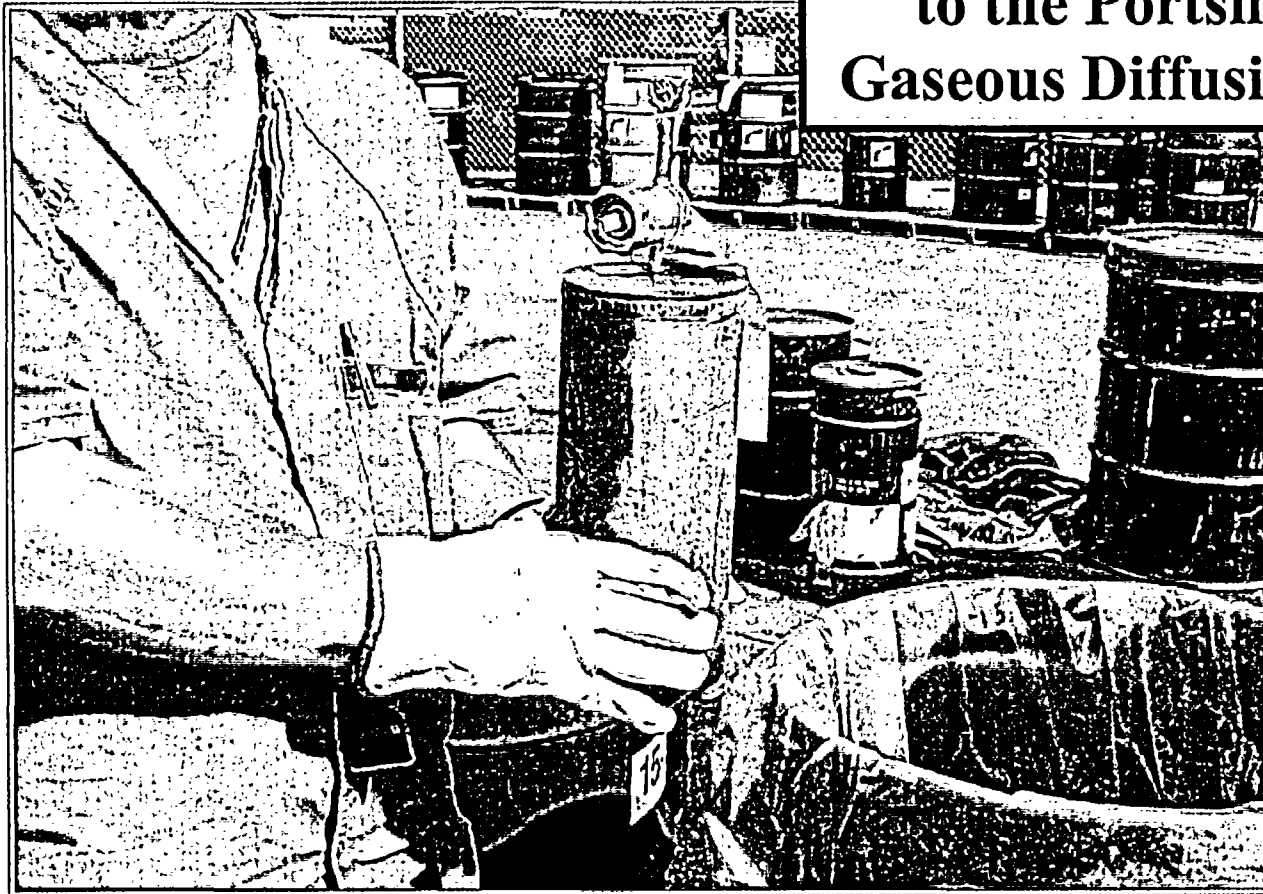


**Transportation of UF₆
Cylinders from East
Tennessee Technology Park
to the Portsmouth, OH
Gaseous Diffusion Plant Site**



Attachment 2

Recap:

- UF₆ Cylinders will be transported from ETTP, near Oak Ridge, TN to the Portsmouth Gaseous Diffusion Plant Environmental Restoration Facility, located near Portsmouth, OH for eventual disposal
- Each cylinder will be transported a single time using the ETTP Transportation Plan that incorporates many safety features.
- approx. 325 cylinders 30" diameter:
shipped inside UX-30 overpack
cylinders do not meet ANSI N14.1
request exemption submitted to DOT – April 7th
amendment request submitted to NRC to temporarily allow shipment of 30" cylinders in the UX-30 – April 7th
- approx. 440 cylinders <30" diameter
shipped in "30ECV", and also inside the UX-30 overpack
30ECV meets performance requirements of ANSI N14.1
request for exemption from 49CFR173.420 also submitted to DOT – June 27th
CoC amendment request to temporarily permit shipment of the 30ECV cylinders in the UX-30 –
??

- Approximately 4-5 of the <30” cylinders cannot meet subcritical criterion when water in-leakage is assumed.

Cylinder #	Cylinder Type	U-235 Grams Assay	UF ₆ Enrichment	Net Weight
MD1185	12A ⁽²⁾	6045g	4.46%	442 lbs
MD0694 ⁽¹⁾	12A ⁽²⁾	3650g	2.43%	372 lbs
MD1203 ⁽¹⁾	12A ⁽²⁾	2747g	2.00%	448 lbs

70's

1. These cylinders will be re-assayed with longer counting times, which could possibly re-categorize them into the “30 ECV submittal.”
2. Cylinders comply with ANSI N14.1 configuration and materials requirements.

Possible submittal under §71.55(g):

Packages containing uranium hexafluoride only are excepted from the requirements of paragraph (b) of this section provided that:

- (1) Following the tests specified in §71.73 (“Hypothetical Accident Conditions”) there is no physical contact between the valve body and any other component of the packaging, other than its original point of attachment, and the valve remains leak tight;*
- (2) There is adequate quality control in the manufacture, maintenance, and repair of packagings;*
- (3) Each package is tested to demonstrate closure before each shipment; and*
- (4) The uranium is enriched to not more than 5 weight percent uranium-235.*

□ 30ECV (and UX-30) would also be used for the 1-3 cylinders authorized under §71.55(g). Issues to be addressed:

(1) Structural analysis requirements – especially with no valve on the 30ECV.

Performance requirements of the 30ECV (again, with no valve on the 30ECV).

(2) Duratek's QA program is adequate for fabrication of the 30ECV.

(3) The currently planned pre-shipment testing is adequate to demonstrate closure.

(4) UF₆ is enriched to <5%.

**Comparison of <30" Amendment Application (30ECV)
to Possible Application Under §71.55(g)**

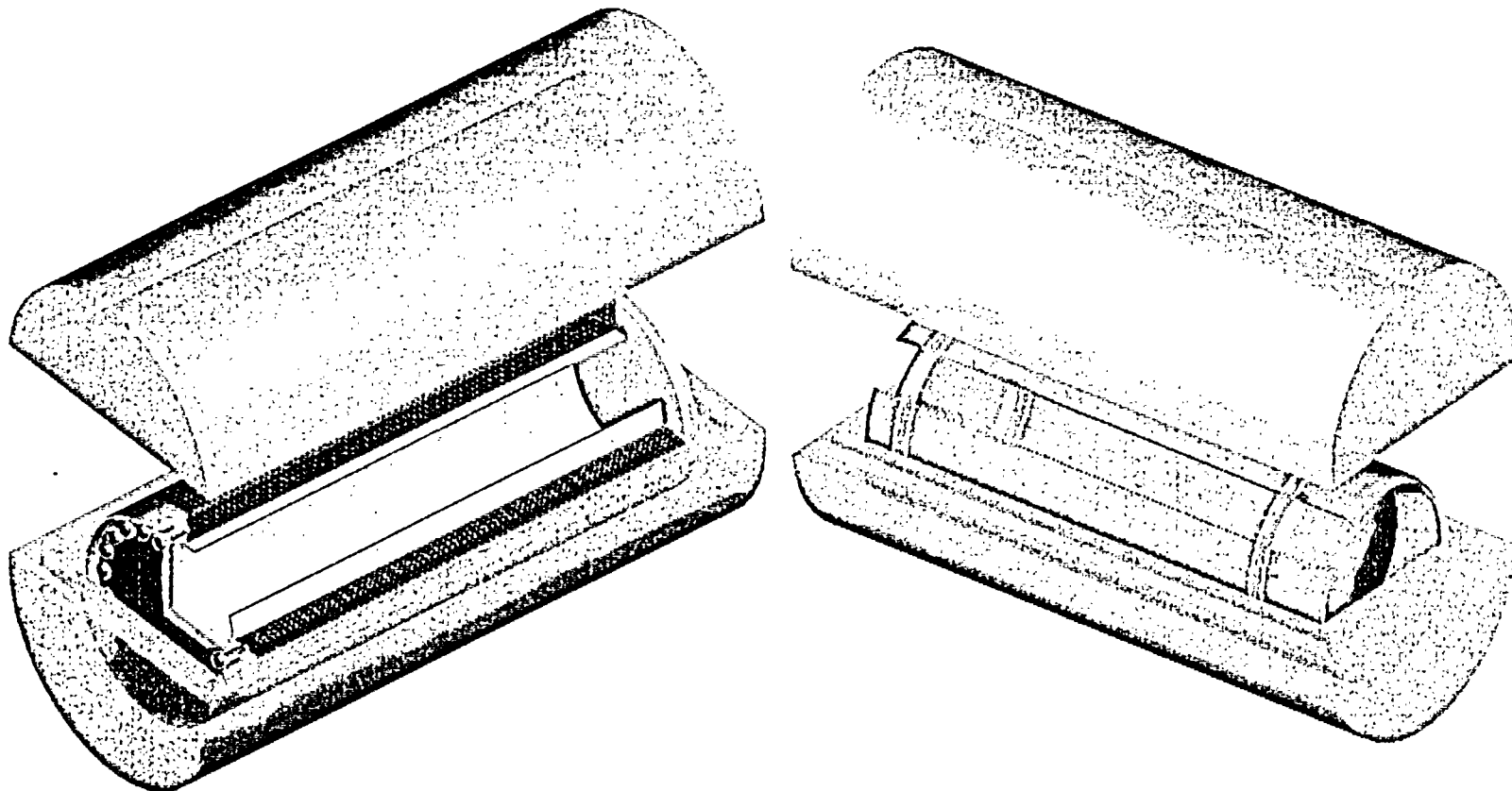
Chapter of Application	<30" Cylinder/30ECV Submittal	Proposed §71.55(g) Submittal
Chapter 1: Introduction	<ul style="list-style-type: none"> ■ contents (UX-30) is 30ECV cylinder weighing maximum of 4000 lbs ■ maximum UF₆ is 1600 lbs ■ see Chapter 6 for maximum U₂₃₅ 	<ul style="list-style-type: none"> ■ Same (except mass limits U235) ■ permitted contents would be determined in the Chapter 6 analysis
Chapter 2: Structural	<p>30ECV is equivalent in protection to the 30B cylinder because:</p> <ul style="list-style-type: none"> ■ similar in size, shape, dimensions, etc. ■ lid is tightly secured and leak tested before each shipment ■ lid is recessed ■ total maximum weight of 30ECV is 4000 lbs compared to 6620 lbs for 30B ■ materials of construction are the same ■ ends of 30ECV better protected ■ both are ASME Code Stamped ■ design specs the same ■ two additional layers of foam on the 30ECV ■ 30ECV does not have a valve ■ foam dunnage on interior of insert for 30ECV ■ ETTP Transportation Plan 	<p>Same?</p> <p>Equivalent to "...no contact between over-pack and valve?"</p>

Chapter of Application	<30" Cylinder/30ECV Submittal	Proposed §71.55(g) Submittal															
Chapter 3: Thermal	Same as 30B (conservative assumption)	Same															
Chapter 4: Containment	<ul style="list-style-type: none"> ■ hydrostatic and air tests required for 30B by ANSI N14.1 also performed on 30ECV ■ Soap Bubble Test on 30ECV, lid, and bolts ■ Gas Pressure Drop Test on leak test port in the lid 	Same?															
Chapter 5: Shielding	n/a	n/a															
Chapter 6: Criticality	<ul style="list-style-type: none"> ■ analysis performed assuming water in-leakage <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">U₂₃₅ Enrich Limit (w/o)</th> <th style="text-align: center;">U₂₃₅ Mass Limit (g)</th> <th style="text-align: center;">CSI</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">4000</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">1600</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">1000</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">100</td> <td style="text-align: center;">800</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	U ₂₃₅ Enrich Limit (w/o)	U ₂₃₅ Mass Limit (g)	CSI	3	4000	0	5	1600	0	15	1000	0	100	800	0	<ul style="list-style-type: none"> ■ analysis performed assuming water exclusion ■ approach for determining maximum permitted mass <ul style="list-style-type: none"> - based on actual data - based on maximum mass UF₆ - based on maximum mass U-235 <p style="text-align: right; margin-right: 20px;">} generic</p> <ul style="list-style-type: none"> ■ calculate CSI?
U ₂₃₅ Enrich Limit (w/o)	U ₂₃₅ Mass Limit (g)	CSI															
3	4000	0															
5	1600	0															
15	1000	0															
100	800	0															

<p>Chapter 7: Operating Procedures</p>	<ul style="list-style-type: none"> ■ cylinders shipped a single time ■ ETPP transportation plan ■ place cylinders in Tyvek® sacks ■ perform leak tasks ■ gross weight of cylinders <900 lbs ■ maximum U₂₃₅ based on criticality table 	<p>Same?</p>
<p>Chapter 8: Acceptance Tests and Maintenance</p>	<ul style="list-style-type: none"> ■ acceptance criteria for 30ECV ■ ANSI N14.1 inspection and testing ■ ASME Sec. VIII ■ VT and MT all welds 	<p>Same?</p>

30ECV Structural Evaluation

- Demonstration of the compliance with the regulatory requirements of 10 CFR 71 for the 30ECV cylinder package is performed by a comparison with a similar package (30B/C Package)



30ECV & 30B/C Cylinder Package Comparison**Similar Features**

- Both 30ECV and 30B/C Cylinders are shipped inside a UX-30 Overpack
- Similar Overall Dimensions

Quantity	30ECV	30B/C
Length	81.5 inch	81.5 inch
Body Diameter	30 inch	30 inch
Shell Diameter	20 inch	30 inch
Shell Thickness	½ inch	½ inch

- Both are constructed from the same material – SA 516 Gr. 70
- Both are designed for 200 psig, and hydrostatically tested to 400 psig
- Both are designed, fabricated, tested, and stamped per ASME Code, Section VIII

30ECV & 30B/C Cylinder Package Comparison

Superior Features

- Smaller 30ECV weight – 4,000 lb versus 6,620 lb
- 2" thick baseplate versus ½" semi elliptical head
- 2" thick flange/lid versus ½" semi elliptical head
- 30ECV packages do not have valves, eliminating the most vulnerable component of the package during the HAC tests
- Gasket seal between the flange and lid of the ECV cylinders
- 30ECV lid secured by 20 1 1/8" bolts, torqued to 400 ft-lb, providing ample bolt pretension and gasket compression

30ECV & 30B/C Cylinder Package Comparison

Additional Features

- Recessed lid - provides protection against a direct impact during HAC events
- Cushioning material around the shell - provides uniform load distribution between the 30ECV vessel and the UX-30 Overpack
- Dunnage material inside the cavity – reduces the payload inertia during HAC, provides uniform load distribution between the payload and the 30ECV cylinders
- 30ECV controlled shipment – made under ETTP transportation plan versus the general shipment of the 30B/C cylinders – limits the likelihood and severity of the potential accidents.

30ECV Structural Evaluation**Fissile Material Package Requirements (10 CFR 71.55)**

- Packages exempted from additional requirements if they meet the following:
(71.55(g))

Requirement	30ECV Compliance
During the HAC test, there is no physical contact between the valve body and any other component of the package, other than at its original point of attachment, and the valve remains leak tight	✓
Adequate quality control	✓
Each package tested to demonstrate closure before each shipment	✓
The uranium is enriched to not more than 5 weight percent U ₂₃₅	✓

- 30ECV has no valves. The package integrity and leak tightness has been demonstrated by comparison with an equivalent package that successfully met the HAC tests

30ECV Structural Evaluation

Conclusion

- By demonstrating that the 30ECV package has similar or superior structural features compared to another licensed package, it is concluded that the 30ECV packages will provide equivalent or better safety against the normal conditions of transport (NCT) and hypothetical accident conditions (HAC) tests loading as the licensed package.
- The additional requirements for the fissile material packages are also satisfied.

Summary:

Additional requirements (over present <30" cylinder submittal) to demonstrate meeting §71.55(g)?

- analyses (Chapters 2 and 6)
- operational (Chapter 7)
- acceptance criteria (Chapters 4 and 8)

Format for additional submittal:

- supplement to <30" present submittal
- entirely new submittal

ETTP 48" Cylinders
Proposed DOT Exemption

Applicable Standard	Model	Total # Cyls	HEELS							OVER MASS LIMIT FOR HEELS						
			Number of Cylinders							Mass	Number of Cylinders					Mass
			≤50 lbs UF6	>1% Enrich	≤Max. Enrich (1% or 4.5%)	<Max. Enrich and ANSI Compliant	>Max. Enrich (1% or 4.5%)	>Max. Enrich and ANSI Compliant*	Max. UF6 Wt (lbs)	>50 lbs UF6	>1% Enrich	≤Max. Enrich (1% or 4.5%)	>Max. Enrich (1% or 4.5%)	ANSI Compliant	Max. UF6 Wt (lbs)	
ANSI N14.1 - 2001	48A	17	14	13	5	0	9	8	31.6	3	3	3	0	3	58.2	
Max 4.5% Enrich. Permitted	48X	39	39	38	36	0	3	3	46.9	0	0	0	0	0	0.0	
ANSI N14.1 - 2001	48OM	2	2	0	1	0	1	0	27.0	0	0	0	0	0	0.0	
Max 1% Enrich. Permitted	48G	1	1	0	1	0	0	0	0.0	0	0	0	0	0	0.0	
ANSI N14.1 - 1971	48T	10	9	8	7	0	2	2	48.0	1	1	1	0	1	121.0	
Max 4.5% Enrich. Permitted	48OH	5	2	2	1	0	1	1	23.8	3	3	3	0	3	58.0	
	48OHI	11	6	6	2	0	4	4	22.2	5	5	5	0	5	222.2	
Totals:		85	73	67	53	0	20	18		12	12	12	0	12		

*ANSI compliant except for U-235 enrichment; this includes U-stamped.
Note: also may not be ANSI compliant in terms of maintenance history.

10/24

ETTP 48" Cylinders
Proposed DOT Exemption

Possible Exemption Requests for 48" Cylinders

48" Cylinders	Mass UF6	Enrichment	Compliant with ANSI N14.1	> Maximum Enrichment	Exemptions
85	≤ 50 lbs	>1%	Yes	Yes	<ul style="list-style-type: none"> ■ §173.420 (ANSI N14.1) ■ §173.420 (Sec. VIII of ASME Code) ■ §173.420 (pressure)
	73	67	18	20	
		≤ 1%	No	No	
	6	55	53		
	>50 lbs	>1%	Yes	Yes	<ul style="list-style-type: none"> ■ §173.420 (pressure) ■ 49CFR173.417
	12	12	12	0	
		≤ 1%	No	No	
		0	0	12	

ETTP 48" Cylinders
Proposed DOT Exemption

Exemptions Requested:

□ 49CFR173.420

(1) compliance with ANSI N14.1 for <50 lbs cylinders

maximum enrichment

physical condition (but not shell thickness)

manufacture/maintenance history

(2) ASME Sec. VIII Code Stamp for <50 lbs cylinders

(3) cylinder pressure (vacuum) for all cylinders

□ 49CFR173.417(a) – requirement for 10CFR71 packaging for >1% enrichment
for >50 lbs cylinders

ETTP 48" Cylinders
Proposed DOT Exemption

Justifications:

- can demonstrate that cylinders are safe in fire accident
- cylinders meet DOT 7A requirements
- quantity of UF_6 in each cylinder is extremely small
- cylinders are in good physical condition
- cylinders will be shipped in CI48 overpacks if UF_6 mass is >50 lbs (12 cylinders)
- cylinders are being removed from environment

ETTP 48" Cylinders
Proposed DOT Exemption

Compensatory Measures:

- ETTP Transportation Plan
- limited cylinder population; each cylinder only shipped a single time