

AP Cartridge Testing Factsheet

REPORT SUMMARY

PNNL-25860, *Analysis of Respirator Cartridge Performance Testing on a Hanford AP Tank Farm Primary Exhauster Slipstream*

One of the Tank Vapor Assessment Team (TVAT) recommendations was to confirm that air-purifying respiratory protective equipment is effective in reducing exposure to tank vapors and gases below acceptable levels. The use of self-contained breathing apparatus (SCBA) has been implemented for workers in the tank farms until these evaluations have been completed. SCBA weighs about 30 lbs. and increases the ergonomic risk. Switching from SCBA to respirator cartridge masks can protect workers from tank vapors and gases while reducing ergonomic risk.

Two respirator cartridges (SCOTT 7422-SC1 multipurpose cartridge and 7422-SD1 multipurpose/P100 particulate cartridge) were tested following the experimental method as defined by OSHA ([OSHA Link](#)). Respirator cartridge testing indicated positive results. Undiluted vapors and gases from the AP Farm tank ventilation exhaust stack were directed through the cartridge(s). The chemicals present in the tank vapors and gases were measured before and after the cartridge. Results (PNNL-25860) demonstrated the cartridges were effective in filtering direct headspace vapors and gases for four to six hours respectively. In 2017, additional cartridge testing will be performed at locations to be determined. Once the cartridge is fully endorsed by all parties, it will be implemented for use at tank farms.



Figure 1. SCOTT 7422-SC1 and 7422-SD1



AP Cartridge Testing Factsheet

1. Is DOE going to back testing results and take responsibility and liabilities?

- An independent third party, designated by HAMTC, is reviewing the cartridge testing protocols and methodology.
- This testing approach has been discussed with the Hanford Site Wide Respiratory Committee.
- Once the cartridge is fully endorsed by all parties, it will be implemented for use at tank farms.

2. How can you test for mixed gasses?

- Appropriate sampling media was used to capture the ventilation exhaust stack and headspace gas and vapor mixture.
- Vapors and gases were sampled directly from the tank ventilation exhaust stacks in AN Farm, AP Farm, AW Farm, and 702-AZ, and from the tank headspaces in A-101, AX-101, BY-108, and SY-102.
- The gas and vapors come from the tanks themselves so therefore are the best mixtures to test.

3. Did we test for everything in the tank and how do we know?

- Gas and vapor samples were taken from the ventilation exhaust stack and headspaces during the tests.
- This included thousands of chemicals, and the COPCs (with the exception of nitrous oxide and methanol) (see question 4).
- Samples were further compared for everything in the analytical equipment chemical library.

4. Do we have the technology to see nitrous oxide and if so, have we detected it in our exhaust stream?

- Nitrous oxide is detected using direct reading instruments, such as the MIRAN SapphiRe Analyzer and Passive monitoring badges.
- Nitrous oxide has been detected in tank ventilation exhaust streams but it was not analyzed for during the cartridge testing because there is not a NIOSH-approved respirator filtration cartridge.
- Existing sampling data has shown no personal exposures in work areas in excess of the regulatory limits.



AP Cartridge Testing Factsheet

5. Who approved the sample jig and or who approved the process?

- The sample apparatus (jig) and process were reviewed by Operations, Industrial Hygiene, RadCon and Engineering.
- Performing testing on actual gases is the most reliable OSHA-approved testing method.
- The respirator cartridges were tested following the experimental method as defined by OSHA.

6. Was the humidity taken into consideration? (Humidity band)

- Humidity and temperature were considered and were recorded throughout all tests.
- Humidity is part the evaluation in PNNL-25860, *Analysis of Respirator Cartridge Performance Testing on a Hanford AP Tank Farm Primary Exhauster Slipstream*.
- The effect of humidity and temperature will be evaluated and documented prior to field use.

7. Did we test during waste disturbing activities?

- Waste disturbing activities were not planned at the time so this has not yet been tested.
- Future tests will likely include waste disturbing activities when operations resume.

8. Why did we choose these locations to sample first?

- The DST and SST head space and ventilation exhaust stack sampling locations were selected with input and feedback from the workforce, Chemical Vapors Solutions Team (CVST), Chemical Vapors Project Team, WRPS Management and DOE-ORP.
- The headspace and ventilation exhaust stacks provide the highest sources of chemical vapor concentrations, thus the most challenging conditions to test against. In addition, tank farms were selected based on chemical mixtures and where primary work activities are planned.
- The sample locations included where primary work activities are planned.

9. Why did you choose Scotts filters first and are we going to test the rest of them?

- The worker/CVST input in accordance with ISMS and VPP principals.
- Priority of the respirator cartridges tested were selected based on the population of workers' mask fit per mask model.
- The cartridge was chosen based upon the chemicals of present. Additional cartridges are planned to be tested in 2017.



AP Cartridge Testing Factsheet

10. Did we actually test in the Headspace?

- Gases and vapors were sampled directly from A-101, AX-101, BY-108, and SY-102 tank headspaces, and from AN Farm, AP Farm, AW Farm, and 702-AZ ventilation exhaust stacks.
- These undiluted sources provided a conservative test because they come directly from the tanks themselves.
- Thus, chemical concentrations are higher than what a worker would experience in a breathing zone.

11. Has NIOSH and or OSHA bought off on our testing methods?

- OSHA requires end of service life determination, and identifies methods for establishing cartridge end of service life.
- Conducting experimental test is the most reliable OSHA method, especially for multiple contaminants, such as those present in the tank headspace.
- NIOSH has tested and approved the respirator and cartridges used for the vapors and gases.

12. Does the manufacturer allow for this type of cartridge use?

- Manufacturers anticipate testing of their respiratory cartridges for NIOSH approval, as required by OSHA.
- OSHA mandates employers establish an end of service life and/or a change out schedule and provides the experimental testing as one of the identified methods. ([OSHA 1910.134\(d\)\(3\)\(iii\)\(B\)\(2\)v.](#))
- Cartridges are designated and manufactured for chemical groups, and submitted for NIOSH certification.