these stations are normally limited to 5% U-235 assay. Cylinder fill and assay limits are discussed in Section 3.2.1.1.2.

When the Tails loop is being used for product withdrawal, double block valves between loops are closed and chained to prevent mixing of assays. Continuous assay monitoring is required. The assay is verified by the laboratory analysis before the withdrawal is started. Some valves on the withdrawal headers may be chained and/or locked to prevent misvalving.

Liquid cylinders are moved by crane (Section 3.2.1.1.4), one at a time, and are not carried over other cylinders in the temporary storage yard, where they are stored until the solidification criteria defined in SAR Section 3.2.7 have been satisfied.

The heated housings around lower liquid distribution headers, condenser and accumulator housings have 1-inch holes drilled in their bottoms to provide immediate drainage or vaporization in case of a UF₆ leak in those areas. The 8-inch i.d. accumulators at the ERP Station are exceptions. They are

located outside the heated housing and they are insulated with fiberglass and covered with an aluminum outer sheath. This insulation has an o.d. of 13 inches. To ensure that there is no leakage of UF_6 into the insulation, the 8-inch accumulators are leakrated annually. Should a small leak occur, the system would be subcritical, at an H/U-235 ratio of 10, at 10% assay.

3.2.2.11 Safety Structures, Systems, and Components

The information contained in this section has been deleted. Safety structures, systems and components are delineated in Chapter 4, Accident Analysis, of this SAR.

3.2.2.12 Administrative Controls

The information in this section has been deleted. Administrative controls required for the safe operation of systems, structures and components have been specified in the TSR portion of the Application.

3.2.2.13 Surveillance

The information in this section has been deleted. Surveillance requirements required for the safe operation of systems, structures and components have been specified in the TSR portion of the Application.

3.2.3 Top Product (PW) and Side Withdrawals

Both permanent (fixed) and portable facilities and equipment are available to withdraw enriched UF_6 from any point in the enrichment cascade.

The Product Withdrawal Facility (PW) is a fixed facility located in the south west corner of the X-326 Building that was used to withdraw HEU product. The UF_6 was removed from the cascade by routing it through headers from the desired cell and stage to a manifold in the PW facility (see Figure 3.2-13).

Side withdrawal facilities make use of a portable unit consisting of a refrigeration unit and bath mounted on a scale. A schematic of a typical portable unit is shown in Figure 3.2-16. A cylinder is immersed in the bath and connected by pigtailed to the line recorder manifold of the unit (or half unit) from which the withdrawal is to be made on the cell floor. The withdrawal point is selected by putting the line recorder selector switch on the appropriate cell. Control samples can be obtained from the line recorder manifold lines in the ACR. The UF_6 flow is established by the pressure differential between the suction and discharge pressures of the withdrawal stage compressor. As the UF_6 enters the cold cylinder, it condenses to a solid and the non-condensable gases return to the cascade through the line recorder return line. Line recorder manifold withdrawal connections are located in each unit of X-326

3.7 HEU AND MEU ACTIVITIES

3.7.1 Description

The Regulatory Approach for Post NRC Certification of Gaseous Diffusion Plants (JW Parks to GP Rifakes, October 11, 1995), DOE will retain regulatory authority over HEU, except for residual HEU that is held up in equipment subsequent to DOE HEU cleanout performed as part of the HEU suspension project and Category III quantities (or less) of other HEU (these small quantities of HEU may be handled incidental to general enrichment activities).

The Fundamental Nuclear Materials Control Plan, submitted as part of this SAR and the associated programs and plans, describes the accounting methods for HEU activities.

Heel quantities of HEU material are stored in 5", 8" and 12" cylinders in the X-345 facility which is not leased by USEC. The HEU is moved under DOE oversight from the X-345 facility to a cylinder cleaning facility in a non-certified portion of the X-705 Building.

After a cylinder has been fed, a relatively small amount of non-volatile uranium typically remains in the cylinders. This "heel" is removed by a cleaning process conducted in a DOE-regulated X-705 Small Cylinder Cleaning area or shipped offsite for cleaning. Solutions resulting from the cleaning process are blended with solutions containing normal, depleted or LEU to reduce the assay to less than 10 wt-% ^{235}U . The solution is then transferred to the uranium recovery area where it is converted to uranium oxides; finally the oxides are stored for future disposition. The cleaned cylinders and any cylinders destroyed during the cleaning process are returned to DOE.

As a part of the normal operation of the gaseous diffusion process, cells are treated with oxidant gases to remove deposits of uranyl fluoride and other compounds from the cascade equipment surfaces in a manner described in Section 3.1.1.12. Generally, these treatments liberate a few hundred to several thousand grams of uranium from deposits. The treatment gases, including any uranium liberated from deposits as UF_6 , are evacuated to surge drums and then returned to the enrichment cascade at a point near its origin.

Cell treatment may result in the liberation of small quantities of residual HEU that was left in USEC process equipment following completion of the DOE cleanup process. This may occur at any point during the remaining operational life of the enrichment cascade. The liberated HEU material will mix with the LEU material in the process equipment and surge drums and the treatment gases will be returned to the cascade, where it will be mixed with the much larger quantities of uranium present in the interstage flow at LEU enrichments. This process ensures that the blended stream remains within the ^{235}U possession limits defined in Table 1-3. Analysis of uranium enrichment is not performed prior to returning the mixtures to the cascade. Any changes in uranium inventory due to "recovery" of the relatively small amounts of HEU would be reflected in USEC's enrichment cascade Inventory Difference (ID) during periodic inventories.

In addition to the HEU downblending activities, there may be occasions when equipment or components removed from the LEU cascade, X-705 Building or other leased areas contain uranium greater than USEC's possession limits due to the presence of material left from previous DOE operations. This includes equipment or components in the X-326 facility that need to be removed for maintenance or other operational purposes and contain retained inventory of UF_6 plated out on the inside surfaces (includes both shutdown and operating equipment in the X-326 facility); material and equipment such as alumina traps, seal exhaust oil and GP containers from always-safe vacuums that are generated as part of ongoing operations in X-326, or equipment in X-705 that needs to be removed for maintenance purposes. On those occasions when material is discovered in uninstalled equipment in any USEC-leased and NRC-certified area of the PORTS plant that exceeds USEC's possession limits, the PORTS NRC Resident Inspector will be notified of the situation; and the equipment, components, or items will be moved to a DMSA within seven days after removal for storage or further processing. Equipment and components may subsequently be disassembled and decontaminated in an area in the X-705 Building which is placed temporarily under DOE regulation with appropriate safeguards in place (see the description of the process in Section 3.7.2). Material removed which exceeds USEC's possession limits will be retained by DOE or will be blended with LEU solution until the overall enrichment is less than USEC's possession limits. DOE regulation and associated safeguards will cease to be applied when material equal to or greater than USEC's possession limits is no longer present. The blended-down solution would be processed through uranium recovery as described above. While the X-705 area is temporarily converted to DOE regulation, access to the DOE regulated areas is controlled in accordance with the DOE Regulatory Oversight Agreement (ROA).

3.7.2 Temporary Conversion of Leased Areas of the X-705 Facility from NRC to DOE Regulation

Temporary conversion of leased areas of the X-705 facility from NRC regulation to DOE regulation will be accomplished as follows:

1. USEC will send a written request to NRC and DOE to temporarily convert an area of X-705 to DOE regulation for a specific activity in order to remain in compliance with USEC's possession limits. This notification will include a description of the work planned to be done, why USEC's possession limits may be exceeded if the work was done under NRC regulation, anticipated start and end dates for the temporary conversion, and a justification that NRC regulated activities will not be impacted by the temporary conversion.
2. USEC will receive written approval from NRC and DOE to proceed with temporary conversion to DOE ROA regulation prior to beginning the work activity, along with the approved start and end dates.
3. USEC will complete the subject activity (or suspend the activity if an unacceptable impact on other NRC activities have been identified) and then perform a static special inventory and a security sweep of the specific area to provide a high degree of assurance that materials are not present that would cause USEC to exceed its possession limits after conversion to NRC regulation.

4. USEC will notify NRC and DOE in writing that the activity is complete (or has been suspended if an unacceptable impact on other NRC regulated activities has been identified), that USEC requests conversion to NRC regulation, and that converting the area to NRC regulation will not result in USEC exceeding its possession limits.
5. DOE will notify NRC and USEC in writing of any open findings or issues related to the subject area of the facility to NRC, and that DOE agrees with the conversion to NRC regulation.
6. DOE and NRC will agree to a date when all regulatory authority will convert from DOE regulation to NRC regulation, and NRC will notify USEC and DOE of this date in writing.
7. The area will convert to NRC regulation on the date specified by NRC.

3.7.3 Organization and Responsibilities

When HEU quantities greater than Category III are eliminated from PORTS (other than residual holdup that may be encountered during cell treatment and equipment removal described in Section 3.7.1 above), NRC will be the regulator for the entire USEC operated site and the DOE Regulatory Oversight Agreement (ROA) will expire. However, should remaining quantities of HEU or MEU greater than Category III be physically removed from USEC equipment subsequent to expiration of the DOE ROA, the material will be the responsibility of DOE.

The DOE ROA will cease to apply to all facilities or activities for which NRC assumes regulatory authority. This may occur on the entire site or on a facility, area, or activity basis. The DOE ROA will continue to be used for regulation after NRC certification for leased uncertified facilities, areas or activities after NRC assumes regulatory oversight. Such facilities and areas include the X-705 Small Cylinder Cleaning area; such activities include the movement of HEU along USEC leased roadways.

The boundaries between DOE and NRC regulation will not coincide with the USEC/DOE lease during the transition period (HEU activities after NRC certification) from DOE to NRC oversight. The boundaries where the DOE ROA will apply after initial NRC certification of PORTS are described in the SAR and the associated programs and plans and the DOE Compliance Plan.

A segregated DOE-regulated area in X-705 has been modified to allow cleaning of all sizes of cylinders following refeed. Processing of HEU materials in other areas of X-705 is complete. The DOE ROA will apply to identified, segregated areas in X-705 for these remaining refeed support activities. However, if refeed support activities involving quantities of HEU greater than Category III levels continue, which are not confined to the segregated areas, then the DOE ROA will cover the entire X-705 facility.

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August 6, 1998

Appendix A - Deleted.

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LIST OF EFFECTIVE PAGES

List of Effective Pages - Volumes 1 & 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
i	23	xi	19	xxi	19
ii	23	xii	19	xxii	19
iii	19	xiii	19	xxiii	23
iv	19	xiv	23	xxiv	19
v	23	xv	19	xxv	22
vi	21	xvi	21	xxvi	19
vii	21	xvii	19	xxvii	19
viii	19	xviii	19	xxviii	19
ix	23	xix	19		
x	19	xx	19		

Introduction - Volume 1

<u>Page</u>	<u>Revision</u>
1	22
2	22
3	22
4	19

Table of Contents - Volumes 1 & 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
i	19	xiii	19	xxv	19
ii	19	xiv	19	xxvi	19
iii	19	xv	19	xxvii	19
iv	19	xvi	19	xxviii	19
v	19	xvii	19	xxix	19
vi	23	xviii	19	xxx	19
vii	19	xix	19	xxxi	19
viii	19	xx	19	xxxii	19
ix	19	xxi	19	xxxiii	19
x	19	xxii	19	xxxiv	19
xi	19	xxiii	19		
xii	19	xxiv	19		

LIST OF EFFECTIVE PAGES

Definitions - Volume 1

<u>Page</u>	<u>Revision</u>
1	11
2	19
3	11
4	1

Chapter 1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
1-1	2	1-10	4	A-5	8
1-2	19	1-11	4	A-6	8
1-3	3	1-12	4	A-7	19
1-4	2	A-1	19	A-8	8
1-5	2	A-1a	8	A-9	19
1-6	23	A-1b	8	A-10	19
1-7	23	A-2	8	A-11	8
1-8	4	A-3	19	A-12	8
1-9	23	A-4	8		

Section 2.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
2.1-1	1	2.1-10	1	2.1-19	8
2.1-2	19	2.1-11	8	2.1-20	8
2.1-3	19	2.1-12	1	2.1-20a	8
2.1-3a	3	2.1-13	8	2.1-20b	8
2.1-3b	2	2.1-14	8	2.1-21	1
2.1-4	1	2.1-15	8	2.1-22	1
2.1-5	1	2.1-15a	8	2.1-23	1
2.1-6	1	2.1-15b	8	2.1-24	1
2.1-7	2	2.1-16	8	2.1-25	1
2.1-8	1	2.1-17	8	2.1-26	1
2.1-9	1	2.1-18	8		

LIST OF EFFECTIVE PAGES

Section 3.0 - Volume 1

<u>Page</u>	<u>Revision</u>
3.0-1	1
3.0-2	1

Section 3.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.1-1	1	3.1-28		3.1-51	19
3.1-2	1	3.1-29	1	3.1-52	19
3.1-3	1	3.1-30	1	3.1-53	1
3.1-4	23	3.1-31	1	3.1-54	1
3.1-5	8	3.1-32	1	3.1-55	1
3.1-6	19	3.1-33	1	3.1-56	1
3.1-7	1	3.1-34	19	3.1-57	19
3.1-8	19	3.1-35	1	3.1-58	19
3.1-9	8	3.1-36	1	3.1-59	19
3.1-10	1	3.1-37	1	3.1-60	19
3.1-11	1	3.1-38	1	3.1-61	19
3.1-12	1	3.1-39	1	3.1-62	19
3.1-13	8	3.1-40	1	3.1-63	1
3.1-14	8	3.1-41	1	3.1-64	2
3.1-15	19	3.1-42	1	3.1-64a	2
3.1-16	1	3.1-43	1	3.1-64b	2
3.1-17	19	3.1-44	19	3.1-65	1
3.1-18	19	3.1-45	19	3.1-66	19
3.1-19	1	3.1-45a	1	3.1-67	1
3.1-20	8	3.1-45b	1	3.1-68	19
3.1-21	1	3.1-46	1	3.1-69	19
3.1-22	19	3.1-47	19	3.1-70	19
3.1-23	1	3.1-48	19	3.1-71	1
3.1-24	19	3.1-48a	2	3.1-72	2
3.1-25	19	3.1-48b	2	3.1-73	19
3.1-26	19	3.1-49	1	3.1-74	19
3.1-27	19	3.1-50	1	3.1-75	1

LIST OF EFFECTIVE PAGES

Section 3.1 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.1-76	1	3.1-103	19	3.1-132	3
3.1-77	19	3.1-104	19	3.1-133	19
3.1-78	2	3.1-105	19	3.1-134	19
3.1-79	19	3.1-106	1	3.1-135	2
3.1-80	1	3.1-107	19	3.1-136	2
3.1-80a	19	3.1-108	1	3.1-137	19
3.1-80b	19	3.1-109	1	3.1-138	1
3.1-81	1	3.1-110	1	3.1-139	19
3.1-82	1	3.1-111	1	3.1-140	19
3.1-83	1	3.1-112	19	3.1-141	19
3.1-84	1	3.1-112a	1	3.1-142	21
3.1-85	1	3.1-112b	1	3.1-143	19
3.1-86	3	3.1-113	19	3.1-144	1
3.1-87	1	3.1-114	1	3.1-145	1
3.1-88	1	3.1-115	1	3.1-146	19
3.1-89	19	3.1-116	1	3.1-147	19
3.1-90	2	3.1-117	1	3.1-147a	1
3.1-91	1	3.1-118	1	3.1-147b	1
3.1-92	1	3.1-119	1	3.1-148	1
3.1-93	1	3.1-120	19	3.1-149	3
3.1-94	1	3.1-121	1	3.1-150	3
3.1-94a	3	3.1-122	19	3.1-151	19
3.1-94b	3	3.1-123	1	3.1-152	19
3.1-95	19	3.1-124	1	3.1-153	1
3.1-96	19	3.1-125	19	3.1-154	1
3.1-97	1	3.1-126	19	3.1-155	1
3.1-98	19	3.1-127	1	3.1-156	1
3.1-99	19	3.1-128	1	3.1-157	1
3.1-100	1	3.1-129	3	3.1-158	1
3.1-101	19	3.1-130	1	3.1-159	1
3.1-102	1	3.1-131	19	3.1-160	1

LIST OF EFFECTIVE PAGES

Section 3.2 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.2-1	1	3.2-33	19	3.2-67	1
3.2-2	1	3.2-34	19	3.2-68	1
3.2-3	19	3.2-35	19	3.2-69	3
3.2-4	19	3.2-36	3	3.2-70	19
3.2-5	1	3.2-37	3	3.2-71	1
3.2-6	1	3.2-38	19	3.2-72	19
3.2-7	19	3.2-39	19	3.2-73	19
3.2-8	19	3.2-40	19	3.2-74	3
3.2-9	16	3.2-41	19	3.2-75	1
3.2-10	16	3.2-42	23	3.2-76	1
3.2-11	16	3.2-43	3	3.2-77	1
3.2-12	1	3.2-44	19	3.2-78	19
3.2-13	19	3.2-45	1	3.2-79	19
3.2-14	19	3.2-46	1	3.2-80	19
3.2-15	19	3.2-47	1	3.2-81	1
3.2-16	22	3.2-48	2	3.2-82	1
3.2-17	8	3.2-49	1	3.2-83	1
3.2-17a	8	3.2-50	1	3.2-84	19
3.2-17b	8	3.2-51	1	3.2-85	1
3.2-18	1	3.2-52	2	3.2-86	1
3.2-19	2	3.2-53	1	3.2-87	1
3.2-20	1	3.2-54	2	3.2-88	1
3.2-21	19	3.2-55	1	3.2-89	1
3.2-22	19	3.2-56	1	3.2-90	1
3.2-23	19	3.2-57	1	3.2-91	1
3.2-24	19	3.2-58	1	3.2-92	1
3.2-25	19	3.2-59	19	3.2-93	1
3.2-26	19	3.2-60	19	3.2-94	1
3.2-27	19	3.2-61	22	3.2-95	1
3.2-28	1	3.2-62	19	3.2-96	19
3.2-29	19	3.2-63	19	3.2-97	19
3.2-30	19	3.2-64	19	3.2-98	19
3.2-31	2	3.2-65	19	3.2-99	1
3.2-32	19	3.2-66	1	3.2-100	1

LIST OF EFFECTIVE PAGES

Section 3.2 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.2-101	1	3.2-111	1	3.2-121	1
3.2-102	1	3.2-112	1	3.2-122	1
3.2-103	1	3.2-113	1	3.2-123	1
3.2-104	1	3.2-114	1	3.2-124	1
3.2-105	1	3.2-115	1	3.2-125	1
3.2-106	1	3.2-116	1	3.2-126	1
3.2-107	1	3.2-117	1	3.2-127	1
3.2-108	1	3.2-118	1	3.2-128	1
3.2-109	1	3.2-119	1	3.2-129	19
3.2-110	1	3.2-120	1	3.2-130	1

Section 3.3 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.3-1	1	3.3-21	2	3.3-41	19
3.3-2	19	3.3-22	3	3.3-42	1
3.3-3	1	3.3-23	19	3.3-43	19
3.3-4	1	3.3-24	1	3.3-44	19
3.3-5	1	3.3-25	1	3.3-45	19
3.3-6	3	3.3-26	1	3.3-46	19
3.3-7	19	3.3-27	1	3.3-47	1
3.3-8	19	3.3-28	8	3.3-48	19
3.3-9	19	3.3-29	1	3.3-49	19
3.3-10	3	3.3-30	1	3.3-49a	19
3.3-11	19	3.3-31	1	3.3-49b	19
3.3-12	19	3.3-32	1	3.3-50	19
3.3-13	3	3.3-33	19	3.3-51	1
3.3-14	19	3.3-34	1	3.3-52	2
3.3-15	1	3.3-35	1	3.3-53	19
3.3-16	19	3.3-36	1	3.3-54	1
3.3-17	19	3.3-37	19	3.3-55	3
3.3-18	3	3.3-38	1	3.3-56	1
3.3-19	19	3.3-39	19	3.3-57	1
3.3-20	19	3.3-40	19	3.3-58	1

LIST OF EFFECTIVE PAGES

Section 3.4 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.4-106	1	3.4-111	1	3.4-116	1
3.4-107	1	3.4-112	1	3.4-117	1
3.4-108	1	3.4-113	8	3.4-118	1
3.4-109	1	3.4-114	1	3.4-119	1
3.4-110	1	3.4-115	1	3.4-120	1

Section 3.5 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.5-1	1	3.5-22	1	3.5-45	3
3.5-2	3	3.5-23	1	3.5-46	1
3.5-3	19	3.5-24	1	3.5-47	1
3.5-4	1	3.5-25	2	3.5-48	8
3.5-5	3	3.5-26	1	3.5-49	1
3.5-6	1	3.5-27	2	3.5-50	1
3.5-7	1	3.5-28	2	3.5-51	2
3.5-8	2	3.5-29	19	3.5-52	2
3.5-9	1	3.5-30	1	3.5-53	2
3.5-10	3	3.5-31	15	3.5-54	3
3.5-11	3	3.5-32	2	3.5-55	3
3.5-12	19	3.5-33	19	3.5-56	2
3.5-13	19	3.5-34	19	3.5-57	1
3.5-13a	19	3.5-34a	3	3.5-58	1
3.5-13b	19	3.5-34b	3	3.5-58a	3
3.5-13c	19	3.5-35	2	3.5-58b	3
3.5-13d	19	3.5-36	2	3.5-59	1
3.5-14	19	3.5-37	2	3.5-60	1
3.5-15	19	3.5-38	2	3.5-61	1
3.5-16	19	3.5-39	1	3.5-62	1
3.5-17	19	3.5-40	1	3.5-63	1
3.5-18	2	3.5-41	2	3.5-64	1
3.5-19	3	3.5-42	2	3.5-65	1
3.5-20	3	3.5-43	3	3.5-66	1
3.5-21	2	3.5-44	3		

LIST OF EFFECTIVE PAGES

Section 3.6 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.6-1	1	3.6-24	19	3.6-47	1
3.6-2	1	3.6-25	19	3.6-48	1
3.6-3	1	3.6-26	19	3.6-49	1
3.6-4	19	3.6-27	19	3.6-50	19
3.6-5	2	3.6-28	19	3.6-51	19
3.6-6	3	3.6-29	1	3.6-52	19
3.6-7	3	3.6-30	1	3.6-53	1
3.6-8	2	3.6-31	1	3.6-54	19
3.6-9	2	3.6-32	3	3.6-55	1
3.6-10	1	3.6-33	2	3.6-56	1
3.6-11	3	3.6-34	1	3.6-57	19
3.6-12	3	3.6-35	1	3.6-58	1
3.6-13	19	3.6-36	1	3.6-59	1
3.6-14	1	3.6-37	1	3.6-60	19
3.6-15	19	3.6-38	1	3.6-61	1
3.6-16	19	3.6-39	1	3.6-62	19
3.6-17	19	3.6-40	1	3.6-63	1
3.6-18	19	3.6-41	1	3.6-64	1
3.6-19	19	3.6-42	1	3.6-65	1
3.6-20	2	3.6-43	1	3.6-66	1
3.6-21	1	3.6-44	1	3.6-67	1
3.6-22	2	3.6-45	1	3.6-68	1
3.6-23	1	3.6-46	1		

Section 3.7 - Volume 1

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
3.7-1	23	3.7-4	3
3.7-2	23	A-1	23
3.7-3	23	A-2	23

LIST OF EFFECTIVE PAGES

Section 5.1 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.1-1	2	5.1-22	1	5.1-43	1
5.1-2	2	5.1-23	3	5.1-44	1
5.1-3	2	5.1-24	1	5.1-45	1
5.1-4	2	5.1-25	1	5.1-46	1
5.1-5	19	5.1-26	1	5.1-47	1
5.1-6	19	5.1-27	1	5.1-48	1
5.1-7	19	5.1-28	1	5.1-49	1
5.1-8	2	5.1-29	1	5.1-50	1
5.1-9	19	5.1-30	1	5.1-51	1
5.1-10	19	5.1-31	19	5.1-52	1
5.1-11	19	5.1-32	1	5.1-53	1
5.1-12	19	5.1-33	1	5.1-54	1
5.1-13	19	5.1-34	1	5.1-55	1
5.1-14	1	5.1-35	1	5.1-56	1
5.1-15	1	5.1-36	1	5.1-57	1
5.1-16	1	5.1-37	1	5.1-58	1
5.1-17	1	5.1-38	1	5.1-59	1
5.1-18	1	5.1-39	1	5.1-60	1
5.1-19	1	5.1-40	1	5.1-61	1
5.1-20	1	5.1-41	1	5.1-62	1
5.1-21	1	5.1-42	1		

Section 5.2 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.2-1	2	5.2-7	2	5.2-13	3
5.2-2	2	5.2-8	2	5.2-14	4
5.2-3	2	5.2-9	4	5.2-15	4
5.2-4	3	5.2-10	4	5.2-16	3
5.2-5	3	5.2-11	2	5.2-17	19
5.2-6	3	5.2-12	23	5.2-18	19
5.2-6a	3				
5.2-6b	3				

LIST OF EFFECTIVE PAGES

Section 5.3 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.3-1	3	5.3-15	3	5.3-27	19
5.3-2	3	5.3-16	3	5.3-28	19
5.3-3	4	5.3-17	3	5.3-29	2
5.3-4	3	5.3-18	19	5.3-30	2
5.3-5	4	5.3-19	3	5.3-31	2
5.3-6	3	5.3-20	19	5.3-32	19
5.3-7	19	5.3-20a	8	5.3-33	2
5.3-8	3	5.3-20b	8	5.3-34	19
5.3-9	4	5.3-21	3	5.3-35	19
5.3-10	4	5.3-22	3	5.3-36	2
5.3-11	3	5.3-23	19	5.3-37	19
5.3-12	3	5.3-24	19	5.3-38	2
5.3-13	3	5.3-25	3	5.3-39	2
5.3-14	3	5.3-26	3	5.3-40	2

Sections 5.4 & 5.5 - Volume 2

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
5.4-1	3	5.4-5	3	5.4-9	3
5.4-2	19	5.4-6	3	5.4-10	19
5.4-3	3	5.4-7	3	5.5-1	19
5.4-4	3	5.4-8	3	5.5-2	1

LIST OF FIGURES
Chapter 2 (Continued)

Figure	Page
2.6-7 "BLUME" PORTS Seismic Hazard Curves	2.6-22
2.6-8 Interpretation of the BLUME and Seismic Hazard Curve for PORTS	2.6-23
2.6-9 Estimated Peak Acceleration Return Periods, Dames and Moore - Seismic Hazard Curve	2.6-24
2.6-10 TERA - PORTS Seismic Hazard Curve	2.6-25
2.6-11 Superimposed Results for Fernald and PORTS	2.6-26
2.6-12 Recommended Fernald and PORTS Seismic Hazard Curve	2.6-27

TABLE OF CONTENTS
Chapter 3

	Page
3.0 FACILITY AND PROCESS DESCRIPTION	3.0-1
3.1 CASCADE SYSTEMS	3.1-1
3.1.1 Uranium Enrichment Cascade	3.1-1
3.1.2 Purge Cascade System	3.1-98
3.1.3 Freezer/Sublimers Systems	3.1-120
3.1.4 Cold Recovery System	3.1-129
3.1.5 Freon Degradation System	3.1-152
3.1.6 Cascade Systems Safety Systems, Design Features, and Administrative Controls	3.1-162
3.2 UF ₆ FEED, WITHDRAWAL, SAMPLING, HANDLING, AND CYLINDER STORAGE FACILITIES AND SYSTEMS	3.2-1
3.2.1 Cascade UF ₆ Feed and Sampling Systems	3.2-4
3.2.2 Tails and Product (ERP and LAW) Withdrawals	3.2-20
3.2.3 Top Product (PW) and Side Withdrawals	3.2-42
3.2.4 The High Assay Sampling Facilities (HASA)	3.2-44
3.2.5 UF ₆ Cylinder Shipping and Receiving	3.2-60
3.2.6 Cylinder Storage	3.2-62
3.2.7 UF ₆ Cylinder Transport	3.2-72
3.2.8 Safety Systems, Design Features for Safety, and Administrative Controls	3.2-74

TABLE OF CONTENTS
Chapter 3 (Continued)

	<u>Page</u>
3.3 URANIUM RECOVERY AND CHEMICAL SYSTEMS	3.3-1
3.3.1 X-705 Decontamination and Recovery Facility	3.3-1
3.3.2 X-705 Waste Water Treatment Facility	3.3-42
3.3.3 Contaminated Storage Facilities	3.3-52
3.3.4 Bionitrification Facilities	3.3-55
3.4 POWER AND UTILITY SYSTEMS	3.4-1
3.4.1 Electrical Systems	3.4-1
3.4.2 Plant Water System	3.4-7
3.4.3 Plant Nitrogen System	3.4-21
3.4.4 Plant Air System	3.4-27
3.4.5 Plant Steam and Condensate Systems	3.4-31
3.4.6 Plant Waste Systems and Facilities	3.4-33
3.4.7 HF/F ₂ Systems	3.4-38
3.5 GENERAL SUPPORT FACILITIES AND SYSTEMS	3.5-1
3.5.1 Maintenance Facilities	3.5-1
3.5.2 Laboratories and Pilot Plants	3.5-20
3.5.3 Receiving and Storage Facilities	3.5-29
3.5.4 Communications and Data Processing	3.5-34
3.5.5 Administration Facilities	3.5-43
3.5.6 Health Protection Facilities	3.5-46
3.6 FIRE PROTECTION AND RADIATION ALARM SYSTEMS AND ENVIRONMENTAL PROTECTION FACILITIES	3.6-1
3.6.1 Fire Protection Systems	3.6-1
3.6.2 Radiation Alarm Systems	3.6-12
3.6.3 Environmental Protection Facilities	3.6-22
3.7 HEU AND MEU ACTIVITIES	3.7-1
3.7.1 Description	3.7-1
3.7.2 Temporary Conversion of Leased Areas of the X-705 Facility from NRC to DOE Regulation	3.7-2
3.7.3 Organization and Responsibilities	3.7-3
APPENDIX A (Deleted)	A-1

<u>Volume Limit</u>	<u>Maximum ²³⁵U Enrichment (wt. percent)</u>
55-Gallon	1.4
30-Gallon	2.0
22-Quart	5.5
14-Quart	10.0
5-Quart	not limited

The bases for the container sizes are provided in each NCSE prepared for those operations requiring containers. Specific details of these bases can be obtained by referring to the particular NCSE of concern.

Interaction

Interaction is controlled by spacing items bearing fissile material when those items could result in a criticality accident if not properly spaced. The spacing necessary to maintain a safe array of fissile material units is determined in the NCSE performed for the array. The spacing requirements are documented in the NCSA for the operation. The amount of spacing needed between items is determined based on analysis of the normal and credible abnormal process upset conditions for the particular operation. The basis for the spacing is documented in PORTS NCSEs. Other spacing requirements are applied on a case-by-case basis, depending on the results of a given NCSE.

Geometry

Geometry control is applied by limiting equipment dimensions for those systems which depend on the geometry for criticality safety. The geometry is determined in the NCSE which is performed for each system and depends on the normal and credible abnormal process upsets conditions related to the specific system. For example, the following dimensions are used in geometry controls:

<u>Volume Limit</u>	<u>Maximum ²³⁵U Enrichment (wt. percent)</u>
5-Inch Depth	5
3.5-Inch Depth	10
1.5-Inch Depth	not limited
10.25-Inch Inside Diameter (ID)	5
8.2-Inch ID	10
5-Inch ID	not limited

The inside diameters are for geometries of unspecified length. Containers with larger inside diameters and limited heights are used as evaluated in NCSEs. Geometry controls are specified in the NCSAs.

Mass

Mass controls are applied on a case-by-case basis depending on the fissile material operation involved. The acceptable mass is determined based on the specific NCSE performed for the operation. The safe mass value depends on many factors including the geometry, ^{235}U enrichment, composition, etc. The safe mass values are communicated to the operating personnel via the NCSAs.

A typical operating limit is 350 g ^{235}U , regardless of enrichment. A maximum mass of 760 grams ^{235}U is considered subcritical, as recognized by ANSI/ANS-8.1. If under an abnormal condition the mass would not exceed 760 grams ^{235}U , the operation would be considered to be subcritical.

Enrichment

Uranium-containing material on the plantsite with ^{235}U enrichment ≤ 1 wt. percent is considered incapable of supporting a nuclear chain reaction, but interaction of such materials with materials of higher enrichment is taken into consideration in the specific NCSE for those operations which involve material enriched to ≤ 1 wt. percent.

At PORTS, the maximum ^{235}U enrichment of product UF_6 is 10.0 wt. percent. Small quantities of higher enriched uranium may be present on the plantsite in the form of laboratory samples and standards for instrument calibration purposes and in Department of Energy (DOE) operations as described below.

DOE operations involving greater than 10.0 wt. percent ^{235}U on plantsite are ongoing. For NCS, at interfaces between uranium enriched to greater than 10.0 wt. percent ^{235}U and uranium of less than 10.0 wt. percent ^{235}U , either specific controls are present to limit enrichment to less than 10.0 wt. percent ^{235}U , or the possibility of the higher enrichment is addressed in the NCS evaluation for the operation. When 5", 8", and 12" cylinders with residual UF_6 of greater than 10.0 wt. percent ^{235}U are cleaned in X-705, the HEU solutions generated are mixed with LEU solution and double sampled to confirm the ^{235}U enrichment is less than 10.0 wt. percent prior to transfer to a NRC-regulated area. In some cases, equipment removed from X-326 could contain residual deposits of HEU. The HEU deposits individually will not be of NCS concern since the HEU suspension project will reduce HEU deposits to below a minimum critical mass, including measurement error for the enrichment of the deposit. In X-705, this equipment would be disassembled, and the bulk of the deposit removed to favorable geometry containers. The equipment would then be decontaminated further in the tunnel cleaning operation. Small amounts of HEU may have entered the seal exhaust oil and trapping material in X-326 during initial HEU refeed and during HEU suspension activities. Due to the large quantity of LEU present, the enrichment would not exceed 10.0 wt. percent in these materials. The operations involved were originally approved for enrichments of up to 100 wt. percent ^{235}U .

The maximum ^{235}U enrichment for each operation is established by the specific NCSE. The NCSA shall specify the maximum acceptable enrichment for each operation. Credible process upset conditions which could alter the ^{235}U enrichment shall also be considered in the NCSEs. Many operations at PORTS were previously approved for enrichments higher than 10.0 wt. percent ^{235}U . Those operations evaluated assuming this higher enrichment will have a larger margin of safety than indicated in the evaluation, due to the lower enrichment of the uranium actually being processed.

LIST OF EFFECTIVE PAGES

<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>	<u>Page</u>	<u>Revision</u>
i	23	2-5	2	6-1	1
ii	19	2-6	1	6-2	12
iii	19	3-1	1	6-3	12
iv	19	3-2	12	6-4	2
v	19	3-3	12	6-5	19
vi	19	3-4	2	6-6	19
vii	19	3-5	12	6-7	12
viii	19	3-6	1	6-8	12
1-1	1	4-1	12	7-1	12
1-2	19	4-2	12	7-2	3
1-3	1	4-3	12	7-3	12
1-4	12	4-4	12	7-4	3
1-5	12	4-5	12	7-5	12
1-6	1	4-6	2	7-6	3
1-7	23	4-7	2	8-1	2
1-8	23	4-8	12	8-2	1
1-8a	4	4-9	12	9-1	12
1-8b	23	4-10	2	9-2	3
1-9	19	4-11	12	10-1	12
1-10	1	4-12	3	10-2	1
1-11	1	5-1	12	A-1	19
1-12	1	5-2	12	A-2	12
1-13	1	5-3	2	B-1	1
1-14	1	5-4	2	B-2	1
1-15	1	5-5	15	C-1	1
1-16	1	5-6	2	C-2	1
1-17	1	5-7	12	D-1	19
1-18	1	5-8	2	D-2	1
2-1	1	5-9	15	D-3	2
2-2	1	5-10	15	D-4	1
2-3	19	5-11	3	E-1	19
2-4	12	5-12	1	E-2	19

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Table 1-1 Possession Limits for NRC-Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
A. Source Material ^{4,5}	92	Solid, liquid, and gas	UF ₆ , UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	300,000 MTU ^a	Uranium (including natural, depleted and recycled) and daughter products and process contaminants and wastes
					Laboratory chemicals Analysis of samples ^c
B. Source Material	90	Solid and liquid	Soluble and insoluble chemicals, metal	10 Ci	Instrument calibration and check sources
					Laboratory chemicals, instrument calibration sources, plated metallic sources, instrument check sources Analysis of samples ^c
C. Special Nuclear Material ^{6,7}	92	Solid, liquid, and gas	UF, UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	300,000 MTU ^a	Uranium (including recycled) enriched in isotope 235 up to 10 percent by weight, uranium daughter products and process contaminants and wastes, to include: (1) laboratory chemicals, (2) analysis of samples ^c , (3) instrument calibration and check sources, or (4) material that may be held up in facilities and equipment from previous operations
					Uranium enriched in isotope 235 from 10 percent up to 20 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities, (2) laboratory chemicals, (3) analysis of samples ^c , or (4) instrument calibration and check sources.

Table 1-1 (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	92	Solid, liquid and gas	UF ₆ , UF ₄ , UO ₂ F ₂ , oxides, metal and other compounds	1,000 g ²³⁵ U ^a	Uranium enriched in isotope 235 to 20 percent and up to 98 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities, (2) laboratory chemicals, (3) analysis of samples*, or (4) instrument calibration and check sources.
Special Nuclear Material	94	Sealed source		50 Ci	Instrument calibration sources, NDA
		Sealed glass ampules		3 Ci	Instrument calibration sources, NDA
		Unsealed sources		0.5 Ci	Laboratory chemicals Analysis of samples*
	94	Any	Any	That resulting from the feed of recycled or FSUP uranium	Process contaminants and wastes, material held in equipment from previous operations
D. By-Product Material	3-89, 91	Sealed source		1 Ci with no single isotope to exceed 100 mCi, except as noted below	Calibration, instrument internal source
		Unsealed source		1 Ci with no single isotope to exceed 100 mCi, except as noted below	Instrument calibration and check sources
					Laboratory chemicals Analysis of samples*

Table 1-1. (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	27Co-57	Sealed Source		10 Ci	Calibration, internal Instrument standard, NDA
	27 Co-60	Sealed Source		450 Ci	Calibration, NDA, Process sources
		Unsealed Source		0.5 Ci	Laboratory chemicals Analysis of samples ^a
	28 Ni-63	Sealed Source		10 Ci	Process sources, internal instrument standards
	38 Sr-90	Sealed Source		0.5 Ci	Calibration
		Unsealed Source		0.5 Ci	Laboratory chemicals, Analysis of samples ^a
	43 Tc-99	Sealed Source		10 Ci	Calibration
		Unsealed Source		5 Ci	Laboratory chemicals, Analysis of samples ^a
		Any	Any	That resulting from the feed of recycled or FSU ^u uranium	Process contaminants and wastes, material held in equipment from previous operations
	55 Cs-137	Sealed Source		2,000 Ci	Calibration, NDA, Process sources
		Unsealed Source		0.5 Ci	Laboratory chemicals Analysis of samples ^a
	61 Pr-147	Sealed Source		0.5 Ci	Calibration
	70 Yb-169	Sealed Source		5.0 Ci	Calibration, NDA
	81 Tl-207	Sealed Source		1.0 Ci	Calibration
	88 Ra-226	Sealed Source		15 Ci	Calibration

Table 1-1 (Continued)

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	93, 96, 97, 99, 100	Sealed source Unsealed source		0.5 Ci 1.0 Ci	Calibration Laboratory chemicals Analysis of samples ^a
	93, 95-100	Any	Any	That resulting from the feed of recycled or FSU uranium ^c	Process contaminants and wastes, material held in equipment from previous operations
	95	Sealed source Unsealed source	Oxides, metals Oxides, metals, solutions	15 Ci 0.5 Ci	Calibration, process source Analysis of samples ^a Laboratory chemicals
	98	Sealed source Unsealed source	Oxides, metals Oxides, metals, solutions	10 Ci 0.5 Ci	Calibration, NDA Analysis of samples ^a Laboratory chemicals

a. MTU - Metric Tons Uranium

b. See 10 CFR Part 76 definitions: Special nuclear material means: (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of Section 51 of the act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched in any of the foregoing, but does not include source material.

c. FSU meets the ASTM Standard C996, Standard Specification for Uranium Hexafluoride Enriched to Less Than 5 percent ²³⁵U; UF₆ for enrichment meets the ASTM Standard C787, Standard Specification for Uranium Hexafluoride for Enrichment.

d. Recycled uranium includes the feed and processing of Paducah Product and the "stockpile" UF₆ transferred from DOE to USEC for enrichment.

e. "Analysis of samples" refers to the analysis of samples (from USEC activities, DOE-PORTS and DOE-other sites, and offsite requestors) utilizing existing facilities and analytical techniques to process low-level radioactivity samples bounded by the possession limits stated in this table.

f. Except for Paducah Product and the "stockpile" UF₆ transferred from DOE to USEC for enrichment, uranium to be fed to the cascade will meet the requirements of ASTM Standard C996, "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ²³⁵U" or ASTM Standard C787, "Standard Specification for Uranium Hexafluoride for Enrichment" for reprocessed UF₆. All other uranium that does not meet the requirements of ASTM C996 or C787 for reprocessed UF₆ may be accepted for storage and subsequent dispositioning but will not be introduced to the cascade, with the exception of small amounts (e.g., 50 pounds UF₆) associated with sampling, subsampling, and analyses required to establish receiver's values.

g. These possession limits do not include material in USEC leased space from previous DOE operations to include retained inventory of uranium plated out on the inside surfaces of both shutdown and operating equipment in the X-326 facility; specific components in the X-326 cascade that need to be removed for maintenance or other operational purposes; material and equipment such as alumina traps, seal exhaust oil and GP containers from always-safe vacuums that are generated as part of ongoing operations in X-326; or material held up in X-705 equipment (some of which may have to be removed for maintenance).

FSU - Former Soviet Union