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Savannah River Remediation
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Savannah River Remediation Tank Vapor Action Plan

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Background

In October 2014, the Savannah River National Laboratory (SRNL) published a report detailing technical issues and recommendations to better protect workers from exposure to harmful vapors emerging from the high-level waste (HLW) tanks at the Hanford Tank Farms (Wilmarth 2014). This SRNL-led assessment was requested by the Hanford tank farm operating contractor, Washington River Protection Solutions (WRPS), after a number of workers reported symptoms while working on or around the HLW tanks. The Hanford Tank Farm Vapor Assessment Team (TVAT) completed the assessment and issued their report which included 47 supporting recommendations along with 10 overarching recommendations for programmatic and operational improvements.

Savannah River Remediation (SRR), in response to the Hanford report, convened a team to review the technical issues and recommendations from the Hanford assessment report against the SRS Tank Farm facilities and the current SRR Industrial Hygiene (IH) program. This SRR team included a representative from SRR Engineering Programs (as the team lead), the Hanford TVAT lead, SRNS Analytical Laboratories, SRR Industrial Hygiene, and SRR Tank Farm Operations. A member of the Department of Energy-Savannah River (DOE-SR) field office participated as well.

The SRR review was an in-depth evaluation of all recommendations from the Hanford report to determine applicability to the SRS tank farm facilities and to identify where there were gaps in the SRR IH program related to tank vapor management. The evaluation was completed over several weeks and included a review of the Hanford Implementation Plan which was developed by WRPS in response to the TVAT Assessment Report. The SRR review identified 13 potential gaps affecting various aspects of the SRR Industrial Hygiene program for tank vapor management (Thaxton 2015). This action Plan identifies the SRR Plan to respond to each of these gaps.

The 13 gaps are listed below:

1. The most significant technical gap is associated with the exposure assessment strategy that mercury concentrations in air bound other possible contaminants. Improvements to the documentation of this technical basis should include when this strategy is applicable. Compiling the documentation into a single document would provide a resource for IH and operations/engineering.
2. Periodic head space sampling of the waste tanks for non-mercury chemical vapors is not routinely performed. This would help confirm that the mercury hazard bounds the hazard from other chemicals.
3. SRR should ensure that new facilities or processes are adequately evaluated to identify potential new vapor hazards.
4. As a result of mercury concentration increases observed in certain areas, fugitive emissions should be re-examined, with a focus on fugitive emissions when tank ventilation is not operating.

5. Another area of potential improvement has to do with exposure scenarios similar to those postulated to occur at Hanford, e.g., episodic ground-based releases from breathing tanks. Continuous monitoring has not been utilized to rule out episodic releases.
6. There is no methodology established for communicating employee exposure information (from an event) to other members of the Similar Exposure Group (SEG).
7. In the event of a potential exposure, IH does not have a standard protocol for response. As a result, there is inconsistency in what investigative data is gathered and what information is transmitted to Medical (in the case of an employee being sent to Medical for evaluation). Additionally, it is not clear what the proper medical evaluation and follow-up should be for potential vapor exposure events.
8. The team was not able to see where the IH programs have substantially reviewed the exposure data and documented the program results. This is mainly due to lack of IH staffing. No formal documentation could be found concerning proper staffing levels for the IH group, and interviews with IH management and personnel indicate that additional staffing could be utilized for more effective IH program execution.
9. Routine vapor hazard awareness training may be warranted based upon increasing mercury vapor concentrations observed during the last five years. Personnel should be well aware of the increased hazard and the appropriate response to abnormal conditions (e.g., loss of waste tank ventilation). The training and qualification programs for the ventilation engineers do not address the IH technical basis for how the ventilation systems protect potential worker exposures. Also, the awareness of the use of the American Industrial Hygiene Association (AIHA) assessment strategy of Similar Exposure Groups was not understood by the members of the review team outside of the IH members.
10. Post-job IH reviews are not currently part of the IH program.
11. The Employee Notification Reports generated by the IH Database (EISM) should be evaluated for improvements that would more clearly and effectively communicate associated worker exposure results.
12. There are very few mercury samples being taken to reinforce no exposures (and verify effectiveness of existing engineered controls), and to improve longitudinal exposure assessments for workers. While area and job monitoring is routinely performed, personnel exposure monitoring is rarely required. Increased personnel monitoring would be useful in verifying that existing engineered controls are effective.
13. SEG rosters need to be routinely updated to ensure that exposure/hazard communication reaches the target audience.

Action Plan

The following actions were identified by the SRR review team to address the 13 identified gaps. These actions are listed in priority order with target completion dates identified. Each action references (in brackets) the gaps that are addressed by that action.

Action 1:
Develop and implement a sampling plan to more thoroughly document levels of non-mercury chemical vapors in SRS waste tanks. [1, 2]

The basic strategy for executing non-mercury chemical vapor sampling is as follows:

- Perform baseline head space sampling of all waste tanks except for closed tanks and tanks 12 and 16 (waste removal is complete and closure is pending for tanks 12 & 16).
- Perform head space sampling during a representative suite of typical tank evolutions as available (e.g., waste removal, salt dissolution, waste transfers, chemical cleaning).
- Initial sampling will include total volatile organic compounds (VOC), amines, ammonia, and NO_x. Mercury vapor concentrations will also be determined for comparison to levels of non-mercury vapors.

Total analysis costs are estimated to be $65K (assuming radiological release of samples). Time required to complete the sampling plan is estimated to be 18 months.

Based upon results of baseline sampling, the Tank Vapor Team will determine if more detailed sampling is warranted (e.g., Suma Canister analysis to quantify individual VOC constituents). Evaluate data to determine if continued periodic non-mercury vapor sampling is warranted.

Deliverable A1-1: Develop and issue a sampling plan to determine levels of non-mercury chemical vapors in SRS waste tanks.
Target Date: 11/30/2015 Assigned to: Tank Vapor Team

Deliverable A1-2: Develop a technical report to document sample results and evaluate the validity of the SRR exposure assessment strategy that the mercury vapor hazard bounds the hazard from other contaminants.
Target Date: 3 months after completion of sampling Assigned to: Tank Vapor Team

Action 2:
Develop a plan to perform nearly continuous monitoring of mercury vapor concentrations on waste tank tops to help confirm that SRS is not experiencing episodic or fugitive emissions that could put personnel at risk from tank vapors. Executing this plan should also help verify the effectiveness of existing engineered vapor controls (i.e., active ventilation with elevated stacks). [4, 5]

Existing field instrumentation cannot perform continuous monitoring. The Mercury Tracker instrument can collect and store data every second but has limitations on data storage. The Jerome 405 instrument takes a 12 second sample every minute and the Jerome 505 instrument takes a 28 second sample every minute. The Jerome 405 instrument requires an occasional 40 minute regeneration cycle to prevent sensor saturation. While these instruments cannot perform continuous sampling, they are adequate for nearly continuous sampling and should be adequate to obtain the data needed to determine whether SRS is experiencing episodic or fugitive emissions on or around the waste tanks.

Listed below is the basic strategy planned for execution of continuous monitoring.

- Perform 2 sampling evolutions per month
- Each sampling evolution will run for a week (or as long as instrument capability allows)
- Targets for the sampling evolutions will be chosen at the beginning of each quarter
- Instrumentation will require power and protection from rain
- Tanks targeted for sampling evolutions should include:
  - Waste tanks with ventilation systems out of service (bounding condition for episodic releases)
  - Waste tanks with high mercury vapor concentrations (e.g., Tank 22 & DWPF feed tanks) to provide bounding conditions for fugitive emissions and to verify effectiveness of engineered controls)
  - Waste tanks being mixed
- Evaluate data to determine if changes to the current IH tank vapor management program are warranted or if changes to the nearly continuous monitoring plan are warranted.

Deliverable A2-1: Develop and issue a plan to perform nearly continuous monitoring of mercury vapor concentrations on waste tank tops.
Target Date: 1/29/2016 Assigned to: Tank Vapor Team

Deliverable A2-2: Develop a technical report to document the monitoring data and to evaluate the validity of the SRR position that significant episodic and fugitive emissions are not occurring in the SRS Tank Farms. Include data from personnel monitoring (Action 3) in this technical report.
Target Date: 3 months after completion of sampling Assigned to: Tank Vapor Team

Action 3:
Utilize data from personnel monitoring to evaluate worker exposure to mercury vapors. Tank Farm personnel monitoring for mercury exposure has been increased in 2015 as part of the SRR Industrial Hygiene program. Similar to Action 2, personnel monitoring data will help confirm that SRS is not experiencing episodic or fugitive emissions that could put personnel at risk from tank vapors. Additionally, it will help verify the effectiveness of existing engineered vapor controls (i.e., active ventilation with elevated stacks) and provide the data necessary for improved exposure assessments of workers. [4, 5, 12]

The strategy for the SRR program for personnel monitoring for mercury vapors should include the following:

- Utilize passive badge monitors (for total mercury)
- Perform 5 sampling evolutions per month
- Tanks targeted for sampling may include:
  - Waste tanks with ventilation systems out of service
  - Waste tanks with high mercury vapor concentrations (e.g., Tank 22 & DWPF feed tanks)
  - Waste tanks being mixed
- Activities targeted for sampling may include:
  - Routine operator rounds of waste tanks and evaporators
  - Routine operations or maintenance evolutions in the Tank Farms
  - Removal or replacement of equipment from waste tanks (e.g., removal of slurry pumps or transfer pumps)
  - Routine Radiological Protection activities associated with waste tanks and evaporators

Deliverable: Evaluate data to determine if changes to the Industrial Hygiene tank vapor management program are warranted. Include this evaluation as part of the technical report described in deliverable A2-2 (above).

Action 4:
Perform an Industrial Hygiene Manpower Study to determine and validate appropriate IH staffing levels. Consideration should be given to making this an independent study. [8]

Deliverable A4-1: Industrial Hygiene Manpower Study
Target Date: 3/31/2016 Assigned to: Field Safety & Health

Action 5:
Develop and conduct a training briefing to ensure that personnel understand the mercury vapor hazard, especially for waste tanks with high concentrations of mercury vapor. Employees must understand that HEPA filters are not protective for the chemical vapor hazard. Determine the target audience for this training and develop a methodology to ensure that the appropriate personnel receive this training on a specified frequency (e.g., biennially). [9]

Deliverable A5-1: Develop, approve, and issue training package.
Target Date: 6/30/2016 Assigned to: Tank Vapor Team & SRR Training

Deliverable A5-2: Identify personnel requiring this training and complete the training for identified personnel.
Target Date: 9/30/2016 Assigned to: SRR Training

Deliverable A5-3: Develop and execute a methodology to ensure that appropriate personnel receive this training on a specified frequency.
Target Date: 9/30/2016 Assigned to: Tank Vapor Team & SRR Training

Action 6:
Develop and conduct training for Cognizant System Engineers for Ventilation Systems to ensure that they understand the liquid waste vapor management program and how their systems impact the program and help protect personnel from chemical vapor hazards. [9]

Deliverable A6-1: Develop, approve, and issue training package for ventilation system Cognizant System Engineers.
Target Date: 6/30/2016 Assigned to: SRR Engineering Programs & SRR Training

Deliverable A6-2: Complete training for ventilation system Cognizant System Engineers.
Target Date: 8/31/2016 Assigned to: Tank Farm Engineering

Deliverable A6-3: Revise qualification cards for Tank Farm ventilation system engineers to include this training.
Target Date: 11/30/2016 Assigned to: SRR Training

Action 7:
Develop and implement a procedure for responding to potential chemical vapors exposures. The procedure should identify the exposure thresholds for IH referral of affected personnel to medical, the types of data to be collected in case of an event, and communication protocols. [7]

Deliverable A7-1: Issuance of procedure.
Target Date: 9/30/2016 Assigned to: Tank Vapor Team

Action 8:
Enhance the participation of Industrial Hygiene in the Consolidated Hazards Analysis (CHA) process. The intent would be to ensure that chemical hazards are evaluated for 10 CFR 851 compliance in addition to the evaluation for safety basis impacts. [3]

Deliverable A8-1: Provide documentation of implementation actions in STAR Item 2014-CTS-013315.
Target Date: 4/30/2016 Assigned to: SRR Engineering Programs

Action 9:
Evaluate the process used for pre-job and post-job radiological reviews. Determine if this process (or something similar) can be implemented for pre-job and post-job IH reviews. [10]

Deliverable A9-1: Document evaluation in STAR Item 2014-CTS-013315 and document any new actions as applicable.
Target Date: 1/31/2016 Assigned to: Tank Vapor Team

Action 10:
Establish and implement a methodology for communicating exposure information to other members of a Similar Exposure Group (SEG). [6]

Deliverable A10-1: Provide documentation of implementation actions in STAR Item 2014-CTS-013315.
Target Date: 6/30/2016 Assigned to: Industrial Hygiene

Action 11:
Update the SEG rosters and implement a system to provide for regular update of SEG rosters. [13]

Deliverable A11-1: Provide documentation of implementation actions in STAR Item 2014-CTS-013315.
Target Date: 10/30/2016 Assigned to: Industrial Hygiene

Action 12:
Review Employee Notification Reports for changes to make the reports simpler and clearer for the receiving employee. [11]

Deliverable A12-1: Issue revised format for air breathing zone Employee Notification Reports.
Target Date: 6/30/2016 Assigned to: Industrial Hygiene

References

1. Wilmarth, W. R., M. A. Maier, T. W. Armstrong, R. L. Ferry, J. L. Henshaw, R. A. Holland, M. A. Jayjock, M. H. Le, J. C. Rock, and C. Timchalk, "Hanford Tank Vapor Assessment Report," SRNL-RP-2014-00791, Rev. 0, October 30, 2014.

2. Thaxton, G. D., Bumgardner, D. C., Kahal, E. J., Schweder, M. B., Wilmarth, W. R., Stoyle, C. B., "Review of Hanford Tank Vapor Assessment Team Recommendations for Applicability to Savannah River Remediation," SRR-LWE-2015-00050, revision 0, June 2015.

3. Britt, T.E., Crump, S.L., Martin, D.J., Thaxton, G.D., Freed, E.J., "Location of the Principal volatile Organics, Ammonia compounds, Organo-Metallics, and NOx Gases resident in the Tank Farms, X-ESR-H-00020, revision 0, October 25, 2004.