



## NIOWAVE, INC.

1012 North Walnut Street  
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July 17, 2018

NRC Region III Office  
2443 Warrenville Road, Suite 210  
Lisle, IL 60532-4352

Attn: Mr. Frank Tran, Ms. Cassandra Frazier, Ms. Patricia Pelke, Dr. Peter Lee

Subj: Niowave Additional Information for Submission of Amendment 07 to License 21-35144-02

Dear Mr. Tran,

In response to your phone call on July 13, 2018, we provide the following to address your request for additional information:

1. Provide additional details on effluent concentration calculations (120 mCi of Rn-222 and progenies) and show that it is less than the release limit.

We are installing a HEPA filter inline on the gas bag exhaust to prevent particulates from exiting the gas capture bags (see a green box in Fig.1). The HEPA filter is a Flanders brand filter which is >99% efficient at filtering particles down to 0.3 micron. As such, only Rn-222 will be released from the gas capture bags effluent. The maximum amount of Rn-222 that we can have in a gas bag can be found assuming all the radon in the glovebox is distributed uniformly and all the gas from the antechamber is transferred into the gas bag. Assuming the glove box contains 120 mCi of Rn-222 (the maximum possible amount we are licensed to possess) and taking into account the ratio of the volumes of the glovebox and the antechamber, the maximum amount of Rn-222 which can end up in the gas bag is 11.5 mCi. Using this number as the initial activity, after 60 days of DIS, the activity of Rn-222 will be 2.2E-4 mCi:

$$A_{t=60days} = A_0 e^{-\lambda t} = 11.5 \text{ mCi} e^{-\frac{\ln(2)60 \text{ days}}{3.8 \text{ days}}} = 0.00022 \text{ mCi}$$

The average annual concentration then will be 1.4E-14  $\mu\text{Ci/mL}$ , which is four orders of magnitude lower than the limit from the Column 1 of Table 2 in 10 CFR 20 Appendix B (see Table 1 below). Every time there is a release we will log it in the effluent release log (please see attached), which will account for both fission products of uranium and Rn-222.

Table 1. Activity of Rn-222, its average annual concentration and comparison to the limit in 10 CFR20 Appendix B.

Inventory after 60 days of DIS for 11.5 mCi of Rn-222				
	Activity [mCi]	Avg. Annual [ $\mu\text{Ci/mL}$ ]	10 CFR 20 App. B Limit [ $\mu\text{Ci/mL}$ ]	Ratio
Rn-222	2.2E-04	1.4E-14	1.0E-10	1.4E-04

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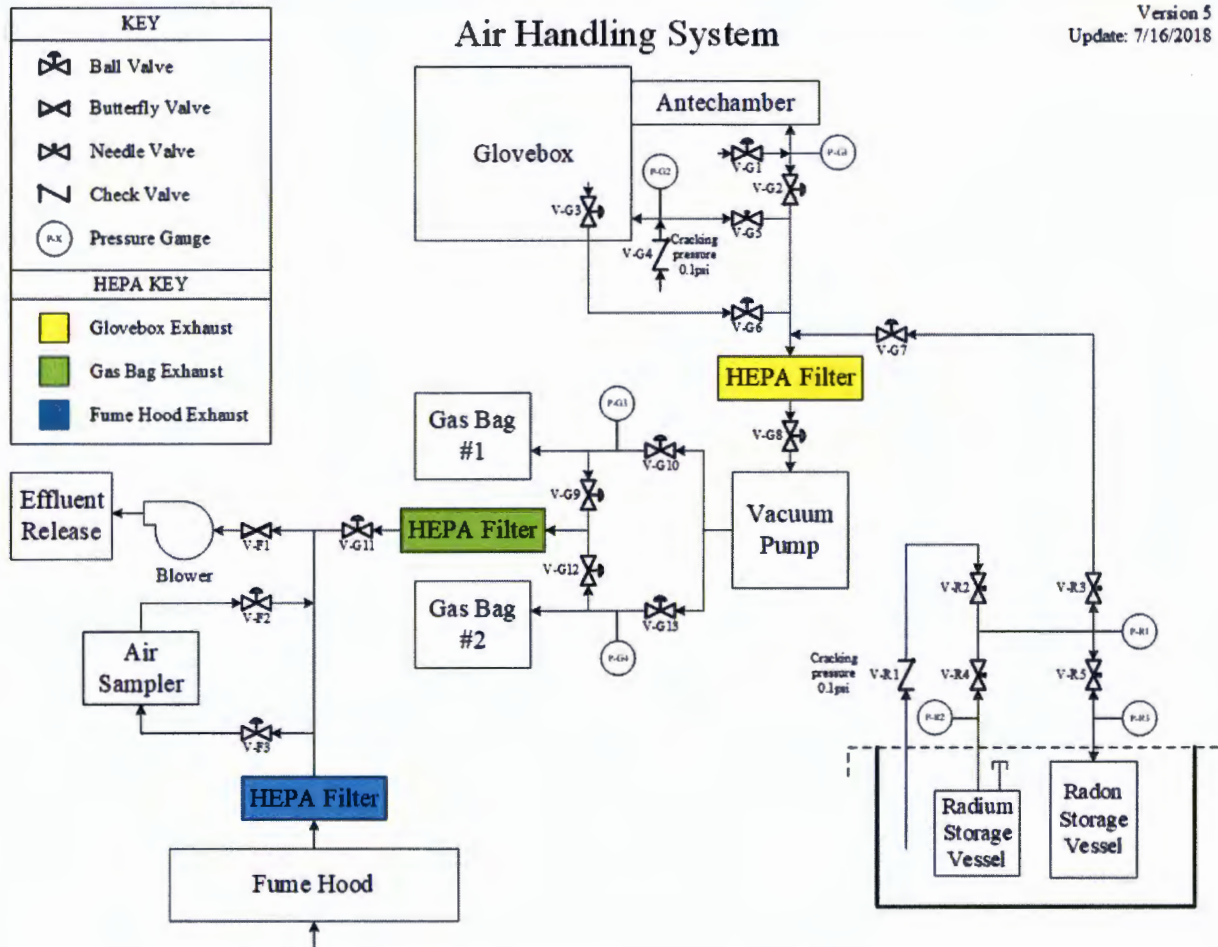


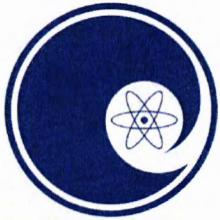
Figure 1. Air handling system flow diagram

- Provide additional details on HEPA filtration. What is the efficiency of the filters? How often will we inspect and replace them?

There are three HEPA filters in our system (see yellow, green, and blue boxes in Fig. 1). The details on the filters are summarized in Table 2. All the HEPA filters will be inspected annually, or more frequently in case of noticeable changes in system pressure during operation.

Table 2. HEPA filters in the Niowave NERD building ventilation system

Filter	Brand	Efficiency
Fume Hood Exhaust	Flanders	>99.97%, 0.3 micron
Glovebox Exhaust	Matheson	100%, 0.01 micron
Gas Bag Exhaust	Flanders	>99.97%, 0.3 micron



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We hope that this addresses your questions and look forward to your visit the week of July 30<sup>th</sup> 2018.  
Thank you for your guidance and oversight throughout the amendment process.

Sincerely,

Dr. Terry Grimm  
President and Senior Scientist





**NIOWAVE**  
*Accelerating Your Particles*

## Effluent Release Record

DATE: \_\_\_\_\_

*In Accordance with NRC License No. 21-35144-02 Amendment 7*

**Effluent Release Tracking Code:** \_\_\_\_\_

**Operation:** \_\_\_\_\_

### Activities of Isotopes Present in Effluent Release

Isotope	Activity Released to Date [mCi]	Activity Released During Op [mCi]	Percent of Yearly Limit
Kr-85m	0	0	0.0%
Kr-87	0	0	0.0%
Kr-88	0	0	0.0%
I-131	0	0	0.0%
I-132	0	0	0.0%
I-132m	0	0	0.0%
I-133	0	0	0.0%
I-134	0	0	0.0%
I-135	0	0	0.0%
Xe-133	0	0	0.0%
Xe-133m	0	0	0.0%
Xe-135	0	0	0.0%
Xe-138	0	0	0.0%
Radon With Daughters	0	0	0.0%

**Calculations Performed By:** \_\_\_\_\_

**Approved By (RSO):** \_\_\_\_\_

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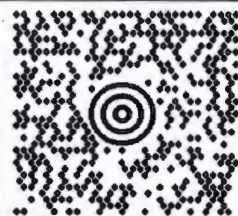
AMANDA GRIMM  
517-999-3475  
NIOWAVE  
1012 N. WALNUT ST  
LANSING MI 48906

0.2 LBS LTR

1 OF 1

**SHIP TO:**

F. TRAN, C. FRAZIER, P. PELKE, P. LEE  
NRC REGION III OFFICE  
SUITE 210  
2443 WARRENVILLE ROAD  
**LISLE IL 60532**



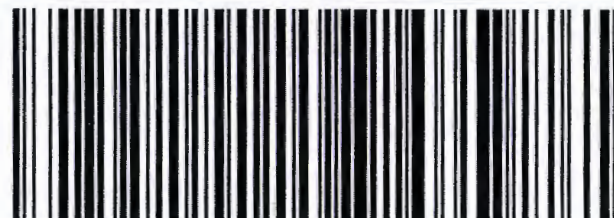
**IL 603 9-03**



**UPS 2ND DAY AIR**

TRACKING #: 1Z 524 12X 02 9634 7706

**2**



BILLING: P/P

Reference#1: 18-8010

UIS 20.5.12. WNTINV50 03.0A 07/2018

