Implementation Plan for Hanford Tank Vapor Assessment Report Recommendations

Prepared for the U.S. Department of Energy
Office of River Protection

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Abbreviations, Initialisms, and Acronyms

AIHA	American Industrial Hygiene Associate
ALARA	As Low As Reasonably Achievable
AOP	Abnormal Operating Procedure
CHAT	Chemical Hazard Awareness Training
COPC	Chemicals of Potential Concern
CVST	Chemical Vapor Solutions Team
DOE	U.S. Department of Energy
DR	Dose-Response
DRI	Direct Reading Instrument
DST	Double-Shell Tank
EA	Exposure Assessment
EJTA	Employee Job Task Analysis
ESH&Q	Environmental, Safety, Health, and Quality
FTE	Full-Time Equivalent
FY	Fiscal Year
GC/MS	Gas Chromatograph / Mass Spectrometer
IH	Industrial Hygiene / Industrial Hygienist
IS	Industrial Safety
ISM	Integrated Safety Management
LOQ	Limit of Quantification
ND	Non-Detect
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
OEL	Occupational Exposure Limit
OR	Overarching Recommendation
ORP	Office of River Protection
PI	Performance Indicators
PPE	Personal Protective Equipment
R&D	Research and Development
RadCon	Radiological Control
RC	Risk Communication
RCH	Risk Characterization
RCW	Revised Code of Washington
RM	Risk Management
ROM	Rough Order of Magnitude
RQL	Reliable Quantitation Limit
SC	Site Characterization
SCBA	Self-Contained Breathing Apparatus

SOEN	Shift Office Event Notification
SST	Single-Shell Tank
SRNL	Savannah River National Laboratory
STEL	Short-Term Exposure Limit
TMP	Technical Maturation Plan
TOC	Tank Operations Contract
TVAT	Tank Vapor Assessment Team
TWA	Time Weighted Average
VCZ	Vapor Control Zone
VOC	Volatile Organic Chemical
VRZ	Vapor Reduction Zone
WDA	Westinghouse document accountability
WRPS	Washington River Protection Solutions LLC

1.0 EXECUTIVE SUMMARY

One of Hanford's most challenging projects continues to be the safe management of approximately 56 million gallons of radioactive and chemically complex waste stored in underground tanks. Managing this waste must occur in parallel with operations to remove waste from the single-shell tanks, manage available double-shell tank space, and install infrastructure necessary to safely and reliably deliver the waste to the Waste Treatment Plant for treatment. One potential hazard of concern in the tank farms is the presence of chemical vapors released from the tanks in various ways, which may enter workers' breathing spaces and potentially cause physical reactions or health effects.

Beginning in early 2014, some 50 Washington River Protection Solutions (WRPS) and other employees reported potential exposures to chemical vapors in and outside of the tank farms and received medical evaluations for these events. While chemical vapors hazards at Hanford's tank farms have been reduced over the years, WRPS and the U.S. Department of Energy's (DOE) Office of River Protection (ORP) recognized that new approaches and technologies could reduce the potential for worker exposure to chemical vapors even further.

WRPS chartered Savannah River National Laboratory (SRNL) in April 2014 to establish and oversee a panel of external, independent experts to examine chemical vapors management and related worker-protection measures at the Hanford tank farms.

Known as the Tank Vapor Assessment Team (TVAT), this group released its report in late 2014 (SRNL-RP-2014-00791, "Hanford Tank Vapor Assessment Report," October 30, 2014; http://srnl.doe.gov/documents/Hanford_TVAT_Report_2014-10-30-FINAL.pdf). The report recognized that WRPS' overall worker-protection program, based on accepted and traditional industry health and safety practices, and is focused on protecting against the long-term health effects resulting from cumulative or ongoing chemical exposures. The TVAT hypothesized that short, intermittent, higher-concentration (bolus) vapor exposures are a likely cause of reported worker health effects, particularly upper respiratory irritation.

According to the TVAT, verifying the existence and quantifying the amount of such potential transient acute exposure requires a different approach than the traditional IH monitoring regime employed by WRPS. The TVAT report outlined 10 Overarching Recommendations (ORs)—encompassing 47 more-specific recommendations—to help reduce the potential for chemical vapor exposures in the near-term and to define steps to conclude whether bolus exposures are the primary cause of the reported worker health effects.

To address the TVAT report recommendations, WRPS has developed this implementation plan with multiple proposed response actions, a corresponding schedule, and estimated costs.

WRPS actions are organized according to the report's 47 recommendations and grouped into six technical assessment areas investigated by the TVAT: Site Characterization (SC); Exposure

Assessment (EA); Dose-Response (DR); Risk Characterization (RCH); Risk Management (RM); and, Risk Communication (RC).

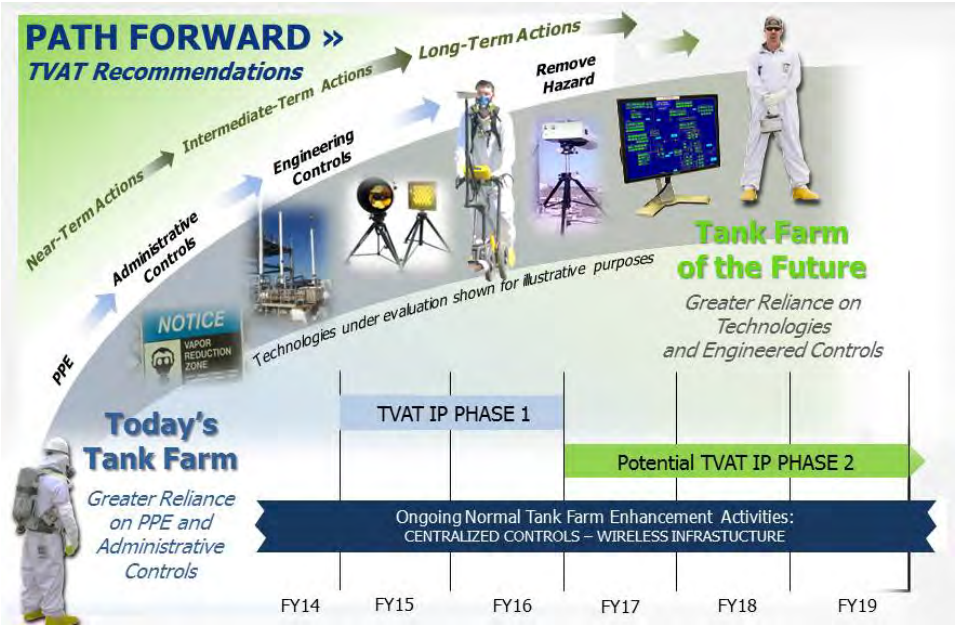
A number of actions recommended by the TVAT report and outlined in this plan already have been implemented, and several others are underway. The TVAT acknowledged that limiting worker exposure to bolus emissions of chemical vapors "represents an extraordinary challenge that cannot be easily addressed through traditional approaches."

Execution of the implementation actions is planned to occur in two phases. A primary focus of Phase 1 (FY 2015-2016) will be data collection to determine the validity of the hypothetical bolus exposure or identify other exposure mechanisms. Key program elements in Phase 1 include, but are not limited to, expanded sampling and characterization of tank head space gases; evaluation and procurement of new field and personnel monitoring equipment; evaluation and implementation of tailored personal protection equipment; and increased hiring and training of industrial hygiene staff. These actions will mitigate potential hazards on a tank farm-specific basis; enhance characterization of chemical constituents in the waste; improve sampling and detection technology; and increase real-time monitoring.

Depending on information gathered and analyzed in Phase 1, Phase 2 actions, costs and schedules (FY 2017-2019 and beyond) currently identified in the plan will be reviewed and, as needed, revised to reflect any updates to the technical basis, as well as the ongoing deployment of new technology and/or findings from research and development activities. A second major part of Phase 2 is the institutionalization of an enhanced industrial hygiene program. This enhanced program includes attributes of a standard process for ongoing monitoring, continued sampling for changing conditions, and the incorporation of vapor management controls into new projects.

WRPS and ORP recognize that verifying the existence of and addressing potential exposures to chemical vapors over a large area and number of tank farms will take a sustained, ongoing effort. WRPS has established a project team that will lead its implementation of the actions in this plan. A panel of external experts has been established to monitor implementation, validate research and development plans and progress, and assess progress and effectiveness of vapor prevention and mitigation strategies.

Current waste retrieval efforts are concentrated in C Farm, where retrieval activities in 13 of the 16 single-shell waste tanks have been completed.



The Evolution of Vapor Controls in Hanford Tank Farms

2.0 INTRODUCTION

2.1 HANFORD TANK WASTE

The underground storage tanks on the DOE's Hanford Site hold approximately 56 million gallons of radioactive and chemical waste that are the byproduct of processing nuclear materials for the nation's weapons programs.

The tank waste generates vapors as heat and radiation break down chemical compounds. In the double-shell tanks (DSTs), some chemical vapors are exhausted with active ventilation, while the single-shell tanks (SSTs) are normally passively ventilated. In both types of tanks, the vapors are passed through filters to remove, to the extent possible, radioactive particles and some chemical compounds.

2.2 FORMATION OF TANK VAPOR ASSESSMENT TEAM AND DEVELOPMENT OF RECOMMENDATIONS

As a result of more than two dozen workers receiving medical evaluations in March and April 2014, following reported on-the-job exposures to chemical vapors emanating from the waste storage tanks, WRPS requested that SRNL establish and oversee a panel of external, independent experts to examine chemical vapors management and related worker protection measures at the Hanford tank farms. WRPS also asked that the study include an enhanced scope for analysis and recommendation beyond the previous technical reviews of Hanford-tank-waste-vapor policies and issues.

In June 2014, as a result of the WRPS request, SRNL assembled a team of external, recognized experts to perform an independent review of the chemical vapors program. The ten-member team was comprised of members from academia, industry, and government agencies, and included a representative of the Hanford Atomic Metal Trades Council, the bargaining unit that represents union tank farm workers. Its members brought a wide range of knowledge and expertise across many disciplines, including the fields of occupational risk assessment, nuclear waste processing, air emission releases from storage tanks, worker safety, and biological monitoring and modeling. The team's activities were observed by members of DOE's Office of Enterprise Assessment and by members of the Radioactive Air Emissions Section of the Washington State Department of Health.

The TVAT conducted its assessment along lines of inquiry in six technical assessment areas: site characterization, exposure assessment, dose-response assessment, risk characterization, risk management, and risk communication.

The TVAT released its report in late October 2014. The team hypothesized that short, intermittent, higher-concentration (bolus) vapor events are occurring and that exposures to such vapors are a likely cause of reported worker health effects, particularly upper respiratory irritation. Based on the six technical assessment areas, the team developed 10 Overarching

Recommendations that reflect cross-cutting programmatic issues. In support of the Overarching Recommendations, the team provided 47 recommendations for improvements to reduce the potential of chemical vapor exposure in the near term and to try to conclude whether bolus exposures are the primary cause of the reported worker health effects.

To address the TVAT recommendations, WRPS was tasked to develop an implementation plan to address the recommendations of the TVAT report.

The 10 Overarching Recommendations are discussed in Section 3.0. The 47 supporting recommendations and corresponding actions are detailed in Section 4.0, grouped according to the appropriate technical assessment area. Section 5.0 contains schedule and cost information. Appendix A provides a table cross-referencing the overarching and supporting recommendations.

2.3 IMPLEMENTATION PLAN SCOPE

This implementation plan addresses the 10 Overarching Recommendations and 47 supporting recommendations identified in the TVAT report.

2.4 IMPLEMENTATION PLAN ASSUMPTIONS

The following assumption applies to this implementation plan:

- Resources will be authorized by DOE to complete the required scope and activities in a phased approach outlined in the plan to resolve the vapor issues.

Implementation of this plan may be impacted by technical and programmatic uncertainties. Key areas of uncertainty are:

- Technology Development – Developing new monitoring technologies may result in schedule delays and additional costs. This plan calls for using available industry technology as much as practical and minimizing technology development.

- Resource Availability – There may not be enough qualified industrial hygiene staff available.

- Development and Acceptance of Exposure Standards – There are no existing standards for potential bolus exposures to many of the chemicals of potential concern (COPCs). Engineering controls standards and calibrations need to be established following tank head space sampling and characterization to identify any additional key COPCs.

3.0 SUMMARY RESPONSES TO THE TEN OVERARCHING RECOMMENDATIONS FROM THE TANK VAPOR ASSESSMENT REPORT

OR1: Hanford Site contractor and DOE management actively demonstrate commitment to improve the current program and ultimately resolve the vapor exposure concerns.

> **Response:** *Management is demonstrating its commitment to this program by committing its personal oversight, as well as a dedicated staff, to develop and execute the Implementation Plan to enhance the Industrial Hygiene chemical vapor program. Cost estimates, staffing plans, and proposed schedules have been developed for the detailed actions in the Implementation Plan. Several elements of the Implementation Plan are already underway and are expected to be integrated into the Tank Operations Contract (TOC) lifecycle project baseline.*

OR2: Implement measureable benchmarks to assure operational and cultural parity among chemical vapor, flammability, and radiological control (RadCon) programs.

> **Response:** *The Implementation Plan identifies actions necessary for the chemical vapor program to attain parity with the WRPS RadCon program. This will include chemical As Low As Reasonably Achievable (ALARA) implementation of Integrated Safety Management System core functions, Voluntary Protection Program tenets, and benchmarking initiatives that focus on industry-standard, best-management practices for chemical safety and may include incorporation of a DOE national standard or revision to 10 C.F.R. § 851, "Worker Safety and Health Program." Training, chemical-vapor control monitoring, and comparable staffing have commenced. Additional actions are being initiated to incorporate chemical ALARA into the current work-control processes utilizing RadCon program rigor.*

OR3: Establish a program to sample proactively the head space of tanks to validate and enhance chemical characterization.

> **Response:** *A program will be developed that includes prioritization of tank head space sampling and use of the latest analytical methods under quiescent and waste-disturbing*

conditions in order to update the current Chemicals of Potential Concern and the Technical Basis of the chemical vapor program.

OR4: Accelerate development and implementation of a revised industrial hygiene exposure assessment strategy that is protective of worker health and establishes stakeholder confidence in the results for acute, as well as chronic, exposures.

Response: *Recommendation #3 above is being accelerated and once results from implementation of recommendation #3 are available, the Industrial Hygiene Exposure Assessment Strategy will be updated for documented exposure limits. However, developing postulated bolus exposure limits will require deploying new technologies to measure these transient events that have not been observed with existing field instruments. In addition, bolus occupational exposure limits (OELs) determined from scientifically validated health studies are not available for many chemicals. Those OELs may need to be developed by external experts.*

OR5: Modify the medical case evaluation process and reporting procedures to recognize the appropriate uses and limitations of the available monitoring data and other potential exposure information when evaluations are made regarding tank chemical vapor exposures.

Response: *The Implementation Plan includes actions to communicate the limitations of the sampling data for chemical vapors and enhance employee sampling and monitoring notification letters. The on-site medical provider has reviewed potential software and analysis tools to better evaluate and track potential exposure effects. This action will be managed contractually between the DOE-Richland Operations Office and the medical provider with communication to the tank farms contractor. Medical case evaluations are determined by a third party administrator.*

OR6: To reduce the impacts of bolus exposures, utilize real-time personal detection and protective equipment technologies specifically designed to protect individual employees.

Response: *Immediate actions have been initiated that include the use of supplied air for individual employees working in the SST farms. Supplied air is also required for individual employees working in DST farms where there is the potential for low-threshold chemical vapors. These controls will be in place until further evaluation and technical analyses are completed. A program looking at advanced technology is established with a recommended list of instrumentation and equipment. Multiple technologies are being evaluated to include advanced personal protective equipment (PPE), alternative personal sampling, and enhanced area monitoring. The implementation of these technologies may include specification/requirements development, procurement and process/field implementation, and pilot-testing.*

OR7: Accelerate implementation of tailored engineering technologies to detect and control vapor emissions and exposures experienced in the Hanford tank farms ("tank farm of the future").

> **Response:** *The tank farms contractor has established a Chemical Vapor Solutions Team (CVST) subcommittee (Engineering Controls) to evaluate current field-deployed technologies and newly developed technologies. The program is looking at imaging cameras with alarms, increased stack heights for dispersion, abatement techniques, and air-flow promoters.*

OR8: Augment the Hanford Tank Farm IH Program to further develop competencies to address the tank vapor exposure issues.

> **Response:** *The tank farms contractor has revised the current chemical vapor management strategy to include increased staffing; specialized training qualifications; chemical ALARA; risk communication; increased exposure monitoring and sampling strategies; and expansion of personal protective equipment requirements. IH staffing will be increased across most functions to parallel the RadCon program. Increased field presence, enhanced training, and a qualification program will be added. The program will benefit from more specific IH guidelines and requirements.*

Industrial hygiene technicians routinely monitor for chemical vapors in Hanford's tank farms.

OR9: Effectively communicate vapor exposure issues and actions proactively with all stakeholders.

> **Response:** *A near-term action in the Implementation Plan is to improve the clarity and enhance communication of vapor information with employees and stakeholders, including exposure issues and actions.*

OR10: Investigate and pursue external research opportunities and partnerships to address data and technology gaps related to vapor exposure, effects, and mitigation.

> **Response:** *An annual Grand Challenge process has been established over the last two years to promote innovative solutions. Participants include representatives from national labs, universities, and other technical experts to identify the most promising solutions to ORP technical challenges. Vapor-related solutions being considered include the destruction of noxious vapors with ultraviolet light, and the development of a Hanford SST farm passive breather filter. In addition, ORP is committed to working with other agencies including NIH and NIOSH, to promote studies and investigations to support evaluation of chemical vapor bolus exposures. Due to the complex nature of the challenges and the need to make adjustments based upon performance of near-term actions (e.g., sampling), ORP will establish ongoing processes to identify and manage research opportunities and partnerships with national labs, industry, and academia to solve existing and emerging vapor-related challenges. To ensure ongoing alignment in the identification and pursuit of technology solutions, the external expert panel will include some TVAT team members to provide ongoing feedback related to research and partnership opportunities.*

Overarching Recommendations (OR)

4.0 PLANNED ACTIONS TO ADDRESS THE TVAT RECOMMENDATIONS

This section contains a summary table of planned actions organized according to the TVAT recommendations and grouped into six technical assessment areas: site characterization, exposure assessment, dose-response assessment, risk characterization, risk management, and risk communication. Section 5.0 provides a detailed description of the planned schedule.

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
Site Characterizations			
TVAT 1 – SC1	Develop a prioritized program to sample and characterize tank head space composition and stratification during quiescent as well as disturbed conditions.	• Develop a prioritized project schedule to sample tank head spaces during quiescent as well as waste-disturbing conditions. (Phase 1 and 2) • Develop and/or revise the head space sampling Data Quality Objectives. (Phase 1) • Incorporate sample results into the existing IH Technical Basis. (Phase 1)	In progress Scheduled Scheduled
TVAT 2 – SC2	Assess the potential for materials to plate or condense in vent risers, stacks and HEPA filters, and characterize the emissions for each condition.	• Conduct an assessment of the potential for materials to plate or condense. (Phase 1)	Scheduled
TVAT 3 – SC3	Implement technologies to assess fugitive sources of emissions that are not connected to tank head spaces and characterize the emissions for each non-head space fugitive source.	• Initiate technological evaluations, field testing, and deployment of advanced technologies focused on fugitive emission sources. (Phase 1) • Implement procurement and deployment of the selected monitoring/sampling technology, based on evaluation and field testing. (Phase 1) • Develop and issue a technical maturation plan (TMP), including subject-matter expert reviews for identified technologies. (Phase 1)	In progress In progress In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 4 – SC4	Identify and implement new technologies to detect, locate and quantify fugitive and episodic releases.	• Develop and issue a technical maturation plan for new technologies. The review, selection, and incorporation of selected technologies will include subject-matter expert reviews. (Phase 1)	In progress
		• Initiate multiple actions to perform technological evaluations, field testing, and deployment of new technologies focused on fugitive emission sources. Based on the evaluation and field testing, procurement and deployment of the selected monitoring/sampling technology will be implemented. (Phase 1)	In progress
TVAT 5 – SC5	Identify and implement new technologies to quantify stack and vent emissions with suitable local alarms so that workers can respond in a timely fashion.	• Develop and issue a technical maturation plan for new technologies. The review, selection, and incorporation of selected technologies will include subject-matter expert reviews. (Phase 1)	In progress
		• Initiate multiple actions to perform technological evaluations, field testing, and deployment of new technologies focused on stack and vent emission sources and local alarming systems. (Phase 1)	In progress
		• Implement procurement and deployment of the selected monitoring/sampling technology, based on evaluation and field testing. (Phase 2)	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
Exposure Assessment			
TVAT 6 – EA1	Continue the development and expedite deployment of new techniques for real-time response and appropriate sampling for short duration intermittent releases.	• Schedule actions which include the assessment of characterizing tank head spaces. (Phase 1)	Completed
		• Develop and issue a technical maturation plan for new technologies. The review, selection, and incorporation of selected technologies will include subject-matter expert reviews. (Phase 1)	In progress
		• Perform air dispersion models to increase the fidelity of the technical basis for the vapor control zones. (Phase 1)	In progress
		• Initiate actions to accelerate the procurement of additional real-time direct reading instruments, personal sample pumps, and alarm-detecting capabilities to capture and protect workers from short/intermittent bolus releases. (Phase 1)	In progress
		• Based on the results, incorporate the changes into a revised IH Technical Basis. The characterization will assist in strengthening the overall program requirements and will focus on potential bolus exposures within the tank farms. (Phase 1)	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 7 – EA2	Identify and implement sampling and/or in-situ analytical methods as appropriate for reactive volatile organic chemicals (VOCs), submicron aerosol, volatile metal compounds, and volatile metalloid compounds that may be present but would have been missed by past head space sampling and analytical methods.	• Contract with industry experts to revise and update the 2004 Droppo Report (PNNL-14767, *Characterization of the Near-Field Transport and Dispersion of Vapors Released from the Headspaces of Hanford Site Undergound Storage Tanks*," J. G. Droppo, July 2004) based on newer technologies, methodologies, and sampling/monitoring results. (Phase 1)	Scheduled
		• Perform an assessment that focuses on the development of sampling strategies, utilizing analytical methods for reactive VOCs, submicron aerosols, volatile metal compounds, and volatile metalloid compounds. Results of the assessment will determine appropriate actions for implementing sampling methodology enhancements. (Phase 1)	Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 8 – EA3	Use modeling, including computational fluid dynamics methods, to determine the potential locations, conditions, and next steps in attempting to measure sporadic exposure events.	• Contract with industry experts to perform dispersion modeling. The basis of the model will help to determine the predicted locations and levels of potential chemical vapor emissions, effectiveness of increased stack heights, and other engineered controls. (Phase 1) • Incorporate additional models, such as the American Industrial Hygiene Associate (AIHA) Air Dispersion Model, into the work control & worker protection program. (Phase 1)	In progress Scheduled
Dose Response			
TVAT 9 – DR1	Conduct an additional review and re-prioritization of COPCs under tank-disturbing conditions to provide adequate emission characterizations, OEL development, and worker exposure surveillance.	• Initiate additional exhaust stack sampling, head space sampling, and fugitive-emission monitoring/sampling. (Phase 1 and 2) • Perform COPCs evaluation for both waste-disturbing and non-waste disturbing activities and incorporate into the IH Technical Basis, employee training programs, qualification programs, and stakeholder communications. (Phase 1 and 2)	Completed In progress
TVAT 10 – DR2	Conduct a rigorous review of the COPC list to ensure it is current, and develop a process to document the mechanisms used to ensure	• Perform an IH program review and incorporate changes as necessary. (Phase 1)	Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
	COPC updates and the basis for changes in the COPC list over time.	• Incorporate a formal technical review process that incorporates periodic technical evaluations, decisions, and program enhancements. (Phase 1 and 2)	In progress
TVAT 11 – DR3	Conduct additional evaluations of COPC toxicological studies to provide insight into the sensory and pathophysiological irritation response, including the role of mixture interactions and the potential need for additional toxicological evaluation.	• Conduct a toxicological study on tank chemistry mixtures and how they interact with the COPC listing and other chemical constituents. (Phase 1 and 2) • Incorporate results of the evaluation into the IH program requirements as necessary. (Phase 2)	Scheduled Scheduled
TVAT 12 – DR4	Perform a comprehensive evaluation of acute odor thresholds and toxicity effect levels for each COPC to facilitate the establishment of action levels based upon the relationship between odor and toxicity thresholds.	• Conduct an assessment on acute odor threshold and toxicity effect levels for each COPC. Results of the assessment may assist with the establishment of action levels for odor and toxicity threshold relationships. (Phase 1 and 2) • Incorporate results of the evaluation into the IH program requirements as necessary. (Phase 2)	Scheduled Scheduled
TVAT 13 – DR5	Continue to evaluate COPC OELs within the context of observed symptomatology versus 10% of the irritations thresholds and develop a "new" acute OEL list.	• Conduct an assessment to extrapolate a short-term bolus exposure and compare to 10% of the excursion limit. (Phase 1 and 2) • Incorporate results of the evaluation into the IH program requirements as necessary. (Phase 2)	Scheduled Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 14 – DR6	Maintain a robust health surveillance program that follows up with exposed workers to evaluate short- and long-term consequences from vapor exposures.	• Participate in and provide feedback on DOE's evaluation of an enhanced medical-surveillance program that provides continuous feedback and evaluation results based on short-term and long-term health consequences to the exposed worker. (Phase 1)	Scheduled
TVAT 15 – DR7	Evaluate tank vapor mixture toxicological interactions at concentrations associated with transient plume exposures to modify OELs to accommodate mixture effects.	• Conduct a review on the vapor mixture toxicological interactions at concentrations associated with transient plume exposures. In the event this review results in any changes to OELs, the cost and schedule for implementation of these changes will be addressed separately. (Phase 1)	Scheduled
TVAT 16 – DR8	Develop an overall IH strategy for aerosol evaluations that focus on analytical quantifications, the evaluation of chemical aerosols for inclusion in the COPC list, as well as the establishment of appropriate aerosol OELs.	• Conduct a review of potential aerosol hazards focused on analytical quantifications. (Phase 1) • Incorporate results of the evaluation into the IH program requirements as necessary. (Phase 1)	Scheduled Scheduled
TVAT 17 – DR9	Develop a research strategy roadmap in partnership with DOE, national laboratories, and university faculty subject-matter experts to address critical questions regarding tank vapor emissions and exposures.	• Collaborate with technical experts (e.g., national laboratories, medical providers, other prime contractors) and implement actions through the tank farms operations contract managed by DOE-ORP. (Phase 1)	Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		• Provide, based on the results of evaluations, studies, and assessments, appropriate notifications to the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health to support the development of a national standard for chemical vapor bolus exposures and/or revision to 10 CFR 851. (Phase 2)	Scheduled
		• Support an epidemiology study for the health effects from acute and chronic vapor exposures that include health effects, medical surveillance and other epidemiology studies available. (Phase 2)	Scheduled
		• Incorporate results of the evaluation and ongoing research strategy into the IH program requirements as necessary. (Phase 2)	Scheduled
Risk Characterization			
TVAT 18 – RCH1	Identify an Occupational Exposure Limit – Ceiling Limit – (OEL-C) for each analyte in Hanford tank head spaces.	• Update the existing program to incorporate OEL-Time Weighted Averages (TWA), and Short-Term Exposure Limit (STEL) values for each analyte in the head space. (Phase 1)	Scheduled
		• Support the study, evaluation, and	Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		potential development of an OEL-C for analytes that do not currently have an established OEL value. (Phase 2)	
TVAT 19 – RCH2	Classify and conduct toxicological testing on a reasonable number of distinct types of Hanford tank head space vapors (e.g., potential classes of tank vapor types such as ammonia rich, ammonia poor, nitrosamine rich).	• Conduct a toxicological study on tank chemistry mixtures and how they interact with the COPC listing. (Phase 1) • Incorporate results of the evaluation into the IH program requirements as necessary. (Phase 1)	Scheduled Scheduled
TVAT 20 – RCH3	Use the OEL-C from analysis or subsequent toxicological testing to characterize the hazard index and risk from the tank vapor mixtures.	• Provide results from the toxicological studies and establishment of OEL-C to DOE and support a revision to the hazard index. (Phase 1)	Scheduled
TVAT 21 – RCH4a	(Chronic) The WRPS IH program has in place procedures for evaluating chronic chemical exposures [based on Time Weighted Average (TWA)]; it is recommended that more periodic follow-up monitoring be conducted and documented to provide needed data for the industrial hygienist to verify that worker chronic exposures have not changed with time.	• Initiate a strategy for an enhanced IH monitoring routine for the tank farms. This includes developing and implementing additional routine processes to identify and validate chemical vapor controls and fugitive emission points. (Phase 1) • Incorporate results from the routine monitoring and sampling into the IH program and promulgate the necessary changes to ensure that hazard characterization is appropriately evaluated and enhanced. (Phase 2) • Incorporate results of the monitoring and	In progress Scheduled Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		sampling into advanced vapor training for employees. (Phase 2)	
TVAT 22 – RCH4b	(Acute) Transient vapor/gas exposures (i.e. high dose rate) are substantially greater than what is currently measured as a TWA; alternative strategies for evaluating transient plume-like vapor exposures are recommended and adherence to excursion limit principles must be implemented (5 times OEL).	• Incorporate additional monitoring programs based on short episodic releases from tank farm sources and other appropriate forms of short-duration exposures sampling (e.g., alternative personal sampling), in addition to Short-Term Exposure Limit (STEL) sampling/monitoring. The program will account for more than traditional TWAs, but also bolus-type events. (Phase 1) • Incorporate results of the monitoring and sampling into advanced vapor training for employees. (Phase 1 and 2)	In progress Scheduled
TVAT 23 – RCH4c	(Medical Surveillance) Routine medical surveillance is a key workplace evaluation tool needed to predict health impairment from vapor exposures; appropriately designed epidemiology studies focused on tank farm workers are recommended to evaluate the potential long-term health consequences.	• Initiate a review of the medical surveillance program for chemical compounds found within the current IH technical basis and incorporate into the Employee Job Task Analysis (EJTA) program. (Phase 1) • Support the study, evaluation, and potential development of epidemiology studies focused on long-term health consequences. (Phase 1) • Ensure that the results from	Completed Scheduled Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		epidemiology studies are communicated to the workforce and incorporate appropriate changes into the existing medical surveillance program. (Phase 2)	
		• Schedule an assessment and follow-up reviews to ensure that the appropriate level of emphasis is placed on the maintenance and incorporation of changes based upon results from related studies, evaluations, and assessments. (Phase 2)	Scheduled
Risk Management			
TVAT 24 – RM1a	Provide and manage IH professional and technician staffing levels to properly characterize and assess worker vapor exposure in the tank farms.	• Build the IH organization with the correct expertise and resources to assist with the characterization, enhanced monitoring, research, and exposure assessment modeling. (Phase 1)	Completed
TVAT 25 – RM1b	Provide and manage IH professional and technician staffing levels to participate in all planning, execution and evaluation phases of tank farm work activity, similar to radiological and flammability control functions.	• Complete staffing comparisons between radiological controls, flammability, and IH. (Phase 1)	Completed
		• Complete and implement additional qualifications and requirements for the IH function. (Phase 1)	Completed
		• Initiate actions to increase IH staffing levels so that additional emphasis will be placed on work planning, field execution, and oversight. (Phase 1)	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 26 – RM1c	Provide and manage IH professional and technician staffing levels to properly recommend and evaluate the effectiveness of work practices, PPE and engineering controls.	• Complete staffing comparisons between radiological controls, flammability, and IH. (Phase 1) • Initiate actions to increase IH staffing levels so that additional emphasis will be placed on work practices, PPE, and engineering controls. (Phase 1)	Completed In progress
TVAT 27 – RM1d	Provide and manage IH professional and technician staffing levels to effectively inform, advise, and train line functions and address workers concerns regarding tank farm vapors. In addition, available analytical resources should be re-evaluated and increase to assure the timely reporting of sample results associated with tank farm vapors.	• Complete staffing comparisons between radiological controls, flammability, and IH. (Phase 1) • Initiate hiring actions to increase IH staffing levels so that additional emphasis will be placed on informing and training line functions and managers regarding worker concerns. (Phase 1) • Hire additional professionals to support lab work scope resulting in a timely reporting of sample results. (Phase 1) • Place external contracts for additional sample processing capabilities. (Phase 1)	Completed In progress Completed Completed

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 28 – RM1e	DOE should increase its focus on chemical hazards and develop more specific implementation guidelines on the anticipation, recognition, evaluation, and control of chemical hazards that is comparable to the focus and rigor given to radiological hazards. Consistent guidance on implementation of IH programs in DOE facilities would assist in assuring functional parity with radiological controls.	• Collaborate with DOE to appropriately establish tailored program parity between IH programs and 10 CFR 835, "Radiological Controls Program." (Phase 2)	In progress
TVAT 29 – RM2	Achieve functional parity of the IH program with the radiological control program with respect to worker training and core competencies.	• Evaluate the current DOE programmatic requirements between IH and RadCon, and develop processes to address programmatic differences. (Phase 1) • Develop and implement advanced training based on an evaluation and review by DOE-ORP. (Phase 2)	In progress Scheduled
TVAT 30 – RM3	Expand general chemical hazard awareness training (CHAT) for tank farm workers to be more consistent with the length and intensity of the radiological-hazard training currently mandated for all site workers.	• Enhance CHAT to increase worker, supervisor, and management understanding of chemical management practices, specific to the tank farms.(Phase 1) • Incorporate CHAT training into the existing employee training profiles and EJTA. (Phase 1)	Scheduled Completed

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 31 – RM4	Adequately staff the IH function to ensure proper resources are deployed in the planning, pre-job, job execution, and post-job ALARA review in a fashion similar to that of the radiological control function.	• Complete staffing comparisons between radiological controls, flammability, and IH. (Phase 1)	Completed
		• Initiate hiring actions to increase IH staffing levels so that additional emphasis will be placed on work planning, job execution and post-job ALARA review. (Phase 1)	In progress
		• Initiate the enhancement of a Chemical ALARA process into the existing work control program. This may include program development, implementation strategy, training, and program assessments. (Phase 2)	In progress
		• Use elements from the radiological program and process safety management models to develop the program structure (Phase 2).	Scheduled
TVAT 32 – RM5	Redefine unacceptable chemical exposure risk to include short-term, episodic exposure to chemicals that can result in adverse health impacts.	• Update tank farm-specific chemical information sheets and IH Technical Basis documents to reflect short-term, bolus exposure hypothesis to chemicals, based on the results from tank head space sampling and advanced monitoring. (Phase 2)	Scheduled

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 33 – RM6	Investigate and implement best available technologies to detect and control vapor plumes from fugitive sources as well as from vents and stacks.	• Initiate actions to conduct research, evaluation, and field testing of technologies to detect and control chemical vapor plumes. (Phase 1)	In progress
		• Form a dedicated task team of technical experts, workers, and managers to research and implement the most appropriate methods. Solicited industry experts for additional review. This effort has been underway since June 2014. (Phase 1)	Completed
		• Begin field testing for multiple technologies. (Phase 1)	Completed
		• Select and deploy appropriate technologies, based on the technical evaluation and field testing. (Phase 2)	In progress
		• Conduct training programs and employee orientations related to new technologies. (Phase 2)	In progress
TVAT 34 – RM7a	Establish a more effective methodology for designating Vapor Control Zones (VCZs) and Vapor Reduction Zones (VRZs).	• Initiate a comprehensive review and evaluation regarding the establishment, implementation, and maintenance of VCZs and VRZs. (Phase 1)	In progress
		• Incorporate the results of the comprehensive review enhancements into the existing IH program and review	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		on regular basis to ensure effectiveness. (Phase 1 and 2)	
		• Conduct a comprehensive evaluation of air dispersion modeling based on the AIHA Standards to assist in the revaluation of VCZ and VRZ boundaries. (Phase 1)	In progress
TVAT 35 – RM7b	Confirm that air-purifying respiratory protective equipment is effective in reducing exposure to tank vapors below acceptable levels.	• Implement the use of half-face/full-face combination chemical-cartridge respirators in the SST farms with the appropriate posting and communications of this control, based on the release of the TVAT report. (Phase 1)	Completed
		• Implement the control of supplied air for all work in SST and DST farms where there is a potential for low-threshold vapors. These controls were initiated to focus on worker safety while respiratory protection (i.e., cartridge effectiveness) evaluations could be conducted). (Phase 1)	Completed
		Perform chemical-cartridge technical evaluation to determine source-sampling locations, duration of samples, sample results, modeling, and vapor-control zones to confirm respiratory protective equipment is effective. (Phase 1)	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 36 – RM8	Modify the medical case evaluation process and reporting procedures to recognize the appropriate uses and limitations of the available monitoring data and other potential exposure information when evaluations are made regarding vapor exposures.	• Support DOE and the Hanford on-site medical provider to refine the medical protocol for potential chemical exposure evaluations. (Phase 1) • Enhance communications to medical providers; describe the limitations of the sampling data for chemicals and vapors in ongoing and frequent interactions among medical service providers and the tank farms contractor as changes in the sampling data or monitoring technologies occur. (Phase 1)	In progress Completed
TVAT 37 – RM9	Verify that all programs associated with vapor controls are properly vetted, evaluated, communicated and tracked to ensure timely completion.	• Incorporate and track all actions associated with the chemical vapor management process through currently established corrective action management system. (Phase 1)	In progress
TVAT 38 – RM10	All levels of line management demonstrate that they are committed to reducing the potential for tank farm vapors releases and continuously improving management systems to assure all workers are properly protected.	• Initiate monthly senior-level management meetings with IH staff and field personnel to ensure direct feedback and that information is communicated. (Phase 1) • Issue a statement from senior ORP and tank farms contractor management to employees and stakeholders supporting the recommendations of the Tank Vapor Assessment Report, and committing to	Completed Completed

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
		implement the recommendations. (Phase 1)	
		• Have the tank farms contractor Executive Safety Review Board (ESRB) approve and monitor the implementation plan. (Phase 1)	Scheduled
		• Add and align resources to ensure the successful implementation of programs, processes, procedures, manuals, training, and work planning to incorporate the improvements in the overall WRPS IH Program. (Phase 2)	In progress
		• Establish an external technical panel to monitor implementation, validate research and development plans, and assess effectiveness of vapor prevention and mitigation strategies. (Phase 1)	Completed

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
Risk Communication			
TVAT 39 – RC1	Develop more routine and transparent communications, which offer unsolicited information to the Hanford Challenge, Hanford Concern's Council, and other interested community groups regarding potential health impacts, health and safety risks, and WRPS/DOE efforts to reduce risk to employees and the community.	• Continue efforts to provide additional information about chemical vapor issues, health risks and progress being made to mitigate workplace hazards through periodic presentations, public announcements, and other communication vehicles. The frequency will vary depending on audience and project activities. (Phase 1)	In progress
TVAT 40 – RC2	Improve the EJTA process to include opportunities for worker engagement and buy-in into the process and protective measures assuring the health and safety of the worker.	• Enhance the EJTA program to include improved worker engagement and buy-in into the process and protective measures. This includes worker review, comment, and concurrence when changes are made. (Phase 1) • Incorporate continued evaluation and assessment of the process into the integrated assessment plan to ensure that the recent changes have been effective. (Phase 2)	Completed Completed

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 41 – RC3	Improve the degree of employee involvement in and ultimate acceptance of all teams and programs that are associated with tank farm vapor issues (e.g., PERs, CVST).	• Initiate efforts to develop and formalize a chemical ALARA program to manage and oversee overall improvements for vapors focused on improving worker engagement. It will manage the corrective actions and improvements identified within the Tank Vapor Assessment Report, and oversee implementation of advanced detection and monitoring technologies, IH vapor practices, analyses, sampling methods, and sampling protocols. Program elements include the development and management of a chemical vapor communications plan, performance indicators, and program effectiveness reviews. (Phase 1 and 2)	In Progress
TVAT 42 – RC4	Revise the content of the employee monitoring notification letters to include more relevant information regarding the capabilities and limitations of technology used to collect and analyze samples, which should include clear definitions for concepts such as “ND” vs. “<LOQ” vs. “<RQL.”	• Revise the content of the employee monitoring notification letters to include more detailed analysis of the sampling, monitoring, limitations of instrumentation, and analysis. These revisions will continue as new monitoring becomes available.	In Progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 43 – RC5	Establish a greater IH technician and professional presence in the tank farms and undergo specific risk communication training and improve their ability to deliver effective risk communications to employees.	• Hire additional qualified Industrial Hygienists and Technicians to support field activities and increase field presence. (Phase 1) • Develop and establish a training module focused on risk communication. This training course will be required for safety & health professionals and selected line management. (Phase 1)	Completed In progress
TVAT 44 – RC6	Perform an alternatives assessment for the current Shift Office Event Notification (SOEN) process to identify other methods to assure that all workers potentially impacted by vapor events (i.e. WRPS, MSA, visitors) are immediately alerted of a vapor event and understand what mitigating actions they must take to avoid possible health or safety impacts.	• Perform a specialty assessment of personnel notification systems and seek out alternative methods for immediate notification of employees. (Phase 1) • Take appropriate action to address any improvement opportunities, based on the results of the assessment. (Phase 2)	In progress Scheduled
TVAT 45 – RC7	Deploy appropriate laboratory resources to ensure timely analysis and reporting of IH results, and ensure all exposure data is assigned correctly to all members of the Similar Exposure Group.	• Hire additional professionals to support lab work scope resulting in a timely reporting of sample results. (Phase 1) • Place external contracts for additional sample processing capabilities. (Phase 1) • Perform a review of the existing Similar Exposure Groups basis to ensure proper assignment. (Phase 1)	Completed Completed In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
TVAT 46 – RC8	Communicate in a timely fashion to all employees the results of incident investigations, including a description of event, results of any samples taken, lessons learned, and corrective actions planned and completed.	• Revise and improve the event-response protocol for chemical vapor events, which includes improved communications with all employees (e.g., notification letters, event investigation forms, information posting boards). (Phase 1)	Completed
		• Enhance communication mechanisms (e.g., SOEN) for other Hanford Site contractors and subcontractors. (Phase 1)	Completed
TVAT 47 – RC9	Evaluate and improve the communication system associated with vapor events and result of worker compensation claims.	*Medical case evaluations and workers compensation claim determinations are made by organizations outside of DOE and its tank farms contractor.*	
		• Improve information provided for the processing of worker compensation claims. This information includes monitoring and sampling results at the time of the potential exposure, working conditions, weather conditions, and the activities occurring during the period when the employee experienced the symptoms. (Phase 1)	Completed
		• Increase the frequency of worker briefings, feedback sessions, and regular interface meetings. (Phase 1)	In progress

Table 1. Planned Actions Addressing the TVAT Report Recommendations.

TVAT #	Recommendation	Actions	Status
Table Key:			
DR = Dose-Response Assessment		*RCH = Risk Characterization*	
EA = Exposure Assessment		*RM = Risk Management*	
RC = Risk Communication		*SC = Site Characterization*	

5.0 SCHEDULE AND ESTIMATED COST

Presented below is the schedule and Rough Order of Magnitude (ROM) cost estimate developed to support the implementation plan. The schedule covers late 2014 through 2019.

The cost estimate is presented as a ROM because the scope has not been developed utilizing certified costs and pricing, and contract modifications have not occurred at the time this plan was written. The Phase 1 estimate for FY 2015-2016 is estimated between $60 and $70 million and will include, but is not limited to, expanded sampling and characterization of tank head space gases; evaluation and procurement of new field and personnel monitoring equipment; evaluation and implementation of tailored personal protection equipment; and increased hiring and training of industrial hygiene staff. These actions will mitigate potential hazards on a tank farm-specific basis; enhance characterization of chemical constituents in the waste; improve sampling and detection technology; and increase real-time monitoring.

Depending on information gathered and analyzed in Phase 1, Phase 2 actions, costs and schedules (FY 2017-2019 and beyond) currently identified in the plan will be reviewed and, as needed, revised to reflect any updates to the technical basis, as well as the ongoing deployment of new technology and/or findings from research and development activities. A second major part of Phase 2 is the institutionalization of an enhanced industrial hygiene program. This enhanced program includes attributes of a standard process for ongoing monitoring, continued sampling for changing conditions, and the incorporation of vapor management controls into new projects.

It is important to note that the ROM cost range does not include potential future actions that may become necessary as studies and technology development actions are completed. The ROM only provides for the cost to complete the actions specifically identified in the implementation plan. The ROM cost range also does not include any efficiency impacts (cost or schedule) as a result of implementing these actions against the contract/performance baseline. The ROM amounts will be revised into certified cost and pricing as the scope is added to WRPS' TOC contract through contract modification(s).

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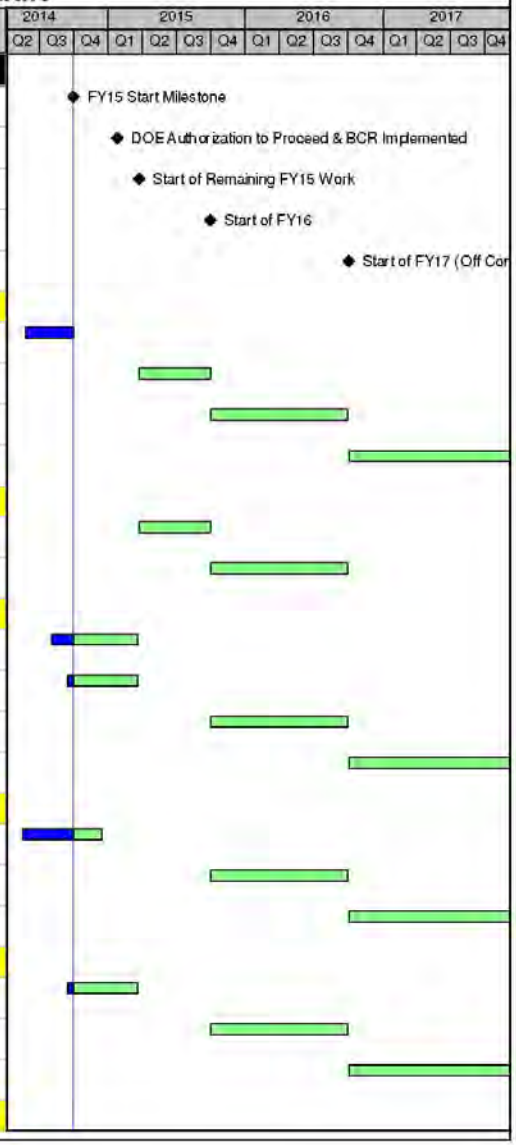
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
TVAT		01-Apr-14 A	30-Sep-19
SM-FY15	FY15 Start Milestone	01-Oct-14 A	
SM-NTE	DOE Authorization to Proceed & BCR Implemented	26-Jan-15*	
SM-NTE10	Start of Remaining FY15 Work	23-Mar-15*	
SM-20	Start of FY16	01-Oct-15*	
SM-30	Start of FY17 (Off Contract)	03-Oct-16*	
TVAT 1-SC1		25-May-14 A	30-Sep-19
250	222S Lab Sampling	25-May-14 A	30-Sep-14 A
235 FY15	Develop a Plan / Schedule for Tank Headspace Sampling (SC1)	23-Mar-15	29-Sep-15
235 FY16	Maintain Plan / Schedule for Tank Headspace Sampling (SC1)	01-Oct-15	30-Sep-16
235 Off	Maintain Plan / Schedule for Tank Headspace Sampling (SC1) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 2-SC2		23-Mar-15	29-Sep-16
590 FY15	Chemical Plating Assessment (SC2)	23-Mar-15	29-Sep-15
590 FY16	Chemical Plating Assessment (SC2)	01-Oct-15	29-Sep-16
TVAT 3-SC3		03-Aug-14 A	30-Sep-19
510 FY15	Develop and Implement TMP (SC3)	03-Aug-14 A	20-Mar-15
535 FY15	Evaluate New Technology for Fugitive Vapor Sources (SC3)	15-Sep-14 A	20-Mar-15
535 FY16	Test New Technology for Fugitive Vapor Sources (SC3)	01-Oct-15	30-Sep-16
535 Off	Deploy New Technology for Fugitive Vapor Sources (SC3) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 4-SC4		19-May-14 A	30-Sep-19
550 FY15	Evaluate Hand Held Tech. for Fugitive Emissions (SC4)	19-May-14 A	17-Dec-14
550 FY16	Test Hand Held Tech. for Fugitive Emissions (SC4)	01-Oct-15	30-Sep-16
550 Off	Deploy and Maintain Hand Held Tech. for Fugitive Emissions (SC4) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 5-SC5		15-Sep-14 A	30-Sep-19
560 FY15	Evaluate Alarming and Communication Devices (SC5)	15-Sep-14 A	20-Mar-15
560 FY16	Test Alarming and Communication Devices (SC5)	01-Oct-15	30-Sep-16
560 Off	Deploy and Maintain Alarming and Communication Devices (SC5) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 6-EA1		19-May-14 A	30-Sep-19



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Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
490 CVST	Technology Improvements Evaluation and Recommendation (CVST)	19-May-14 A	30-Sep-14 A
495 CVST	Procure Additional Respiratory Protection Equipment and Stream Line Process (CVST)	26-May-14 A	30-Sep-14 A
520 FY15	Evaluate Real-Time Detection Technologies (EA1)	15-Aug-14 A	20-Mar-15
500 CVST 15	Maintain Respiratory Protection Equipment and Stream Line Process (CVST)	01-Oct-14 A	20-Mar-15
790	Pilot Employee Monitoring / Detection Instrumentation (DRI, Grab Bag Sampling Devices, Alarming Devices)	23-Mar-15	18-Jun-15
770	Develop IH Personnel Instrument Requirements and Specifications	23-Mar-15	17-Jul-15
CAA-CVR1088	222S Lab Upgrades and Analytical Costs Vapors Sampling (Suma Cans)	23-Mar-15	29-Sep-15
780	IH Personnel Instrument Delivery	20-Jul-15	17-Aug-15
520 FY16	Evaluate Real-Time Detection Technologies (EA1)	01-Oct-15	07-Dec-15
500 CVST 16	Maintain respiratory protection equipment and stream line process (CVST)	01-Oct-15	30-Sep-16
525 FY16	Test Real-Time Detection Technologies (EA1)	08-Dec-15	30-Sep-16
525 Off	Deploy Real-Time Detection Technologies (EA1) (Off Contract)	03-Oct-16	30-Sep-19
505 CVST Off	Maintain Respiratory Protection Equipment and Stream Line Process (CVST) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 7-EA2		23-Mar-15	31-Mar-16
390 FY15	Review and Update The Droppo 2004, PNNL Study	23-Mar-15	30-Sep-15
355 FY15	Develop Sampling Strategy for Reactive VOAs, Aerosols, Etc.(EA2)	22-May-15	30-Sep-15
345 FY15	Develop Field Stability and Recovery Study (EA2)	22-May-15	30-Sep-15
355 FY16	Develop Sampling Strategy for Reactive VOAs, Aerosols, Etc.(EA2)	01-Oct-15	31-Mar-16
345 FY16	Develop Field Stability and Recovery Study (EA2)	01-Oct-15	31-Mar-16
TVAT 8-EA3		01-Oct-14	29-Sep-15
800 FY15	Engineered Features and Comprehensive Dispersion Modeling DQO (CVST)	01-Oct-14	20-Mar-15
330	Develop and Evaluate Modeling Including CFD to Predict Bolus Exposures and the Effectiveness of Stack Heights (EA3)	23-Mar-15	29-Sep-15
TVAT 9-DR1		01-Apr-14 A	30-Sep-19
190	CVST - Data Mining and Analysis	01-Apr-14 A	05-Dec-14
CAA-CVR398	222S Lab Vapors Sampling	23-Mar-15	30-Sep-15
245 FY15	Sample Tank Headspace during Waste Disturbing Activities (DR1)	09-Jul-15	25-Sep-15
255 FY15	Sample Tank Exhaust Stacks During Waste Disturbing Activities (DR1)	09-Jul-15	25-Sep-15

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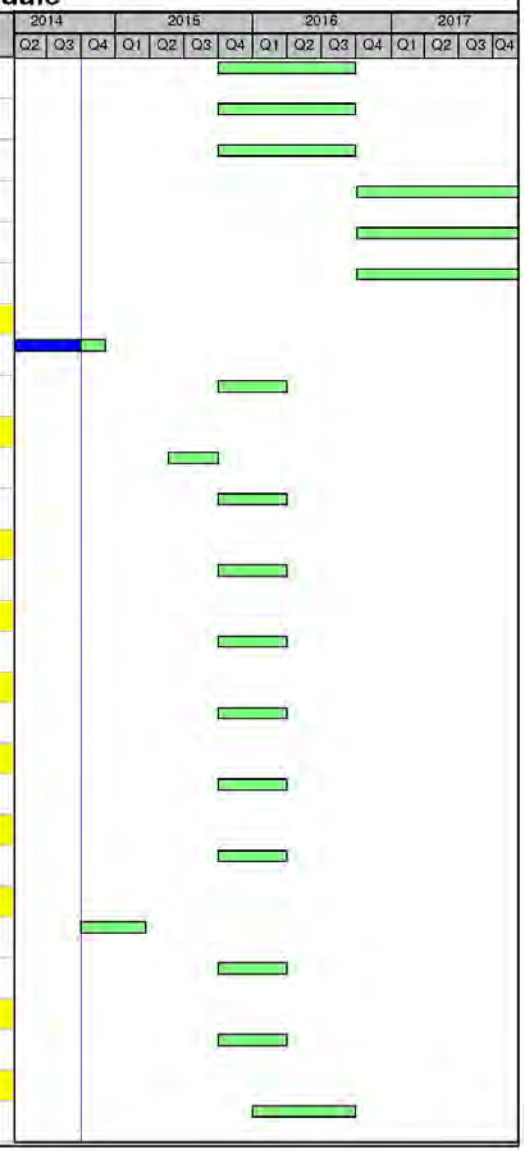
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
245 FY16	Sample Tank Headspace during Waste Disturbing Activities (DR1)	01-Oct-15	30-Sep-16
255 FY16	Sample Tank Exhaust Stacks During Waste Disturbing Activities (DR1)	01-Oct-15	30-Sep-16
CAA-CVR400	222S Lab Vapors Sampling	01-Oct-15	30-Sep-16
245 Off	Sample Tank Headspace During Waste Disturbing Activities (DR1) (Off Contract)	03-Oct-16	30-Sep-19
255 Off	Sample Tank Exhaust Stacks During Waste Disturbing Activities (DR1) (Off Contract)	03-Oct-16	30-Sep-19
CAA-CVR402	222S Lab Vapors Sampling	03-Oct-16	30-Sep-19
TVAT 10-DR2		01-Apr-14 A	31-Mar-16
191	CVST - Data Mining and Analysis	01-Apr-14 A	05-Dec-14
265 FY16	Evaluate / Update COPC Listing (DR2)	01-Oct-15	31-Mar-16
TVAT 11-DR3		22-May-15	31-Mar-16
275 FY15	Toxicological Study of Tank Chemical Mixtures (DR3)	22-May-15	30-Sep-15
275 FY16	Toxicological Study of Tank Chemical Mixtures (DR3)	01-Oct-15	31-Mar-16
TVAT 12-DR4		01-Oct-15	31-Mar-16
285 FY16	Eval. Bolus Odor Threshold and Toxicity Effect Levels for COPC's (DR4)	01-Oct-15	31-Mar-16
TVAT 13-DR5		01-Oct-15	31-Mar-16
365 FY16	Develop / Update aCOPCs (DR5)	01-Oct-15	31-Mar-16
TVAT 14-DR6		01-Oct-15	31-Mar-16
375 FY16	Evaluate Medical Surveillance Program (DR6)	01-Oct-15	31-Mar-16
TVAT 15-DR7		01-Oct-15	31-Mar-16
295 FY16	Perform Assessment of Mixture Effects (DR7)	01-Oct-15	31-Mar-16
TVAT 16-DR8		01-Oct-15	31-Mar-16
305 FY16	Aerosol Evaluation (DR8)	01-Oct-15	31-Mar-16
TVAT 17-DR9		01-Oct-14	31-Mar-16
750 FY15	Evaluate Potential Research on Epidemiology at National Labs / Universities (DR9)	01-Oct-14	20-Mar-15
750 FY16	Evaluate Potential Research on Epidemiology at National Labs / University (DR9)	01-Oct-15	31-Mar-16
TVAT 18-RCH1		01-Oct-15	31-Mar-16
315 FY16	OEL Development for COPC's (RCH1)	01-Oct-15	31-Mar-16
TVAT 19-RCH2		30-Dec-15	30-Sep-19
760 FY16	Perform Toxicological Testing and Study on Tank Vapors (RCH2)	30-Dec-15	30-Sep-16



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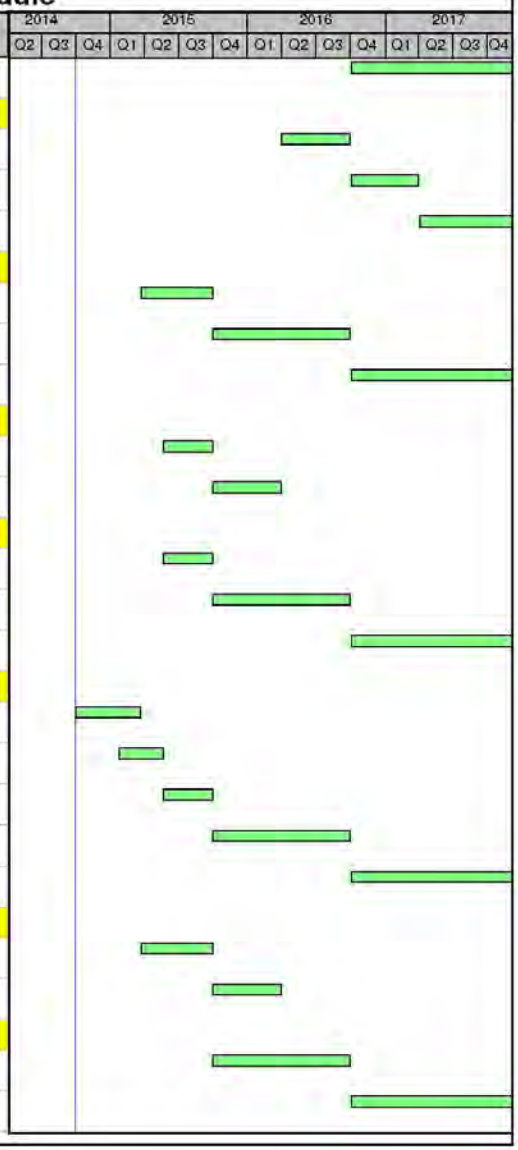
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
760 OFF	Perform Toxicological Testing and Study on Tank Vapors (RCH2) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 20-RCH3		01-Apr-16	30-Mar-18
385 FY16	Re-characterize the Hazard and Risk Index (RCH3)	01-Apr-16	30-Sep-16
385 Off	Provide Toxicological Testing Results to DOE to Update Hazard Index and Risk Report (RCH3)	03-Oct-16	31-Mar-17
390 Off	DOE to Update Hazard Index and Risk Report	03-Apr-17	30-Mar-18
TVAT 21-RCH4a		23-Mar-15	30-Sep-19
335	Develop and Implement IH Routine Program for SST / DST (RCH4A)	23-Mar-15	29-Sep-15
900 FY16	Maintain IH Routine Program for SST / DST (RCH4A)	01-Oct-15	30-Sep-16
900 OFF	Maintain IH Routine Program for SST / DST (RCH4A) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 22-RCH4b		22-May-15	31-Mar-16
395 FY15	Perform Assessment on Acute High Concentration, Episodic Exposures (Bolus) (RCH4B)	22-May-15	30-Sep-15
395 FY16	Perform Assessment on Acute High Concentration, Episodic Exposures (Bolus) (RCH4B)	01-Oct-15	31-Mar-16
TVAT 23-RCH4c		22-May-15	30-Sep-19
405 FY15	Perform Epidemiological Assessment on Acute Episodic Exposures (Bolus) (RCH4C)	22-May-15	30-Sep-15
405 FY16	Perform Epidemiological Assessment on Acute Episodic Exposures (Bolus) (RCH4C)	01-Oct-15	30-Sep-16
405 Off	Perform Epidemiological Assessment on Acute Episodic Exposures (Bolus) (RCH4C) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 24, 25, 26-RM1a		01-Oct-14 A	30-Sep-19
130	Ensure Appropriate Funding and Resources are Available to Implement the Plan (RM1A)	01-Oct-14 A	20-Mar-15
645	Hire and Train Additional IH Staff (RM1A)	26-Jan-15	21-May-15
660 FY15	Recruit, Hire & Maintain Additional IH Professionals (RM1A)	22-May-15	30-Sep-15
660 FY16	Maintain Additional IH Professionals (RM1A)	01-Oct-15	30-Sep-16
660 Off	Maintain Additional IH Professionals (RM1A) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 27-RM1d		23-Mar-15	31-Mar-16
200 FY15	Perform GAP Analysis on 10 CFR 835 and 10 CFR 851 (RM1E)	23-Mar-15	29-Sep-15
200 FY16	Perform GAP Analysis on 10 CFR 835 and 10 CFR 851 (RM1E)	01-Oct-15	31-Mar-16
TVAT 28-RM1e		01-Oct-15	30-Sep-19
240 FY16	IH Manual Development (RM1e)	01-Oct-15	30-Sep-16
240 Off	IH Manual Development (RM1e) (Off Contract)	03-Oct-16	30-Sep-19



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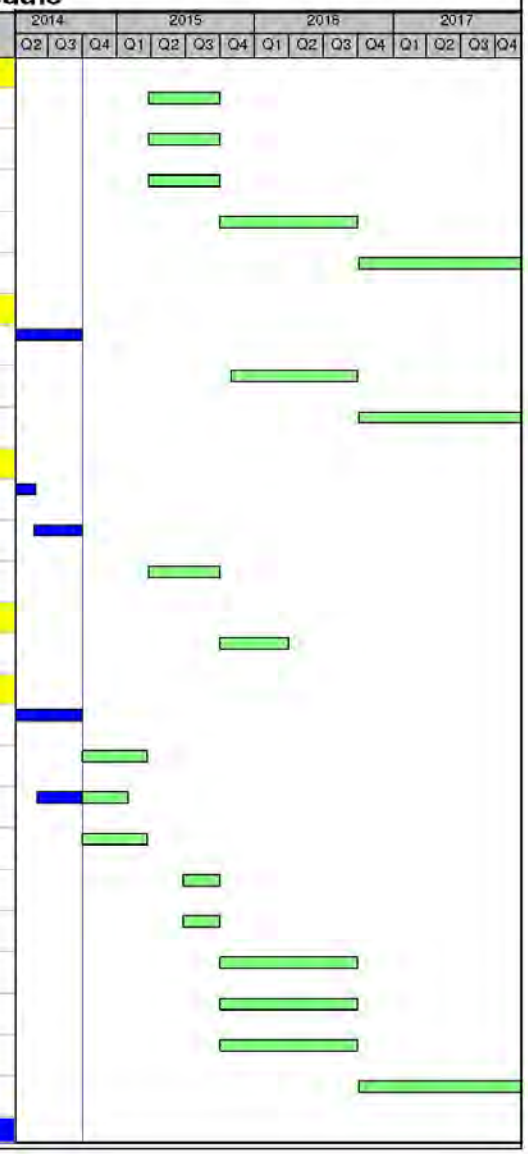
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
TVAT 29-RM2		23-Mar-15	30-Sep-19
205	Develop R2/A2 for Chem ALARA and enhance IH work control involvement (RM1B & RM1C)	23-Mar-15	29-Sep-15
820 FY15	Develop Chem Vapor 1 and 2 Training (RM2)	23-Mar-15	29-Sep-15
840 FY15	Develop Chem Vapor Manual and Procedures (RM2)	23-Mar-15	29-Sep-15
840 FY16	Implement and Maintain Chem Vapor Manual and Procedures (RM2)	01-Oct-15	30-Sep-16
840 Off	Maintain Chem Vapor Manual and Procedures (RM2) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 30-RM3		01-Apr-14 A	30-Sep-19
625 CVST	Chemical Vapor Training (CVST)	01-Apr-14 A	30-Sep-14 A
650 FY16	Implement and Maintain Worker Chemical Awareness Training (RM3)	28-Oct-15	30-Sep-16
650 Off	Maintain Worker Chemical Awareness Training (RM3) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 31-RM4		01-Apr-14 A	29-Sep-15
445 CVST	Implement Low Threshold Vapor Controls Through the General Hazard Analysis and Respiratory Protection Program (CVST)	01-Apr-14 A	30-May-14 A
640 CVST	Chemical Vapors - 222S Labs Sampling (CVST)	26-May-14 A	30-Sep-14 A
210	Develop Chem ALARA Program and Associated Performance Indicators (RM4)	23-Mar-15	29-Sep-15
TVAT 32-RM5		01-Oct-15	31-Mar-16
415 FY16	Update TF Docs for Short Term Exposures (RM5)	01-Oct-15	31-Mar-16
TVAT 33-RM6		04-Apr-14 A	30-Sep-19
450 CVST	Down-Select Additional IH Technologies for Tank Farms (CVST)	04-Apr-14 A	30-Sep-14 A
RM6 LOE10	RM6 Hammock	04-Apr-14 A	20-Mar-15
580 CVST	Data Mining and Analysis, Evaluation, and Recommendation (CVST)	02-Jun-14 A	29-Jan-15
605 FY15	Evaluate New Tech. for Vapor Emission Detection and Control (RM6)	01-Oct-14	20-Mar-15
950 FY15	Asset Monitoring System (AMS) Predictive Maintenance Deployment	22-Jun-15*	30-Sep-15
960 FY15	Wireless Leak Detector Deployment	22-Jun-15*	30-Sep-15
605 FY16	Evaluate New Tech. for Vapor Emission Detection and Control (RM6)	01-Oct-15	30-Sep-16
950 FY16	Asset Monitoring System (AMS) Predictive Maintenance Deployment	01-Oct-15	30-Sep-16
960 FY16	Wireless Leak Detector Deployment	01-Oct-15	30-Sep-16
605 Off	Test New Tech. for Vapor Emission Detection and Control / Implementation and Maintenance (RM6) (Off Contract)	03-Oct-16	30-Sep-19
New Technology		26-Jan-15	29-Nov-16



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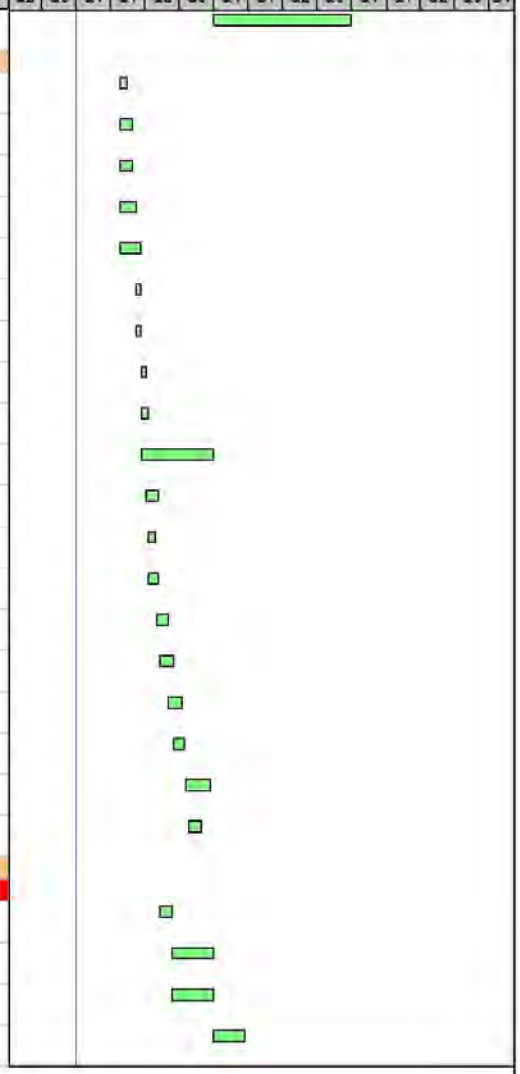
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
PM30	New Technology Engineering Task Management	01-Oct-15	30-Sep-16
Engineering Task Management		26-Jan-15	30-Sep-15
CAA-CVR598	Team Mobilization and Orientation	26-Jan-15	13-Feb-15
CAA-CVR608	Prepare and Award Procurement for PNNL to Support CVST Technologies Bench Scale Testing	26-Jan-15	27-Feb-15
CAA-CVR618	Prepare SOW and Award Procurement to Safer Systems (Phase 1) (Prep)	26-Jan-15	27-Feb-15
CAA-CVR628	Develop Group 1 Requirements and Specifications (OP FTIR, UV FTIR, and FLIR Bench / Pilot Testing Contractor)	26-Jan-15	09-Mar-15
PM10	New Technology Engineering Task Management	26-Jan-15	20-Mar-15
CAA-CVR1278	Prepare SOW Develop Group 1 Procurements (OP FTIR, UV FTIR, and FLIR Bench / Pilot Testing Contractor) Phase 1 (SVT)	10-Mar-15	20-Mar-15
CAA-CVR1308	Develop Group 2 Requirements and Specs (Fixed Point Sensors, SUMMA Canister, Meteorological, and Haz-scanner) Phase 1	10-Mar-15	20-Mar-15
CAA-CVR1048	Prepare SOW Develop Group 1 Procurements (OP FTIR, UV FTIR, and FLIR Bench / Pilot Testing Contractor) Phase 2 (SVT)	23-Mar-15	03-Apr-15
CAA-CVR638	Develop Group 2 Requirements and Specs (Fixed Point Sensors, SUMMA Canister, Meteorological, and Haz-scanner) Phase 2	23-Mar-15	10-Apr-15
PM20	New Technology Engineering Task Management	23-Mar-15	30-Sep-15
CAA-CVR648	Conduct Group 1 Procurements (OP FTIR, UV FTIR, and FLIR Bench / Pilot Testing Contractor) (SVT)	06-Apr-15	08-May-15
CAA-CVR658	Develop Group 3 Requirements and Specifications (N2O Badges, Personal GPS, Bench-Scale, and Pilot-Scale)	13-Apr-15	01-May-15
CAA-CVR1058	Prepare SOW Develop Group 2 Procurements (Fixed Point Sensors, SUMMA Canister, Meteorological, and Haz-scanner) (SVT)	13-Apr-15	08-May-15
CAA-CVR1068	Prepare SOW Develop Group 3 Procurements (N2O Badges, Personal GPS, Bench-Scale, and Pilot-Scale) (SVT)	04-May-15	01-Jun-15
CAA-CVR668	Conduct Group 2 Procurements (Fixed Point Sensors, SUMMA Canister, Meteorological, and Haz-scanner) (SVT)	11-May-15	15-Jun-15
CAA-CVR708	Conduct Group 3 Procurements (Personal GPS, Bench-Scale, and Pilot-Scale) (SVT)	02-Jun-15	07-Jul-15
CAA-CVR1298	Prepare SOW and Award for SME Support (For Bench Scale Testing)	16-Jun-15	14-Jul-15
CAA-CVR1078	SME Support for Bench Scale Testing	20-Jul-15	23-Sep-15
CAA-CVR1288	Prepare SOW and Award Procurement to Safer Systems (Phase 2) (For Bench / Pilot Scale)	27-Jul-15	28-Aug-15
Group 1 Procurement		11-May-15	23-Feb-16
Ultraviolet (UV) FTIR Stack		11-May-15	23-Feb-16
CAA-CVR688	Delivery of Ultraviolet (UV) FTIR	11-May-15	11-Jun-15
CAA-CVR1138	Ultraviolet (UV) FTIR Implementation (Procedure, Software, QA and Training) Phase 1	12-Jun-15	30-Sep-15
CAA-CVR1148	Ultraviolet (UV) FTIR Software Installation and Testing Phase 1	12-Jun-15	30-Sep-15
CAA-CVR778	Ultraviolet (UV) FTIR Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	23-Dec-15



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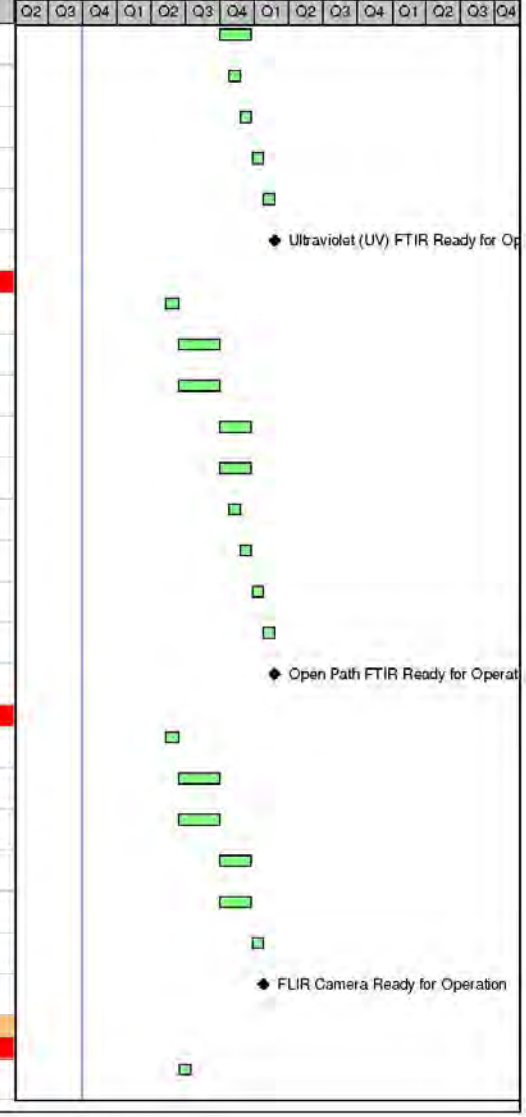
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
CAA-CVR788	Ultraviolet (UV) FTIR Software Installation and Testing Phase 2	01-Oct-15	23-Dec-15
CAA-CVR988	Engineering Design for Ultraviolet (UV) FTIR Implementation	27-Oct-15	23-Nov-15
CAA-CVR442	Prepare and Release ECN for Ultraviolet (UV) FTIR Implementation	24-Nov-15	23-Dec-15
CAA-CVR444	Prepare and Release Work Package for Ultraviolet (UV) FTIR Implementation	28-Dec-15	25-Jan-16
CAA-CVR446	Ultraviolet (UV) FTIR Installation	26-Jan-16	23-Feb-16
CAA-CVR450	Ultraviolet (UV) FTIR Ready for Operation		23-Feb-16
Open Path FTIR (Fourier Transform Infared) Spectrometer		11-May-15	23-Feb-16
CAA-CVR678	Delivery of Open Path FTIR	11-May-15	11-Jun-15
CAA-CVR1158	Open Path FTIR Implementation (Procedure, Software, QA and Training) Phase 1	12-Jun-15	30-Sep-15
CAA-CVR1168	Open Path FTIR Software Installation and Testing Phase 1	12-Jun-15	30-Sep-15
CAA-CVR758	Open Path FTIR Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	23-Dec-15
CAA-CVR768	Open Path FTIR Software Installation and Testing Phase 2	01-Oct-15	23-Dec-15
CAA-CVR978	Engineering Design for Open Path FTIR Implementation	27-Oct-15	23-Nov-15
CAA-CVR424	Prepare and Release ECN for Open Path FTIR Implementation	24-Nov-15	23-Dec-15
CAA-CVR426	Prepare and Release Work Package for Open Path FTIR Implementation	28-Dec-15	25-Jan-16
CAA-CVR428	Open Path FTIR Installation	26-Jan-16	23-Feb-16
CAA-CVR432	Open Path FTIR Ready for Operation		23-Feb-16
FLIR Camera		11-May-15	25-Jan-16
CAA-CVR698	Delivery of FLIR Camera	11-May-15	11-Jun-15
CAA-CVR1178	FLIR Camera Implementation (Procedure, Software, QA and Training) Phase 1	12-Jun-15	30-Sep-15
CAA-CVR1188	FLIR Camera Software Installation and Testing Phase 1	12-Jun-15	30-Sep-15
CAA-CVR798	FLIR Camera Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	23-Dec-15
CAA-CVR808	FLIR Camera Software Installation and Testing Phase 2	01-Oct-15	23-Dec-15
CAA-CVR998	Engineering Design for FLIR Camera Implementation	28-Dec-15	25-Jan-16
CAA-CVR520	FLIR Camera Ready for Operation		25-Jan-16
Group 2 Procurement		16-Jun-15	21-Mar-16
Fixed Point Sensors (REA Guard 2 and MSA Chemguard)		16-Jun-15	21-Mar-16
CAA-CVR728	Delivery of Fixed Point Sensors	16-Jun-15	17-Jul-15



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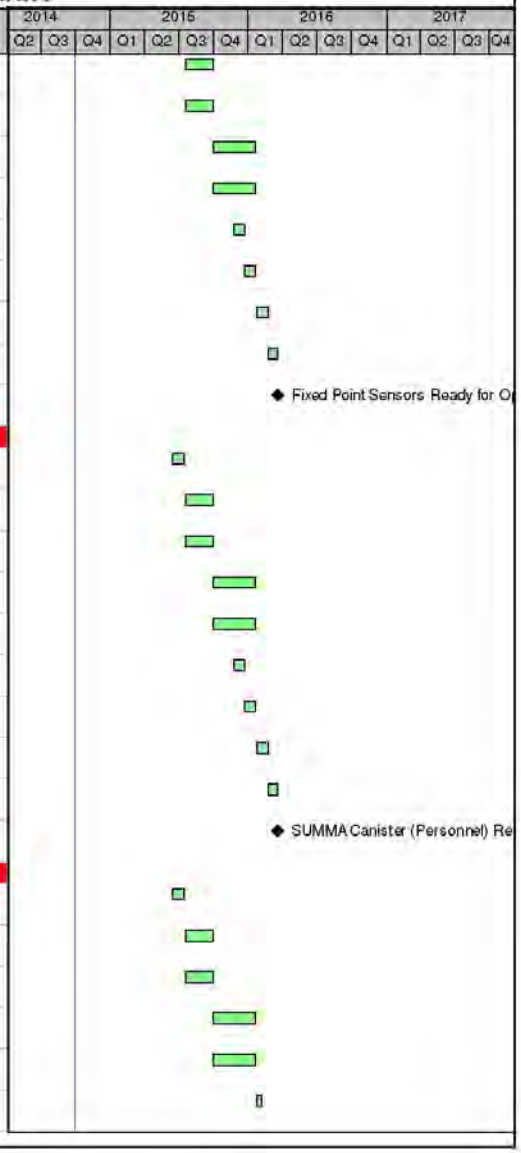
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
CAA-CVR1098	Fixed Point Sensors Implementation (Procedure, Software, QA and Training) Phase 1	20-Jul-15	30-Sep-15
CAA-CVR1108	Fixed Point Sensors Software Installation and Testing Phase 1	20-Jul-15	30-Sep-15
CAA-CVR858	Fixed Point Sensors Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	22-Jan-16
CAA-CVR868	Fixed Point Sensors Software Installation and Testing Phase 2	01-Oct-15	22-Jan-16
CAA-CVR476	Engineering Design for Fixed Point Sensors Implementation	23-Nov-15	22-Dec-15
CAA-CVR478	Prepare and Release ECN for Fixed Point Sensors Implementation	23-Dec-15	22-Jan-16
CAA-CVR480	Prepare and Release Work Package for Fixed Point Sensors Implementation	25-Jan-16	22-Feb-16
CAA-CVR482	Fixed Point Sensors Installation	23-Feb-16	21-Mar-16
CAA-CVR486	Fixed Point Sensors Ready for Operation		21-Mar-16
SUMMA Canister (Personnel)		16-Jun-15	21-Mar-16
CAA-CVR718	Delivery of SUMMA Canister (Personnel)	16-Jun-15	17-Jul-15
CAA-CVR1118	SUMMA Canister (Personnel) Implementation (Procedure, Software, QA and Training) Phase 1	20-Jul-15	30-Sep-15
CAA-CVR1128	SUMMA Canister (Personnel) Software Installation and Testing Phase 1	20-Jul-15	30-Sep-15
CAA-CVR838	SUMMA Canister (Personnel) Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	22-Jan-16
CAA-CVR848	SUMMA Canister (Personnel) Software Installation and Testing Phase 2	01-Oct-15	22-Jan-16
CAA-CVR458	Engineering Design for SUMMA Canister (Personnel) Implementation	23-Nov-15	22-Dec-15
CAA-CVR460	Prepare and Release ECN for SUMMA Canister (Personnel) Implementation	23-Dec-15	22-Jan-16
CAA-CVR462	Prepare and Release Work Package for SUMMA Canister (Personnel) Implementation	25-Jan-16	22-Feb-16
CAA-CVR464	SUMMA Canister (Personnel) Installation	23-Feb-16	21-Mar-16
CAA-CVR468	SUMMA Canister (Personnel) Ready for Operation		21-Mar-16
Haz-Scanner		16-Jun-15	05-Feb-16
CAA-CVR748	Delivery of Haz-Scanner	16-Jun-15	17-Jul-15
CAA-CVR1198	Haz-Scanner Implementation (Procedure, Software, QA and Training) Phase 1	20-Jul-15	30-Sep-15
CAA-CVR1208	Haz-Scanner Software Installation and Testing Phase 1	20-Jul-15	30-Sep-15
CAA-CVR878	Haz-Scanner Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	22-Jan-16
CAA-CVR888	Haz-Scanner Software Installation and Testing Phase 2	01-Oct-15	22-Jan-16
CAA-CVR498	Haz-Scanner Installation	25-Jan-16	05-Feb-16



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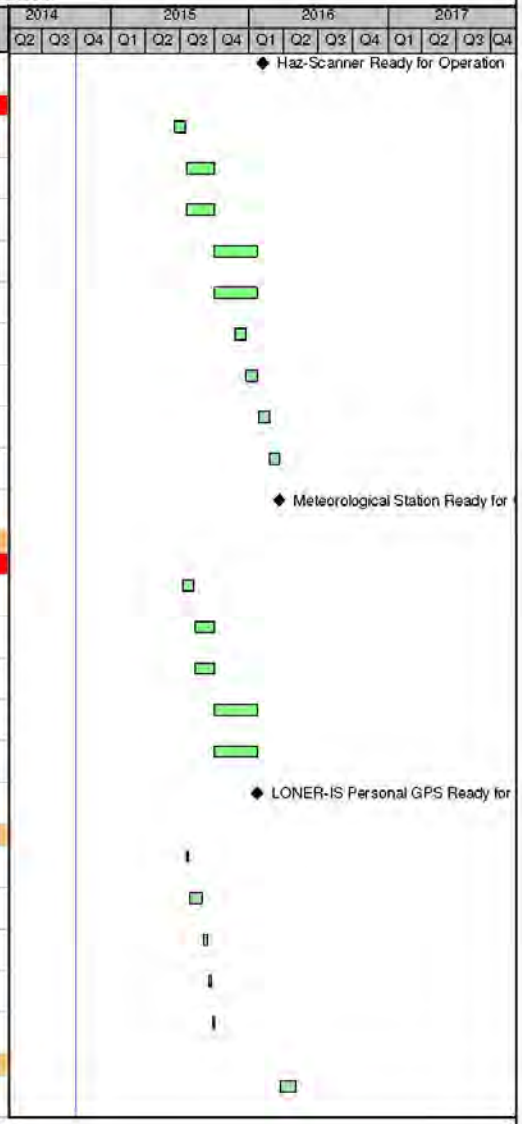
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
CAA-CVR502	Haz-Scanner Ready for Operation		05-Feb-16
Meteorological Station		16-Jun-15	21-Mar-16
CAA-CVR738	Delivery of Meteorological Station	16-Jun-15	17-Jul-15
CAA-CVR1218	Meteorological Station Implementation (Procedure, Software, QA and Training) Phase 1	20-Jul-15	30-Sep-15
CAA-CVR1228	Meteorological Station Software Installation and Testing Phase 1	20-Jul-15	30-Sep-15
CAA-CVR898	Meteorological Station Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	22-Jan-16
CAA-CVR908	Meteorological Station Software Installation and Testing Phase 2	01-Oct-15	22-Jan-16
CAA-CVR564	Engineering Design for Meteorological Station Implementation	23-Nov-15	22-Dec-15
CAA-CVR566	Prepare and Release ECN for Meteorological Station Implementation	23-Dec-15	22-Jan-16
CAA-CVR568	Prepare and Release Work Package for Meteorological Station Implementation	25-Jan-16	22-Feb-16
CAA-CVR570	Meteorological Station Installation	23-Feb-16	21-Mar-16
CAA-CVR574	Meteorological Station Ready for Operation		21-Mar-16
Group 3 Procurement		08-Jul-15	22-Jan-16
Loner IS Personal GPS		08-Jul-15	22-Jan-16
CAA-CVR818	Delivery of LONER-IS Personal GPS	08-Jul-15	07-Aug-15
CAA-CVR1248	LONER-IS Personal GPS Implementation (Procedure, Software, QA and Training) Phase 1	10-Aug-15	30-Sep-15
CAA-CVR1258	LONER-IS Personal GPS Software Installation and Testing Phase 1	10-Aug-15	30-Sep-15
CAA-CVR928	LONER-IS Personal GPS Implementation (Procedure, Software, QA and Training) Phase 2	01-Oct-15	22-Jan-16
CAA-CVR938	LONER-IS Personal GPS Software Installation and Testing Phase 2	01-Oct-15	22-Jan-16
CAA-CVR556	LONER-IS Personal GPS Ready for Operation		22-Jan-16
Bench-Scale Testing		20-Jul-15	30-Sep-15
CAA-CVR828	Safer Systems Perform Siting Study for CVST Technologies Bench Scale Testing	20-Jul-15	24-Jul-15
CAA-CVR918	Safer Systems Set-up to Perform CVST Technologies Bench Scale Testing	27-Jul-15	27-Aug-15
CAA-CVR948	Safer Systems Perform CVST Technologies Bench Scale Testing	31-Aug-15	11-Sep-15
CAA-CVR958	Safer Systems Document CVST Technologies Bench Scale Testing Results	14-Sep-15	24-Sep-15
CAA-CVR968	Revise TRL Assessment of CVST Technologies Based on Bench Scale Testing	25-Sep-15	30-Sep-15
Pilot-Scale Testing		22-Mar-16	29-Nov-16
CAA-CVR1038	Install the modeling Software and integrate with site systems	22-Mar-16	02-May-16



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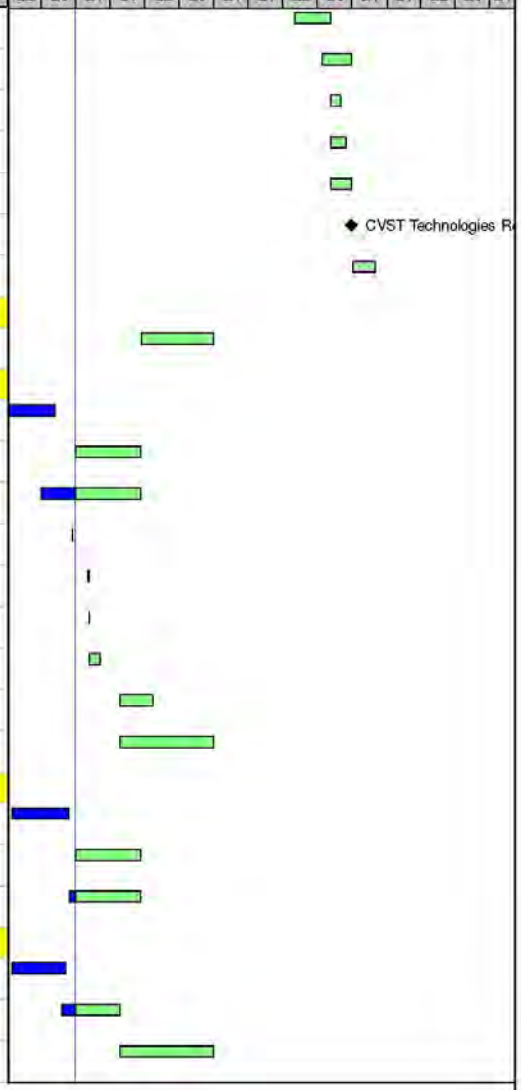
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
CAA-CVR590	Perform Integrated System Field Tests	03-May-16	04-Aug-16
600 FY16	Evaluation of Abatement Technology (RM6)	14-Jul-16	30-Sep-16
CAA-CVR592	Finalize Field System Configuration	05-Aug-16	01-Sep-16
CAA-CVR1268	Pilot Scale Report	05-Aug-16	15-Sep-16
CAA-CVR594	Revise TRL Assessment of CVST Technologies Based on Pilot Scale Testing	05-Aug-16	30-Sep-16
CAA-CVR596	CVST Technologies Ready to Implement in Field		30-Sep-16
600 Off	Evaluation of Abatement Technology (RM6) (Off Contract)	03-Oct-16	29-Nov-16
TVAT 34-RM7a		23-Mar-15	30-Sep-15
705 FY15	Evaluate Protocols for Establishing VCZ / VRZ (RM7A)	23-Mar-15	30-Sep-15
TVAT 35-RM7b		04-Apr-14 A	30-Sep-15
325 CVST	Streamline of PPE Evaluation & Recommendation (CVST)	04-Apr-14 A	06-Aug-14 A
RM7B LOE	RM7b Hammock	04-Apr-14 A	20-Mar-15
485	Evaluate Existing Inventory of Respiratory Protection Equipment to Determine Effectiveness (RM7B)	30-Jun-14 A	20-Mar-15
455	Expanded Requirements for Half and Full Face Respiratory Protection Equipment within SST's (RM7B)	22-Sep-14 A	24-Sep-14 A
460	Implementation of Supplied Air- CBA (RM7B)	03-Nov-14	04-Nov-14
465	Develop Evaluation Plan for Chem Cartridges Full-time Field Use (RM7B)	04-Nov-14	06-Nov-14
470	Perform Evaluation Plan for Chem Cartridges for Full-time Field Use (RM7B)	06-Nov-14	04-Dec-14
480	Implement Communications Plan for Evaluation Process of Chem Cartridges (RM7B)	26-Jan-15	23-Apr-15
475	Develop Communications Plan for Evaluation Process of Chem Cartridges (RM7B)	26-Jan-15	30-Sep-15
TVAT 36-RM8		15-Apr-14 A	20-Mar-15
425	Medical Protocol and Communications Evaluation & Recommendation	15-Apr-14 A	11-Sep-14 A
RM8 LOE	RM8 Hammock	15-Apr-14 A	20-Mar-15
435	Clarify with Medical Stakeholders Regarding the Limitations on Monitoring Data (RM8)	15-Sep-14 A	20-Mar-15
TVAT 37-RM9		15-Apr-14 A	30-Sep-15
630 CVST	Event Response Improvements Evaluation and Recommendation (CVST)	15-Apr-14 A	03-Sep-14 A
730	Establish and Implement an Action Tracking Mechanism for IH Improvements (RM9)	25-Aug-14 A	23-Jan-15
730 FY15	Establish and Implement an Action Tracking Mechanism for IH Improvements (RM9)	26-Jan-15	30-Sep-15



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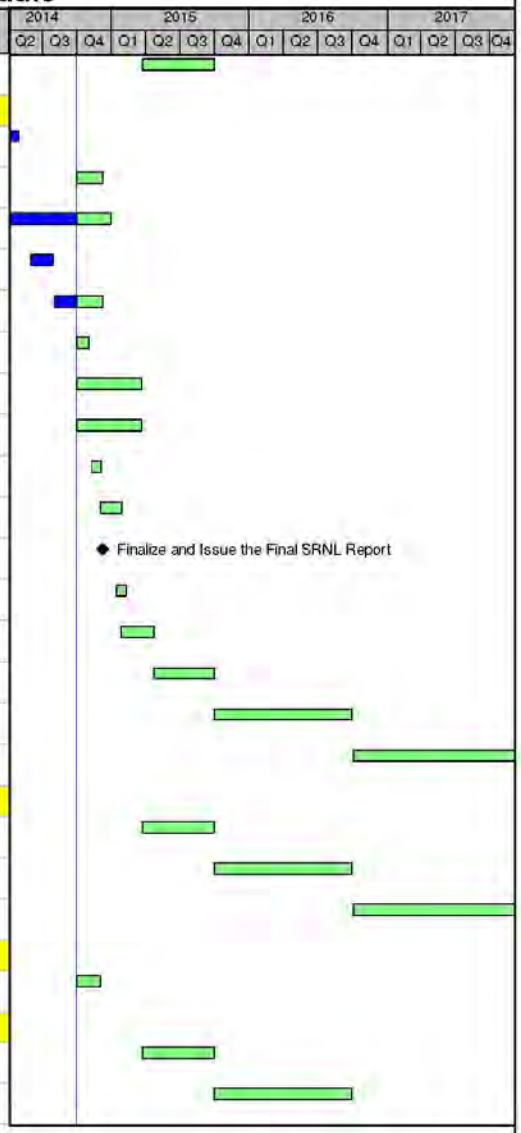
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
585	Evaluate Valving / Ventilation Process During Waste Disturbing Operations (NT5)	23-Mar-15	30-Sep-15
TVAT 38-RM10		01-Apr-14 A	30-Sep-19
100 CVST	Revitalize the CVST	01-Apr-14 A	30-Apr-14 A
RM10 LOE	RM10 Hammock	01-Apr-14 A	08-Dec-14
105 CVST	Initiated Formal Common Cause Analysis	01-Apr-14 A	31-Dec-14
115 CVST	Chartered the TVAT	02-Jun-14 A	31-Jul-14 A
120	TVAT Conduct the Assessment	01-Aug-14 A	08-Dec-14
140	Issue a Statement from Sr Mgmt Accepting the Recommendations From the TVAT (RM10)	01-Oct-14	03-Nov-14
135	Senior Management Meeting with IH Staff (RM10)	01-Oct-14 A	20-Mar-15
810 FY15	Initiate and Maintain Chem ALARA Sub-Team (RM10)	01-Oct-14	20-Mar-15
145	Present Implementation Plan to CVST (RM10)	10-Nov-14	05-Dec-14
660	Establish an Independent Expert Panel to Monitor Implementation	01-Dec-14	28-Jan-15
155	Finalize and Issue the Final SRNL Report		08-Dec-14
150	Present Implementation Plan to ESRB (RM10)	15-Jan-15*	09-Feb-15
PM FY15	Project Management (FY 15)	26-Jan-15	23-Apr-15
PM FY26	Project Management (FY 15)	24-Apr-15	30-Sep-15
PM FY16	Project Management (FY 16)	01-Oct-15	30-Sep-16
PM Off	Project Management (Off Contract)	03-Oct-16	30-Sep-19
TVAT 39-RC1		23-Mar-15	30-Sep-19
740 FY15	Develop and Implement a Communication Strategy for External Stakeholder Communications (RC1)	23-Mar-15	30-Sep-15
740 FY16	Develop and Implement a Communication Strategy for External Stakeholder Communications (RC1)	01-Oct-15	30-Sep-16
740 Off	Develop and Implement a Communication Strategy for External Stakeholder Communications (RC1) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 40-RC2		01-Oct-14	01-Dec-14
720	Enhance the EJTA Program (RC2)	01-Oct-14	01-Dec-14
TVAT 41-RC3		23-Mar-15	30-Sep-19
185 FY15	Implement and Maintain Chem ALARA Program (RC3)	23-Mar-15	30-Sep-15
185 FY16	Implement and Maintain Chem ALARA Program (RC3)	01-Oct-15	30-Sep-16



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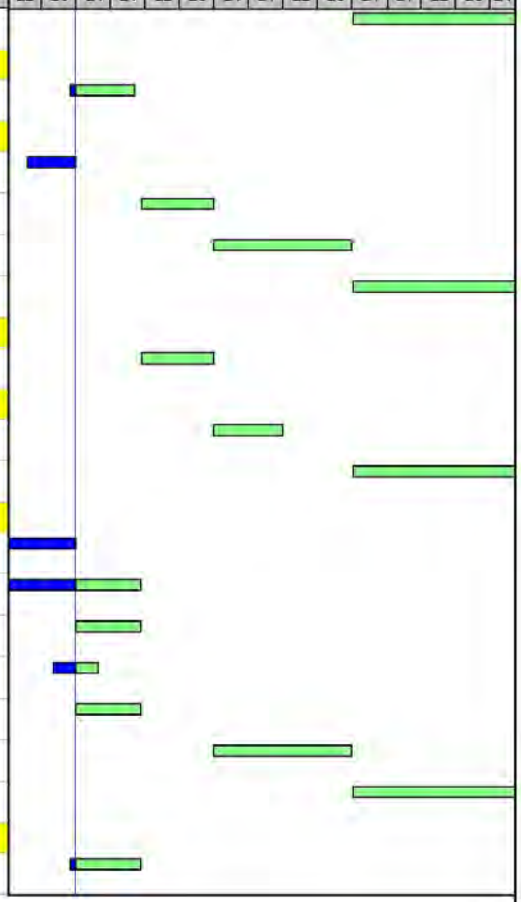
Chemical Vapor Implementation Plan Schedule

Activity ID	Activity Name	Start	Finish
185 Off	Maintain Chem ALARA Program (RC3) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 42-RC4		15-Sep-14 A	05-Mar-15
430	Enhance the Employee Monitoring Notification Letter (RC4)	15-Sep-14 A	05-Mar-15
TVAT 43-RC5		26-May-14 A	30-Sep-19
635 CVST	Design and Development Support(IH Comm Board - Data Visualization) (CVST)	26-May-14 A	30-Sep-14 A
670 FY15	Enhance IH Personnel Training (RC5)	23-Mar-15	30-Sep-15
670 FY16	Maintain IH Personnel Continuous Training (RC5)	01-Oct-15	30-Sep-16
670 Off	Maintain IH Personnel Continuous Training (RC5) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 44-RC6		23-Mar-15	30-Sep-15
725 FY15	Assess SOEN and Communication Systems and Implement Results (RC6)	23-Mar-15	30-Sep-15
TVAT 45-RC7		01-Oct-15	30-Sep-19
695 FY16	Review Determination and Development of SEGs (RC7)	01-Oct-15	31-Mar-16
695 Off	Review Determination and Development of SEGs (RC7) (Off Contract)	03-Oct-16	30-Sep-19
TVAT 46-RC8		01-Apr-14 A	30-Sep-19
160 CVST	Weekly, Monthly, Quarterly Messages from President to Work Force and OHC's	01-Apr-14 A	30-Sep-14 A
110 CVST	Safety Vapor Briefings Conducted (Safety stand down)	01-Apr-14 A	20-Mar-15
RC8 LOE	RC8 Hammock	01-Apr-14 A	20-Mar-15
715	Revise Event Response / Communications (RC8)	01-Aug-14 A	26-Nov-14
165 CVST FY15	Weekly, Monthly, Quarterly Messages from President to Work Force and OHC's	01-Oct-14 A	20-Mar-15
165 CVST FY16	Weekly, Monthly, Quarterly Messages from President to Work Force and OHC's	01-Oct-15	30-Sep-16
165 CVST Off	Weekly, Monthly, Quarterly Messages from President to Work Force and OHC's (CVST)	03-Oct-16	30-Sep-19
TVAT 47-RC9		15-Sep-14 A	20-Mar-15
440	Collaborate with Medical Stakeholders Relating to More Effective Communication Processes (Workers Comp. Program) (RC9)	15-Sep-14 A	20-Mar-15



APPENDIX A

TABLE OF OVERARCHING AND SUPPORTING RECOMMENDATIONS

Listed below for easy reference are the 10 Overarching Recommendations and the 47 supporting recommendations from the six technical assessment areas, followed by a table cross-referencing the recommendations.

OVERARCHING RECOMMENDATIONS

OR1: Hanford site contractor and U.S. Department of Energy (DOE) management actively demonstrate commitment to improve the current program and ultimately resolve the vapor exposure concerns.

OR2: Implement measurable benchmarks to assure operational and cultural parity among chemical vapor, flammability, and radiological control programs.

OR3: Establish a program to sample proactively the head space of tanks to validate and enhance chemical characterization.

OR4: Accelerate development and implementation of a revised Industrial Hygiene (IH) exposure assessment strategy that is protective of worker health and establishes stakeholder confidence in the results for acute as well as chronic exposures.

OR5: Modify the medical case evaluation process and reporting procedures to recognize the appropriate uses and limitations of the available monitoring data and other potential exposure information when evaluations are made regarding tank chemical vapor exposures.

OR6: To reduce the impacts of bolus exposures, utilize real-time personal detection and protective equipment technologies specifically designed to protect individual employees.

OR7: Accelerate implementation of tailored engineering technologies to detect and control vapor emissions and exposures experienced in the Hanford tank farms ("tank farm of the future").

OR8: Augment the Hanford Tank Farm IH programs to further develop competencies to address the tank vapor exposure issues.

OR9: Effectively communicate vapor exposure issues and actions proactively with all stakeholders.

OR10: Investigate and pursue external research opportunities and partnerships to address data and technology gaps related to vapor exposure, effects, and mitigation.

SUPPORTING RECOMMENDATIONS

Site Characterization

SC1: Develop a prioritized program to sample and characterize tank head space composition and stratification during quiescent as well as disturbed conditions.

SC2: Assess the potential for materials to plate or condense in vent risers, stacks, and high-efficiency particulate air (HEPA) filters, and characterize the emissions for each condition.

SC3: Implement technologies to assess fugitive sources of emissions that are not connected to tank head spaces, and characterize the emissions for each non-head space fugitive source.

SC4: Identify and implement new technologies to detect, locate and quantify fugitive and episodic releases.

SC5: Identify and implement new technologies to quantify stack and vent emissions with suitable local alarms so that workers can respond in a timely fashion.

Exposure Assessment

EA1: Continue the development and expedite deployment of new techniques for real-time response and appropriate sampling for short duration intermittent releases.

EA2: Identify and implement sampling and/or *in situ* analytical methods as appropriate for reactive VOCs, submicron aerosol, volatile metal compounds, and volatile metalloid compounds that may be present but would have been missed by past head space sampling and analytical methods.

EA3: Use modeling, including Computational Fluid Dynamics methods, to determine the potential locations, conditions, and next steps in attempting to measure sporadic exposure events.

Dose Response

DR1: Conduct an additional review and re-prioritization of COPCs under tank-disturbing conditions to provide adequate emission characterization, OEL development, and worker exposure surveillance.

DR2: Conduct a rigorous review of the COPC list to ensure it is current, and develop a process to document the mechanisms used to ensure COPC updates and the basis for changes in the COPC list over time.

DR3: Conduct additional evaluations of COPC toxicological studies to provide insight into the sensory and pathophysiological irritation response, including the role of mixture interactions and the potential need for additional toxicological evaluation.

DR4: Perform a comprehensive evaluation of acute odor thresholds and toxicity effect levels for each COPC to facilitate the establishment of action levels based upon the relationship between odor and toxicity thresholds.

DR5: Continue to evaluate COPC OEL's within the context of observed symptomatology versus 10% of the irritation thresholds and develop a "new" acute OEL list.

DR6: Maintain a robust health surveillance program that follows-up with exposed workers to evaluate short- and long-term consequences from vapor exposures.

DR7: Evaluate tank vapor mixture toxicological interactions at concentrations associated with transient plume exposures to modify OELs to accommodate mixture effects.

DR8: Develop an overall IH strategy for aerosol evaluations that focus on analytical quantification, the evaluation of chemical aerosols for inclusion in the COPC list as well as the establishment of appropriate aerosol OELs.

DR9: Develop a research strategy roadmap in partnership with DOE, National Laboratories, and University faculty subject matter experts to address critical questions regarding tank vapor emissions and exposures.

Risk Characterization

RCH1: Identify an OEL-C for each analyte in Hanford tank head space(s).

RCH2: Classify and conduct toxicological testing on a reasonable number of distinct types of Hanford tank head space vapors (e.g., potential classes of tank vapor types such as ammonia rich, ammonia poor, nitrosamine rich).

RCH3: Use the OEL-C from analysis or subsequent toxicological testing to characterize the hazard index and risk from the tank vapor mixtures.

RCH4a: (Chronic) The WRPS IH program has in place procedures for evaluating chronic chemical exposures (based on TWA); it is recommended that more periodic follow-up monitoring be conduct and documented to provide needed data for the industrial hygienist to verify that worker chronic exposures have not changed with time.

RCH4b: (Acute) Transient vapor/gas exposures (i.e. high dose rate) are substantially greater than what is currently measured as a TWA; alternative strategies for evaluating transient plume like vapor exposures is recommended and adherence to excursion limit principles must be implemented (five times OEL).

RCH4c: (Medical Surveillance) Routine medical surveillance is a key workplace evaluation tool needed to predict health impairment from vapor exposures; appropriately designed epidemiology studies focused on tank farm workers are recommended to evaluate the potential long-term health consequences.

Risk Management

RM1a: Provide and manage IH professional and technician staffing levels to properly characterize and assess worker vapor exposure in the tank farms.

RM1b: Provide and manage IH professional and technician staffing levels to participate in all planning, execution and evaluation phases of tank farm work activity, similar to radiological and flammability control functions.

RM1c: Provide and manage IH professional and technician staffing levels to properly recommend and evaluate the effectiveness of work practices, PPE and engineering controls.

RM1d: Provide and manage IH professional and technician staffing levels to effectively inform, advise, and train line functions and address workers concerns regarding tank farm vapors. In addition, available analytical resources should be re-evaluated and increased to assure the timely reporting of sample results associated with tank farm vapors.

RM1e: DOE should increase their focus on chemical hazards and develop more specific implementation guidelines regarding the anticipation, recognition, evaluation and control of chemical hazards, comparable to the focus and rigor given to radiological hazards. Consistent guidance on the implementation of the IH programs in DOE facilities would assist in assuring functional parity with radiological controls at Hanford and other facilities within DOE.

RM2: Achieve functional parity of the IH program with the radiation control program with respect to worker training and core competencies.

RM3: Expand general CHAT training for tank farm workers to be more consistent with the length and intensity of the radiological hazard training currently mandated for all site workers.

RM4: Adequately staff the IH function to assure proper resources is deployed in the planning, pre-job, job execution, and post-job ALARA review in a fashion similar to that of the radiological control function.

RM5: Redefine unacceptable chemical exposure risk to include short-term, episodic exposure to chemicals that can result in adverse health impacts.

RM6: Investigate and implement best available technologies to detect and control vapor plumes from fugitive sources as well as from vents and stacks.

RM7a: Establish a more effective methodology for designating Vapor Control Zones (VCZs) and Vapor Reduction Zones (VRZs).

RM7b: Confirm that air-purifying respiratory protective equipment is effective in reducing exposure to tank vapors below acceptable levels.

RM8: Modify the medical case evaluation process and reporting procedures to recognize the appropriate uses and limitations of the available monitoring data and other potential exposure information when evaluations are made regarding vapor exposures.

RM9: Verify that all programs associated with vapor controls are properly vetted, evaluated, communicated and tracked to ensure timely completion.

RM10: All levels of line management demonstrate that they are committed to reducing the potential for tank farm vapors releases and continuously improving management systems to assure all workers are properly protected.

Risk Communication

RC1: Develop more routine and transparent communications, which offer unsolicited information to the Hanford Challenge, Hanford Concern's Council, and other interested community groups regarding potential health impacts, health and safety risks, and WRPS/DOE efforts to reduce risk to employees and the community.

RC2: Improve the employee job task analysis process with opportunities for worker engagement and buy-in into the process and protective measure assuring the health and safety of the worker.

RC3: Improve the degree of employee involvement in and ultimate acceptance of all teams and programs that are associated with tank farm vapor issues (e.g., PERs, CVST).

RC4: Revise the employee monitoring notification letters to include more relevant information regarding the capabilities and limitations of the technology used to collect and analyze samples, which should include clear definitions for concepts such as "ND" vs. "<LOQ" vs. "<RQL."

RC5: Establish a greater IH technician and professional presence in the tank farms, provide risk-communication training, and improve their ability to communicate with employees.

RC6: Perform an alternatives assessment for the current SOEN process to identify other methods to assure that all workers potentially impacted by vapor events (i.e. WRPS, MSA, visitors, etc.) are immediately alerted of a vapor event and understand what mitigating actions they must take to avoid possible health or safety impacts.

RC7: Deploy appropriate laboratory resources to assure timely analysis and reporting of IH results, and ensure all exposure data is assigned correctly to all members of the SEG.

RC8: Communicate in a timely fashion to all employees the results of incident investigation, including description of event, results of any samples taken, lessons learned, and corrective actions planned and completed.

RC9: Evaluate and improve the communication system associated with vapor events and results of Workers' Compensation claims.

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Appendix A

TABLE OF OVERARCHING AND SUPPORTING RECOMMENDATIONS

Overarching Recommendations Supporting Recommendations	OR 1	OR 2	OR 3	OR 4	OR 5	OR 6	OR 7	OR 8	OR 9	OR 10
SITE CHARACTERIZATION										
SC1			X	X		X	X			
SC2							X			
SC3	X					X	X		X	X
SC4	X		X			X	X		X	X
SC5	X			X		X	X		X	
EXPOSURE ASSESSMENT										
EA1	X			X		X	X		X	X
EA2			X	X		X	X			
EA3	X			X			X			
DOSE-RESPONSE										
DR1		X	X		X	X				X
DR2		X	X		X	X			X	X
DR3		X	X		X	X				X
DR4		X	X		X	X			X	X
DR5		X	X		X	X				X
DR6		X	X		X	X				X
DR7		X	X		X	X				X
DR8		X	X		X	X			X	X
DR9		X	X		X	X				X
RISK CHARACTERIZATION										
RCH1			X	X		X	X			X
RCH2			X	X		X	X			X
RCH3				X		X	X			X
RCH4a				X						
RCH4b			X	X		X	X			X
RCH4c					X					
RISK MANAGEMENT										
RM1a	X		X	X		X	X		X	X
RM1b	X			X		X	X	X	X	
RM1c	X				X	X	X	X	X	
RM1d	X					X	X	X	X	
RM1e	X	X								
RM2	X						X	X	X	
RM3	X						X	X	X	
RM4	X						X	X		
RM5	X		X			X	X	X	X	
RM6					X	X	X			X
RM7a							X	X	X	
RM7b							X	X	X	
RM8	X				X					
RM9	X					X	X	X	X	
RM10	X							X	X	

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Appendix A

TABLE OF OVERARCHING AND SUPPORTING RECOMMENDATIONS

Overarching Recommendations Supporting Recommendations	OR 1	OR 2	OR 3	OR 4	OR 5	OR 6	OR 7	OR 8	OR 9	OR 10
RISK COMMUNICATION										
RC1									X	X
RC2								X	X	
RC3				X		X	X		X	X
RC4				X			X	X	X	
RC5	X						X	X	X	
RC6							X			X
RC7	X							X	X	
RC8	X							X	X	
RC9	X			X				X	X	