WRPS Integrated Chemical Vapor Hazard Control Program

Final Quarterly Report – September 2019

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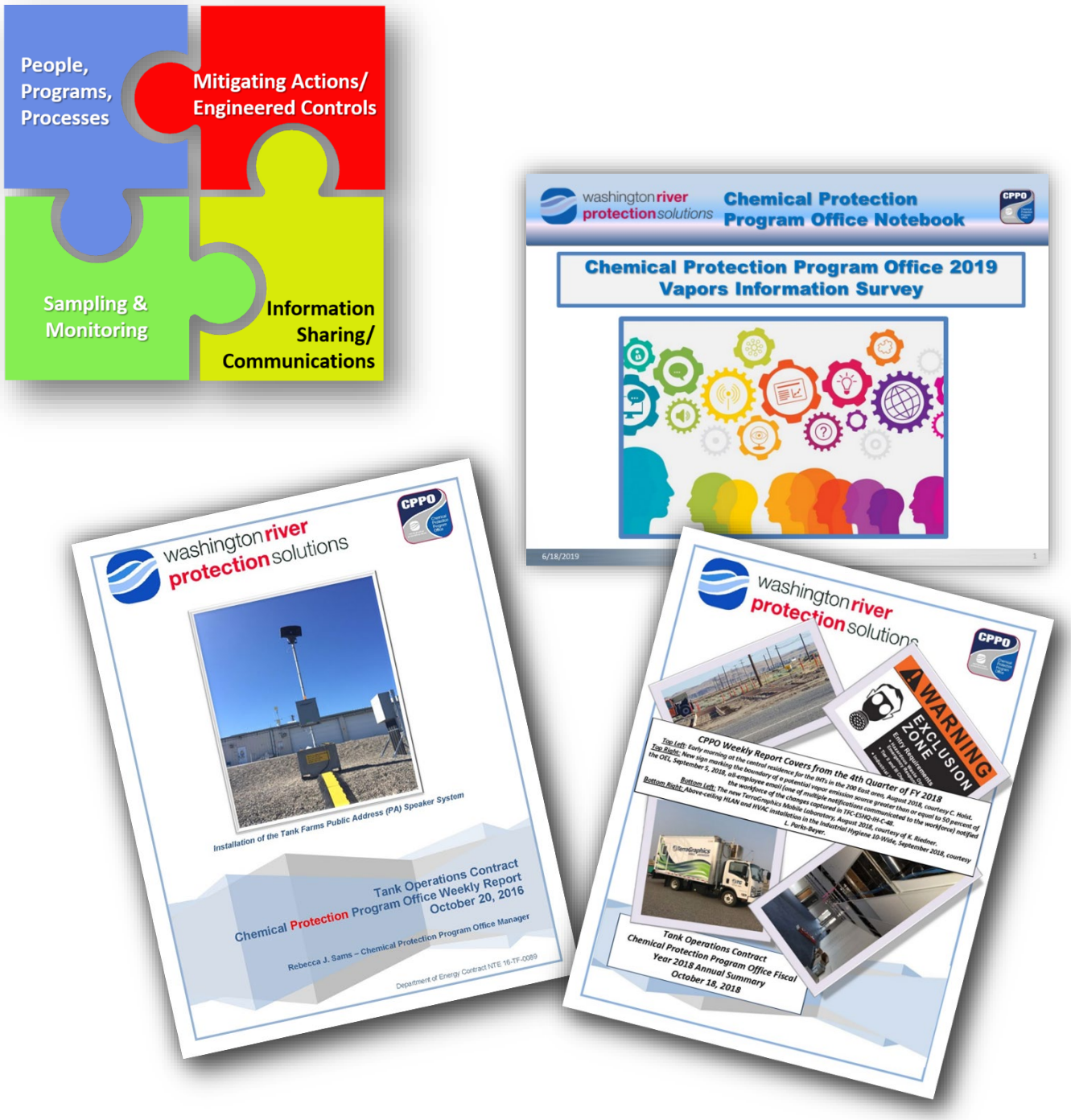

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Introduction

Washington River Protection Solutions, LLC (WRPS) has made tremendous progress in the past few years strengthening its programs and addressing external and internal recommendations related to chemical vapor protection at the tank farms. The Chemical Protection Program Office (CPPO) has played an integral role in this success by tracking and reporting on the status of vapors mitigation strategies, and providing worker communications and worker engagement opportunities. Since 2016, the CPPO has provided weekly and later, monthly reports on the status of vapors related efforts. This 4th Quarter report for Fiscal Year (FY) 2019 provides a high-level overview of what WRPS has accomplished under the Comprehensive Vapor Action Plan (CVAP).

The CPPO was established as a temporary program office, and in keeping with this plan, this report marks the department's final work product. As CVAP-related work has been largely completed, ongoing reporting is no longer necessary. CPPO's other work scope, namely worker engagement and communications, has been institutionalized within other areas of the company to sustain the efforts long-term.

1. State of Vapors Related Activities

WRPS witnessed an increase in reported odor events in early 2014. In response to those events, WRPS reinstituted the Chemical Vapors Solutions Team (CVST) and later chartered the Savannah River National Laboratory (SRNL) to establish and oversee a panel of external, independent experts, known as the Tank Vapors Assessment Team (TVAT). TVAT examined chemical vapor management and related worker protection measures at the Hanford tank farms, before releasing its report in late 2014, which outlined recommendations for reducing the potential for chemical vapor exposures.[1]

The Implementation Plan for Hanford Tank Vapor Assessment Report Recommendations (WRPS-1500142) was developed to address TVAT's 117 recommendations and was originally planned to occur in two phases. Phase One, completed at the end of FY 2016, was comprised primarily of research and design. During the latter part of Phase One, multiple assessments were conducted on the progress of the implementation plan and/or WRPS' overall Industrial Hygiene (IH) program. These assessments were conducted by the National Institute for Occupational Safety and Health (NIOSH), Department of Energy Office of Inspector General (OIG), Center for Toxicology and Environmental Health, LLC (CTEH), Department of Energy (DOE)-Office Environment, Safety, and Health Assessments (EA-32), and the Hanford Vapors Expert panel. The assessment recommendations, feedback from stakeholders, and the Phase Two actions were incorporated into a comprehensive vapor management strategy that focused on the vision that all workers on the

[1] SRNL-RP-2014-00791, *Hanford Tank Vapor Assessment Report*, 2014.

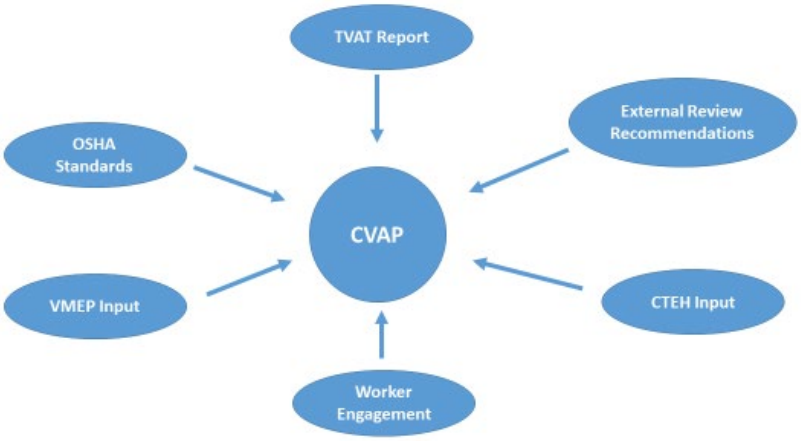
Hanford Central Plateau continue to be protected by a comprehensive approach to vapors management, and that workers *are* safe and *feel* safe. This strategy was established in the Hanford Vapor Integrated Safety Management Strategy (HVISMS) document (WRPS-1700777).

The HVISMS identifies eight core principles that provide the basis for chemical vapor management and related worker protection measures in the tank farms:

1. Centralize command and control to monitor farms and enable pre-emptive actions.
2. Further demonstrate unrestricted boundaries are safe from tank vapor exposures.
3. Apply defense-in-depth (multi-layered) safety controls for increased worker protection.
4. Improve work sites through engineered controls and abatement technologies.
5. Drive continuous improvement in the IH Program technical basis, qualifications, and rigor.
6. Continue to enhance worker involvement in determining how work is performed.
7. Communicate effectively with the workforce and other stakeholders to continue to build trust and credibility.
8. Support enhanced medical programs and systems.

The CVAP is the WRPS implementation plan to define and establish chemical vapor actions to mitigate vapor events at the Hanford Tank Farms and covers work from fiscal year (FY) 2017 to 2019. The plan's actions also address the (371) recommendations from each assessment and supersedes the Implementation Plan for Hanford Tank Vapor Assessment Report Recommendations.

Figure 1. The CVAP



An integrated project team that included both DOE Office of River Protection (ORP) and WRPS staff developed the CVAP, which was built on the eight HVISM core principles. The CVAP execution plan is designed around the following eight Key Performance Parameters (KPPs):

KPP 1: Engagement and effectiveness measurement
KPP 2: Institutionalize the IH Chemical Vapor Technical Basis

KPP 3: IH program parity with the RadCon program
KPP 4: Engineered controls
KPP 5: Define unrestricted work boundaries
KPP 6: Institutionalize single shell tank operations stewardship program
KPP 7: Chemical vapor respiratory protection hierarchy of controls, and
KPP 8: Support medical program enhancements

2. Comprehensive Vapor Action Plan - Key Performance Parameters

KPP 1. Engagement and Effective Measurement

Establish a comprehensive vapor management communication plan, engagement processes, and effectiveness measurements (related to core principles 6 and 7).

WRPS undertook several efforts to increase the quantity and quality of chemical vapors-related information provided to the workforce including the establishment of the CPPO. The temporary program office was tasked to deliver on KPP 1.

Vapors-related communications

A comprehensive Vapor Communications Plan was developed as a supplement to the WRPS Communication Plan (WRPS-1604608) and identifies opportunities for engagement of the WRPS workforce regarding chemical vapors associated with the Hanford Tank Farms and vapors-related topics for communication. Implementation of the plan is documented through the CPPO Look-Ahead, which is a tool is used to plan and communicate upcoming vapors-related information topics. The Look-Ahead corresponds to plans and strategy in real-time. Internal coordination is strengthened as topics and timing align with C&PR and/or IH campaigns that cover vapors information.

Several vapors-specific communication products were also developed and deployed to increase the transparency and frequency of vapors-related information provided to the workforce. The CPPO Notebook was created as a mechanism for managers to share vapors-related information with the workforce. Provided on a weekly basis as a PowerPoint presentation (with speaker notes) and as a video narrated by a technical expert, the CPPO Notebook provides current and timely updates of vapor-related mitigation activities and related information. Notebooks are also posted to the WRPS intranet, are accessible to workers, and have been incorporated into the weekly Safety Startup meetings. Following the closure of the CPPO office, notebooks continue to be provided by the Environmental Safety, Health & Quality (ESH&Q) organization.

A vapors tab was created on the home page of the WRPS intranet, streamlining access to a variety of internal vapors resources. WRPS also created the award-winning HanfordVapors.com external website, which provides a wide assortment of vapors-related information and explains vapor protective measures at the tank farms.

Figure 2. HanfordVapors.com website

Working with PNNL, the Data Access & Visualization (DAV) tool was also developed and deployed to the external website. Launched in October 2017, this tool takes the Site Wide Industrial Hygiene Database (SWIHD) data and displays more than 100,000 IH chemical samples from the Hanford Tank Farms in a visual graphic interface format available to the workforce and the public.

Worker engagement

Face-to-face worker engagement with management and technical experts provides the opportunity to address questions or concerns in real-time, increases transparency, and facilitates worker understanding through the provision of fact-based answers.

The CVST, reestablished in 2014, is a joint management/employee initiative to review processes and solutions to improve WRPS' hazard identification, controls, training, and communication for tank farm chemical odors and vapors. Team Vapor Representatives (TVRs) were established as a result of a 2017 LEAN rapid improvement event hosted by the CPPO. Workers designated as TVRs attend CVST meetings to give voice to the workforce and to carry back to their peers the information received from the meetings. The meetings provide ongoing updates to vapors-mitigation efforts and an opportunity for worker-management engagement. Video recordings are routinely made of the meetings, and all employees can access CVST meeting content as it is posted on the intranet.

The CVST developed several sub-teams comprised of employees and a dedicated senior manager to find innovative solutions and provide feedback on vapor issues and initiatives. These sub-teams included Headspace Sampling, Performance Indicators, Rounds and Routines, Sampling Pilot, Chemical Hazard Awareness Training (CHAT) Training, Risk Assessment, Work Control, New Technology, Chemical Cartridges, Fugitive Emissions, and CVST Communications.

WRPS industrial hygienists, CPPO subject matter experts, and CTEH toxicologists (subcontracted through the CPPO) have also attended pre-job briefings, plan of the day meetings, Hanford Atomic Metal Trades Council (HAMTC) Safety Representative meetings, and chemical worker training sessions to address worker questions or concerns regarding chemical vapors at the work site in person.

Effectiveness assessments and recommendations tracking

CPPO conducted three annual communications effectiveness surveys (2017, 2018, 2019) to assess and drive improvements in vapor-related information provided to the workforce. The data show overall satisfaction with the information provided, and an important increase in worker perceptions of the credibility and understandability of the information. Two focus groups (2018, 2019) were also conducted to validate communication effectiveness and identify opportunities for improvement.

Figure 3. CPPO Workplace Surveys on Effective Communications.

Weekly and monthly vapors reports documenting progress in implementing the CVAP were developed and provided to management, and posted to the internal website. A TVAT mid-point management assessment was conducted to critically evaluate all TVAT related Problem Evaluation Resolution (PER) actions to verify that the action taken sufficiently addressed the TVAT recommendation and included the necessary documentation to be complete.

Additionally, the status of all 371 recommendations have also been monitored and tracked. As shown in Table 1 below, all but a handful of the recommendations are expected to be completed by September 30, 2019. Currently, 3 recommendations are in progress.

Table 1. Completed Recommendations

Report	As of August 29, 2019				
	Total	Validated Complete	Field Work Complete	In Progress	Pending
TVAT	117	111	4	2	0
OIG	3	3	0	0	0
NIOSH	54	54	0	0	0
EA-32	31	31	0	0	0
CTEH	24	24	0	0	0
VMEP I, II	67	66	1	0	0
Other	75	72	2	1	0
Total	371	361	7	3	0

External Assessments Recommendations Status

Those remaining recommendations are logged into the PER system, providing continued tracking and resolution (shown in Table 2) permitting monitoring of the outstanding PERs after September 30, 2019.

Table 2. Problem Evaluation Resolution

Recommendation	Report Origin	Status	Subject	PER	PER Status	Anticipated Recommendation Completion
16	WRPS-1604060.1	FWC	PTR-MS	WRPS-PER-2017-2157.2	Open	FY19
151	SRNL-RP-2014-00791	In Progress	VMDS	WRPS-PER-2017-2154.16	Open	FY19
160	SRNL-RP-2014-00791	FWC	Process and Procedures	WRPS-PER-2017-0720	Closed	FY19
163	SRNL-RP-2014-00791	FWC	COPC and OEL	WRPS-PER-2017-0610	Closed	FY19
164	SRNL-RP-2014-00791	FWC	Process and Procedures	WRPS-PER-2017-0720	Closed	FY19
192	SRNL-RP-2014-00791	In Progress	VMDS	WRPS-PER-2017-2154.21	Open	FY19
195	SRNL-RP-2014-00791	FWC	Cartridge and Sampling	WRPS-PER-2017-2158.12	Closed	FY19
284	VMEP II	FWC	Training	WRPS-PER-2017-0723	Closed	FY19
301	DOE-ORP	In Progress	VMDS	WRPS-PER-2018-0553.1	Open	FY19
1003	SRNL-TR-2016-00193	FWC	COPC and OEL	WRPS-PER-2017-0718.2	Open	FY19

KPP 2 & 3. Industrial Hygiene Technical basis and program parity

Maintain IH Chemical Vapors Technical Basis and chemicals of potential concern (COPC). Institutionalize a disciplined and rigorous process for updates to include new scientific findings and enhanced understandings of potential exposures (related to core principle 5).

Maintain an IH program and institutionalize vapor program requirements, best practices and program parity, and complete necessary training to support full implementation (relates to core principles 3 and 5). The scope identified in this plan will be institutionalized within WRPS programs and become the normal way to conduct work within tank farms.

WRPS completed the update of RPP-22491, Industrial Hygiene Chemical Technical Basis, and developed the following complement of documents institutionalizing maintenance and methodology of the Industrial Hygiene Technical Basis and program:

- TFC-PLN-174, Industrial Hygiene Chemical Vapor Technical Basis Program Plan,
- TFC-ESHQ-IH-C-67, Maintenance of the Industrial Hygiene Chemical Vapor Technical Basis,
- TFC-ESHQ-IH-C-66, Identifying Chemicals of Concern in Hanford Tank Farms,
- TFC-ESHQ-IH-C-48, Managing Tank Chemical Vapors,
- TFC-PLN-34, Industrial Hygiene Exposure Assessment Strategy,
- TFC-ESHQ-IH-C-69 Industrial Hygiene Exposure Assessments,
- TFC-ESHQ-IH-C-63, IH Modeling for Exposure Assessments,
- TFC-PLN-173 Use of FFAPR in Actively Ventilated Tank Farms.

This documentation provides a disciplined and rigorous process for periodically reviewing IH data. It also provides the criteria and requirements to create a new Hanford Tank Farm occupational exposure limit (HTFOEL), if necessary.

An updated IH Manual (TOC-IH-58435) was also prepared providing plans and procedures into a structure more readily understood by management, IH staff and the workforce.

WRPS created a new Health Process Plan (HPP) review process, TFC-CHARTER-71, WRPS Internal Review Panel and External Review Panel Process for Review of Health Process Plan Recommendations. The panel evaluates recommendations, and the economic and feasibility impacts of the implementation.

Figure 4. IHT Monitoring for Vapors

WRPS also worked with Pacific Northwest National Laboratory (PNNL) to evaluate leading indicators for more difficult-to-measure Chemicals of Potential Concern (COPC's) at the tank farms. Ammonia was verified as an appropriate sentinel chemical for monitoring tank farm chemical vapors using real-time monitoring and direct reading instruments.

Since ammonia detections may indicate the presence of harder-to-detect vapor chemicals, IH can use real-time monitoring of ammonia to determine when conditions change. Real-time detections of ammonia can alert IH to take immediate action, thereby reducing workers' risk of exposure to other COPCs that are not measured in real-time.

Work is ongoing with PNNL in support of a chemical mixture model (CMM) to develop health code numbers for IH-determined priority chemicals supporting exposure assessment. The CMM will use a sum of fractions approach for common target organ receptors, and improves upon the ACGIH mixture method by focusing the analysis, improving accuracy, and reducing unnecessary conservatism.

WRPS deployed the Air Pollution Graphical Environmental Modeling System-Tank Farms (APGEMS-TF), a state-of-the-art atmospheric dispersion and dose-assessment model developed for emergency planning, preparedness and response application, for air dispersion modeling. APGEMS is used as a confirmation model for real-time emergency responses because it is quick to set up and has fast runtimes.

APGEMS-TF was customized to model vapors events at the Hanford tank farms, using real-time data from Hanford such as wind direction, wind speed, and atmospheric stability from the Hanford meteorological network. Air dispersion modeling is the mathematical simulation of how pollutants disperse in the ambient atmosphere. The model can be used to determine how a pollutant from a source, such as a ventilation stack, affects the air in the workers' breathing zone. APGEMS-TF can model vapors from single or multiple emission sources. At the Hanford Site, air dispersion modeling is used to understand the potential impact of vapor emissions.

WRPS also worked with Kenexis to develop quantitative risk assessment (QRA) models to predict the frequency and concentration of potential vapor releases from the tank farms. The QRA model provides mathematically based probabilities and consequences of a potential event in and around tank farms under several different conditions (meteorological, geography, waste-disturbing conditions, ventilation system status, etc.). IH uses the QRA to support the development of IH exposure assessments and control strategy decisions for tank farm work processes, including the necessary controls for a task and the placement of monitoring equipment.

The DAV tool has been enhanced for IH use with development of the Internal Data Access & Visualization (I-DAV). The I-DAV provides enhanced data conditioning and resource optimized analysis of large volumes of IH data (vastly reducing conditioning tasks), and integrated data analysis of all data types supporting comprehensive exposure assessments. I-DAV uses Tableau Server and scripting languages to augment critical IH and engineering data analysis functions.

The Data Fusion and Advisory System (DFAS) powered by AECOM SmartSite compiles vast amounts of dynamic data and delivers it in an easily understandable dashboard monitor. DFAS is a predicative model that is used to foresee changes in tank farm conditions based on observed trends and correlations. DFAS is currently being piloted to identify necessary refinements, develop operational expectations and procedures, and identify and develop the appropriate level of necessary training.

Figure 5. IH 10-Wide Building in Development

Industrial hygiene technicians (IHTs) and their first line supervisors were relocated to a centralized mobile office (MO) building. The MO now houses approximately 100 workers. The building, MO-2553, commonly known as the 10-wide, is in 200 East, across from Purex area near the vicinity of Baltimore Avenue and 4th street.

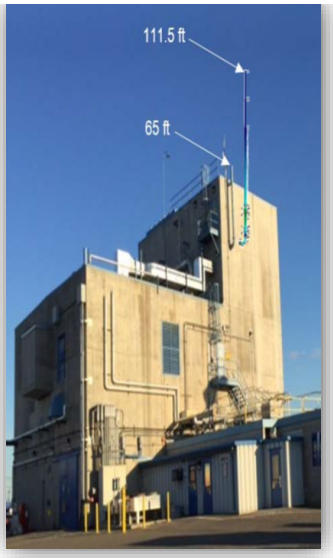
The IH department provided *Risk Communication Technique* and *Crucial Conversations* training to its staff. Further, WRPS implemented the Enhanced Chemical Hazard Awareness Training (CHAT) developed in 2016 and completed a training evaluation report to capture recommendations from students for improvement. These improvements were included in the new Chemical Worker training.

KPP 4. Engineering Controls

Complete engineering control concept demonstrations for Strobic®[2] Air Tri-stack and NUCON®[3] International, Inc. thermal combustion in support of unrestricted work boundaries (related to core principles 1, 3, 4 and 6).

Engineering controls are designed to isolate workers from the hazard, or place a barrier between the worker and the hazard prior to the hazard coming into contact with the worker.

Figure 6. Example of Stack Extension



As part of infrastructure and engineering controls, WRPS has upgraded a number of exhauster stacks across the tank farms increasing the physical height of some exhauster stacks, and in some cases, raising the exhauster stack discharge elevation higher using support or terrain. Stack extensions have been implemented in the following farms: AP, A, and AX, and the 242-A Evaporator.

AW Farm physical stack height is planned to be increased pending the Washington State Department of Ecology's approval.

New exhausters are also being installed in A and SY farms.

Figure 7. NUCON® Vapor Abatement Unit

The Chief Technology Office (CTO) worked with Savannah River National Laboratory to conduct a vendor workshop to assess the feasibility of identified and proposed engineering control options for supplemental exhaust equipment and vapor destruction technologies. Following a down-selection process, site visits were conducted for the most viable engineering control options, and two technologies were identified for further development and demonstration.

WRPS has been working with NUCON® on the Thermal Oxidation System, which thermally destroys vapors using an internal combustion engine. Tank vapors pass through a demister to remove liquid from the gas stream. The vapor stream is

[2] Strobic® is a registered trademark of Strobic Air Corporation, Bensalem, Pennsylvania.
[3] NUCON® is a registered trademark of Nucon International, Inc., Columbus, Ohio

pre-heated by passing through an electric heater to reach the optimal mercury removal temperature.

An activated carbon bed (MERSORB®[4]) removes mercury from the vapor stream prior to thermal oxidation. The combustion engine then destroys the tank vapors. A catalytic converter and particulate filter complete the vapor destruction process. Phase One and Two testing of the NUCON® system have been conducted and have resulted in positive destruction and removal efficiencies of key COPCs, indicating potential viability for certain tank farm applications. NUCON® is in the design phase and WRPS is preparing for Phase Three testing.

WRPS also tested an off-the-self component, the Strobic Tri-Stack Ventilator®[5], as a possible alternative to stack extension. The unit is a self-diluting fan that uses a multiple-stack design that combines outside air with exhaust discharge, creating a virtual stack extension. Strobic Tri-Stack Ventilator® testing was completed and a final determination regarding next steps is pending a decision by WRPS and the Department of Energy Office of River Protection (DOE-ORP).

[4] MERSORB is a registered trademark NUCON International, Inc., Columbus, OH.
[5] Strobic Air Tri-Stack is a registered trademark of Strobic Air Corporation, Bensalem, Pennsylvania.

KPP 5. Administrative Controls and Monitoring

Define unrestricted work boundaries and implement monitoring on active stack ventilation and unrestricted work boundaries in the A farms (relates to core principles 1, 2, 3, 4 and 6).

WRPS, in coordination with ORP Safety and Health, developed a white paper defining the unrestricted work boundary related to tank vapor management titled *Industrial Hygiene Basis for Defining the Unrestricted Work Boundary*. IH revised TFC-ESHQ-IH-C-48, Managing Tank Chemical Vapors in order to simplify risk classification categories, align terminology with industry standards used in HAZWOPER training, and to assist in the demarcation and communication of areas with greater potential of tank chemical hazards. *Exclusion Zone* replaces *Vapor Control Zone* as the term for the boundary of a potential vapor emission source, where COPCs may be experienced at levels greater than 50 percent of the OEL. Updated signage has been placed at the tank farms.

Real-time exhauster stack monitors using Ultraviolet-Differential Optical Absorption Spectroscopy (UV-DOAS) are installed in A Complex stack exhausters for AN, AW, AX and AY/AZ (702-AZ), and will be turned over to Operations by the end of FY 2019. The exhauster stack monitor is an optical spectrum analyzer providing real-time ammonia monitoring.

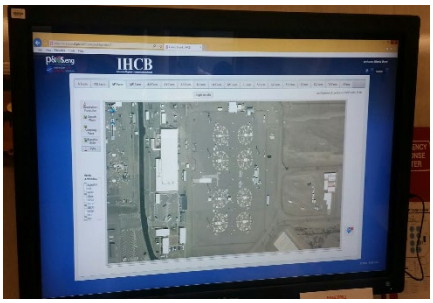
WRPS performed pilot scale tests of several pieces of equipment intended to provide safe and reliable monitoring and detection in the farms. The tests identified viable components for a Vapor Monitoring and Detection System (VMDS) to notify and warn operators and workers during a changed condition. The components of the VMDS consist of the stack monitoring for ammonia. Fence line monitoring continues to be evaluated. The VMDS supports safe work boundaries and is tied to the central shift office monitoring system.

WRPS installed the Event Notification System (ENS), which provides enhanced audible and visual alerts when the Central Shift Office needs to relay significant information or direction to field personnel. The Central Shift Office initiates the alert message, which is carried through several radio towers to the vapor display systems located inside the change trailers, the wireless public address speaker, reader boards, and the beacons located outside the tank farms.

WRPS has worked with vendors providing a mobile laboratory to provide routine support and monitoring. The mobile lab is equipped with state-of-the-art monitoring instrumentation, including a proton transfer reaction mass spectrometer (PTR-MS), a carbon dioxide (CO_2) monitor, a weather station, a global positioning system (GPS), and a cavity ring down spectrometer measuring ammonia to low parts per billion (PPB) levels. The mobile lab provides high fidelity measurements of compounds with proton affinities less than water and mass between 30 and 300 atomic mass units (amu). It provides high sensitivity (to the low parts per trillion by volume) and high temporal resolution (collecting samples at two second intervals). While the mobile lab can see preliminary

results in near real time, the data requires significant analysis, often taking two to three weeks, before the final results are known. The Central Shift Office is notified when sustained vapor concentrations are at or above 50 percent of OEL concentrations.

Figure 8. IH Communication Boards

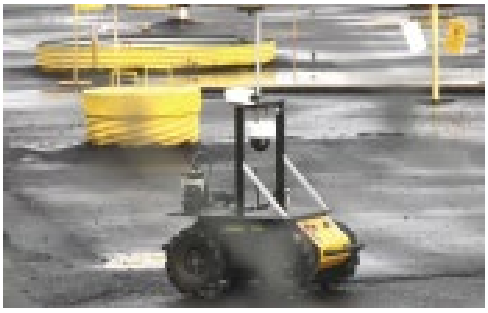


WRPS implemented a new Industrial Hygiene Communication Board (IHCB) in eight Tank Farm change trailers. The IHCB displays a satellite aerial image of the tank farms with several information layers, including exclusion zones and the locations of work activities. Before entering the tank farms, workers can view tank vapor information, Shift Office notifications, sample plans and respiratory protection forms from the IHCBs.

KPP 6. Tank Operations Stewardship

Institutionalize a tank operations stewardship program that minimizes required tank farm personnel entries and establishes parameters for locating ancillary personnel and offices (relates to core principles 1, 3 and 6).

Figure 9. Autonomous Instrument Vehicle



The Single-Shell Tank (SST) stewardship program is reducing work entries into the non-active, SST tank farms. WRPS identified and evaluated several actions to reduce or eliminate SST workforce entries. Remote monitoring equipment is being installed in the TY and TX Farms, and is scheduled to be completed in early FY 2020. The two automated tasks are monitoring the tank content temperatures and measuring the tank content surface levels.

WRPS also developed an autonomous instrument vehicle (AIV) with waypoint navigation or remote control that may be used to reduce worker entries into the farms. The AIV may collect vapor-related data in preparation of cleanup activities, conduct visual inspections, investigate incidents, take radiological surveys, and use ground-penetrating radar. Phase 2 of the AIV project targets improved scanning, camera capability, collision avoidance and wireless transmission.

KPP 7. Hierarchy of Controls

Provide options to promote the hierarchy of controls for chemical vapor respiratory protection beyond current use of self-contained breathing apparatus (SCBA) (relates to core principles 3 and 6).

With the goal of promoting the hierarchy of controls for chemical vapor respiratory protection beyond the use of SCBA, WRPS conducted cartridge testing on nine sources and contracted PNNL to prepare test reports. The reports were evaluated by StoneTurn Consulting, the independent third party selected by HAMTC in accordance with the memorandum of agreement (MOA).

Figure 10. Use of FFAPR

A cartridge testing jig and protocol were developed to provide a reliable repeatable method of testing air purifying respirator cartridges from tank farm chemical mixtures. Cartridge testing was performed at nine different DST and SST tank farms. PNNL reviewed and analyzed the data and prepared reports on the effectiveness of the cartridges.

Chemical cartridge testing has confirmed that the cartridges for air purifying respirators are effective for the chemical mixtures found in the Hanford Tank Farms. StoneTurn Consulting verified the testing process and results.

As of today, full-face, air-purifying respirators have been implemented in all actively ventilated tank farms for risk classification (RC) 1 and RC2 work.

In addition to cartridge testing, WRPS evaluated the use of airline hoses and a more lightweight, ergonomic SCBA.

WRPS conducted field-testing on a number of personal ammonia detectors including C2Sense®[6] and ToxiRAE®[7] Pro, 5Ventis™ Pro V[8], the 6GfG Micro IV detectors[9], and ChromAir® Badges[10].

Figure 11. ToxiRAE®

Personal Ammonia Monitors (ToxiRAE® Pro) are direct-reading instruments (DRIs) that provide real-time monitoring of ammonia concentrations at levels in the parts per million (ppm). The instrument is a portable, continuous, single-gas monitor intended for individual use. It has alarming capabilities, both visual and audible, that warn workers of a change in condition in their workspace. If ammonia concentrations reach the predetermined set points (6 ppm Response Level, 12 ppm Action Level), the ToxiRAE® Pro alarms and workers are expected to follow prescribed response actions to prevent potential overexposure.

KPP 8. Support medical program enhancements

Support medical program enhancements in conjunction with responsible Hanford Site organizations and establish update to WRPS process/procedures (related to core principle 8).

Figure 12. HPMC OMS Logo

HPMC OCCUPATIONAL MEDICAL SERVICES

WRPS partnered with HPMC Occupational Medical Services (OMS) to improve the medical evaluation processes for tank farm workers. Chemical Exposure Evaluation Process (CEEP) information sheets are provided to employees who report an exposure. WRPS has established an exclusion process to keep workers out of hazardous areas until laboratory results are reviewed, and HPMC-OMS established a one to two business day voluntary follow-up of blood testing and a 1-day follow-up to review laboratory results provided in writing. A nurse case manager and program coordinator interface directly with exposed workers.

HPMC OMS has initiated an epidemiology study, providing a focused review of tank farm worker medical surveillance data to maximize the usefulness of current medical surveillance and screening activities and to help establish the most appropriate occupational medical care for tank farm workers. HPMC OMS has also collaborated with CTEH toxicologists on a literature review of possible biomarkers for effective post-exposure testing.

[6] C2Sense is a registered trademark by C2Sense®, Inc., Cambridge, Massachusetts.
[7] RAE® Systems by Honeywell, San Jose, California
[8] Ventis™ Pro5 Multi-Gas Monitor is a registered trademark by Industrial Scientific in Pittsburgh, Pennsylvania.
[9] GfG Micro IV Single Gas Detector from GfG Instrumentation, Inc.
[10] ChromAir® is registered to Morphix Technologies, Virginia Beach, Virginia.

Conclusion

WRPS has strengthened its approach to chemical vapor management at the tank farms and put in place a fully Integrated Chemical Vapor Hazard Control Program to support the WRPS mission, while ensuring workers *are* safe and *feel* safe. The Integrated Chemical Vapor Hazard Control Program delivers:

- A robust and comprehensive IH Chemical Vapor Technical Basis;
- Centralized real-time source monitoring, area and personal monitoring, and improved notification systems;
- Improved engineered controls;
- Improved knowledge and skills of IH staff;
- Verification of chemical cartridge effectiveness;
- Continuous improvement in technology development, testing and application;
- Continued workforce engagement in work planning and vapor program improvements; and
- Improvements in vapor-related medical program and protocols.

> "*The last several years, we have significantly improved our understanding of vapor hazards at the farms*," said John Eschenberg, WRPS President and Chief Executive Officer. "*Through successful implementation of the CVAP, WRPS has strengthened its approach to chemical vapor management at the tank farms to fully support the WRPS mission, including our commitment to deliver tank waste to the Waste Treatment Plant via the direct feed of low-activity waste (DFLAW) system. Ensuring and validating our workers are safe – and feel safe – is critical to our goal of delivering on customer expectations safely and successfully.*"

As a result of CVAP efforts, WRPS will continue the transition from management-directed respiratory protection equipment to a risk-based program for identifying the appropriate personal protective equipment for each task. As WRPS continues to collect and analyze data associated with the unexpected short-term exposure episode (USEE) to inform and confirm exposure assessment information and modeling, it will implement the interim respiratory selection guide recommended by StoneTurn Consultants. However, with added confidence that the changes implemented through the CVAP have been effective and exposure assessment tools are confirmed, a final transition to a fully risk-based respiratory selection process will be made.

IH has made tremendous progress in analyzing the hazards in the field and understanding them. The IH program has increased its staffing to support field engagement and provide more oversight. These changes give IH and Operations the necessary tools to warn workers and to get them to a safe location in a timely manner to mitigate exposures. Effective implementation of the CVAP has helped WRPS institutionalize chemical vapor protections that mitigate the potential for vapor incidents and ensure that workers *are* safe and *feel* safe while working in and around the Hanford Tank Farms.