

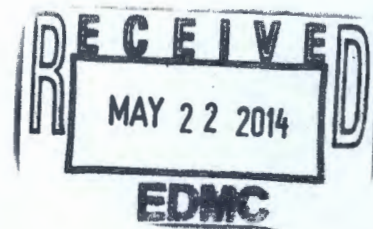


**Department of Energy**  
 Richland Operations Office  
 P.O. Box 550  
 Richland, Washington 99352

14-ESQ-0079

MAY 16 2014

Mr. J. Martell, Manager  
 Radioactive Air Emissions Section  
 State of Washington  
 Department of Health  
 309 Bradley Boulevard, Suite 201  
 Richland, Washington 99352



Dear Mr. Martell:

**AS LOW AS REASONABLY ACHIEVABLE CONTROL TECHNOLOGY (ALARACT)  
 DEMONSTRATION FOR HIGH-EFFICIENCY PARTICULATE AIR (HEPA) FILTER  
 LIFETIME 331 BUILDING HEPA FILTER AGE ASSESSMENT**

- References: (1) RL ltr. to J. Martell, WDOH, from M. McCormick, "As Low As Reasonably Achievable Control Technology (ALARACT) Demonstration for High-Efficiency Particle Absorber (HEPA) Filter Lifetime at the 325 Building and 331 Building, 300 Area, Hanford Site, Richland, Washington," 14-ESQ-0031, dtd. January 28, 2014.
- (2) WDOH ltr. to S.L. Charboneau, RL, from J. Martell, "As Low As Reasonably Achievable Control Technology (ALARACT) Demonstration: EP-325-01-S (EU 361) and EP-331-01-V (EU 412)," AIR 13-1101, dtd, November 13, 2013.

Enclosed is the 331 Building HEPA Filter Age Assessment as required by the State of Washington, Department of Health (WDOH) letter AIR 13-1101 and the U. S. Department of Energy Richland Operations Office letter 14-ESQ-0031, References (1) and (2). The assessment identifies the age of HEPA filters at the 331 Building and follows the process previously used at the 325 Building.

The 331 Building HEPA Filter Age Assessment is submitted in consideration of the ALARACT demonstration required by WDOH and is submitted pursuant to the Washington Administrative Code 246-247, "Radiation Protection – Air Emissions."

If you have any questions, please contact me, or your staff may contact Stacy L. Charboneau, Assistant Manager for Safety and Environment, on (509) 373-3841.

Sincerely,

*Matt McCormick*  
 Matt McCormick  
 Manager

ESQ:DEJ

Enclosure

cc w/encl: See page 2

1222955

Mr. J. Martell  
14-ESQ-0079

-2-

MAY 16 2014

cc w/encl:

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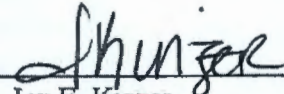
D. Zhen, EPA

Administrative Record (File: 325 Building and 331 Building)  
Environmental Portal, LMSI, A3-95

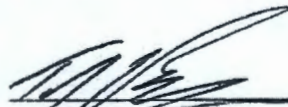
System Assessment


331 HEPA Filter Age Assessment

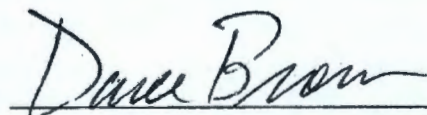
April 2014

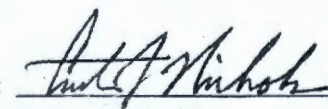
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Reviewed By:  4/24/14  
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Reviewed By:  4/25/14  
 Dave M. Brown, Chief Engineer Date

Approved By:  4-25-14  
 Curt J. Nichols, 331 Building Manager Date

### **Introduction**

The 331 Building was constructed in 1970 to accommodate a wide variety of biological and ecological research studies. The three-story building has over 10,000 m<sup>2</sup> of space with over 100 offices, more than 70 individual laboratories, and specialized areas such as animal rooms and glove boxes. The abatement technology for the main stack includes a minimum of a single stage of high-efficiency particulate air (HEPA) filtration from which radiological air is exhausted.

### **Specifications**

Primary HEPA filters are self-contained and have the following typical specifications:

- 1) Manufacturer: Flanders.
- 2) Model #s:
  - a) O-007-W-43-N2-NU-00-23-GG-FU5.
  - b) T-000-W-43-05-NU-51-23-GG-FU5.
- 3) Capacity: 1000 cfm.
- 4) Specification: S418973-SPCP1.
- 5) COC required per QA-180.
- 6) Function Test Results required per QA-192.
- 7) Independent lab test required per QA-174A.

### **Qualification Testing**

Independent off-site HEPA filter efficiency testing, in conjunction with in-service leak testing, confirms  $\geq 99.95\%$  filter efficiency during a filter's life-cycle. Each new HEPA filter is independently tested at the Department of Energy (DOE) sanctioned Filter Test Facility prior to being placed into service. Testing ensures filtration efficiency using a worse-case mono-disperse aerosol size (i.e., most penetrating particle size is typically 0.3 micron).

Primary HEPA filters are in-service leak tested when installed and are re-tested annually thereafter. In-service testing confirms whether or not the installed filter-to-frame seal etc. has  $< 0.05\%$  aerosol penetration and that the configuration has not degraded. In-service leak testing of HEPA filters typically use a poly-disperse "cold" aerosol. In-service leak testing is performed in accordance with the requirements of ASME/ANSI N511-2007, "In-Service Testing of Nuclear Air Treatment, Heating, Ventilation, and Air-Conditioning Systems."

### **Service Life**

The recommended HEPA filter service life (storage plus service) is ten years based on ASME AG-1, "Code on Nuclear Air and Gas Treatment", Non-mandatory Appendix FK-A, and the DOE Nuclear Air Cleaning Handbook. Both references base the ten-year life on the study UCRL-AR-134141, "Maximum HEPA Filter Life" (1999), by W. Bergman. This study correlates a statistically insignificant reduction of dry filter media tensile strength and an improvement in filter media burst

strength, both versus filter age. The study also acknowledges that filtration efficiency generally improves with service-life. The study's ten-year limit is:

*"...to ensure that HEPA filters will perform under postulated accident conditions."*

The postulated accident is not specified but is presumably an off gas surge that bursts the filter media.

### **HEPA Filter Age**

The 331 Building HEPA filter ages are listed in Table 1, "HEPA Filter Status." The average filter life is 6.6 years. Filter age was determined firstly from the nameplate manufacturing date. Where filters had no manufacturing date listed, the serial numbers' sequential order was used to infer the manufacturing date. There are six filters in place that are greater than ten years old from the date of manufacture.

### **Documented Safety Analysis**

The 331 Building does not have a Documented Safety Analysis (DSA).

### **Recommendations**

This assessment recommends the following:

1. Within four years, replace or cease operations through HEPA filters at the 331 Building that are in excess of ten years from the date of manufacture.
2. Solicit the ASME standards committee for the ten-year age limit.

### **References**

1. ASME AG-1, "Code on Nuclear Air and Gas Treatment", Non-mandatory Appendix FK-A.
2. DOE Nuclear Air Cleaning Handbook.
3. UCRL-AR-134141, "Maximum HEPA Filter Life" (1999), by W. Bergman.

Table 1 – 331 Building HEPA Filter Status

HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-192-HEPA	171A	Cobalt Room	169864	1987	2011	Yes	27
HVE-284-HEPA	108	Safety Cab #1 Prim / Filter Box, 1 filter	285849	1997	2008	Yes	17
HVE-141-HEPA	151	Rm Exh	N291991		2000	Yes	14
HVE-575-HEPA	163/169	Hoods 163 - 169 Filter B	571969	2002	2007	Yes	12
HVE-60-HEPA	102	Hood 1	614688	2003	2004	Yes	11
HVE-121-HEPA	307	Hood 1	610738	2003	2004	Yes	11
HVE-035-HEPA	302	Hood 1, Filter Box, 1 filter	N253656		2004	Yes	10
HVE-030-HEPA	308	Hood 1, Filter Box, 1 filter	N253655		2004	Yes	10
HVE-051-HEPA	316	Hood 1, Filter Box, 1 filter	N253712		2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	916556	2004	2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	916567	2004	2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	916562	2004	2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	916563	2004	2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	922336	2004	2004	Yes	10
HVE-624-HEPA	313/315	hoods and rm exh	916560	2004	2004	Yes	10
HVE-341-HEPA	175	Hood 2	936055	2004	2008	Yes	10
HVE-90-HEPA	122 & 124	Cage Wash	926923	2004	2008	Yes	10
HVE-445-HEPA	125	HD 1	924110	2004	2007	Yes	10
HVE-327-HEPA	173A	Prim Hood 1	924113	2004	2008	Yes	10

HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-258-HEPA	170	hood 4 (east)	864932	2004	2008	Yes	10
HVE-270-HEPA	170	hood 4 (west)	864930	2004	2008	Yes	10
HVE-87-HEPA	124	Rm Exh, Filter Box, 2 Filters	1089466	2004	2008	Yes	10
HVE-87-HEPA	124	Rm Exh, Filter Box, 2 Filters	1089468	2004	2008	Yes	10
HVE-224-225-796-HEPA	113/166	113 4 Snorkels 113 1 to 1 Rm 166 HDS 1 - 12 / Filter Box, 3 Filters	916558	2004	2010	Yes	10
HVE-184-HEPA	129	HDS 1&2 Filter B	1006036	2005	2007	Yes	9
HVE-574-HEPA	163/169	Hoods 163 - 169 Filter A	1006037	2005	2007	Yes	9
HVE-280-HEPA	152	Hood 6 and all GBs	1126720	2006	2008	Yes	8
HVE-246-HEPA	170	hood 1	1126721	2006	2008	Yes	8
HVE-301-HEPA	170	hood 2	1126707	2006	2008	Yes	8
HVE-291-HEPA	170	hood 3	1126312	2006	2008	Yes	8
HVE-196-HEPA	179A	Hoods 1&2 Filter A	1126719	2006	2008	Yes	8
HVE-199-HEPA	179A	Hoods 1&2 Filter B	1126447	2006	2008	Yes	8
HVE-139-HEPA	356	Hoods 2&3 Filter A	1126732	2006	2008	Yes	8
HVE-133-HEPA	356	Hoods 2&3 Filter B	1126449	2006	2008	Yes	8
HVE-224-225-796-HEPA	113/166	113 4 Snorkels 113 1 to 1 Rm 166 HDS 1 - 12 / Filter Box, 3 Filters	1298930	2006	2010	Yes	8
HVE-224-225-796-HEPA	113/166	113 4 Snorkels 113 1 to 1 Rm 166 HDS 1 - 12 / Filter Box, 3 Filters	1298929	2006	2010	Yes	8
HVE-334-HEPA	175	Hood 1	1417194	2007	2008	Yes	7
HVE-124-HEPA	305	Rm Exh	1698860	2008	2012	Yes	6
HVE-181-HEPA	121	Hood 1	1478937	2008	2010	Yes	6

HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-788-HEPA	163/169	Hoods 163 - 169 Filter D	1478812	2008	2010	Yes	6
HVE-234-HEPA	170	hoods 6&7 filter A	1478956	2008	2010	Yes	6
HVE-57-HEPA	102	Hood 2 & Lab Vac Exh	1449590	2008	2009	Yes	6
HVE-97-HEPA	121	Snorkels (6) Rm Exh (2)	1449568	2008	2009	Yes	6
HVE-598-HEPA	152	Hood 10	1449583	2008	2009	Yes	6
HVE-786-HEPA	163/169	Hoods 163 - 169 Filter C	1449571	2008	2010	Yes	6
HVE-170-HEPA	164	Hoods 1&2 Filter A	1449579	2008	2010	Yes	6
HVE-790-HEPA	164	Hoods 1&2 Filter B	1449562	2008	2010	Yes	6
HVE-792-HEPA	170	hoods 6&7 filter B	1449567	2008	2010	Yes	6
HVE-113-HEPA	311	Hood1	1449581	2008	2009	Yes	6
HVE-129-HEPA	350	hoods 1&2 & 2 snorkels	1449573	2008	2009	Yes	6
HVE-131-HEPA	354	Rm Exh	1449585	2008	2009	Yes	6
HVE-186-HEPA	129	HDS 1&2 Filter A	1449586	2008	2009	Yes	6
HVE-127-HEPA	350	Hoods 1&2 snorkels		2008	2009	Yes	6
HVE-794-HEPA FILT A	116	HDS 1&2	1478866	2008	2010	Yes	6
HVE-040-HEPA FILT B	116	HDS 1&2	1478949	2008	2010	Yes	6
HVE-156-HEPA	158	Hoods 1&2 Filter A	1449580	2008	2010	Yes	6
HVE-135-HEPA	158	Hoods 1&2 Filter B	1449561	2008	2010	Yes	6
HVE-795-HEPA	113	Corridor Closet	1698859	2009	2012	Yes	5
HVE-080-HEPA	122	Rm Exh	1698865	2009	2012	Yes	5



HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-149-HEPA	151	Hood 1	1698858	2009	2012	Yes	5
HVE-160-HEPA	152	Filter 1 Hoods 2, 8 & 9	1673184	2009	2013	Yes	5
HVE-202-HEPA	355	Hood 4	1673183	2009	2010	Yes	5
HVE-167-HEPA	152	Hood 3	1673177	2009	2011	Yes	5
HVE-208-HEPA	355	Hood 1	1673178	2009	2012	Yes	5
HVE-181-HEPA	181	Rm Exh	1673179	2009	2012	Yes	5
HVE-105-HEPA	152	Hood 4	1698861	2009	2012	Yes	5
HVE-63-HEPA	110	HDI & Safety Cab 2	2002972473	2010	2013	Yes	4
HVE-153-HEPA	152	Hood 1	2002972227	2010	2013	Yes	4
HVE-164-HEPA	152	Filter 2 Hoods 2, 8 & 9	200297546	2010	2013	Yes	4
HVE-173-HEPA	152	Hood 5	2002972467	2010	2013	Yes	4
HVE-523-HEPA	152	Hood 7	2002972229	2010	2013	Yes	4
HVE-586-HEPA	319	Filter A	2002972221	2010	2013	Yes	4
HVE-587-HEPA	319	Filter B	2002972218	2010	2013	Yes	4
HVE-588-HEPA	319	Filter C	2002972228	2010	2013	Yes	4
HVE-217-HEPA	355	Hood 1 Filter A	2002972458	2010	2013	Yes	4
HVE-214-HEPA	355	Hood 1 Filter B	2002972465	2010	2013	Yes	4
HVE-308-HEPA	355	Hood 2 Filter B	2002972459	2010	2013	Yes	4
HVE-313-HEPA	355	Hood 2 Filter A	2002888749	2010	2013	Yes	4
HVE-70-HEPA	112	Hood 1 PRI	2003115729	2011	2013	Yes	3

HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-576-HEPA	170	hood 5	2003115727	2011	2013	Yes	3
HVE-211-HEPA	355	Hood 3 Filter B	2003115726	2011	2014	Yes	3
HVE-346-HEPA	190	Hood 1	2003095088	2011	2013	Yes	3
HVE-118-HEPA	307	Rm Exh	2003095092	2011	2014	Yes	3
HVE-109-HEPA	317	Vas & hood & Rm exh	2003095094	2011	2013	Yes	3
HVE-83-HEPA	164B janitor closet	Room Exhaust	2003095083	2011	2013	Yes	3
HVE-107-HEPA	317	Vas & hood & Rm exh	2003095095	2011	2013	Yes	3
HVE-108-HEPA	317	Vas & hood & Rm exh	2003095090	2011	2013	Yes	3
HVE-205-HEPA	355	Hood 3 Filter A	2002095089	2011	2014	Yes	3
HVE-143-HEPA	151	Hoods 2&3 / Fiter Box of 4 Filters / Bottom	2003024122	2011	2013	Yes	3
HVE-143-HEPA	151	Hoods 2&3 / Fiter Box of 4 Filters / Bottom	2003024123	2011	2013	Yes	3
HVE-143-HEPA	151	Hoods 2&3 / Fiter Box of 4 Filters / Top	2003023992	2011	2013	Yes	3
HVE-143-HEPA	151	Hoods 2&3 / Fiter Box of 4 Filters / Top	2003024129	2011	2013	Yes	3
HVE-125-HEPA	311A	Rm Exh	2003014779	2011	2013	Yes	3
HVE-195-HEPA	195/196 197/198		2003105937	2011	2012	Yes	3
HVE-195-HEPA	195/196 197/198		2003105938	2011	2012	Yes	3
HVE-195-HEPA	195/196 197/198		2003105939	2011	2012	Yes	3
HVE-195-HEPA	195/196 197/198		2003105940	2011	2012	Yes	3
HVE-195-HEPA	195/196 197/198		2003105941	2011	2012	Yes	3

HEPA Filter	Room	Component	Serial Number	Mfr. Date	Install Date	Field Verified*	Age
HVE-195-HEPA	195/196 197/198		2003105942	2011	2012	Yes	3
HVE-103-HEPA	TEMP CAPPED	Out of Service	146184		1997	Yes	NA
HVE-305-HEPA	170	Safety Cabinet #1 / Out of Service	936099	2004	2008	Yes	NA
HVE-178-HEPA	113-115B	Out of Service	307251	1972	1972	Yes	NA
HVE-101-HEPA	321-74	Rm Exhaust, Filter Removed and Capped				Yes	NA
HVE-374-HEPA	323-25	Rm Exhaust, Filter Removed and Capped				Yes	NA
						Avg. =	6.6

\*All filters verified to the extent possible.