

**BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC**

In re Final RCRA Permit for)	
)	
Evoqua Water Technologies LLC and)	
Colorado River Indian Tribes)	RCRA Appeal No. RCRA 18-01
2523 Mutahar Street)	
Parker, Arizona 85344)	
)	
EPA RCRA ID No. AZD982441263)	

**EVOQUA WATER TECHNOLOGIES LLC'S
PARTIAL RESPONSE TO REGION IX'S POST-HEARING BRIEF**

ATTACHMENT A



July 21, 2014

Via UPS and Electronic Mail

Mike Zabaneh, P.E.
Environmental Engineer/Project Manager
RCRA Permits Office
Lands Division
US EPA Region 9
Mail Code LND-4-2
75 Hawthorne Street
San Francisco, CA 94105

Re: Response to EPA Comments - Permit Application for Evoqua Water Technologies (Formerly Siemens Water Technologies) - EPA ID # AZD 982 441 263, dated April 2012

Dear Mr. Zabaneh

In a letter dated May 15, 2014 and received via certified mail on May 23, the United States Environmental Protection Agency Region 9 (EPA) requested supplemental information regarding the Evoqua Water Technologies (Evoqua) Facility's Resource Conservation and Recovery Act permit application dated April 2012. Enclosed with this cover letter are Evoqua's responses to those requests.

Evoqua thanks EPA for its prior agreement to extend the due date to this response to July 22, 2014 to address these comments.

Included in the enclosure are Evoqua's responses to each comment. In addition, the enclosure contains an attachment which addresses the details behind the summary comments (Comments 8, 9, and 10) regarding the risk assessment. CPF, who completed the original HHRA and Ecological Assessment, was employed to address those specific comments.

Evoqua is also electronically attaching the sections and appendices that were affected by our responses. Each section or appendix which was modified also has been changed to reflect Evoqua Water Technologies' (EWT) name and we have deleted the Siemens Industry, Inc. (SII) references.



We appreciate the opportunity to address the comments. Please let me know if you have any further questions.

Sincerely

Original Signed

Monte McCue
Director of Plant Operations
Evoqua Water Technologies

Cc: Mr. Wilfred Nabahe, CRIT Environmental Officer

Evoqua Response to Request for Information and Comments on the April 2012 Permit Application Submittal for Evoqua (formerly Siemens) Water Technologies

APRIL 2012 PERMIT APPLICATION

COMMENT 1: Because, previously, the operator's certification of the permit application was made in December 2009, all the information submitted since that date -- including the information requested in this letter -- must be certified by the operator in accordance with 40 CFR § 270.11.

EVOQUA RESPONSE: The operator's certification of the permit application has been recertified by an Evoqua officer and is attached in Section L. Evoqua supplied EPA a certification dated June 2014. We understand EPA would like a new certification dated July 22, 2014. We will send this to EPA in the near future.

COMMENT 2: Please provide a complete copy of the 40 CFR Part 61 Subpart FF compliance plan with all the appendices and attachments and incorporate it as part of the Part B application, since it is partly being used to comply with the 40 CFR Part 264 Subpart CC requirements, which are required for certain specific units at this facility.

EVOQUA RESPONSE: We are providing a copy of our 40 CFR Part 61 Subpart FF compliance plan and we request that you incorporate it into the Part B application to the extent it applies to tanks, containers and their associated hazardous waste management units that are subject to 40 CFR Part 264, Subpart CC. As we have discussed, the Subpart FF compliance plan also applies to units that are not subject to RCRA Subpart CC regulation, and we therefore limit the incorporation of the compliance plan to those units that are subject to Subpart CC regulation.

Subpart FF will continue to apply to both Subpart CC and non-Subpart CC regulated units, but we expect that the Part B permit requirement will apply only to the Subpart CC regulated units. We ask that EPA reference the Subpart FF compliance plan in the Part B permit with a notation stating that the plan applies under the Part B permit only to those Subpart FF-regulated tanks, containers and associated hazardous waste management units that are also subject to Subpart CC regulation.

COMMENT 3: Please incorporate the Startup Shutdown Malfunction Plan as part of the Part B application.

EVOQUA RESPONSE: The SSMP is included as Appendix XXII in the Part B Application. As we have previously discussed, Evoqua understands that it will be subject to the requirements laid out in the SSMP plan when final permit is granted.

COMMENT 4: Hoppers H-1 and H-2 are considered ancillary equipment to Tanks T-1, T-2, T-5 and T-6 under RCRA and must meet each of the requirements applicable to ancillary equipment that are set forth in 40 CFR Part 264, Subpart J. Please obtain and submit written assessments for Hoppers H-1 and H-2 that meet the requirements of 40

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CFR § 264.192(a) and that demonstrate compliance with 40 CFR § 264.192. In addition, Evoqua needs to submit a work plan with a schedule for providing secondary containment for the spent carbon unloading Hopper H-1 in accordance with 40 CFR § 264.193. Depending on the timing of the schedule, the performance of the leak test requirement found at 40 CFR § 264.193(i) may be necessary.

EVOQUA RESPONSE: As we have previously discussed, hoppers H-1 and H-2 will be replaced, and we propose to submit a design to EPA for approval in advance of their replacement. The hoppers will be designed to meet the requirements for ancillary equipment under 40 CFR 264.192 and .193(f). Evoqua will update EPA with a fabrication schedule in the near future. Once the new hopper design is approved, Evoqua will install the hoppers and then will supply a written assessment under 40 CFR 264.192(a), certified by a P.E.

COMMENT 5: Please add to the operating record in Appendix XXI the operations and maintenance manuals listed in Table D-2 of Section D, which are to be maintained at the facility for the life of the equipment that each such manual pertains to.

EVOQUA RESPONSE: As we discussed and agreed on the phone, a list of manuals will be added to the facility's Record Retention document in Appendix XXI to address this issue.

COMMENT 6: Please add the four (4) Satellite Accumulation Areas and the less than 90 day storage bin to the solid waste management units list in Table J-2 of section J and to the list of equipment/items for closure in Table 2-1 in Appendix XV of the Part B application. In Table J-2, please provide a brief one paragraph description for each satellite accumulation area, the location, and what hazardous waste goes in each one, and how often they get emptied (on average). This information is needed for updating the RCRA Facility Assessment and because these areas constitute solid waste management units.

EVOQUA RESPONSE: This has been added to the SWMU table in Section J as requested and Table 2-1 of the RCRA Closure Plan. A revised Section J and Appendix XV are attached)

COMMENT 7: Evoqua needs to provide justification in the Part B application for testing the Automatic Waste Feed Cutoff (AWFCO) and associated alarms monthly instead of weekly as required in 40 CFR §§ 63.1206(c)(3)(vii) and 264.347(c) and (d). If justification is not provided then the AWFCO needs to be added to the Weekly Checklist.

EVOQUA RESPONSE: The method in which the facility tests AWFCO systems to actually shut off waste feed force a value into the PLC that is out of range and this physically shuts the feed to the furnace off. This test, which takes approximately 15 minutes to complete, upsets the feed to the furnace, which causes non-steady state

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conditions. In the interest of maintaining steady state feed to the unit, Evoqua only conducts this test once per month. If this is acceptable to EPA permitting management, Evoqua will prepare a formal request to the RA.

COMMENT 8: The list of the top ten “risk-drivers” of the contaminants of potential concern from the 2008 Risk Assessment should be re-examined to ensure that EPA has not updated the toxicity criteria for any of these compounds since the last time this analysis was performed. To the extent that the Agency’s toxicity criteria (slope factors or reference doses) have changed, the facility’s Risk Assessment should be updated to reflect and capture these changes. This level of update would be considered an update to the hazard identification component of the Risk Assessment.

EVOQUA RESPONSE: This comment was addressed by identifying “risk-drivers”, updating toxicity criteria (slope factors and reference doses) and updating the quantitative risk assessment results. A summary of this analysis is provided below. A detailed discussion with supporting information is provided in an attached memo prepared by CPF Associates, Inc., the independent scientific research and consulting firm that conducted the original risk assessment work for this project in 2007 and 2008.

Top ten risk drivers for chronic health risks (cancer and non-cancer health effects) were identified for both stack and fugitive emissions. The risk drivers were identified for those receptors and locations evaluated in the risk assessment with the highest risk results. The toxicity criteria for the risk-driver compounds were then updated, as applicable, based on a review of currently available criteria from the data sources recommended in USEPA’s Human Health Risk Assessment Protocol (HHRAP) guidance for combustion source risk assessments (e.g., USEPA’s Integrated Risk Information System). See Attachment 1 for detailed information

The risk assessment results for both stack and fugitive emissions were recalculated incorporating the updated toxicity criteria. The only differences between the updated risks and those presented in the original risk assessment relate to changes in chronic toxicity criteria for risk-driver compounds. The revised results, as in the original risk assessment, were all below USEPA’s benchmark cancer risk level of 1E-5 (one in 100,000) over a 70-year lifetime and below the conservative non-cancer benchmark level of 0.25 used by USEPA for evaluating combustion sources. Overall, the recalculation of risks based on updates to toxicity criteria for risk-drivers supports the findings of the original risk assessment which determined that potential human health risks associated with stack and fugitive emissions were below regulatory benchmark risk levels for chronic non-cancer and cancer health effects.

COMMENT 9: The facility’s Risk Assessment was careful to identify the location of sensitive subgroups of receptors down-gradient from the facility. The location of the following types of facilities or land uses should be updated based upon current

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information: schools, day care facilities, the closest business location, the nearest residential location, convalescent facilities, or hospitals.

EVOQUA RESPONSE: In response to this comment, a driving survey of the facility area was conducted by the Director of Plant Operations to determine whether any new land uses of the types mentioned in USEPA's comment had been developed at locations where potential impacts could be higher than those for the receptors that were evaluated in the original risk assessment. It was determined that no new residences, businesses, day care facilities, schools or hospitals have been developed at locations where impacts could be higher than for the receptors already considered in the risk assessment. The only change in the immediate facility vicinity since the risk assessment was performed is a Department of Motor Vehicles office which has moved to a new location about 0.4 miles (0.6 km) to the north-northwest of the plant on Mutahar street, however, the closest business with the highest potential impacts is still the same as indicated in the original risk assessment (i.e., the La Paz County Agricultural Extension Office located directly across the street from the plant). See Attachment 1 for detailed information

COMMENT 10: Please incorporate any modified processes, procedures, industrial operations or types of waste accepted to the risk analysis to make certain that releases from the facility (either stack or fugitive in-nature) are consistent with the patterns of releases modelled or assumed in the Risk Assessment.

EVOQUA RESPONSE: With respect to potential stack emissions, it was determined that current processes, procedures and operations remain consistent with those considered and addressed in the risk assessment.

With respect to potential fugitive emissions, all spent carbon is currently received at the outdoor hopper rather than some being received at the indoor hopper, as it was in the past. Additionally, under current conditions, a lower proportion of wet/aqua carbon (used for water treatment) and a higher proportion dry/vapor carbon (used for air treatment) is accepted compared to the 2003-2006 receipts considered in the risk assessment. Other than this, the processes, procedures and operations are consistent today with those that were addressed in the risk assessment.

Given these changes, potential risks associated with fugitive emissions from spent carbon unloading at the outdoor hopper were recalculated. The recalculation incorporated more recent spent carbon data, a more refined method for calculating emissions of organic compounds from spent carbon unloading, and updated toxicity criteria. Other than these modifications, all other aspects of the risk calculations were the same as in the original risk assessment. A detailed discussion with supporting information is provided in the attached memo prepared by CPF Associates, Inc.

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The risk assessment results were recalculated for the receptors and locations with the highest risks associated with fugitive emissions. The revised chronic risk results were orders of magnitude below USEPA’s benchmark cancer risk level of 1E-5 (one in 100,000) over a 70-year lifetime and below the conservative non-cancer benchmark level of 0.25 used by USEPA for evaluating combustion sources. The revised acute risk assessment results were all well below the common regulatory target level of one for acute inhalation risks, by orders of magnitude. These results corroborate the findings of the original risk assessment which showed that potential human health risks associated with spent carbon unloading at the outdoor hopper were below regulatory benchmark risk levels for chronic and acute health effects. See Attachment 1 for detailed information

COMMENT 11: Please provide updated information regarding coordination with the local authorities (i.e. Police and Fire Departments) for the CRIT, the city of Parker, and La Paz County. Appendix XIII of the Part B application contains agreements that go back to 2004 and earlier.

EVOQUA RESPONSE: The updated agreements have been included in Appendix XIII which is attached.

COMMENT 12: Please add the following shutdown period inspection checklist to Appendix XII.

INSPECTION CHECKLIST (MINIMUM FREQUENCY OF 18 MONTHS)

	Evoqua Comments
THERMAL TREATMENT SYSTEM	
Furnace Brickwork (Internal) - Condition of Brick/Hearths	The condition of the brickwork has no bearing on emissions. Brickwork is periodically inspected, and when needed, it is repaired, but this does not require a specific inspection schedule to protect the environment, health or safety.
Furnace Draft Sensor - Check for Buildup and Plugging	Has been included in new inspection checklist which is attached in Appendix XII
Furnace Shaft - Check Gearbox Oil	The oil level has no bearing on plant emissions
Afterburner Brickwork (Internal) - Check Condition of Brick/Choke Ring	The condition of the afterburner brickwork has no effect on emissions from the stack. Emission limits incorporated in the permit insure the proper operation of the afterburner (Carbon Monoxide is used as a surrogate for acceptable combustion to ensure that combustion conditions are optimal).
Afterburner Slag Buildup - Check for Slag Buildup	The level of slag in the afterburner brickwork has no effect on emissions. Emission limits incorporated in the permit insure the proper operation of the afterburner (Carbon Monoxide is used as a surrogate for acceptable combustion to

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	ensure combustion conditions are optimal).
P-22 Scrubber Pump - Impeller, Motor, Coupling - Inspection of Internal Parts	The scrubber pump condition and performance is continuously monitored by the pump output (gpm). Operating limits (required pump output in gallons per minute) incorporated in the permit insure the proper operation of this pump
P-22 Strainer – Inspection - Check and Clean if Needed	Same comment as above. The strainer is BEFORE the magnetic flow meters.
Quench/Venturi Sprays - Visual Inspection	Has been included in new inspection checklist which is attached in Appendix XII
Quench/Venturi Magnetic Flow Meters Calibration	Has been included in new inspection checklist which is attached in Appendix XII
P-27 Scrubber Pump - Impeller, Motor, Coupling - Inspection of Internal Parts	The scrubber pump condition and performance is continuously monitored by the pump output (gpm). Operating limits (required pump output in gallons per minute) incorporated in the permit insure the proper operation of this pump.
P-27 Strainer – Inspection Check Pump PSI	Same comment as above. The strainer is BEFORE the magnetic flow meters.
Packed Bed Scrubber Sprays Visual Inspection	Has been included in new inspection checklist which is attached in Appendix XII
Packed Bed Scrubber Packing Inspection Packing Condition	Has been included in new inspection checklist which is attached in Appendix XII
Wet Electrostatic Precipitator (Internal) - Inspection	The WESP performance is continuously monitored by the secondary voltage of the unit (kvDC). Operating limits (required kvDC) are already incorporated in the permit and insure the proper operation of this unit.
Wet Electrostatic Precipitator (Insulators) Inspect Insulators/ Clean	The WESP performance is continuously monitored by the secondary voltage of the unit (kvDC). Operating limits (required kvDC) are already incorporated in the permit and insure the proper operation of this unit.
Wet Electrostatic Precipitator (Insulators) - Wash Down as Needed	WESP insulators are not washed down.

EVOQUA RESPONSE: We have added an additional checklist to Appendix XII to include the five items listed above. This new checklist will be completed at a minimum of 18 months but not necessarily at every shutdown.

Evoqua disagrees that there should be any annual shutdown inspection requirement in the Part B permit for the remainder of the items above. As an example EPA requests to annually shut down to check “P-22 Scrubber Pump - Impeller, Motor, Coupling - Inspection of Internal Parts”. This particular pump supplies scrubber water to the quench, venturi scrubber, water seal in addition to providing the scrubber bleed. The facility has a permit requirement of a minimum of 75 gpm combined to the scrubber

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(quench/venturi/water seal). The pump also must bleed a minimum 58 gpm from the scrubber system, which is another permit requirement. Both of the flows are measured on a rolling hour basis and monitored every 5 seconds by the computer and are tied to an alarm. Both are rolling hour averages are tied to a Waste Feed Cut Off (WFCO) limit. Facility operators monitor flows continuously and pump performance can be gauged and determined by the amount of flow put out. A requirement to physically tear a perfectly functioning pump apart seems unreasonable.

This same rationale applies similarly to P-27 and the strainers (which have nothing to do with pump performance).

The WESP's secondary voltage is also monitored like the pumps and is also tied to a WFCO. The WESP's performance is monitored continuously and performance can be gauged by the secondary voltage rolling our average.

The facility will already be subject to emissions limits, substantial process monitoring requirements, and elaborate equipment and process inspection requirements. The inspections that EPA suggests for annual shutdowns are not necessary to detect performance declines, but are more appropriately characterized as evaluations to prevent unlikely facility malfunctions that would precipitate shutdowns.

Evoqua has standard maintenance and inspection procedures that protect the plant from such events and a very long history of consistent operations that demonstrate a high level of performance without unlikely malfunctions.

In any event, it should be clear in the permit that these inspections are not required during every shutdown, but instead are required to be conducted at a minimum frequency.

COMMENT 13: Please update the Daily Inspection Sheet in Appendix XII as shown in the table below.

Daily Inspection Checklist

	Comments on EPA additions
CONTAINER STORAGE AREA	
RCRA containers closed during storage	In Existing Inspection.
RCRA containers have required labels	In Existing Inspection
Check for leaking RCRA containers	In Existing Inspection
Check storage pad - free of cracks and gaps that would prevent a spill from being contained	In Existing Inspection
Aisles not blocked and allow inspection	In Existing Inspection
Sump clean and free of contamination	In Existing Inspection
Containers in compliance with Subpart CC	In Existing Inspection

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	Comments on EPA additions
	In Existing Inspection
UNLOADING PADS AND SECONDARY CONTAINMENT	
All Unloading pads - Check for cracks/gaps and spills	In Existing Inspection
Secondary Containment - Free of Cracks and Gaps	In Existing Inspection
Secondary Containment Sump - Clean and Free of Contaminants	In Existing Inspection
Bermed Concrete in Process Area	This should not be added as it is not part of the RCRA-regulated containment pad.
Bermed containment in the process area (east of warehouse; containment for T-1, T-2, T-5 and T-6) (SWMU #1) for deterioration of the containment system caused by corrosion or other factors	This duplicates the entry above for inspections of secondary containment
Sump by tank T-9 for deterioration (SWMU #3)	This should not be added as the sump and T-9 are not RCRA-regulated.
Unloading area Pad Receiving area/pad (AOC #3) (150 x 24') for deterioration	This duplicates the entry above for inspections of all unloading pads.
Sump by unloading hopper H-1 (SWMU #2) for deterioration	Included in the unloading pad inspection
Hopper H-1 loading/unloading area (Hopper Containment Pad [SWMU 11], [AOC #4]) for deterioration	This duplicates the entry above for inspections of all unloading pads.
Hopper H-2 loading/unloading area (AOC #5) for deterioration	This duplicates the entry above for inspections of all unloading pads.
Spent carbon unloading/transfer area containment pad on the north side of the Facility (SWMU #14) (44' x 80') for deterioration	This should not be added as it is not part of the RCRA-regulated containment pad. Whether it is identified as a SWMU is not relevant to operational inspection requirements.
STORAGE TANK SYSTEMS/ANCILLARY EQUIPMENT	
T-1 Valves/Leaks/Piping Outside Secondary Containment	In Existing Inspection
T-1 Tank Corrosion/Signs of Leakage	In Existing Inspection
T-1 Waste Feed Cutoff (Overfill Control)- Proper Operation	In Existing Inspection
T-1 construction materials and area immediately surrounding the externally accessible portion of the tank system, including secondary containment system to detect erosion or signs of releases of hazardous waste.	Added to Evoqua's daily inspection.
T-2 Valves/Leaks/Piping Outside	In Existing Inspection

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	Comments on EPA additions
Secondary Containment	
T-2 Tank Corrosion/Signs of Leakage	In Existing Inspection
T-2 Waste Feed Cutoff (Overfill Control) - Proper Operation	In Existing Inspection
T-2 construction materials and area immediately surrounding the externally accessible portion of the tank system, including secondary containment system to detect erosion or signs of releases of hazardous waste.	Added to Evoqua's daily inspection
T-5 Valves/Leaks/Piping Outside Secondary Containment	In Existing Inspection
T-5 Tank Corrosion/Signs of Leakage	In Existing Inspection
T-5 Waste Feed Cutoff (Overfill Control) - Proper Operation	In Existing Inspection
T-5 construction materials and area immediately surrounding the externally accessible portion of the tank system, including secondary containment system to detect erosion or signs of releases of hazardous waste.	Added to Evoqua's daily inspection
T-6 Valves/Leaks/Piping Outside Secondary Containment	In Existing Inspection
T-6 Tank Corrosion/Signs of Leakage	In Existing Inspection
T-6 Waste Feed Cutoff (Overfill Control) - Proper Operation	In Existing Inspection
T-6 construction materials and area immediately surrounding the externally accessible portion of the tank system, including secondary containment system to detect erosion or signs of releases of hazardous waste.	Added to Evoqua's daily inspection
T-18 Valves/Leaks/Piping	In Existing Inspection
T-18 Tank Corrosion/Signs of Leakage	In Existing Inspection
T-18 Waste Feed Cutoff (Overfill Control) - Proper Operation	In Existing Inspection
T-18 Internal Tank Integrity/Internal Tank Free of Leaks	In Existing Inspection
T-18 construction materials and area immediately surrounding the externally accessible portion of the tank system, including secondary containment system to detect erosion or signs of releases of hazardous waste.	Added to Evoqua's daily inspection
Carbon adsorption systems (WS-1, WS-2, WS-3) - Check for leaks, proper operation	In Existing Inspection
Hopper H-1 - Leaks/Corrosion/and piping	In Existing Inspection

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	Comments on EPA additions
outside the secondary containment	
Hopper H-2 - Leaks/Corrosion/and piping outside the secondary containment	In Existing Inspection
THERMAL TREATMENT SYSTEM	
RF-2 Associated Equipment – Furnace Feed Valve Proper operations and Dewater Screw Corrosion	Verbiage added to Evoqua’s Daily Inspection.
Furnace Hearth Doors (HWMU #2) – Corrosion/Leakage	Already included below as part of the furnace inspection.
Furnace Shaft Cooling Fan and backup fan (HWMU #2) – Inspect and Check Belts	This should not be added as it is not part of the RCRA–regulated unit and has no bearing on emissions
Rotary Air lock	Verbiage added to Evoqua’s Daily Inspection.
RF-2 APC Equipment (Afterburner, Quench/Venturi, Packed bed, WESP, ID Fan, Pumps, etc.) for leaks, drips, spills	In Existing Inspection
RF-2 Furnace and associated equipment (pumps, valves, conveyors, pipes, etc.) - thorough visual inspection for leaks, spills, fugitive emissions, and signs of tampering.	Verbiage added to Evoqua’s Daily Inspection.
CEMS Operation - Calibration - Proper Working Order including a review of the calibration check data, an inspection of the recording system, an inspection of the control panel warning lights, and an inspection of the sample transport and interface system (e.g., flow meters, filters, etc.) as appropriate.	Verbiage added to Evoqua’s Daily Inspection.
Process monitoring instrument readouts (Control Room) - Proper Operation	In Existing Inspection
Alarms - Proper Working Order	In Existing Inspection
SAFETY EQUIPMENT	
Telephone - Proper Working Order	In Existing Inspection
Lighting - Proper Operation	In Existing Inspection
SCBA's/Escape Pack - Filled Properly	In Existing Inspection
Cell Phone - Proper Working Order, charged.	In Existing Inspection
Water Seal Quench Venturi– Inspect for Level/Corrosion	Verbiage added to Evoqua’s Daily Inspection.

EVOQUA RESPONSE: See comments above.

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COMMENT 14: Hazardous waste containers at the facility are subject to the air emissions standards and requirements specified in 40 CFR Part 264, Subparts BB and CC. Pursuant to 40 CFR § 264.1088, inspection and monitoring of any air emission control equipment used to comply with Subpart CC must be performed in accordance with a written plan and schedule. Please provide a plan and schedule that meets the requirements of this provision and that addresses the inspections required by 40 CFR §§ 264.1086(c)(4), (d)(4), and (e)(4), as appropriate.

EVOQUA RESPONSE: A revised Subpart CC plan have been included in the Part B application which addresses non-Subpart FF regulated containers and the methodology through which the containers will be inspected upon receipt. The plan can be found in Appendix XX of the permit application.

Attachement 1

**Response to USEPA Risk Assessment Comments (8, 9,
and 10) on the April 2012 Permit Application for the
Evoqua Water Technologies Carbon Reactivation
Facility – July 18, 2014**



Scientific Research and Consulting

MEMO

To: M. McCue, Evoqua Water Technologies LLC
From: S. Foster, CPF Associates, Inc.
Date: July 18, 2014
Re: Response to USEPA Risk Assessment Comments on the April 2012 Permit Application for the Evoqua Water Technologies Carbon Reactivation Facility

INTRODUCTION

This memo presents responses to the U.S. Environmental Protection Agency (USEPA) comments on the April 2012 Permit Application Submittal for Evoqua Water Technologies carbon reactivation plant, specifically focusing on three comments related to the project risk assessment.

BACKGROUND

A comprehensive human health and ecological risk assessment was completed in March 2008 for Evoqua's carbon reactivation plant as part of the facility's permitting activities under the Resource Conservation and Recovery Act (RCRA). The carbon reactivation plant is located within the Colorado River Indian Tribes (CRIT) Reservation, in an industrial park owned by CRIT outside of the Town of Parker, Arizona. The facility reactivates spent carbon which has been previously used to remove pollutants from water and air. The spent carbon is reactivated by heating it to very high temperatures under controlled conditions in a carbon reactivation furnace. The newly reactivated carbon is then reused as an activated carbon product.

The risk assessment for this project is provided in three documents. The first document is the *Draft Risk Assessment for the Siemens Water Technologies Corp. Carbon Reactivation Facility in Parker, Arizona* which was submitted to USEPA on July 30, 2007 (July 2007 risk assessment report). The second document is the *Response To USEPA Region IX Comments on the Draft Siemens Water Technologies Corp. Carbon Regeneration Facility Risk Assessment* which was submitted to USEPA on March 13, 2008, to respond to comments on the draft risk assessment that were received from the Agency in late 2007 (March 2008 response to comments report). An overall summary of the risk assessment is provided in a stand-alone *Executive Summary* also dated March 13, 2008.

In April 2012, a revised RCRA permit application was submitted to USEPA Region IX. The risk assessment documents from 2007 and 2008 were included in an appendix to this application. In May 2014, USEPA Region IX provided comments on the permit application, including several related to the risk assessment. The purpose of this memo is to respond to those USEPA comments specifically related to the risk assessment (comments #8, #9, and #10).

C P F A S S O C I A T E S , I N C .

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www.cpfassociates.com

COMMENT #8**USEPA Comment:**

The list of the top ten “risk-drivers” of the contaminants of potential concern from the 2008 Risk Assessment should be re-examined to ensure that EPA has not updated the toxicity criteria for any of these compounds since the last time this analysis was performed. To the extent that the Agency’s toxicity criteria (slope factors or reference doses) have changed, the facility’s Risk Assessment should be updated to reflect and capture these changes. This level of update would be considered an update to the hazard identification component of the Risk Assessment.

Response:

This comment was addressed through a series of steps, which are each described in more detail below:

- Identify “risk-drivers”
- Update toxicity criteria (slope factors and reference doses) and
- Update the quantitative risk assessment results

Identify Risk-Drivers

The original risk assessment was evaluated in order to identify the top ten risk-drivers for each of the following emission sources and risk results:

- Human health risks associated with stack emissions (excess lifetime cancer risks and chronic non-cancer health effects)
- Human health risks associated with fugitive emissions (excess lifetime cancer risks and chronic non-cancer health effects)

Stack Emissions

The top ten risk-drivers were identified from the risk assessment results for stack emissions that were presented in Section 4.4.1.1 of the July 2007 risk assessment. The evaluation focused on the detected group of compounds referred to as Group 1 in the original report. Group 1 includes 116 compounds that were detected in the Performance Demonstration Test (PDT) in addition to several compounds that were not measured during the PDT but which were evaluated based on emission rates derived from feed rates. For more information about the evaluation of stack emissions, see Section 4.2 of the July 2007 risk assessment report.

The top ten risk-drivers were identified for the receptor types and locations with the highest risk results, as follows:

- Town resident receptor (R_2 Adult and R_2 Child)¹
- Farmer receptor (R_3 Adult and R_3 Child)
- Subsistence fish ingestion receptor (R_only_fish_drain Adult and R_only_fish_drain Child)

¹ The designations for specific receptors were taken from the 2007 risk assessment report (see Table 4.2-7).

The risk-drivers associated with stack emissions are listed in Table 1. Note that the total number of compounds in this table is greater than 10 because the top ten risk-drivers were identified for several different receptors and health endpoints and then combined to create a cumulative compound list for which toxicity criteria would be updated.

Fugitive Emissions

The top ten risk-drivers for fugitive emissions were identified from the risk assessment results as calculated in Section 5 of the *Response to USEPA Region IX Comments* report prepared in March 2008 (*Section 5: Selection of Chemicals for Evaluation – Fugitive Emissions*). The only difference between the March 2008 document and the original July 2007 risk assessment (which presented fugitive emission risk results in Section 4.4.2.1) was the inclusion of total and hexavalent chromium as selected compounds. For more information about the fugitive emissions scenario involving spent carbon unloading, see Section 4.3 in the 2007 risk assessment and Specific Comment, Section 6 in the March 2008 response to comments report.

The top ten risk-drivers were identified for the receptor types and locations with the highest risk results associated with fugitive emissions, as follows:

- Town resident receptor (R_6_resident Adult and R_6_resident Child) ²
- Farmer receptor (R_3_farmer Adult and R_3_farmer Child)

The risk-drivers associated with fugitive emissions are listed in Table 2. As noted above, the total number of compounds in this table is greater than 10 because the top ten risk-drivers were identified for several different receptors and health endpoints and then combined to create a cumulative compound list for which toxicity criteria would be re-evaluated.

Update Toxicity Criteria

For each of the risk-driver compounds, the toxicity criteria used in the original risk assessment were compiled and compared to currently available toxicity criteria. Currently available criteria were obtained from the data sources recommended in USEPA's 2005 Human Health Risk Assessment Protocol (HHRAP) guidance for combustion source risk assessments. This guidance and its recommended data sources were used in the original risk assessment and are still used today for combustion source risk assessment projects. The HHRAP toxicity data sources rely first on USEPA's Integrated Risk Information System (IRIS). In the absence of values in this database, other recommended sources that are periodically updated were reviewed: USEPA's provisional peer-reviewed toxicity values (PPRTV) or, if PPRTV were not available, California Environmental Protection Agency (CALEPA) cancer and non-cancer toxicity criteria and the Agency for Toxic Substances and Disease Registry (ATSDR) minimum risk levels (MRLs). The results of this review are provided in Attachment A. Tables A1 and A2 present updated chronic toxicity criteria for each of the risk-driver compounds associated with stack emissions and fugitive emissions, respectively.

² The designations for specific receptors were taken from the 2007 risk assessment report (see Table 4.3-8).

Table 1
Risk-Driver Compounds: Stack Emissions

Compound	Risk-Drivers Based on Cancer Risks (a)	Risk-Drivers Based on Non-Cancer Results (a)
Aluminum		✓
Aroclor 1254	✓	✓
Barium		✓
Cadmium	✓	✓
Chlordane		✓
Chlorine		✓
Chloroform (Trichloromethane)		✓
DDD, 4,4'-	✓	
DDT, 4-4'-	✓	✓
Heptachlor epoxide		✓
Hydrogen chloride		✓
Lead	✓	✓
Manganese		✓
Mercuric chloride		✓
Methyl mercury		✓
Nickel	✓	✓
Nitrogen dioxide		✓
Sulfur dioxide		✓
<i>PCDDs/PCDFs (Dioxins and Furans)</i>		
2,3,7,8-TCDD	✓	
2,3,7,8-TCDF	✓	
1,2,3,7,8-PeCDD	✓	
1,2,3,7,8-PeCDF	✓	
2,3,4,7,8-PeCDF	✓	
1,2,3,4,7,8-HxCDF	✓	
1,2,3,6,7,8-HxCDF	✓	
2,3,4,6,7,8-HxCDF	✓	
Total Number of Risk-Driver Compounds (b)	14	17

(a) Risk-drivers were identified from the risk assessment results for six (6) different receptors with the highest chronic risks associated with stack emissions in the July 2007 risk assessment: Town resident receptor (R_2 Adult and R_2 Child); Farmer receptor (R_3 Adult and R_3 Child); Subsistence fish ingestion pathway receptor (R_only_fish_drain Adult and R_only_fish_drain Child).

(b) The total number of compounds is greater than 10 because the top ten risk-drivers were identified for several different receptors and health endpoints and then combined to create a cumulative compound list.

Table 2
Risk-Driver Compounds: Fugitive Emissions

Compound	Risk-Drivers Based on Cancer Risks (a)	Risk-Drivers Based on Non-Cancer Results (a)
1,3-Butadiene	✓	✓
1-Hexane (n-hexane)		✓
Acrylonitrile	✓	✓
Arsenic	✓	
Benzene	✓	✓
Chloroform (Trichloromethane)	✓	✓
Cyclohexane		✓
Dichlorobenzene,1,4-	✓	✓
Ethylene Dibromide	✓	✓
Tetrachloroethylene (Perchloroethylene)	✓	✓
Toluene	✓	✓
Trichloroethylene	✓	
Vinyl Chloride	✓	✓
<i>Total Number of Risk-Driver Compounds (b)</i>	11	11

(a) Risk-drivers were identified from the risk assessment results for the receptors with the highest chronic risks associated with fugitive emissions in the July 2007 risk assessment and the March 2008 Response to Comments report: Town resident receptor (R_6 Adult and R_6 Child) and Farmer receptor (R_3 Adult and R_3 Child).

(b) The total number of compounds is greater than 10 because the top ten risk-drivers were identified for several different receptors and health endpoints and then combined to create a cumulative compound list.

Several of the risk-driver compounds have updated toxicity criteria compared to the values available at the time the risk assessment was conducted. Some of these updates could result in higher risks while others could result in lower risks. The most notable change since the risk assessment was conducted is the availability (for the first time from USEPA) of a non-cancer reference dose for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) which affects not only this one compound but also the entire class of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Some changes to toxic equivalency factors (TEFs) for PCDDs/PCDFs have also been adopted by USEPA since the risk assessment was conducted. These and all of the other changes noted in Attachment A were incorporated into the recalculation of risks.

Recalculate Risks

The risk assessment results for both stack and fugitive emissions for the receptors listed above were revised incorporating the updated toxicity criteria. The only differences between these calculations and those presented in the original risk assessment relate to changes in chronic toxicity criteria for the risk drivers. Risks were recalculated using the same publicly available software program, called the Industrial Risk Assessment Program (IRAP), that was used in the original risk assessment and that has been independently programmed to specifically reflect USEPA's 2005 HHRAP guidance. Thus, other than updating toxicity criteria in the IRAP software, no other modifications were made to the IRAP model runs.

The revised risk assessment results taking into account updates to chronic toxicity criteria for the risk-driver compounds are provided in Table 3 for stack emissions and Table 4 for fugitive emissions. The revised results, as in the original risk assessment, are all below USEPA's benchmark cancer risk level of 1E-5 (one in 100,000) over a 70-year lifetime and below the conservative non-cancer benchmark level of 0.25 used by USEPA for evaluating combustion sources.

For stack emissions, the excess lifetime cancer risks increased slightly for the resident and farmer receptors, and were essentially unchanged for the fisher receptors. The non-cancer hazard index results were also essentially unchanged. Even if the fish pathway risks were added to the resident or farmer risks, the results for stack emissions would still be below USEPA's benchmark levels for both cancer and non-cancer effects. For fugitive emissions, the excess lifetime cancer risks and the non-cancer hazard index values did not change. Potential risks associated with the combination of both stack and fugitive emissions would also be less than USEPA's benchmark risk levels.

Overall, the recalculation of risks based on updates to toxicity criteria for risk-drivers corroborates the findings of the original risk assessment which determined that potential human health risks associated with stack and fugitive emissions were below regulatory benchmark risk levels for chronic non-cancer and cancer health effects.

Table 3
Updated Chronic Risk Assessment Results: Stack Emissions
(Updates reflect changes to toxicity criteria for risk drivers)

Receptor Name	Scenario	Description (Exposure Pathways)	Excess Lifetime Cancer Risk (a,c)	Total Hazard Index (b,c)
<i>Residential Receptor (developed area within and around Town of Parker)</i>				
R_2 resident	resident_adult	Residential area in town with highest annual modeled impacts and highest risks (inhalation, soil ingestion, homegrown produce ingestion)	4.E-07	5.E-02
	resident_child		2.E-07	5.E-02
<i>Farmer Receptor (residential area within Colorado River Indian Tribes Reservation, access to irrigation canal system water)</i>				
R_3 resident farmer	farmer_adult	Residential area in Reservation with highest annual modeled impacts and highest risks (inhalation, soil ingestion, homegrown produce ingestion, locally raised beef ingestion, locally raised poultry ingestion, locally raised egg ingestion, locally raised pork ingestion)	1.E-07	2.E-02
	farmer_child		3.E-08	2.E-02
<i>Fish Ingestion Pathway</i>				
R_only fish_drain	fisher_adult	Fish ingestion evaluation for the Main Drain (locally caught fish ingestion)	9.E-09	1.E-02
	fisher_child		1.E-09	1.E-02

(a) The additional (excess) lifetime cancer risks reflect exposure to all potential carcinogens evaluated. The regulatory target cancer risk level used by USEPA for combustion sources is 1E-5 (1 in 100,000). A value of 1E-5 is 10 times higher than 1E-6 and 100 times higher than 1E-7.

(b) The listed hazard index values for non-cancer effects reflect exposure to all evaluated compounds, regardless of the type of health effects. If a hazard index, based on the sum of hazard quotients for all compounds, is above 1, then the hazard index values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted. USEPA uses a target hazard index value, for compounds grouped according to specific types of health effects, of 0.25 for combustion sources. A common regulatory target hazard index value used by most states and many other USEPA programs, for compounds grouped according to specific types of health effects, is 1.

(c) Risks were presented in the original health risk assessment (HRA) report, dated July 2007, in Table 4.4-1 for 116 compounds (Group 1 compounds as described in the risk assessment). This group includes 116 compounds that were detected in the Performance Demonstration Test (PDT) in addition to several compounds that were not measured during the PDT but which were evaluated based on emission rates derived from feed rates. Risks were recalculated for all 116 Group 1 compounds after conducting a review of currently available toxicity values for top ten risk-drivers in response to USEPA's May 2014 comments on the RCRA permit application for the facility. Recommended data sources in USEPA's HHRAP guidance were rechecked and updates to toxicity values were made as applicable for the risk-drivers. See text for further information on toxicity value updates.

Table 4
Updated Chronic Risk Assessment Results: Fugitive Emissions During Spent Carbon Unloading
(Updates reflect changes to toxicity criteria for risk drivers)

Receptor Name	Scenario	Description (Exposure Pathway)	Excess Lifetime Cancer Risk (a,c)	Total Hazard Index (b,c)
<i>Residential Receptor (developed area within and around Town of Parker)</i>				
R_6 resident	resident_adult	Residential area in town with highest annual modeled impacts for fugitive hopper emissions (inhalation)	3.E-08	1.E-03
	resident_child		6.E-09	1.E-03
<i>Farmer Receptor (residential area within Colorado River Indian Tribes Reservation)</i>				
R_3 resident farmer	farmer_adult	Residential area with access to irrigation water with highest annual modeled impacts for stack and fugitive hopper emissions (inhalation)	5.E-08	1.E-03
	farmer_child		7.E-09	1.E-03

(a) The additional (excess) lifetime cancer risks reflect exposure to all potential carcinogens evaluated. The regulatory target cancer risk level used by USEPA for combustion sources is 1E-5 (1 in 100,000). A value of 1E-5 is 10 times higher than 1E-6 and 100 times higher than 1E-7.

(b) The listed hazard index values for non-cancer effects reflect exposure to all evaluated compounds, regardless of the type of health effects. If a hazard index, based on the sum of hazard quotients for all compounds, is above 1, then the hazard index values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted. USEPA uses a target hazard index value, for compounds grouped according to specific types of health effects, of 0.25 for combustion sources. A common regulatory target hazard index value used by most states and many other USEPA programs, for compounds grouped according to specific types of health effects, is 1.

(c) Risks were presented in the original risk assessment report (July 2007) in Table 4.4-4 for 21 compounds that were selected for the fugitives emissions evaluation. Risks were recalculated for all 21 compounds after conducting a review of currently available toxicity values for risk-drivers in response to USEPA's May 2014 comments on the RCRA permit application for the facility. Recommended data sources in USEPA's HHRAP guidance were rechecked and updates to toxicity values were made as applicable for the risk-drivers. See text for further information on toxicity value updates.

COMMENT #9**EPA Comment:**

The facility's Risk Assessment was careful to identify the location of sensitive subgroups of receptors down-gradient from the facility. The location of the following types of facilities or land uses should be updated based upon current information: schools, day care facilities, the closest business location, the nearest residential location, convalescent facilities, or hospitals.

Response:

In response to this comment, a driving survey of the facility area was conducted by the Director of Plant Operations to determine whether any new land uses of the types mentioned in USEPA's comment had been developed at locations where potential impacts could be higher than those for the receptors that were evaluated in the original risk assessment. It was determined that no new residences, businesses, day care facilities, schools or hospitals have been developed at locations where impacts could be higher than for the receptors already considered in the risk assessment. The only change in the immediate facility vicinity since the risk assessment was performed is a Department of Motor Vehicles office which has moved to a new location about 0.4 miles (0.6 km) to the north-northwest of the plant on Mutahar street, however, the closest business with the highest potential impacts is still the same as indicated in the original risk assessment (i.e., the La Paz County Agricultural Extension Office located directly across the street from the plant).

COMMENT 10**EPA Comment:**

Please incorporate any modified processes, procedures, industrial operations or types of waste accepted to the risk analysis to make certain that releases from the facility (either stack or fugitive in-nature) are consistent with the patterns of releases modelled or assumed in the Risk Assessment.

Response:

With respect to potential stack emissions, it was determined that current processes, procedures and operations remain consistent with those considered and addressed in the risk assessment.

With respect to potential fugitive emissions, there has been a change in procedures in that all spent carbon is currently received at the outdoor hopper rather than some being received at the indoor hopper, as it was in the past. Additionally, in the past, approximately 42%-46% of the spent carbon unloaded at the outdoor hopper was wet/aqua carbon (which has been used for water treatment) and 54%-58% was dry/vapor carbon (used for air treatment). Currently, based on 2012-2013 data, this breakdown is roughly 22% wet/aqua carbon and 78% dry/vapor spent carbon. Other than this, the processes, procedures and operations are consistent today with those that were addressed in the risk assessment. Given these changes, potential risks associated with fugitive emissions at the outdoor hopper were re-evaluated. In this re-evaluation, the most recent two full years of spent carbon data were compiled and used to recalculate potential risks. In addition, the methodology used to model fugitive emissions during spent carbon unloading activities at the outdoor hopper was refined to more accurately reflect the adsorption/desorption behavior of organic compounds on activated carbon. The

same 23 compounds evaluated in the original fugitive emissions risk assessment were addressed.³ These refinements, and the updated risk results, are described below.

Recent Spent Carbon Data

The two most recent years of spent carbon data, from January 1, 2012 through December 31, 2013, were compiled to calculate average and maximum concentrations representative of current facility operations. These data are considered more representative of current facility operations than the spent carbon data from 2003-2006 that were relied on in the original risk assessment. While the facility still accepts spent carbon from a variety of sources, some sources that sent spent carbon to the facility during the 2003-2006 period no longer do. Additionally, some spent carbon is currently accepted from new sources not included in the 2003-2006 data. Table 5 presents the average and maximum spent carbon concentrations for the same 23 compounds evaluated previously.

Emission Rates

Using the average and maximum spent carbon concentrations from Table 5, emission rates during spent carbon unloading at the outdoor hopper were calculated and then used to calculate potential air concentrations at several receptor locations in the vicinity of the facility. The general methodology is the same as in the original risk assessment: emission rates are combined with air dispersion modeling results to calculate ambient air concentrations. More information about the air dispersion modeling and receptor locations is provided in Section 4.3.4 of the July 30, 2007 risk assessment report. The receptor locations examined here are those with the highest risks associated with fugitive emissions.

Emission rates for inorganic compounds were calculated using the same the methodology presented in the original risk assessment report (see Section 4.3.3.2 in the July 30, 2007 risk assessment report).

The methodology for calculating organic compound emission rates from spent carbon unloading was refined to more accurately reflect the adsorption/desorption behavior of organic compounds on activated carbon. The methodology in the original risk assessment report relied on a screening-level approach developed by USEPA to model volatile organic compound (VOC) emissions from contaminated soil. This screening-level model estimated the equilibrium partitioning of an organic compound in the air, aqueous and solid phases within a soil matrix, where partitioning is governed by the presence of organic carbon in the soil and a compound's organic carbon:water partition coefficient (K_{oc}) and Henry's law constant (H).⁴ Emissions were then calculated using the vapor-filled pore space equilibrium air concentration in a USEPA model developed to estimate air emissions associated with the dumping of contaminated soil onto a storage pile.⁵

³ For additional information on the modeling and risk assessment of fugitive emissions, see Section 4.3 in the July 2007 risk assessment report and the March 2008 response to comments report (Response to General Comments, Section 2, and Response to Specific Comments, Section 6).

⁴ U.S. Environmental Protection Agency (USEPA). 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Prepared by Environmental Quality Management, Inc. for the Office of Emergency and Remedial Response. February 22, 2004.

⁵ U.S. Environmental Protection Agency (USEPA). 1997. Air Emissions from the Treatment of Soils Contaminated with Petroleum Fuels and Other Substances. Prepared by Radian Corporation for the Atmospheric Protection Branch. Office of Air and Radiation. October 1997. EPA-600/R-97-116.

Table 5
Spent Carbon Information (Based on 2012-2013 Data) (a)

Compound	CAS #	Number of deliveries over 2 year period	Average concentration in received carbon loads (ppm)	Maximum concentration in all received carbon loads (ppm)	Number of deliveries with maximum concentration
1,2-Dibromoethane	106-93-4	7	0.10	0.10	7
1,3-Butadiene	106-99-0	22	5,988	9,330	12
1,4-Dichlorobenzene	106-46-7	57	75	223	14
Acrylonitrile	107-13-1	3	1.0	6,400	3
Arsenic	7440-38-2	72	3.1	46	1
Benzene	71-43-2	2,199	2,518	120,000	1
Beryllium	7440-41-7	30	0.64	1.6	3
Cadmium	7440-43-9	18	0.19	0.48	1
Chloroform	67-66-3	362	147	10,600	2
Chromium	7440-47-3	123	20	1,960	1
Chromium VI (b)	18540-29-9	--	2.6	255	--
Cobalt	7440-48-4	57	4.0	10	3
Copper	7440-50-8	70	42	750	2
Cyclohexane	110-82-7	81	202	700	1
Ethylbenzene	100-41-4	1,069	1,865	131,158	5
Naphthalene	91-20-3	79	37	110	25
n-Hexane	110-54-3	89	3,770	13,000	1
Nickel	7440-02-0	52	18	153	2
Styrene	100-42-5	230	2,281	150,000	1
Tetrachloroethylene	127-18-4	439	5,997	144,000	4
Toluene	108-88-3	1,105	3,359	68,000	4
Trichloroethylene	79-01-6	519	1,333	108,000	2
Vinyl Chloride	75-01-4	233	39	410	18

-- = No data. Chromium VI concentrations were calculated from total chromium data (see note b).

(a) Concentrations were based on 2012-2013 TRI data from Evoqua Parker Facility (January 1, 2012 - December 31, 2013).

(b) The chromium VI concentration was calculated assuming 13% of the total chromium concentration was present as CrVI, based on an evaluation of 137 concurrent CrVI and total chromium measurements in monthly composite spent carbon samples (see Response to Specific Comments, Section 5 of the March 2008 response to comment report).

Activated carbon is, however, a distinctly different medium than soil, valuable precisely because of its extreme affinity to adsorb and tightly retain organic compounds within its porous matrix. The strength of an organic compound's sorption to activated carbon, and its desorption rate, is governed by different mechanisms and characteristics than for soil.⁶

Accordingly, the approach used to calculate potential organic compound emission rates from spent carbon was refined by relying on activated carbon isotherms to calculate vapor-filled pore space concentrations rather than the screening-level partitioning model based on soil. This work was conducted by Dr. Adam Redding, a scientist with Evoqua Water Technologies, based in Pennsylvania, where he directs activated carbon research and development and is a visiting researcher at Penn State University.⁷

Activated carbon isotherms were used to calculate the concentration of each organic compound potentially present in the vapor-filled pore spaces of the spent carbon matrix. Isotherm data is particularly well-suited to this type of calculation since it defines the vapor phase concentration that would exist in equilibrium with the concentration of organic compound that has been adsorbed.⁸ The adsorption affinity of a particular compound bears a strong correlation to several inherent properties of that compound (e.g. vapor pressure, refractive index, relative polarizability, etc.) and models for the isotherm loading have been well-studied and widely published. Additionally, since the risk assessment was conducted, a revised engineering handbook was published (Yaws 2008)⁹ in which extensive and detailed chemical-specific data are provided for use in predicting adsorption and desorption of chemicals on activated carbon.

Using the detailed chemical-specific data set published in Yaws (2008), the corresponding vapor-filled equilibrium concentrations were calculated. These concentrations were then input into subsequent equations applied in the original risk assessment to calculate emission rates.¹⁰ A more detailed discussion of this methodology is provided in Attachment B.

Table 6 presents the calculated emission rates for each compound evaluated in this fugitive emissions risk assessment.

⁶ Gardner, Jury and Gardner. 1991. *Soil Physics / Edition 5*. Wiley, John & Sons; Das, Vivekana and Gaur. 2004. Carbon Removal of volatile organic compound by activated carbon fiber. *Carbon* 42:2949–2962. Fletcher, Yuzak and Thomas. 2004. Adsorption and desorption kinetics for hydrophilic and hydrophobic vapors on activated carbon. *Carbon* 44:989–1004.

⁷ Adam Redding received his PhD in Environmental Engineering from Penn State University in 2008, and also acquired both his master's and bachelor's degrees at Penn State. His dissertation focused on predicting the removal of endocrine disruptors and pharmaceuticals on modified activated carbons. He has published in peer-reviewed journals such as *Desalination and Water Research* and his articles have received more than 250 citations. Adam is also a peer-reviewer for the journals *Environmental Science & Technology*, *Carbon*, *Water Research*, *Chemosphere*, and the *Journal of Hazardous Materials*.

⁸ Foo, K.Y. and Hameed, B.H. 2010. Review: Insights into the modeling of adsorption isotherm systems. *Chemical Engineering Journal* 156:2–10.

⁹ Yaws, C. L. 2008. *Yaws' Handbook of Properties for Environmental and Green Engineering*. Knovel. Online version available at: <http://app.knovel.com/hotlink/toc/id:kpYHPEGE01/yaws-handbook-properties>.

¹⁰ For additional information about calculation of organic compound emission rates, see Section 4.3.3.1 in the original July 2007 risk assessment report. In this re-evaluation, Equation 4-2 was replaced with concentrations in air-filled pore spaces calculated from chemical-specific isotherms. These concentrations were then input into equations 4-3, 4-4 and 4-5 to calculate emission rates. Newer, more refined USEPA models that could be used to update equations 4-3 through 4-5 were not identified based on an online search of USEPA's website.

Table 6
Modeled Fugitive Emission Rates During Spent Carbon Unloading at the Outdoor Hopper

Compound	CAS #	Concentration in spent carbon (ppm) (a)		Emission Rate for Spent Carbon Unloading (g/sec) (b)	
		Average Concentration	Maximum Concentration	Emission Rate Based on Average Concentration (c)	Emission Rate Based on Maximum Concentration (c)
1,2-Dibromoethane	106-93-4	0.10	0.10	< 5.2E-12	< 5.2E-12
1,3-Butadiene	106-99-0	5,988	9,330	1.6E-08	7.7E-08
1,4-Dichlorobenzene	106-46-7	75	223	9.7E-08	1.2E-07
Acrylonitrile	107-13-1	1.0	6,400	< 1.5E-12	3.7E-09
Arsenic	7440-38-2	3.1	46	1.8E-10	2.7E-09
Benzene	71-43-2	2,518	120,000	< 2.2E-12	1.1E-06
Beryllium	7440-41-7	0.64	1.6	3.8E-11	9.4E-11
Cadmium	7440-43-9	0.19	0.48	1.1E-11	2.8E-11
Chloroform	67-66-3	147	10,600	< 3.3E-12	1.5E-10
Chromium	7440-47-3	20	1,960	1.2E-09	1.2E-07
Chromium VI	18540-29-9	2.6	255	1.5E-10	1.5E-08
Cobalt	7440-48-4	4.0	10	2.3E-10	5.9E-10
Copper	7440-50-8	42	750	2.5E-09	4.4E-08
Cyclohexane	110-82-7	202	700	< 2.3E-12	< 2.3E-12
Ethylbenzene	100-41-4	1,865	131,158	1.3E-07	2.6E-07
Naphthalene	91-20-3	37	110	5.4E-09	8.5E-09
n-Hexane	110-54-3	3,770	13,000	< 2.4E-12	< 2.4E-12
Nickel	7440-02-0	18	153	1.1E-09	9.0E-09
Styrene	100-42-5	2,281	150,000	1.3E-07	2.6E-07
Tetrachloroethylene	127-18-4	5,997	144,000	3.0E-07	4.2E-07
Toluene	108-88-3	3,359	68,000	< 2.6E-12	1.6E-11
Trichloroethylene	79-01-6	1,333	108,000	< 3.7E-12	4.0E-08
Vinyl Chloride	75-01-4	39	410	2.0E-11	4.7E-09

(a) Concentrations were based on 2012-2013 TRI data from Evoqua Parker Facility (January 1, 2012 - December 31, 2013).

(b) For information on the methods used to calculate fugitive emission rates for compounds in spent carbon, see text and Attachment B. Also see Section 4.3.3 in the 2007 risk assessment, and the response to General Comment 2 in the 2008 report related to fugitive emissions. The same methods used in the original risk assessment were relied on to calculate emission rates, with the exception that vapor-filled pore space concentrations were calculated using detailed chemical-specific activated carbon isotherms.

(c) For some compounds, the activated carbon isotherms used to calculate vapor-filled pore space concentrations in spent carbon produced results below typical quantification limits (e.g., values as low as 1E-5 to <1E-15 ppmv). For the purposes of calculating fugitive emissions, a default value of 0.00001 ppmv was inserted in place of vapor-filled pore space concentrations calculated to be less than 0.00001 ppmv. The emission rates calculated from this default value are denoted with a "<" sign.

Update Toxicity Criteria

The toxicity criteria used in the original risk assessment for fugitive emissions were compiled and compared to currently available toxicity criteria. Currently available criteria were obtained from the data sources recommended in USEPA's 2005 Human Health Risk Assessment Protocol (HHRAP) guidance for combustion source risk assessments. Both chronic and acute toxicity values were reviewed for the 23 compounds addressed for fugitive emissions, since updated average and maximum spent carbon concentrations were also available. Chronic criteria are relevant for the re-evaluation of fugitive emissions based on average spent carbon concentrations. Acute criteria are relevant for the re-evaluation of fugitive emissions based on maximum spent carbon concentrations. The results of this review for compounds associated with fugitive emissions are provided in Tables A2 and A3 in Attachment A.

Recalculate Risks

The risk assessment results for fugitive emissions were revised incorporating recent spent carbon data, a more refined method for calculating emissions of organic compounds from spent carbon unloading, and updated toxicity criteria.

Risks were recalculated for the receptor types and locations with the highest risk results associated with fugitive emissions in the original risk assessment. For chronic risks, the receptors with the highest risk results were the town resident receptor (R_6_resident Adult and R_6_resident Child) and the farmer receptor (R_3_farmer Adult and R_3_farmer Child). For acute risks, the receptor locations with the highest acute inhalation risk results were the maximum impact point near the outdoor hopper (A_3 max hourly - fugitives), the closest business (A_2 closest business) and the residential area in town with the highest hourly modeled impacts for fugitive hopper emissions (R_5 resident).¹¹ It should be noted that the maximum hourly air concentration impact point is located about 10 meters immediately to the north of the outdoor hopper at the property boundary. There is no residential or commercial land use in the vicinity of this maximum impact location.

Risks were recalculated using the same publicly available software program (IRAP) that was used in the original risk assessment and that has been independently programmed to specifically reflect USEPA's 2005 HHRAP guidance. Chronic risks were recalculated using the average emission rates shown in Table 6, whereas acute risks were recalculated using the maximum emission rates. Other than the updates to input data in the IRAP software noted above (emission rates and toxicity criteria), no other modifications were made to the IRAP model runs.

Tables 7 and 8 present the revised fugitive emissions risk assessment results for chronic and acute health effects, respectively. The revised chronic risk results are many orders of magnitude below USEPA's benchmark cancer risk level of 1E-5 (one in 100,000) over a 70-year lifetime and below the conservative non-cancer benchmark level of 0.25 used by USEPA for evaluating combustion sources. The revised acute risk assessment results are expressed using hazard quotients, which were calculated for each chemical individually. The hazard quotients ranged from less than 1E-9 to 0.001 at the maximum off-site impact point (A_3). These values are all far below the common regulatory target

¹¹ The designations for specific receptors were taken from the 2007 risk assessment report (see Table 4.3-8).

level of one for acute inhalation risks, by orders of magnitude. Even if the hazard quotients for the individual compounds were added together for groups of compounds having similar types of health effects (e.g., respiratory), the combined results would still be far below a target level of one. In general, these revised results are much lower than those in the original risk assessment due to the more refined adsorption/desorption activated carbon isotherm modeling approach used to calculate organic compound emission rates associated with spent carbon unloading.

Conclusion

These results demonstrate that adverse health effects are not expected to occur in areas near to the reactivation facility as a result of inhalation exposure to fugitive emissions during spent carbon unloading at the outdoor hopper. Overall, this analysis corroborates the findings of the original risk assessment which showed that potential human health risks associated with spent carbon unloading at the outdoor hopper were below regulatory benchmark risk levels for chronic and acute health effects.

Table 7
Updated Chronic Risk Assessment Results: Fugitive Emissions During Spent Carbon Unloading

Receptor Name	Scenario	Description (Exposure Pathway)	Excess Lifetime Cancer Risk (a,c)	Total Hazard Index (b,c)
<i>Residential Receptor (developed area within and around Town of Parker)</i>				
R_6 resident	resident_adult	Residential area in town with highest annual modeled impacts for fugitive hopper emissions (inhalation)	2E-13	1E-8
	resident_child		4E-14	1E-8
<i>Farmer Receptor (residential area within Colorado River Indian Tribes Reservation)</i>				
R_3 resident farmer	farmer_adult	Residential area with access to irrigation water with highest annual modeled impacts for stack and fugitive hopper emissions (inhalation)	3E-13	2E-8
	farmer_child		5E-14	2E-8

(a) The additional (excess) lifetime cancer risks reflect exposure to all potential carcinogens evaluated. The regulatory target cancer risk level used by USEPA for combustion sources is 1E-5 (1 in 100,000). A value of 1E-5 is 10 times higher than 1E-6 and 100 times higher than 1E-7.

(b) The listed hazard index values for non-cancer effects reflect exposure to all evaluated compounds, regardless of the type of health effects. If a hazard index, based on the sum of hazard quotients for all compounds, is above 1, then the hazard index values are recalculated for groups of compounds having the same type of health effect and/or a more detailed evaluation may be conducted. USEPA uses a target hazard index value, for compounds grouped according to specific types of health effects, of 0.25 for combustion sources. A common regulatory target hazard index value used by most states and many other USEPA programs, for compounds grouped according to specific types of health effects, is 1.

(c) Risks were presented in the July 2007 risk assessment report in Table 4.4-4. Risks were recalculated for all 23 compounds evaluated for fugitive emissions taking into account three modifications: updates to toxicity criteria, incorporation of recent spent carbon data (average concentrations), and reliance on a more refined method for calculating organic compound emissions that reflects the adsorption/desorption behavior of organic compounds on activated carbon. See text for further information.

Table 8
Updated Acute Risk Assessment Results: Fugitive Emissions During Spent Carbon Unloading

Receptor Name	Description (Exposure Pathway)	Minimum Hazard Quotient (a,b)	Maximum Hazard Quotient (a,b)
<i>Residential Receptors (developed area within and around Town of Parker)</i>			
R_5 resident	Residential area in town with highest hourly modeled impacts for fugitive hopper emissions (inhalation)	<1E-9	3E-6
<i>Maximum Impact Point (undeveloped land area)</i>			
A_3 max hourly - fugitives	Maximum fugitive hopper emissions impact location for hourly concentrations. Occurs on northern facility property boundary. There is no residential or commercial land use in the vicinity of the maximum impact location. (inhalation)	<1E-9	0.001
<i>Non-Residential Areas</i>			
A_2 closest business	Closest developed location beyond property boundary (non-residential) with highest hourly modeled impacts (inhalation)	<1E-9	4E-5

(a) These results are based on both maximum fugitive chemical-specific emission rates and maximum hourly air dispersion modeling results.

(b) The minimum and maximum results are the lowest and highest hazard quotients, respectively, calculated for any individual compound among all of the evaluated compounds. The typical target hazard quotient value used by regulatory agencies is 1.

(c) Acute inhalation risks were presented in Table 4.4-5 in the July 2007 risk assessment report and in Table 13 in the March 2008 response to comment document. Risks were recalculated for all 23 compounds evaluated for fugitive emissions taking into account three modifications: updates to toxicity criteria, incorporation of recent spent carbon data (maximum concentrations), and reliance on a more refined method for calculating organic compound emissions that reflects the adsorption/desorption behavior of organic compounds on activated carbon. See text for further information.

ATTACHMENT A
UPDATES TO TOXICITY CRITERIA

Table A1
Evaluation of Chronic Toxicity Criteria for Risk-Driver Compounds: Stack Emissions

Compound	Comparison of Toxicity Criteria Used in 2007 Risk Assessment to Criteria Available as of June 2014 For Risk Drivers									
	Inhalation Reference Concentration (RfC) (mg/m ³)		Inhalation Unit Risk Factor (URF) (ug/m ³) ⁻¹		Oral Reference Dose (RfD) (mg/kg-day)		Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹		Toxic Equivalency Factor for PCDDs/PCDFs	
	Value	Basis	Value	Basis	Value	Basis	Value	Basis	Value	Basis
Aluminum	No change		no change (b)		No change		no change (b)			
Aroclor 1254	No change (but note comment on RTR) (a)		no value available for original HRA; current value = 0.0001	IRIS	No change		No change			
Barium	No change		no change (b)		original HRA value = 0.07; current value = 0.2	IRIS	no change (b)			
Cadmium	original HRA value = 0.0002; current value = 0.00002	CALEPA	No change		original HRA value = 0.0004; current value = 0.001	IRIS	original HRA value = 0.38; current value = 15	CALEPA		
Chlordane	No change		No change		No change		No change			
Chlorine	No change		no change (b)		No change		no change (b)			
Chloroform (Trichloromethane)	No change		No change		No change		no value available for original HRA; current value = 0.019	CALEPA		
DDD, 4,4'-	no change (b)		No change (but note comment on RTR)(a)		no change (b)		No change			
DDT, 4-4'-	No change (but note comment on RTR) (a)		No change (but note comment on RTR) (a)		No change		No change			
Heptachlor epoxide	No change (but note comment on RTR) (a)		No change		No change		No change			
Hydrogen chloride	No change		no change (b)		No change (but note comment on RTR) (a)		no change (b)			

Table A1
Evaluation of Chronic Toxicity Criteria for Risk-Driver Compounds: Stack Emissions

Compound	Comparison of Toxicity Criteria Used in 2007 Risk Assessment to Criteria Available as of June 2014 For Risk Drivers									
	Inhalation Reference Concentration (RfC) (mg/m ³)		Inhalation Unit Risk Factor (URF) (ug/m ³) ⁻¹		Oral Reference Dose (RfD) (mg/kg-day)		Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹		Toxic Equivalency Factor for PCDDs/PCDFs	
	Value	Basis	Value	Basis	Value	Basis	Value	Basis	Value	Basis
Lead	No change		No change		No change (but note comment on RTR) (a)		No change			
Manganese	No change		no change (b)		No change		no change (b)			
Mercuric chloride	original HRA value = 0.0011 (based on RTR (a)); current value = 0.00003	CALEPA	no change (b)		No change		no change (b)			
Methyl mercury	No change (but note comment on RTR) (a)		no change (b)		No change		no change (b)			
Nickel	original HRA value = 0.0002; current value = 0.000014	CALEPA	No change		No change		no change (b)			
Nitrogen dioxide	No change		no change (b)		no change (b)		no change (b)			
Sulfur dioxide	No change (c)		no change (b)		no change (b)		no change (b)			
<i>PCDDs/PCDFs (Dioxins and Furans) - Included in Top Ten Risk-Drivers</i>										
2,3,7,8-TCDD	no change (b)		original HRA value = 33; current value = 38	CALEPA (d)	no value available for original HRA; current value = 7E-10	IRIS	original HRA value = 150,000; current value = 130,000	CALEPA (d)	no change	
2,3,7,8-TCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,7,8-PeCDD	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	

Table A1
Evaluation of Chronic Toxicity Criteria for Risk-Driver Compounds: Stack Emissions

Compound	Comparison of Toxicity Criteria Used in 2007 Risk Assessment to Criteria Available as of June 2014 For Risk Drivers									
	Inhalation Reference Concentration (RfC) (mg/m ³)		Inhalation Unit Risk Factor (URF) (ug/m ³) ⁻¹		Oral Reference Dose (RfD) (mg/kg-day)		Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹		Toxic Equivalency Factor for PCDDs/PCDFs	
	Value	Basis	Value	Basis	Value	Basis	Value	Basis	Value	Basis
1,2,3,7,8-PeCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	original HRA value = 0.05; current value = 0.03	USEPA (e)
2,3,4,7,8-PeCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	original HRA value = 0.5; current value = 0.3	USEPA (e)
1,2,3,4,7,8-HxCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,6,7,8-HxCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
2,3,4,6,7,8-HxCDF	no change (b)		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
<i>Other PCDDs/PCDFs - Not Among Risk-Drivers But Updated for and Included in Risk Recalculation</i>										
1,2,3,7,8,9-HxCDF	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,6,7,8-HxCDD	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,4,7,8-HxCDD	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,7,8,9-HxCDD	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	

Table A1
Evaluation of Chronic Toxicity Criteria for Risk-Driver Compounds: Stack Emissions

Compound	Comparison of Toxicity Criteria Used in 2007 Risk Assessment to Criteria Available as of June 2014 For Risk Drivers									
	Inhalation Reference Concentration (RfC) (mg/m ³)		Inhalation Unit Risk Factor (URF) (ug/m ³) ⁻¹		Oral Reference Dose (RfD) (mg/kg-day)		Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹		Toxic Equivalency Factor for PCDDs/PCDFs	
	Value	Basis	Value	Basis	Value	Basis	Value	Basis	Value	Basis
1,2,3,4,6,7,8-HpCDD	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,4,6,7,8-HpCDF	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
1,2,3,4,7,8,9-HpCDF	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	no change	
Total OCDD	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	original HRA value = 0.0001; current value = 0.0003	USEPA (e)
Total OCDF	No change		original HRA value = 33*TEF; current value = 38*TEF	CALEPA (d)	no value available for original HRA; current value = 7E-10/TEF	IRIS	original HRA value = 150,000*TEF; current value = 130,000*TEF	CALEPA (d)	original HRA value = 0.0001; current value = 0.0003	USEPA (e)

CALEPA = California Environmental Protection Agency

HRA = health risk assessment

IRIS = U.S. Environmental Protection Agency Integrated Risk Information System

RTR = route-to-route extrapolation from/to inhalation toxicity value to/from an oral toxicity value.

TEF = toxic equivalency factor

(a) The toxicity value used in the 2007 risk assessment was obtained from USEPA's 2005 HHRAP guidance and was based on route-to-route extrapolation from an oral or inhalation toxicity value. In 2009, USEPA published updated guidance for inhalation risk assessment (USEPA 2009) and no longer recommends using inhalation toxicity values generated using simple route-to-route extrapolation. For the purposes of this evaluation, risks were not recalculated without these route-to-route based values. This means that risks in the original risk assessment for these compounds, and here, would be larger than if recalculated without the route-to-route based toxicity values. Source: USEPA. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). EPA-540-R-070-002.

Table A1
Evaluation of Toxicity Criteria for Risk-Driver Compounds: Stack Emissions

Notes (continued)

(b) No value available from USEPA's Human Health Risk Assessment Protocol (HHRAP) guidance recommended data sources, both when risk assessment was conducted (July 2007) and at present (June 2014).

(c) USEPA revoked the annual average NAAQS in 2010 because the Agency determined it was not needed in light of the new 1-hour standard.

(d) CALEPA updated its slope factors for dioxins and furans since the risk assessment was conducted and these values are now included in USEPA's risk screening levels tables under the Superfund Program, although they have not been carried through to IRIS. CALEPA's inhalation unit risk is 38, rather than 33 (ug/m³)⁻¹. CALEPA's oral slope factor is 130,000 rather than 150,000 (mg/kg-day)⁻¹.

(e) USEPA 2010: U.S. Environmental Protection Agency (USEPA). 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. Risk Assessment Forum, Washington, DC. EPA/600/R-10/005.

Table A2
Evaluation of Chronic Toxicity Criteria for Fugitive Emission Compounds

Compound	Comparison of Chronic Toxicity Criteria Used in 2007 Risk Assessment to Criteria Available as of June 2014			
	Inhalation Reference Concentration (RfC) (mg/m ³)		Inhalation Unit Risk Factor (URF) (ug/m ³) ⁻¹	
	Value	Basis of New Value	Value	Basis of New Value
1,3-Butadiene	No change		No change	
1-Hexane (n-hexane)	No change		No change (a)	
Acrylonitrile	No change		No change	
Arsenic	original HRA value = 3E-5; current value = 1.5E-5	CALEPA	No change	
Benzene	No change		No change	
Beryllium	No change		No change	
Cadmium	original HRA value = 0.0002; current value = 0.00002	CALEPA	No change	
Chromium	Original USEPA value based on RTR; USEPA no longer recommends RTR (b)		No change (a)	
Chromium VI	No change		No change	
Cobalt	original HRA value = 0.0001; current value = 6E-6	PPRTV	no value available for original HRA; current value = 9E-3	PPRTV
Copper	Original USEPA value based on RTR; USEPA no longer recommends RTR (b)		No change (a)	
Cyclohexane	No change		No change (a)	
Dichlorobenzene,1,4-	No change		No change	
Ethylbenzene	No change		No change (a)	
Ethylene Dibromide	No change		No change	
Naphthalene	No change		No change (a)	
Nickel	original HRA value = 0.0002; current value = 0.000014	CALEPA	No change	
Styrene	No change		No change (a)	
Tetrachloroethylene (Perchloroethylene)	original HRA value = 0.4; current value = 0.04	IRIS	original HRA value = 5.9E-6; current value = 2.6E-7	IRIS
Toluene	original HRA value = 0.4; current value = 5	IRIS	No change (a)	
Trichloroethylene	original HRA value = 0.6; current value = 0.002	IRIS	original HRA value = 2E-6; current value = 4.1E-6	IRIS
Vinyl Chloride	No change		No change	
Chloroform (Trichloromethane)	No change		No change	

CALEPA = California Environmental Protection Agency; HRA = health risk assessment; IRIS = U.S. Environmental Protection Agency Integrated Risk Information System; PPRTV = Provisional Peer Reviewed Toxicity Values for Superfund; RTR = route-to-route extrapolation from/to inhalation toxicity value to/from an oral toxicity value.

(a) No value available from USEPA's Human Health Risk Assessment Protocol (HHRAP) guidance recommended data sources, both when risk assessment was conducted (July 2007) and at present (June 2014).

(b) The toxicity value used in the 2007 risk assessment was obtained from USEPA's 2005 HHRAP guidance and was based on route-to-route extrapolation from an oral or inhalation toxicity value. In 2009, USEPA published updated guidance for inhalation risk assessment (USEPA 2009) and no longer recommends using inhalation toxicity values generated using simple route-to-route extrapolation. For the purposes of this evaluation, risks were not recalculated without these route-to-route based values. This means that risks in the original risk assessment for these compounds, and here, would be larger than if recalculated without the route-to-route based toxicity values. Source: USEPA. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). EPA-540-R-070-002.

Table A3
Evaluation of Acute Toxicity Criteria for Fugitive Emission Compounds

Compound	Comparison of Acute Inhalation Reference Concentration (RfC) (mg/m3) used in 2007 Risk Assessment to Criteria Available as of June 2014 (a)	
	Value	Basis of New Value
1,3-Butadiene	original HRA value = 1,480; current value = 0.66	CALEPA
1-Hexane (n-hexane)	original HRA value = 1,500; current value = 1,100	TEEL-1
Acrylonitrile	original HRA value = 22; current value = 10	USEPA AEGL-1 (interim)
Arsenic	No change	
Benzene	original HRA value = 1.3; current value = 0.027	CALEPA
Beryllium	original HRA value = 0.005; current value = 0.0023	TEEL-1
Cadmium	original HRA value = 0.03; current value = 0.1	USEPA AEGL-1 (interim)
Chromium	No change	
Chromium VI	No change (b)	
Cobalt	original HRA value = 3; current value = 0.18	TEEL-1
Copper	original HRA value = 0.1; current value = 1.0	TEEL-1
Cyclohexane	original HRA value = 1,000; current value = 340	TEEL-1
Dichlorobenzene,1,4-	original HRA value = 600; current value = 60	TEEL-1
Ethyl benzene	original HRA value = 500; current value = 144	USEPA AEGL-1 (interim)
Ethylene Dibromide	original HRA value = 200; current value = 131	USEPA AEGL-1 (interim)
Naphthalene	original HRA value = 75; current value = 79	TEEL-1
Nickel	original HRA value = 0.006; current value = 0.0002	CALEPA
Styrene	No change	
Tetrachloroethylene (Perchloroethylene)	No change	
Toluene	No change	
Trichloroethylene	No change	
Vinyl Chloride	No change	
Chloroform (Trichloromethane)	No change	

CALEPA = California Environmental Protection Agency; HRA = health risk assessment; USEPA AEGL-1 = 1-hour average acute exposure guideline level developed by USEPA; TEEL-1 = Temporary Emergency Exposure Limit for 1-hour exposure, commissioned by the US Department of Energy.

(a) Acute toxicity criteria hierarchy identified based on USEPA 2005 HHRAP guidance.

(b) No value available from USEPA's Human Health Risk Assessment Protocol (HHRAP) guidance recommended data sources, both when risk assessment was conducted (July 2007) and at present (June 2014).

ATTACHMENT B
DESCRIPTION OF FUGITIVE EMISSIONS MODELING
METHODOLOGY FOR ORGANIC COMPOUNDS

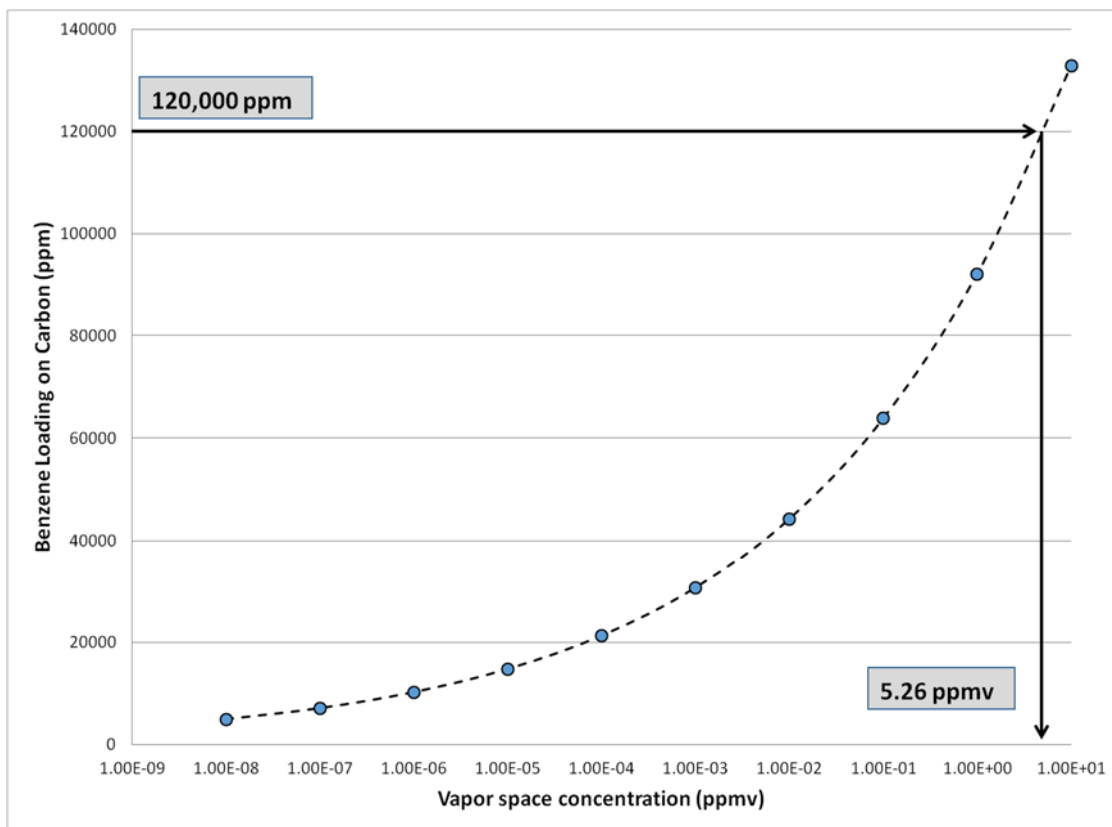
FUGITIVE EMISSIONS MODELING METHODOLOGY FOR ORGANIC COMPOUNDS

This attachment describes the methodology for calculating organic compound emission rates from spent carbon unloading. This methodology relies on activated carbon isotherms to calculate vapor-filled pore space concentrations in the spent carbon matrix.

Isotherms quantify the constant-temperature equilibrium that exists between an adsorbent such as activated carbon and an adsorbate such as a gaseous contaminant. This equilibrium can be represented graphically (Figure 1) where the loading on activated carbon (y-axis) is plotted against the gaseous contaminant concentration (x-axis).

Isotherm data can be readily fit to several numerical models. The Freundlich Isotherm model is the most widely used and most common for describing activated carbon adsorption equilibria.¹² In the Freundlich Isotherm, the loading (Q) is a function of the gas concentration (C) with two constants, "K" and "1/n." In this model, "K" is the adsorption coefficient and "1/n" the adsorption exponent. In the absence of empirical data, these constants are estimated from known properties of gases, such as the molar volume and molar refractivity. Several authors have calculated and compiled the Freundlich Isotherm constants for organic compounds (Yaws 2008) and these constants have been used for the calculations herein (Table 1, and see example calculation below).

Figure 1: Example Isotherm for Benzene - Activated Carbon Loading v. Pore Space Vapor Concentration. Arrows provide a graphical representation of the calculation corresponding to a benzene loading on spent carbon of 120,000 ppm (the maximum loading for spent carbon shown in Table 1.)



¹² Foo, K.Y. and Hameed, B.H. 2010. Review: Insights into the modeling of adsorption isotherm systems. Chemical Engineering Journal 156:2–10.

Table 1: Solid phase compound concentration on spent carbon, Freundlich Isotherm constants, and calculated equilibrium vapor-filled pore space concentrations.

Compound	CAS #	Concentration in spent carbon (ppm)		Freundlich Isotherm Constants (a)		Concentration in vapor-filled pore space of spent carbon (ppmv) (b)	
		Average Concentration	Maximum Concentration	K	1/n	Average Concentration	Maximum Concentration
1,2-Dibromoethane	106-93-4	0.10	0.10	43.27	0.10	<0.00001	<0.00001
1,3-Butadiene	106-99-0	5,988	9,330	1.12	0.28	0.1038	0.5143
1,4-Dichlorobenzene	106-46-7	75	223	40.61	5.97	0.2367	0.2841
Acrylonitrile	107-13-1	1.0	6,400	2.00	0.31	<0.00001	0.0250
Benzene	71-43-2	2,518	120,000	9.21	0.16	<0.00001	5.2645
Chloroform	67-66-3	147	10,600	6.58	0.24	<0.00001	0.00045
Cyclohexane	110-82-7	202	700	6.60	0.17	<0.00001	<0.00001
Ethylbenzene	100-41-4	1,865	131,158	25.50	6.16	0.4498	0.8976
Naphthalene	91-20-3	37	110	93.18	2.42	0.0151	0.0238
n-Hexane	110-54-3	3,770	13,000	9.03	0.13	<0.00001	<0.00001
Styrene	100-42-5	2,281	150,000	28.06	5.74	0.4324	0.8966
Tetrachloroethylene	127-18-4	5,997	144,000	34.75	9.40	0.6492	0.9105
Toluene	108-88-3	3,359	68,000	17.56	0.10	<0.00001	0.00006
Trichloroethylene	79-01-6	1,333	108,000	15.40	0.16	<0.00001	0.1106
Vinyl Chloride	75-01-4	39	410	0.19	0.43	0.00011	0.0269

(a) Source: Yaws, Carl L. (2008). Yaws' Handbook of Properties for Environmental and Green Engineering. Knovel.

(b) For some compounds, the isotherm calculation produces vapor-filled pore space concentrations below typical quantification limits (e.g., values as low as 1E-5 to <1E-15 ppmv). For the purposes of calculating fugitive emissions, a default value of 0.00001 ppmv was inserted in place of vapor-filled pore space concentrations that were calculated to be less than 0.00001 ppmv. These results are denoted with a "<" sign.

Example Calculation for Pore Space Vapor Concentration: Benzene

Given:

Maximum Solid Phase Concentration: 120,000 ppm = **120,000 µg/g**

Freundlich "K": **9.21** (g/100g * 1/ppmv)^{1/n}

Freundlich "1/n": **0.16** (unitless)

Freundlich Isotherm Equation:

$$Q = K \times C^{1/n}$$

(where Q = loading (g/100g) and C = vapor concentration (ppmv))

Step 1: Convert Solid Phase Concentration from $\mu\text{g/g}$ to $\text{g}/100\text{g}$

$$\left(\frac{120,000 \mu\text{g}}{\text{g carbon}}\right)\left(\frac{\text{g}}{10^6 \mu\text{g}}\right) = \frac{0.12 \text{ g}}{\text{g carbon}} = \frac{12 \text{ g benzene}}{100\text{g carbon}}$$

Step 2: Rearrange Freundlich Isotherm Equation to Solve for Pore Space Vapor Concentration (C)

$$Q = K \times C^{1/n}$$

$$\log Q = \log K + \frac{1}{n} \times \log C$$

$$\log Q - \log K = \frac{1}{n} \times \log C$$

$$\frac{\log Q - \log K}{\frac{1}{n}} = \log C$$
$$10^{\frac{\log Q - \log K}{1/n}} = C$$

Step 3: Solve for Pore Space Vapor Concentration (C)

$$10^{\frac{\log Q - \log K}{1/n}} = C$$

$$10^{\frac{\log 12 - \log 9.21}{0.16}} = C = \mathbf{5.26 \text{ ppmv}}$$