UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7

IN THE MATTER OF

Collis, Inc.	)	Docket No. RCRA-07-2012-0014
Respondent	)	

ORDER

Pursuant to 40 C.F.R. § 22.5(a)(1), electronic filing of page 17 of the Consent Agreement and Final Order is authorized in this proceeding.

Dated: March 27, 2013

Karina Borromeo

Karina Borromeo
Regional Judicial Officer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 RENNER BOULEVARD
LENEXA, KANSAS 66219

IN THE MATTER OF:	
Collis, Inc.	CONSENT AGREEMENT AND FINAL ORDER
EPA ID Number IAD047303771	
Respondent	
	Docket No. RCRA-07-2012-0014
Proceeding under Section 3008 (a) and (g) of the Resource Conservation and Recovery Act as amended, 42 U.S.C. § 6928(a) and (g).	

I. PRELIMINARY STATEMENT

This proceeding was initiated on or about March 27, 2012, when the United States Environmental Protection Agency, Region 7 ("Complainant" or "EPA") issued a Complaint, Compliance Order and Notice of Opportunity for Hearing ("Complaint") to Collis, Inc. ("Respondent"). Pursuant to Sections 3008(a) and (g) of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 and the Hazardous and Solid Waste Amendments of 1984 (hereinafter known as RCRA), Title 42 United States Code (U.S.C.), Section 6901 *et seq.*, the Complainant sought civil penalties for alleged violations of Section 3005 of RCRA and of 40 Code of Federal Regulations (C.F.R.), Sections 262.11, 279.22, 273.13, 273.14, and 273.15.

The Complainant and Respondent subsequently entered into negotiations in an attempt to settle the allegations contained in the Complaint. This Consent Agreement and Final Order (CAFO) is the result of such negotiations and resolves without hearing or adjudication all issues relating to the civil administrative claims arising from the allegations in the Complaint.

II. CONSENT AGREEMENT

1. Respondent and the EPA agree to the terms of this Consent Agreement and Final Order and Respondent agrees to comply with the terms of the Final Order. The terms of this CAFO shall not be modified except by a subsequent written agreement between the parties.

2. Respondent admits the jurisdictional allegations of the Complaint and agrees not to contest the EPA's jurisdiction in this proceeding or any subsequent proceeding to enforce the terms of the Final Order set forth below.

3. Respondent neither admits nor denies the factual allegations and legal conclusions set forth in the Complaint.

4. Without admitting liability or fault, Respondent waives its right to further contest the factual allegations and legal conclusions set forth in the Complaint in this or subsequent proceedings to enforce the terms of this CAFO, and agrees not to appeal the Final Order set forth below.

5. Respondent explicitly waives its right to a hearing on any issue of fact or law set forth in the EPA's Complaint by virtue of this settlement but only for this case.

6. Respondent and the EPA each agree to bear their own costs and attorneys' fees.

7. This CAFO addresses and resolves all civil administrative claims for the RCRA violations alleged in the Complaint. Complainant reserves the right to take any enforcement action with respect to any other violations of RCRA or any other applicable law, and Respondent reserves its defenses to any such claims.

8. The effect of settlement described in Paragraph 7, above, of this Consent Agreement is conditioned upon the accuracy of Respondent's representations to the EPA, as memorialized in Paragraph 9, below, of this Consent Agreement.

9. Respondent certifies that by signing this CAFO that to best of its knowledge, Respondent's facility is in compliance with all applicable requirements of RCRA, 42 U.S.C. § 6901 *et. seq.*, and all regulations promulgated thereunder.

10. Respondent agrees that, in settlement of the claims alleged in the Complaint, Respondent shall pay a mitigated civil penalty of $31,379.00 as set forth in Paragraph 1 of the Final Order below, and shall perform two Supplemental Environmental Projects ("SEPs") as set forth in this CAFO. The projected combined penalty mitigation amount of the SEPs is $91,809.00.

11. Respondent agrees to pay any stipulated penalties as set forth in Paragraphs 13 through 21 and 33 of this Consent Agreement.

12. Respondent agrees to perform the compliance activities as set forth in Paragraph 5 of the Final Order.

A. General Stipulated Penalties

13. In addition to the interest and per annum penalties described below, in the event that Respondent fails to pay the full amount of the penalty within the time specified in Paragraph 1 of the Final Order, Respondent agrees to pay Complainant a stipulated penalty in the amount of up to Five Hundred Dollars ($500.00) for each day the default continues.

14. In addition to the interest and per annum penalties described below, in the event Respondent fails to comply with any of the compliance tasks identified in Section B of the Final Order of this CAFO, Respondent shall, for each such failure, be liable for a stipulated penalty in the amount of up to One Hundred Dollars ($100.00) for each day from the first to the fifteenth day, Three Hundred Dollars ($300.00) for each day from the sixteenth to the thirtieth day, and Five Hundred Dollars ($500.00) for each day thereafter that the failure continues.

15. All penalties shall begin to accrue on the date that performance is due or a violation occurs, and shall continue to accrue through the final day of correction of the noncompliance. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations.

16. All penalties owed to the EPA under this Section shall be due within thirty (30) days of receipt of a notification of noncompliance. Such notification shall describe the noncompliance and shall indicate the amount of penalties due. Interest at the current rate published by the United States Treasury, as described at 40 C.F.R. § 13.11, shall begin to accrue on the unpaid balance at the end of the thirty-day period.

17. All penalties under this Section shall be made payable in accordance with Paragraph 2 of the Final Order of this CAFO, and notification shall be provided in accordance with Paragraph 3 of the Final Order of this CAFO.

18. The payment of stipulated penalties shall not alter in any way Respondent's obligations to complete the performance required hereunder.

19. The stipulated penalties set forth in this Section do not preclude the EPA from pursuing any other remedies or sanctions which may be available to the EPA by reason of Respondent's failure to comply with any of the requirements of this CAFO.

20. Notwithstanding any other provision of this Section, the EPA may in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this CAFO.

21. The payment of stipulated penalties specified in this CAFO shall represent civil penalties assessed by the EPA and shall not be deducted by Respondent or any other person or entity for federal, state or local taxation purposes.

B. Supplemental Environmental Project(s)

22. In response to the violations of RCRA, alleged in the Complaint and in settlement of this matter, although not required by RCRA or any other federal, state, or local law, Respondent shall complete the SEPs described in this CAFO, which the parties agree is intended to secure significant environmental or public health protection and improvement.

23. Respondent shall complete the following SEPs: (a) a re-lamping project involving the replacement of high-mercury fluorescent fixtures and bulbs with low-mercury fluorescent fixtures and bulbs at its Facility with a projected eligible cost of $76,952.00, and (b) a paint waste minimizer project that will significantly reduce the Facility's generation of hazardous solvent waste, with a projected eligible cost of $14,857.00 These SEPs shall be performed in accordance with the requirements of this CAFO, including the SEP Work Plan attached as Appendix A and incorporated into this CAFO.

24. Eligible SEP costs include the cost of planning and implementing the SEPs, as detailed in the SEP Work Plan, but do not include overhead, depreciation or wear and tear of equipment owned by Respondent used to perform the SEPs, administrative expenses, legal fees, and contractor oversight expenses.

25. Regarding the SEPs, Respondent certifies to the truth of each of the following:

a. As of the date that Respondent executes this CAFO, Respondent is not required to perform or develop the identified SEP projects by any federal, state, or local law or regulation, nor is Respondent required to perform or develop the SEPs by agreement, grant, or as injunctive relief awarded in any other action in any forum.

b. The SEPs are not projects that Respondent was planning or intending to construct, perform, or implement other than in settlement of the claims resolved in this CAFO.

c. Respondent has not received, and is not negotiating to receive, credit for the SEPs in any other enforcement action.

d. Respondent will not receive any reimbursement for any portion of the SEP expenditures from any other person.

26. SEP Completion Report. Within thirty (30) days of the deadline for completing the SEPs established pursuant to the SEP Work Plan, or as subsequently modified by agreement of the parties, Respondent shall submit a SEP Completion Report to the EPA in accordance with Paragraph 29 of this Consent Agreement. The SEP Completion Report shall conform to the requirements of this CAFO and shall contain the following information:

a. Detailed descriptions of the SEPs as implemented.

b. An itemized list of all eligible SEP costs.

c. Description of the specific environmental and public health benefits resulting from performance of the SEPs, with quantification, as feasible, of the benefits and pollutant reductions. Documentation of such quantification may include, but is not limited to, manifests for the shipment of offsite waste, both before and after implementation of the SEP projects. To the extent that relevant documentation was provided in the SEP Work Plan, Respondent may incorporate that documentation by reference into the SEP Completion Report.

d. Certification by Respondent that the SEPs have been fully implemented pursuant to the provisions of the CAFO, or a statement to the contrary, with a detailed explanation of any deviation from the provisions of the CAFO.

27. In itemizing its costs in the SEP Completion Report, Respondent shall clearly identify and provide acceptable documentation for all SEP costs. For purposes of this Paragraph, "acceptable documentation" includes invoices, purchase orders, or other documentation that specifically identifies and itemizes the individual costs of the goods and/or services for which payment is being made. Cancelled drafts do not constitute acceptable documentation unless such drafts specifically identify and itemize the individual costs of the goods and/or services for which payment is being made. The EPA, at its sole discretion, may, in accordance with Paragraph 30 of the Consent Agreement, require Respondent to submit additional information to determine the adequacy of SEP completion or eligibility of SEP costs.

28. The SEP Completion Report shall include the statement of Respondent, through an officer, signed and certifying under penalty of law the following:

> I certify under penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

29. The SEP Completion Report shall be submitted on or before the due dates specified in this CAFO and subsequent amendments thereto pursuant to the terms of this CAFO, to:

> Kevin Snowden, AWMD/WEMM
> U.S. Environmental Protection Agency, Region 7
> 11201 Renner Boulevard
> Lenexa, Kansas 66219.

30. SEP Completion Report Approval: The SEP Completion Report submitted pursuant to this CAFO shall be reviewed in accordance with the procedures outlined in this Paragraph, which supersedes, for the purposes of these submittals, the procedures outlined in Section C of the Final Order (Submittals). The EPA will review the SEP Completion Report and may approve, approve with modifications, or disapprove and provide comments to Respondent, in addition to requiring further action. If the SEP Completion Report is disapproved with comments, Respondent shall incorporate the EPA's comments and take any specified action and resubmit the SEP Completion Report within thirty (30) days of receipt of the EPA's comments, unless a longer time period is specified by the EPA. If Respondent fails to revise the SEP Completion Report in accordance with the EPA's comments, Respondent shall be subject to the stipulated penalties as set forth in Paragraph 33 of this Consent Agreement.

31. Any public statement, oral or written, in print, film, internet, or other media, made by Respondent making reference to the SEPs shall include the following language:

> This project was undertaken in connection with the settlement of an enforcement action taken by the U.S. Environmental Protection Agency for violations of the Resource Conservation and Recovery Act. 42 U.S.C. § 6901 *et. seq.*

32. For federal income tax purposes, Respondent agrees not to claim the costs expended in the performance of the SEPs as a deductible business expense and agrees not to capitalize the costs expended in the performance of the SEPs in order to increase the basis of Respondent's assets.

33. SEP Compliance. Respondent agrees to pay stipulated penalties as follows:

a. In the event Respondent fails to comply with any of the terms or provisions of this Agreement relating to the performance of the SEPs above, or as provided in a SEP Work Plan approved by the EPA, and/or to the extent that the actual eligible expenditures for the SEPs do not equal or exceed the projected cost of the SEPs described in this Consent Agreement and Final Order, Respondent shall be liable for stipulated penalties according to the provisions set forth below.

i. If the SEPs are satisfactorily completed, but the Respondent spent less than Ninety-One Thousand Eight Hundred and Nine Dollars ($91,809.00) on the SEPs, Respondent shall pay a stipulated penalty to the United States in the amount of the difference between the amount of total eligible SEP costs incurred by Respondent and $91,809.00.

ii. If Respondent halts or abandons work on the SEPs, Respondent shall pay a stipulated penalty of $10,000 in addition to a penalty in the amount of the difference between the amount of total eligible SEP costs incurred by Respondent and $91,809.00.

iii. If Respondent fails to comply with the required schedule for completing the SEPs established pursuant to an approved SEP Work Plan or subsequent revisions thereto or with the deadline for submitting the SEP Completion Report as required above, or to meet the conditions described in Section D of the Consent Agreement below (*Force Majeure*), Respondent shall pay stipulated penalties for each failure to meet an applicable deadline as follows:

Penalty Per Violation Per Day	Period of Noncompliance
$100	1st through 30th day
$300	31st through 59th day
$500	60th day and beyond

Such penalties shall accrue as provided in Paragraph 15 of this Consent Agreement.

iv. Respondent shall pay stipulated penalties for failure to comply with its SEP obligations not more than fifteen (15) days after receipt of written demand by the EPA for such penalties. The method of payment of such penalties shall be in accordance with the provisions set forth in Paragraph 2 of the Final Order portion of this CAFO, below. A decision by the EPA to pursue stipulated penalties for failure to comply with the required schedule for completing the SEPs shall not affect the EPA's ability to pursue statutory penalties for failure to comply with the terms of the Final Order.

C. Late Payment Provisions and Effectiveness

34. Late Payment Provisions: Pursuant to 31 U.S.C. § 3717, the EPA is entitled to assess interest and penalties on debts owed to the United States and a charge to cover the cost of processing and handling a delinquent claim. Interest will therefore begin to accrue on a civil or stipulated penalty if it is not paid by the date required. Interest will be assessed at a rate of the United States Treasury Tax and loan rate in accordance with 31 C.F.R. § 901.9(b). A charge will be assessed to cover the costs of debt collection including processing and handling costs and attorney fees. In addition, a non-payment penalty charge of six (6) percent per year compounded annually will be assessed on any portion of the debt which remains delinquent more than ninety (90) days after payment is due. Any such non-payment penalty charge on the debt will accrue from the date the penalty payment becomes due and is not paid. 31 C.F.R. § 901.9(c) and (d).

35. Respondent understands that failure to pay any portion of the civil penalty on the date the same is due may result in the commencement of a civil action in Federal District Court to collect said penalty, along with interest thereon at the applicable statutory rate

36. This CAFO shall be effective upon filing of the Final Order by the Regional Hearing Clerk for the EPA, Region 7, or with the EPA Headquarters Hearing Clerk, as designated to act for the Regional Hearing Clerk. Unless otherwise stated, all time periods stated herein shall be calculated in calendar days from such date.

37. This CAFO shall remain in full force and effect until Complainant's representative provides Respondent with written notice, in accordance with Paragraph 18 of the Final Order, that all requirements hereunder have been satisfied.

38. Each signatory of this CAFO certifies he or she is fully authorized to enter into the terms of the CAFO.

D. *Force Majeure*

39. Respondent agrees to perform all requirements of this CAFO within the time limits established under this CAFO unless the performance is delayed by a *force majeure*. For purposes of this Order, a *force majeure* is defined as any event arising from causes beyond the control of Respondent, or of any entity controlled by Respondent, including but not limited to its contractors and subcontractors, which delays or prevents performance of any obligation under this CAFO despite Respondent's best efforts to fulfill the obligation. "Best efforts" includes anticipating any potential *force majeure* event and addressing the effects of any such event (a) as it is occurring and (b) after it has occurred, to prevent or minimize any resulting delay to the greatest extent possible. "*Force majeure*" does not include Respondent's financial inability to perform any obligation under this Final Order.

40. If any event occurs or has occurred that may delay the performance of any obligation under this Order, whether or not caused by a *force majeure* event, Respondent shall notify the EPA as soon as possible but not later than 72 hours after the time Respondent first knew of, or by the exercise of due diligence, should have known, that the event might cause a delay. Respondent also shall provide written notice to the EPA, in accordance with Paragraph 6 of this Final Order (Submittals), within seven days after the time Respondent first knew of, or by the exercise of due diligence, should have known of, the event. The notice shall include an explanation and description of the reasons for the delay; the anticipated duration of any delay; Respondent's past and proposed actions to prevent or minimize any delay; a proposed schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Respondent's rationale for attributing any such delay to a *force majeure* event if it intends to assert such a claim, and a statement as to whether, in the opinion of Respondent, such event may cause or contribute to an endangerment to public health, welfare, or the environment. Failure to comply with the above requirements shall preclude Respondent from asserting any claim of *force majeure* for that event for the period of time of such failure to comply and for any additional delay caused by such failure.

41. If the EPA agrees that the delay or anticipated delay is attributable to a *force majeure* event, the time for performance of the obligations under this CAFO that are affected by the *force majeure* event will be extended by the EPA for such time as is necessary to complete those obligations. An extension of time to perform obligations affected by a *force majeure* event shall not, by itself, extend the time to perform any other obligation. If the EPA agrees to an extension of time, such extension shall be provided in writing.

42. If the EPA does not agree that a *force majeure* event has occurred, or does not agree to the extension of time sought by Respondent, the position of the EPA shall control. Respondent preserves its defenses except as otherwise set forth in this CAFO.

III. FINAL ORDER

Pursuant to the authority of Section 3008(a) of RCRA, 42 U.S.C. § 6928(a), and according to the terms of the Consent Agreement set forth above, IT IS HEREBY ORDERED THAT:

A. Payment of Civil Penalty

1. Respondent shall pay a mitigated civil penalty of Thirty-One Thousand Three Hundred and Seventy Nine Dollars ($31,379.00), within thirty (30) days of the effective date of this Final Order.

2. Payment of the penalty by cashier or certified check shall be made payable to "Treasurer of the United States" and remitted to:

United States Environmental Protection Agency
Fines and Penalties
Cincinnati Finance Center
P.O. Box 979077
St. Louis, Missouri 63197-9000.

Wire transfer payments shall be directed to the Federal Reserve Bank of New York as follows:

Federal Reserve Bank of New York
ABA = 021030004
Account = 68010727
SWIFT address = FRNYUS33
33 Liberty Street
New York, New York 10045
Field Tag 4200 of the Fedwire message should read
"D 68010727 Environmental Protection Agency"

On-line payments are available through the Department of Treasury:

www.pay.gov
Enter "sfo 1.1" in the search field.
Open the form and complete required files.

3. The Respondent shall reference the Docket Number, RCRA-07-2012-0014, on the check. A copy of the check or other proof of payment shall also be mailed to:

Office of the Hearing Clerk
U.S. Environmental Protection Agency
Office of Administrative Law Judges
1200 Pennsylvania Ave, N.W., Mail Code 1900L
Washington, DC 20460; and

Chris R. Dudding, Attorney
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219.

4. No portion of the civil penalty or interest paid by Respondent pursuant to the requirements of this CAFO shall be claimed by Respondent as a deduction for federal, state, or local income tax purposes.

B. Compliance Actions

5. Respondent shall take the following actions within the specified time periods, and according to the terms and conditions, specified below.

a. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, an updated copy of the facility contingency plan that includes the capabilities of the emergency equipment, in accordance with 40 C.F.R. § 262.34(a)(4).

b. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, job descriptions for positions at the facility that include hazardous waste management duties, in accordance with 40 C.F.R. § 262.34(a)(4).

c. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, documentation demonstrating that Respondent has performed hazardous waste determinations on all solid waste streams being generated by Respondent at Respondent's facility at 2005 S. 19th Street, Clinton, Iowa, on the date of the Final Order, in

accordance with 40 C.F.R. § 262.11. Such documentation shall include:

i. a description of each solid waste stream generated at the facility (clearly delineating the source of the waste stream);

ii. an indication of whether each solid waste is a hazardous waste or non-hazardous waste and the associated hazardous waste codes that apply to each hazardous waste generated at the facility; and

iii. all information (including but not limited to analytical results, Material Safety Data Sheet documentation, and process knowledge information) which form the basis of Respondent's hazardous waste determinations for each solid waste stream.

d. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, documentation and supporting narrative demonstrating that, for any hazardous waste currently stored on site, such waste is stored in accordance with the permitting requirements of RCRA Section 3005 or that it is exempt from the permitting requirements by meeting the requirements of 40 C.F.R. § 262.34 or other applicable exemption.

e. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, photographic documentation of compliance with the requirement that used oil stored at a generator's facility be labeled or marked clearly with the words "Used Oil," as described in 40 C.F.R. § 279.22(c)(1).

f. Within thirty (30) days of the effective date of this Order provide to the EPA representative referenced below, documentation of compliance with the requirements to close containers of universal waste lamps, to label the containers of waste lamps or the individual lamps, and to track the accumulation period of universal waste stored at the facility, as described in 40 C.F.R. §§ 273.13(d)(1), 273.14(e), and 273.15(c)

g. Within thirty (30) days of the effective date of this Order provide, to the EPA representative referenced below, photographic and narrative documentation that a spill kit is being maintained at the Facility's storage area(s) for hazardous wastes, in accordance with 40 C.F.R. §§ 262.34(a)(4) and 265.32(c), or an explanation why this requirement is not applicable to the Facility.

h. Within ninety (90) days of the effective date of this Order, provide documentation to the EPA representative referenced below, all weekly inspections of all hazardous waste storage areas at the facility performed in accordance with the requirements of 40 C.F.R. §§ 262.34(a)(1)(i) and 265.174, for the period from the effective date of this Order through the date upon which the documentation is provided.

i. Respondent shall implement the Sampling Work Plan for the filter building

container storage area, attached as Appendix B and incorporated into this CAFO, in accordance with the schedule contained therein. During Respondent's implementation of the Work Plan, Respondent shall follow the EPA-approved Quality Assurance Project Plan (QAPP) attached as Appendix C and incorporated into this CAFO.

j. At the close of field activities required pursuant to the Sampling Work Plan, Respondent shall submit a sampling final report, to the EPA representative referenced below, describing the work that was performed and the sampling results. In this report, Respondent may opt to recommend one or more courses of action in light of the sampling findings, including a description of how such action may accord with Respondent's obligations under its existing RCRA Section 3008(h) Administrative Order on Consent (EPA Docket No. VII-94-H-0001), which addresses certain corrective action measures at Respondent's facility. This report shall be reviewed in accordance with Paragraph 9, below, and the EPA shall make a determination whether further sampling or other activities pursuant to RCRA are warranted. Complainant shall provide the final sampling report to the EPA Project Officer assigned to the RCRA Section 3008(h) Administrative Order on Consent (EPA Docket No. VII-94-H-0001).

k. If analysis of the samples collected pursuant to the Sampling Work Plan indicates contamination levels below the action levels approved in the sampling plan, Respondent may submit for the EPA's review and approval in accordance with Paragraph 9 below, a certificate of closure by an independent engineer, which, if approved by the EPA, will be deemed to meet the closure requirements of 40 C.F.R. Section 265, Subpart G, for the filter building container storage area for those potential contaminants. Such determination is limited to the filter building container storage area claims resolved in this CAFO, and shall not be deemed to affect any existing or future obligations to which Respondent may be subject under the existing RCRA Section 3008(h) Administrative Order on Consent (EPA Docket No. VII-94-H-0001).

l. If sampling analysis exceeds the action levels approved in the Sampling Work Plan, the EPA shall determine whether further actions are warranted; such actions may include the performance by Respondent of closure activities pursuant to 40 C.F.R. Part 265, Subpart G or such other course of action set forth in the EPA-approved sampling final report pursuant to subparagraph j above.

m. If the EPA determines that closure of the filter building container storage area is necessary based on the data obtained from the implementation of the Sampling Work Plan indicating contamination that could be attributable to releases, if any, of hazardous wastes from the filter building container storage area which is at issue in this action, Respondent shall submit to the EPA a closure plan for the area that meets the requirements of 40 C.F.R. Part 265, Subpart G. Such plan will be submitted within thirty (30) days of the EPA's written approval of the sampling final report, in which the EPA shall state whether closure of the storage area is required. The closure plan, if any, shall be reviewed in accordance with Paragraph 9, below.

n. If the EPA determines that a closure plan is warranted and that financial assurances

are needed to complete closure, then within thirty (30) days of the EPA's written approval of the sampling final report, or alternatively, of the closure plan submitted by Respondent, in which correspondence the EPA shall state whether financial assurance for closure is to be provided, Respondent shall submit to the EPA evidence that it has established and will maintain financial assurances as described in 40 C.F.R. Part 265, Subpart H.

o. Within sixty (60) days of the close of field activities required pursuant to the closure plan, if closure is required, Respondent shall submit a final report to the EPA representative referenced below describing the work that was performed, to be reviewed in accordance with Paragraph 9, below. Complainant shall provide this final report to the EPA Project Officer assigned to the RCRA Section 3008(h) Administrative Order on Consent (EPA Docket No. VII-94-H-0001).

C. Submittals

6. Respondent shall submit all documents and other correspondence required to be submitted to the EPA by this Final Order to:

Kevin Snowden, AWMD/WEMM
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219.

7. The EPA shall submit any notices or correspondence related to this Consent Agreement and Final Order to:

Hank Evans
General Manager
Collis, Inc.
2005 South 19th Street
Clinton, Iowa 52732-6818; and

Charles M. Denton
Barnes & Thornburg LLP
171 Monroe Avenue, N.W., Suite 1000
Grand Rapids, Michigan 49503.

8. Respondent shall submit in writing to the EPA representative referenced in Paragraph 6 of the Final Order above any request for extension of time to perform actions required by this Final Order.

9. The EPA will review each submission of a plan, report, or request by Respondent, and notify Respondent in writing of the EPA's approval or disapproval of the plan, report, request, or any part thereof. If a submission is disapproved in whole or in part by the EPA, or if the EPA

determines that further action by Respondent is required, the EPA will provide written comments to Respondent explaining the basis for its decision and directing Respondent to take further action as required. Within thirty (30) days of receipt of the EPA's comments pertaining to any submission, or within such longer time as the Parties may agree, Respondent shall submit for EPA review any required work plan for further action to be taken pursuant to the EPA's determination, and/or amend/revise a disapproved submission, addressing all of the EPA's comments, and resubmit same to the EPA. If the EPA disapproves the work plan or revised submission, the EPA may modify and approve the same in accordance with its previous comments. In the event of such modification and approval, the EPA will notify Respondent of the modification/approval.

D. Access

10. The EPA and its authorized representatives shall have access to the Facility at all reasonable times to monitor Respondent's implementation of, and compliance with, the terms of this Final Order. Nothing herein shall be construed to limit the EPA's access authority under RCRA or any other law.

E. Parties Bound

11. This Final Order shall apply to and be binding upon the EPA and Respondent and Respondent's agents, successors and/or assigns. Respondent shall ensure that all contractors, employees, consultants, firms or other persons or entities acting for Respondent with respect to matters included herein comply with the terms of this Consent Agreement and Final Order.

F. Covenant Not to Sue/Reservation of Rights

12. This CAFO addresses and resolves, and the EPA covenants not to sue Respondent for, all civil administrative matters alleged in the EPA's March 27, 2012, Complaint, Docket No. RCRA-07-2012-0014. The EPA reserves the right to take any enforcement action with respect to any other violations of RCRA or any other applicable law.

13. Notwithstanding any other provision of this CAFO, the EPA reserves the right to enforce the terms of the Final Order by initiating a judicial or administrative action under Section 3008 of RCRA, 42 U.S.C. § 6928, and to seek penalties against Respondent in an amount not to exceed thirty-seven thousand five hundred dollars ($37,500) per day per violation pursuant to Section 3008(c) of RCRA, for each day of non-compliance with the terms of the Final Order, or to seek any other remedy allowed by law.

14. Complainant reserves the right to take enforcement action against Respondent for any future violations of RCRA and its implementing regulations and to enforce the terms and conditions of this CAFO. In any subsequent EPA enforcement action, Respondent reserves fully all defenses, rights and claims.

15. Except as expressly provided herein, including the provisions of Section E of this Final Order, nothing in this Consent Agreement and Final Order shall constitute or be construed as a release by either party from any claim (civil or criminal), cause of action, or demand in law or equity by or against any person, firm, partnership, entity or corporation for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release or disposal of any hazardous constituents, hazardous substances, hazardous wastes, pollutants or contaminants found at, taken to, or taken from Respondent's facility.

16. Notwithstanding any other provisions of the CAFO, an enforcement action may be brought pursuant to Section 7003 of RCRA, 42 U.S.C. § 6973, or other statutory authority, should the EPA find that the future handling, storage, treatment, transportation, or disposal of solid waste or hazardous waste at Respondent's facility may present an imminent and substantial endangerment to human health and the environment.

17. The headings in this CAFO are for convenience of reference only and shall not affect interpretation of this Consent Agreement and Final Order.

18. The provisions of this CAFO shall be deemed satisfied upon a written determination by Complainant that Respondent has fully implemented the actions required in the Final Order, which termination shall not be unreasonably withheld or delayed.

COMPLAINANT:

U.S. ENVIRONMENTAL PROTECTION AGENCY

3/21/13
Date

Donald Toensing
Chief
Waste Enforcement and Materials Management Branch
Air and Waste Management Division

3/21/13
Date

Chris R. Dudding
Office of Regional Counsel

RESPONDENT:

COLLIS, INC.

3-21-13
Date

Brian K. Calhoun
Signature

BRIAN CALHOUN
Printed Name

SAFETY & ENVIRONMENTAL DIRECTOR
Title

IT IS SO ORDERED.

3/27/13
Date

Karina Borromeo
Karina Borromeo
Regional Judicial Officer

IN THE MATTER OF Collis, Inc., Respondent
Docket No. RCRA-07-2012-0014

CERTIFICATE OF SERVICE

I certify that a true and correct copy of the foregoing Order was sent this day in the following manner to the addressees:

Copy emailed to Attorney for Complainant:

dudding.chris@epa.gov

Copy mailed First Class Mail to
Attorney for Respondent:

Charles Denton
Barnes & Thornburg LLP
171 Monroe Ave. NW, Suite 1000
Grand Rapids, MI 49503

Copy emailed to Attorney for Respondent:

charles.denton@btlaw.com

and

tammy.helminski@btlaw.com

Copy emailed to:

oaljfiling@epa.gov

Dated:

Kathy Robinson
Hearing Clerk, Region 7

Appendix A

Supplemental Environmental Project Work Plan

Docket No.RCRA-07-2012-0014

Collis, Inc

2005 South 19th Street

Clinton, Iowa 52732

Consistent with Section II B. - Supplemental Environmental Project(s) - of the preceding Consent Agreement and Final Order (CAFO), this Work Plan ("SEP Work Plan") sets forth a detailed scope for two separate Supplemental Environmental Projects (SEP or SEPs) to be implemented at the Collis, Inc. facility in Clinton, Iowa. The following Work Plan includes, for each SEP, itemized projected costs, an implementation schedule, documentation verifying projected costs, and a description of the applicable SEP Category including projected environmental benefits. This SEP Work Plan received USEPA approval on February 1, 2013.

Project Management & Contact Information

For Collis Inc.

Project Manager:	Brian Calhoun –Safety & Environmental Director, SSW Holding Co. Inc. Hank Evans – General Manager, Collis, Inc.	
Mailing Address:	Brian Calhoun 176 West Colon Road Coldwater, MI 49036	Hank Evans 2005 South 19th St. Clinton, IA 52732
Phone:	Brian Calhoun - (517) 227-6118	Hank Evans - (563) 242-1797 Ext 421
Fax:	Hank Evans – (563) 242-0213	
Email:	bcalhoun@sswholding.net	hevans@sswholding.net

For Region 7 – U.S. EPA

Project Manager:	Kevin Snowden, AWMD/WEMM
Mailing Address:	U.S. Environmental Protection Agency, Region 7 11201 Renner Boulevard Lenexa, KS 66219
Phone:	913-551-7022
Fax:	913-551-9022
Email:	Snowden.Kevin@epamail.epa.gov

SEP #1

Project Title:	**Mercury Reduction SEP**

Scope

Collis, Inc. will contract with BLI to retrofit 333 8-foot, 2 lamp T8 fixtures with 4-foot, 4 lamp T8 fixtures using low mercury lamps to reduce total mercury content associated with lighting its facility in Clinton, IA.

Current 8-foot, 2 lamp T8 fixtures, utilize Osram Sylvania T8, Octron®, HO, Linear, High Output lamps which have a mercury content of 9.5 mg per lamp (see attached Osram Sylvania literature summarizing mercury content of their products. Summary is highlighted to show this particular lamp).

These fixtures will be retrofitted with 4-foot, 4 lamp T8 fixtures with low mercury lamps. The selected lamp, a Philips FO32T8/ADV850/ALTO, contains only 1.7 mg of mercury per lamp – reportedly the lowest mercury content of any lamp currently marketed. (see attached Philips literature summarizing the mercury content and environmental benefits of this product. Summary is highlighted to show specific details).

This project also includes the installation of motion sensor switches on all retrofit fixtures (333) as well as an additional 111 motion sensor switches on existing fixtures. Collis has limited employee and forklift traffic within a significant portion of the facility, so the use of motion sensor switches will significantly reduce lamp "burn time" as fixtures will only be on when needed. This "on-demand" usage maximizes lamp life thus reducing mercury disposal and electrical demand.

Projected Cost

Cost Summary

Lighting replacement *	$91,870.94
Alliant incentive (local utility)	$14,919
TOTAL Project	$76,951.94

*Note: attached BLI proposal includes 7% IA Sales Tax.

- Budget includes only contractual fees for material and worked performed to replace existing lighting per the attached October 22, 2012 proposal from BLI Lighting Specialists.
- No Collis, Inc. employee wages or benefits are included in these budget costs.

- Local Utility (Alliant) will provide incentive of $14,919.00, which results in Collis, Inc. incurring costs of approximately $76,951.94.

Detailed Project Budget
See attached October 22, 2012 proposal from BLI Lighting Specialists.

All lamps are to be put into containers and brought back to the BLI facility in Burlington, IA and then picked up by the lighting contractor. They in turn will issue a recycling certificate that all lamps were recycled per applicable rules and regulations. Lamp recycling will be charged at $1.20 per 8' lamp adding an additional $799.20 to the project plus tax of $55.94 for a total of $855.14. If Collis chooses to re-use the retrofitted lamps, which we intend to, this additional charge will not apply. This amount is not included in the cost summary above or the detailed project budget from BLI Lighting Specialists attached.

Implementation Schedule

This Work Plan includes work to replace lighting at Collis Inc. with low mercury lighting to be completed on or before August 1, 2013 and will be contracted to BLI Lighting Specialists of Minnetonka, Minnesota.

Every effort will be made to complete this project on or before August 1, 2013, however Collis is relying entirely on the dates and availability committed to by BLI Lighting Specialists. If for any reason it becomes apparent that this project will not be fully implemented by this date, a written notice will be submitted to the EPA Project Manager as soon as practicable outlining the reason(s) why as well as those efforts being made to expedite the completion of the SEP.

Documentation Verifying Projected Costs

See attached October 22, 2012 proposal from BLI Lighting Specialists.

SEP Category

Utilizing EPA's 1998 SEP Policy as a guide, this re-lamping project has been determined to meet the definition of a "Pollution Prevention" SEP. Implementation of this project will result in the source reduction of mercury by significantly reducing mercury content of each fluorescent lamp currently in use at the Collis facility while increasing the light output per fixture. This project is expected to have a secondary pollution prevention benefit of reducing lighting related electrical demand through the use of more efficient fixtures/lamps and the use of motion sensors.

As an added pollution prevention benefit, we anticipate re-using all 333 existing T8 2 lamp fixtures and associated lamps at other SSW facilities, thus preventing disposal prior to end-of-life. The majority of these fixtures will be replacing high mercury containing, low efficiency T12 and HID fixtures.

Projected Environmental Benefits

1. Mercury content will go from 5,661 mg of mercury to 2,281 mg, which is a reduction of 60%. The lumens per fixture will go from approximately 10,173 to 13,340 which will be a net increase in light levels.

2. Installation of motion sensors on all new fixtures and existing fixtures will maximize lamp life thus reducing electrical demand and long term lamp/mercury disposal. Estimating the reduction in mercury disposal, related to extended lamp life, is very difficult considering the ever changing activity levels within the facility. Reportedly, bulb life can reasonably be expected to be extended by at least 20% however.

3. Maximize public health benefits by reducing future mercury use associated with lighting the Collis facility. Additional public health benefits include the reduction in emissions related to power generation.

4. As a secondary benefit, we anticipate re-using all 333 existing T8 2 lamp fixtures and associated lamps at other SSW facilities. The majority of these fixtures will be replacing high mercury containing, low efficiency T12 and HID fixtures. This reuse reduces mercury content and prevents the premature disposal of serviceable items.

Additional Documentation

Shipping manifests for fluorescent lamp disposal, both before and after the implementation of this SEP project, will be included in the SEP Completion Report.

SEP #2

Project Title:	**Paint Waste Minimizer**

Scope

Powder coat painted parts often require a minor "touch-up" in small areas where the part was hung from the overhead conveyor system as the part made its way through the finishing process. Typically, touch up painting is done with an "air brush" using color matched solvent-based paint. Periodically during the course of operations (down time, shift changes, etc.), the lines and air brushes must be purged and cleaned. This cleaning creates a mixture of paint and solvent (Collis, Inc. uses acetone as a purge/cleaning solvent) which is currently managed as a D001 hazardous waste. Working with Safety Kleen, Collis, Inc.'s paint waste

disposal company, Collis has indentified a paint waste collection and recycling system that would greatly reduce its D001 waste stream. The system is made up of two parts:

1. Automatic fully integrated gun washing station – allows the purging and cleaning of painting equipment without the need to collect, transport and store waste materials in a "satellite" collection drum. With its vapor management system, the automatic wash station greatly reduces the chance for solvent to volatilize to the atmosphere.

2. "Minimizer" solvent recycler – direct condensation distillation unit recovers solvents for reuse that would have otherwise been sent off site as a hazardous waste. Recovered solvents would be reused. This system has a projected 95% recovery efficiency.

Projected Cost

Description	Price
GUN CLEANER, Manual Purchase Price	$3,195.23 (includes 7% IA Sales Tax)
MINIMIZER 110V 5GAL Purchase price	$11,661.93 (includes 7% IA Sales tax)
Total	$14,857.16 (includes 7% IA Sales tax)*

* Note: attached Safety-Kleen Systems proposal does not include 7% IA Sales Tax which accounts for an additional $971.76. Collis recognizes that the $541.80 service and disposal cost listed in the Safety Kleen proposal is not an allowable SEP cost and has not included it in the above projected cost summary.

Implementation Schedule

This equipment will be purchased and its use fully implemented on or before August 1, 2013.

Documentation Verifying Projected Costs

See attached proposal from Safety-Kleen Systems, Inc.

SEP Category

Utilizing EPA's 1998 SEP Policy as a guide, this solvent reclamation project has been determined to meet the definition of a Pollution Prevention SEP. Implementation of this project will result in three separate source reductions of pollution: 1) The automated cleaning system will reduce the amount of solvent needed to clean touch-up paint guns, 2) Paint/solvent mix will be collected and recovered using "in-process recycling". Recovered solvents will be returned

directly to the gun cleaning system as raw materials, 3) the fully automated closed system greatly reduces the potential for paint/solvent to volatilize to the atmosphere.

Projected Environmental Benefits

There will be a significant reduction of a hazardous waste stream and reduction in potential fugitive emissions from solvent cleaning operations. Based on other waste minimization projects currently underway at this Collis, Inc. facility (unrelated to either proposed SEP), in conjunction with this proposed SEP, it anticipates monthly hazardous waste generation to drop to a level that would allow its reclassification from a Large Quantity Generator to a Conditionally Exempt Small Quantity Generator. D001 waste generated over the previous 12 months totaled 5,775 lbs. At 95% efficiency of the new solvent "minimizer" equipment, total D001 waste generation would be reduced to 289 lbs annually or 24lbs/month.

Additional Documentation

Shipping manifests for hazardous paint related waste disposal, both before and after the implementation of this SEP project, will be included in the SEP Completion Report.

The Switch is on to...®
BLI
Lighting Specialists

15275 Minnetonka Blvd. Minnetonka, MN 55345
Ph 800-333-2852 Fx 888-333-2852

Collis, Inc.
Joe French
2005 S 19th St
Clinton, IA 52732

October 22, 2012

Dear Joe,

First off thank you for the opportunity to partner with you and Collis, Inc.

Proposal to retrofit 333 pcs of 8' 2 lamp T8 fixtures, which are of the Osram Sylvania T8, Octron®, HO, Linear, High Output which has a mercury content of 9.5 mg. (I have attached a copy of this report).

The proposed retrofit is a 4' 4 lamp T8 low mercury bulbs, Philips FO32T8/ADV850/ALTO has only 1.7 mg of mercury (I have also attached a spec sheet for this bulb), with sensors on each fixture. This also includes adding 111 sensors on existing fixtures that did not originally have them installed.

The mercury content will go from 5,661 mg of mercury to 2,281 mg of mercury, which is a reduction of 60%. The lumens per fixture will go from approximately 10,173 to 13,340 which will be an increase in your light levels. Your lighting electrical costs will go from $26,189.17 to $12,691.92.

This project has a cost factor of $91,870.94, with approximate Alliant incentive of $14,919.00 which will give you an out of pocket of around $76,951.94.

On the next page there is the breakdown for each type of existing fixture within the facility:

The Switch is on to...®
BLI Lighting Specialists
15275 Minnetonka Blvd. Minnetonka, MN 55345
Ph 800-333-2852 Fx 888-333-2852

Existing Fixture Description Retro Fixture Description	Existing Mercury per Line	Proposed Mercury per Line	Labor Cost	Material Cost	Quantity
Industrial Hooded Fixture, 1' x 8', 2x F96T8/HO (86W), Elec Normal Power Ballast, 120/277V					
RETRO, 4x T8, Program Start, 120/277V, 8" White 92% Reflector, Versa Socket Kit, 32W, 5000K Hi Lumen Lamp, Low Mercury Lamps	2686.0	1074.4	$ 9,260.77	$ 24,825.28	158
Sub Total for Existing Fixture	2686.0	1074.4	$ 9,260.77	$ 24,825.28	158
Load Watts Only, Industrial Hooded Fixture, 4x F32T8 (32W), Elec Normal Power Ballast 120/277V					
LOAD, watts only, adding sensor only no retrofit	651.0	651.0	$ 3,435.96	$ 7,602.05	93
Sub Total for Existing Fixture	651.0	651.0	$ 3,435.96	$ 7,602.05	93
Round Industrial Luminaire, Incandescent 200W, Medium Base, 120V					
FIXTURE, 2x T8, Standard Strip, Norm Power Ballast 120/277V, 32W 5000K Hi Lumen Lamp	0.0	17.0	$ 347.23	$ 826.48	5
REMOVE, From Service and Electric power	0.0	0.0	$ 258.62	$ 7.83	7
Sub Total for Existing Fixture	0.0	17.0	$ 605.85	$ 834.31	12
Industrial Hooded Fixture, 1' x 8', 2x F96T8 (59W), Elec Normal Power Ballast, 120/277V					
RETRO, 4x T8, Progam Start, 120/277V, 8" White 92% Reflector, Versa Socket Kit, 32W, 5000K Hi Lumen Lamp, Low Mercury Lamps	2975.0	1190.0	$ 10,257.18	$ 27,496.35	175
Sub Total for Existing Fixture	2975.0	1190.0	$ 10,257.18	$ 27,496.35	175
Wrap Around Fixture, 1' x 4', 4x F32T8 (32W), Elec Normal Power Ballast, 120/277V					
LOAD, watts only, adding sensor only no retrofit	28.0	28.0	$ 147.78	$ 326.97	4
Sub Total for Existing Fixture	28.0	28.0	$ 147.78	$ 326.97	4
Grid Troffer, 2' x 4', 4x F32T8 (32W), Elec Normal Power Ballast, 120/277V, Prismatic Lense					
LOAD, watts only, adding sensor only no retrofit	14.0	14.0	$ 36.95	$ 81.74	1
Sub Total for Existing Fixture	14.0	14.0	$ 36.95	$ 81.74	1
Wrap Around Fixture, 1' x 4', 2x F32T8 (32W), Elec Normal Power Ballast, 120/277V					
LOAD, watts only, adding sensor only no retrofit	56.0	56.0	$ 295.57	$ 653.94	8
Sub Total for Existing Fixture	56.0	56.0	$ 295.57	$ 653.94	8
Sub Total	5661.0	2281.4	$ 24,040.05	$ 61,820.64	453
Tax at 7%				$ 6,010.25	
Project Total				$ 91,870.94	

The Switch is on to...®
BLI Lighting Specialists
15275 Minnetonka Blvd. Minnetonka, MN 55345
Ph 800-333-2852 Fx 888-333-2852

All of the bulbs will be put into containers and brought back to our facility in Burlington and then picked up by Lighting Resources. They in turn will issue us a recycling certificate that all lamps were recycled as per the current rules and regulations. Bulb recycling will be charged at $1.20 per 8' bulb adding an additional $799.20 to the project plus tax of $55.94 for a total of $855.14. If Collis chooses to re-use the retrofitted bulbs this additional charge will not apply.

If you have any questions please ask and I look forward to hearing from you soon.

Sincerely,

JEFFREY G. STRAUSE
Project Administrator
Budget Lighting, Inc
115 N 4th Street
Burlington, IA 52601
952-939-1731 (p)
319-752-9811 (f)

OSRAM SYLVANIA

Mercury Quantity in Lamps for General Lighting Applications

04/20/12

OSRAM SYLVANIA is **continuously striving to reduce** the levels of mercury in our lamps. The levels in these tables are best projected estimates, subject to machine capabilities.

Lamp Type	Range	Hg Content (mg)
T5, pre-heat	4W to 13W (incl BLB)	15
T5, PENTRON®	All	1.8
PENTRON® Circline	All	9
T5, PENTRON® HO (High Output)	All	1.8
T5, PENTRON® HO (High Output) Seamless	All	3.0
T5, PENTRON® HE Seamless	All	2.5
T12, pre-heat	All	12 to15
T8, pre-heat	All	6
T8, OCTRON®, linear 800, 800XP, and XL	Up to 60"	3.5
T8, OCTRON®, linear 800XP/SS and 800XPS	All	2.9
T8, OCTRON®, linear 700XP	Up to 72"	3.5
T8, OCTRON®, linear 700	Up to 72"	4.8
T8, OCTRON® linear	72" and longer	8.5
T8, OCTRON® linear 800 XV	48"	3.5
T8, OCTRON® linear 800 XV/SS	96"	8.5
T8, OCTRON® linear halo phosphor	Up to 96"	8
T8, OCTRON®, HO, linear (High Output)	All	9.5
T8, OCTRON®, CURVALUME® 6" leg spacing	All	3.75
T8, OCTRON®, CURVALUME® 1 5/8" leg spacing	All	6
T9 Circline	20W	5
T9 Circline	22W, 28W, 40W	15
T12, linear, Rapid Start—halo-phosphor lamps	(excl. HO & VHO)	8
T12, linear, Rapid Start – Designer lamps	(excl. HO & VHO)	4.8
T12, linear, Instant Start	All (>24" L)	9.5
T12, CURVALUME®	All	8
T12, HO (High Output)	All	15
T12, VHO (Very High Output)	All	30
ICETRON®	70W to 150W	18

DULUX EL®, one piece(amalgam and covered, ex. triple tube)	4W to 40W	3
DULUX EL® one piece (bare burner)	4W to 25W	3 to 4
DULUX EL® one piece (bare burner)	25W to 40W	5
DULUX EL®, one piece (triple tube)	15W to 23W	4
DULUX EL®, Circline	20W to 30W	4
DULUX EL® Micro Mini and Living Spaces®	13W to 23W	1.5
DURA-*ONE*®	23W	1.8
DULUX® pin base (excl. some T, and F and L)	5W to 57W	2.5
DULUX® pin base T, T/E	13W to 32W	2.4
DULUX® pin base, T/E/IN	18W to 70W	2.4
DULUX® F, pin base	18W to 36 W	3
DULUX® L, pin base	18W to 55W	3

Mercury Quantity in Lamps for General Lighting Applications

04/20/12

OSRAM SYLVANIA is **continuously striving to reduce** the levels of mercury in our lamps. The levels in these tables are best projected estimates, subject to machine capabilities. When using these numbers to determine compliance with the US Green Building Council's LEED® low mercury credits, please note:

- This calculation requires input of ALL mercury-containing lamps. Each individual lamp does NOT need to meet the individual picogram per lumen hour level, but rather the total level of all lamp types and quantities must achieve that measurement.

- It is important to remember that individual products cannot be LEED-certified.

Lamp Type	Range	Hg Content (mg)
Metal Halide, METALARC® screw base ceramic PAR & TC	20W	2.5
Metal Halide, METALARC® screw base ceramic PAR & TC	24W	3.8
Metal Halide, METALARC® screw base ceramic PAR, T,&TC	39W	5
Metal Halide, METALARC® screw base ceramic PAR, T,&TC	70W	7
Metal Halide, METALARC® screw base ceramic PAR	100W to150W	15
Metal Halide, METALARC® screw base	50W to 100W	13
Metal Halide, METALARC® screw base	150W to 250W	34
Metal Halide, METALARC® screw base	320W to 360W	56
Metal Halide, METALARC® ceramic screw base	50W	8
Metal Halide, METALARC® ceramic screw base	70W	7
Metal Halide, METALARC® ceramic screw base	100W	6.6 to 7.5
Metal Halide, METALARC® ceramic screw base	150W	16
Metal Halide, METALARC® ceramic screw base	250W	18
Metal Halide, METALARC® ceramic screw base	320W	31
Metal Halide, METALARC® screw base	400W to 750W	57 to 80.5
Metal Halide, METALARC® screw base	1000W to 1500W	145
Metal Halide, METALARC® PRO-TECH® POWERBALL®	20W, 39W	2.5
Metal Halide, pin base	39 to 150W	6 to13
Metal Halide, double-ended (excl. HQI DE 150 WDX)	70 to 250W	15
Metal Halide, double-ended - HQI DE 150 WDX only	150W	23
Metal Halide, double-ended	1000 to 3000W	281
Mercury Vapor	50W to 100W	11 to 20
Mercury Vapor	175W	24
Mercury Vapor	250W	48
Mercury Vapor	400W to 1000W	58 to 79
Mercury Vapor H36	1000W	165
High Pressure Sodium, standard	35W to 400W	10.8 to15
High Pressure Sodium, standard, SUPER	>400W to 1000W	18 to 25
High Pressure Sodium, LUMALUX® Standby	70W to 400W	29
High Pressure Sodium, LUMALUX® Standby	1000W	43
High Pressure Sodium, ECO	50W to 400W	15
High Pressure Sodium, PLUS, ECO	50W to 400W	1 to 6
High Pressure Sodium PLUS	1000W	15
High Pressure Sodium, HgF mercury free	70W to 150W	0.0001

Philips Advantage
T8 Lamps featuring
ALTO II Technology

Ideal for applications requiring maximum light output

T8 Collection

Alto II TCLP COMPLIANT*

ALTO II means 50% less mercury than the original ALTO T8 lamps

† This lamp is better for the environment because of its reduced mercury content. All Philips ALTO lamps give you end-of-life options, which can simplify and reduce your lamp disposal costs, depending on your state and local regulations. ALTO II Lamps have only 1.7mg of mercury.

* Fluorescent lamps that are TCLP compliant reduce the amount of pollutants released into the environment.

High performance, extra low mercury

Philips Advantage T8 Lamps are an energy-efficient solution and offer high lumen output.

Ultimate system solution

- High lumens enable multiple system options to maximize energy savings and reduce lighting costs
- Fully dimmable without burn-in

Better for the environment

- Only 1.7mg of mercury with ALTO II Technology
- Reduced impact on the environment without sacrificing performance
- Limited warranty period based on usage+

(+ See back page for footnotes)

PHILIPS

sense and simplicity

Philips Advantage T8 Lamps featuring ALTO II Technology

Ordering, Electrical and Technical Data

	Product Number	Ordering Code	Watts	Pack. Qty.	Color Temp. (Kelvin)	Nom. Length (In.)	Rated Average Life (hrs)[1] 12-hr on Ins. Start	12-hr on Prog. Start	Approx. Initial Lumens[2]	Design Lumens[3]	CRI	Lumen Maint.
●	28130-3	F17T8/ADV830/ALTO	17	30	3000	24	30,000	36,000	1500	1450	85	95%
●	28131-1	F17T8/ADV835/ALTO	17	30	3500	24	30,000	36,000	1500	1450	84	95%
●	28132-9	F17T8/ADV841/ALTO	17	30	4100	24	30,000	36,000	1500	1450	82	95%
●	28140-2	F25T8/ADV835/ALTO	25	30	3500	36	30,000	36,000	2380	2300	84	95%
●	28142-8	F25T8/ADV841/ALTO	25	30	4100	36	30,000	36,000	2380	2300	82	95%
Ⓔ ●	28080-0	F32T8/ADV830/ALTO	32	30	3000	48	30,000	36,000	3100	3000	85	95%
Ⓔ ●	28081-8	F32T8/ADV835/ALTO	32	30	3500	48	30,000	36,000	3100	3000	84	95%
Ⓔ ●	28085-9	F32T8/ADV841/ALTO	32	30	4100	48	30,000	36,000	3100	3000	82	95%
Ⓔ ●	28089-1	F32T8/ADV850/ALTO	32	30	5000	48	30,000	36,000	3000	2910	82	95%

1) Average life under engineering data with lamps turned off and restarted once every 12 operating hours.

2) Approximate initial lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. For expected lamp lumen output, commercial ballast manufacturers can advise the appropriate ballast factor for each of their ballasts when they are informed of the designated lamp. The ballast factor is a multiplier applied to the designated lamp lumen output.

3) Design lumens are the approximate lamp lumen output at 40% of the lamp's rated average life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. Design lumens rated at 3 hours per start on instant start ballast.

4) Average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently.

Ⓔ Lamp meets US Federal Minimum Efficiency Standards.

● This lamp is better for the environment because of its reduced mercury content. All Philips ALTO II lamps give you end-of-life options which can simplify and reduce your lamp disposal costs depending on your state and local regulations.

Footnotes from front.

+ See your sales representative for details

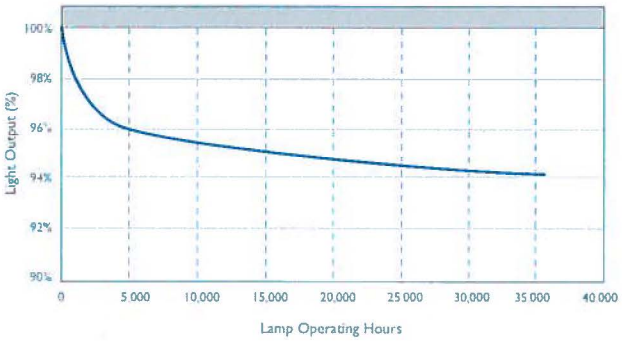
Philips Advantage T8 32W Systems vs. Standard T8 32W Systems

Energy Savings: 2 Lamp vs. 2 Lamp System

Electronic Ballast	Ballast Factor	No. of Lamps	Lumens	System Watts	System Lumens	Savings*
Standard 32W T8	0.87	2	2700	58	4698	
Reduced Light Output 32W T8	0.75	2	3100	51	4725	**$2.80/yr**

95% Lumen Maintenance

Philips Advantage T8 Lamps



Printed in USA 9/12

P-5369-K

www.philips.com

Philips Lighting Company
200 Franklin Square Drive
Somerset, NJ 08873
1-800-555-0050

Philips Lighting
281 Hillmount Road
Markham, Ontario
Canada L6C 2S3
1-800-555-0050
A Division of Philips Electronics Ltd

Safety-Kleen Systems, Inc.
3035 West 73rd Street
Davenport, IA, 52806

October 19, 2012

Joe French
Manager
COLLIS INC
2005 S 19th St,
Clinton, IA 52732-6818

Dear Joe French:

Thank you for helping me better understand your business processes and needs. Below is a proposal aimed to help you address the following strategic initiatives you are currently pursuing:

- Minimize waste generation through [illegible] technology use and disposal techniques
- Reduce risk through Safety-Kleen rigorous operating procedures and guarantee of [illegible] indemnification
- [illegible] consistency of reporting & billing
- [illegible] good will associated with recycling and sustainability through Safety-Kleen [illegible] processes and procedures

We propose delivering the following services:

Description	Price Per Service	Service Frequency in Weeks	Qty
GUN CLEANER, Manual Purchase Price	$2986.20 plus tax	As Needed	2
MINIMIZER 110V 5GAL Purchase price	$10,899.00 plus tax	As Needed	2
COMS, MINIMIZER III Service for unit includes bags and disposal	$541.80	8 to 12 weeks depending on use.	2

Quote is valid for 30 days.

Date: _____

Customer Name: _____

Customer Title: _____

Customer Signature: _____

Safety-Kleen supports more than 330,000 businesses across North America by recycling their used oil and industrial waste, and delivering environmentally friendly cleaning products and services. Customers choose Safety-Kleen because of our personal service, extensive liability protection and focus on sustainable solutions. Our goal is to provide customers like COLLIS INC with the best solutions while keeping your company in balance with the environment.

I look forward to reviewing this proposal with you at your earliest convenience.
Sincerely,

David Smith

David.Smith@safety-kleen.com

Safety-Kleen Systems, Inc.

Appendix B

Sampling Work Plan

Docket No. RCRA-07-2012-0014

Collis, Inc.
2005 South 19th Street
Clinton, Iowa 52732

FINAL

SAMPLING WORK PLAN

FOR

FOCUSED SOIL INVESTIGATION

COLLIS MANUFACTURING FACILITY
2005 SOUTH 19th STREET
CLINTON, IOWA

FEBRUARY 2013

TABLE OF CONTENTS

FIGURES

APPENDIX

LIST OF ACRONYMS

BB&E	BB&E, LLC
bgs	below ground surface
BTVs	Background Threshold Values
CAFO	Consent Agreement and Final Order
ft	feet/foot
HASP	Health and Safety Plan
IDW	investigation derived waste
kg	kilograms
mg	milligrams
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
SM&A	St. John-Mittelhauser & Associates
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

The Collis Manufacturing Facility property (Site) located at 2005 South 19th Street in Clinton, Clinton County, Iowa is depicted on **Figure 1**. In June of 2010 the Site was visited for a routine Resource Conservation and Recovery Act (RCRA) inspection by a United States Environmental Protection Agency (USEPA) contractor. During that inspection, an area near the filter building was identified that stored totes of process acids and caustics (**Figure 2**). USEPA is interested in determining whether any releases occurred from the totes that were observed during the 2010 inspection in excess of the EPA Regional Screening Levels (RSL) for metals in industrial soils (**Appendix A**). This Sampling Work Plan has been developed to conduct a focused soil investigation of this area.

2.0 PRE-SOIL INVESTIGATION ASSESSMENT

Prior to mobilization for soil investigation activities, Collis manufacturing personnel with input from BB&E, LLC (BB&E) and the USEPA will evaluate the area where the 28 containers referenced in the Complaint were stored. This evaluation will include indentifying potential contaminant migration routes through cracks or relief joints (joints) in the two concrete storage pads or via potential runoff due to the slope of the concrete storage pads. Special attention will be paid to those areas where any of the 28 containers referenced in the Complaint were stored off the concrete pads at the time of the EPA contractor's inspection. It is recognized that some level of field discretion may be needed in determining exact sampling locations during the actual sampling event due to unforeseen circumstances (expected to be primarily related to concrete thickness and the presence of steel reinforcement).

3.0 SOIL INVESTIGATION

Pending the results of the Pre-Soil Investigation Assessment, it is anticipated that soil sampling will be conducted in a narrow zone directly adjacent to the two concrete pads at the filter building container storage area. For planning purposes, it is assumed that four (4) shallow soil samples will be collected in the green space along the leading edge of each concrete slab for a total of eight (8) off-slab shallow soil samples (see **Figure 2**). In addition to perimeter sampling, cracks or joints discovered that appear to have compromised the integrity of the slab

to the underlying soils will be marked and subsequently cored to provide access to the soils beneath. It is assumed that up to three (3) samples may be collected from locations beneath each slab where cracks are found to extend to the underlying soils. Each boring will be advanced using a hand auger to approximately six (6) inches in depth; however, it may be necessary to go as deep as one (1) foot to get enough sample volume from beneath the concrete slab through a size-limited core.

Soil samples from hand augers will be collected directly from the borehole unless adequate sample material cannot be obtained. In this case, the sample material will be collected from the auger itself. Samples will be placed in an appropriate container, labeled, and entered on a chain-of-custody form in accordance with the Quality Assurance Project Plan (QAPP). Enough soil will be collected for Quality Assurance/Quality Control (QA/QC) purposes including duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples. If non-disposable equipment is used, rinsate blanks will be collected by pouring over or running distilled water through the sample collection equipment after decontamination and before subsequent sample collection. The rinsate blank will be collected in an appropriate sample container, identical to those used for samples. The purpose of this sample is to determine the potential presence of background contamination resulting from the field equipment or sampling procedure.

The type and number of QA/QC samples will be specified in the approved QAPP. The QAPP is discussed in Section 5.0.

Figure 2 shows the approximate locations of the proposed off-slab soil boring areas as well as the slab areas that may have samples collected from beneath, dependent on field observations. Note that exact boring locations will be based on field observations made during the Pre-Soil Investigation Assessment and modified as appropriate during the actual sampling event. Upon completing the sampling, a surveyor licensed in the State of Iowa will survey the coordinates of all sampling locations to known site reference points. Elevations of sampling locations will not be surveyed.

A written notice will be submitted to the USEPA thirty (30) calendar days prior to the sampling event conducted as part of the implementation of this Sampling Work Plan.

3.1 BACKGROUND SAMPLING

In addition to the sample locations proposed in Section 3.0, a minimum of seven (7) shallow soil samples will be collected at a depth of 0.5 – 1 foot below grade for the purpose of determining site-specific mean background threshold values (BTVs) for metals as necessary. These sample locations are proposed to be beyond the perimeter of the site and the soil borings will be advanced using a hand auger. Proposed background sample locations are shown on **Figure 3**.

The laboratory shall be instructed to hold samples designated as background pending the results of the shallow soil samples collected under Section 3.0. Should the results of the shallow soil samples collected under Section 3.0 be below RSLs for metals in industrial soils then no background samples will be required for analysis. Should any analyte(s) exhibit a concentration greater than RSLs for metals in industrial soils then all background samples will be analyzed for those analytes and evaluated statistically using ProUCL. The laboratory standard turn around time is approximately ten business days. This is well within allowable sample hold times for metals in soil as referenced in the QAPP.

The 2010 *RCRA Final Facility Investigation Report* prepared by St. John-Mittelhauser & Associates (SM&A) for this site was used as reference for determining the sufficient number of background samples to be collected. During the background study for arsenic in soil described in the report, a statistical analysis software program, ProUCL, was used for determining the minimum number of background samples required. According to the Student's t-distribution statistic, a minimum of seven (7) soil samples were required to return a 95% upper confidence limit (UCL) for determining the allowable background standard for surface and subsurface soils.

As reviewed with the USEPA in a 15 February 2013 Conference Call, for the purpose of determining an appropriate number of background samples to be collected during the Focused Soil Investigation, seven (7) soil samples were deemed adequate. During the collection background samples, the field technician, with input from the USEPA, will make an effort collect soils that are similar in type to the soil samples collected off-slab and sub-slab.

The background soil sample results will be used to estimate the mean BTVs. The backgound sample results will be entered into ProUCL which has stastisical methods to compute a 95% upper confidence Limit (UCL) of the mean. The BTVs will be used to compare the mean of the off-slab and sub-slab soil sample results. Should this background analysis need to be conducted, the results and statistical discussion will be presented in the Focused Investigation Summart Report which is subject to review and approval by the USEPA.

3.2 ANALYTICAL TESTING

Each soil sample will be analyzed by ALS Laboratories, Holland, Michigan for the RCRA eight (8) metals, *including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver*, by USEPA Method 6020A. Mercury will be analyzed by USEPA Method 7471B.

3.3 SAMPLING FINAL REPORT

Following the soil investigation described above, a Sampling Final Report will be prepared documenting the field activities and presenting the results. Soil analytical results will be compared to the EPA's Regional Screening Levels for industrial sites. In addition, the Sampling Final Report will include:

- Figure(s) showing the locations of all shallow soil samples collected during the project;
- A table which presents the sampling results for the project which highlights any results that are greater than the EPA RSLs for industrial soils;
- A copy (or electronic copy) of the analytical data package included as an attachment to the final report;
- A discussion concerning any deviations from the USEPA-approved Work Plan and/or QAPP; and
- If necessary, a discussion which proposes the next actions to be taken at the facility (i.e., additional sampling, removal of soils, etc.).

The Sampling Final Report will be submitted to the USEPA no later than 90 days following the completion of field sampling activities.

4.0 PERMITS AND UTILITY CLEARANCE

Although soil borings will be shallow and advanced using hand tools, utilities in the area will be screened against Site drawings as well as contacting the Iowa One Call center for utility clearance.

5.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

Part of this project includes the development of a QAPP. The following will be used as references for the development of this project QAPP:

- "EPA Guidance for Quality Assurance Project Plans" (EPA QA/R-5, EPA/240/B-01/003, March 2001);
- "EPA Guidance for Quality Assurance Project Plans" (EPA QA/G-5, EPA/240/R-02/009, December 2002); and
- Other such applicable guidance that may be identified by the EPA during the review of this Work Plan.

The Draft Final QAPP will be submitted to the USEPA for review and approval. A Final QAPP will be issued upon addressing comments from the USEPA's review of the draft.

6.0 HEALTH AND SAFETY

A specific Health and Safety Plan (HASP) will be developed for the Focused Soil Investigation prior to mobilization for the field active ties described in this work plan.

7.0 DECONTAMINATION OF EQUIPMENT

Soil sampling tools (*e.g.*, trowels, spoons, and knives), which contact soils, will be cleaned with a solution of laboratory-grade soap prior to each sample and rinsed with distilled water.

8.0 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

Since only shallow soil samples are to be collected, little if any investigation-derived solid waste will be generated. The small amounts that are generated will be returned to the sampling location upon completion. Decontamination water generated from the sampling activities will be containerized on-site, pending the receipt of the analytical results. Upon proper characterization of the decontamination water, Collis personnel will properly dispose of the material in accordance with local, state, and federal laws. All sampling gloves and other personal protective equipment will be double-bagged and placed in an on -site municipal waste container.

9.0 RESTORATION

For hand auger boring locations in green space areas, the area will be leveled with hand tools using soil from the immediate vicinity of the sample location such that the sampling areas are returned to grade. For hand auger boring locations beneath the slab, the boring will be backfilled with playground grade sand to the bottom of the concrete and the core void repaired with a concrete patch.

10.0 SCHEDULE

The following is the proposed schedule for focused soil investigation activities.

- Within thirty (30) calendar days following the finalization of the Consent Agreement and Final Order (CAFO) by the USEPA Pre-Soil Investigation Assessment activities will be completed at Collis. As part of the Pre-Soil Investigation Assessment, Collis and BB&E will discuss and confer with the USEPA regarding the selection of specific sampling locations.

- Within ten (10) calendar days following the finalization of the Pre-Soil Investigation Assessment, a written notice will be submitted to the USEPA thirty (30) calendar days prior to the sampling event outlining Collis' schedule to execute sampling activities described in this Sampling Work Plan.

- Within forty-five (45) days of completing the Focused Soil Investigation, a draft summary report will be submitted to the USEPA for comment.
- Within ninety (90) days of completing the Focused Soil Investigation, the Sampling Final Report will be submitted to the USEPA.

11.0 REFERENCES

St. John-Mittelhauser & Associates, Inc., *RCRA Final Facility Investigation Report*, Collis, Inc. Site, Clinton, Iowa, USEPA ID #IAD047303771, November 30, 2010.

FIGURES

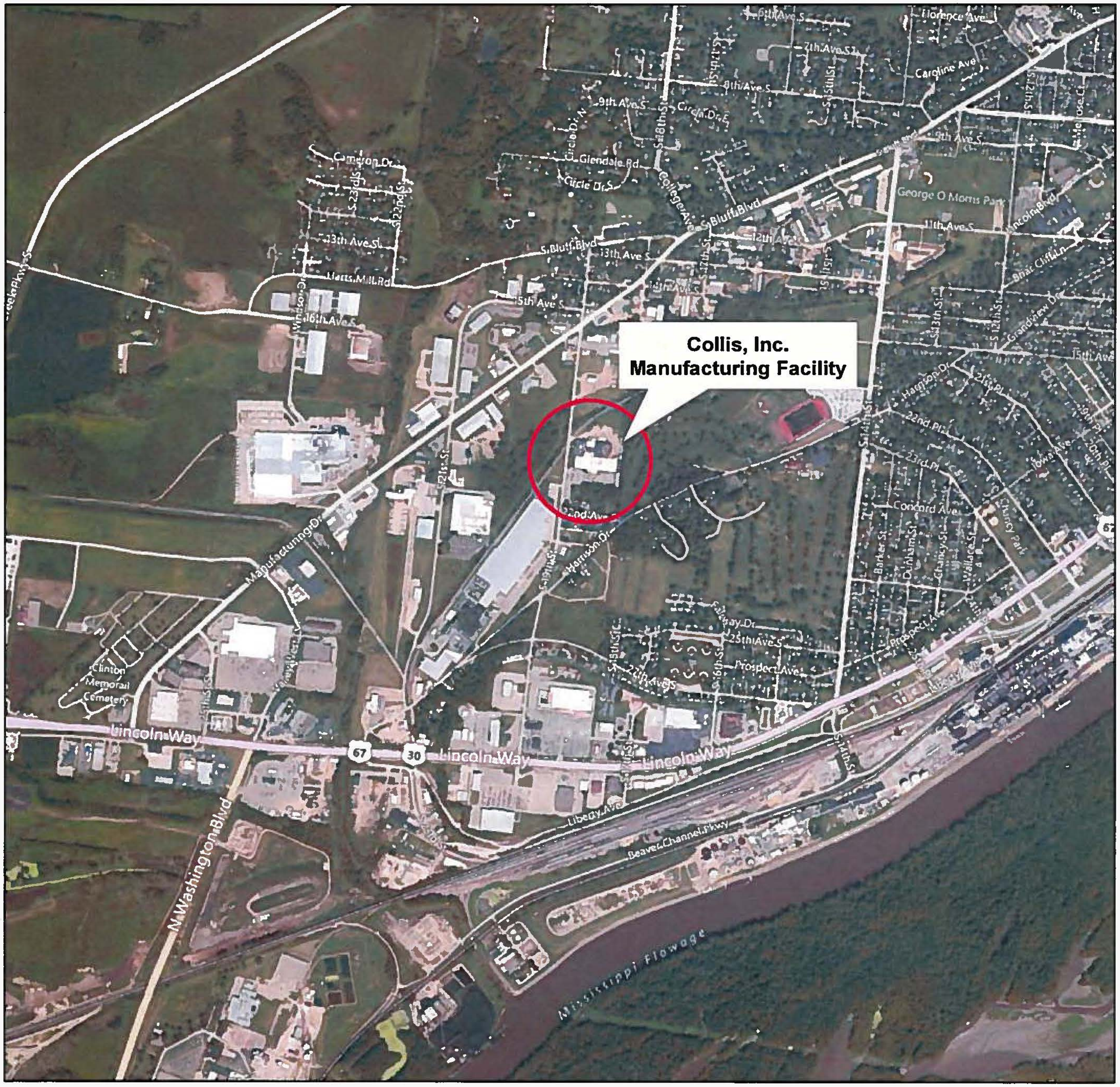


Figure 1

Site Location Map

Collis, Inc. Manufacturing Facility
Clinton, Iowa

NORTH

0 1,500 3,000
Feet

BB&E

JMP - 04/12/2012

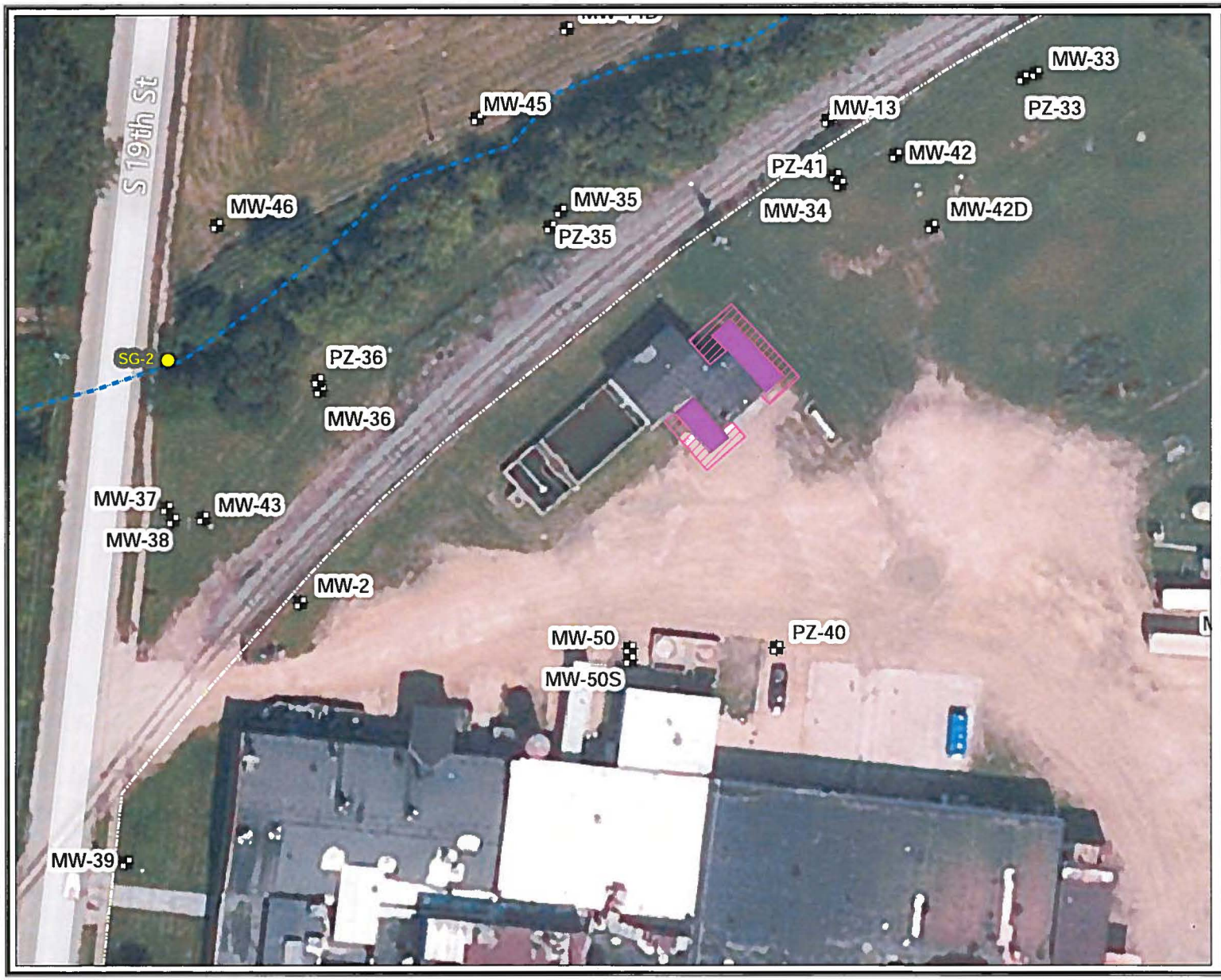


Figure 2

Site Features and
Sample Location Map

Limited Shallow
Soil Investigation

Collis, Inc. Manufacturing Facility
Clinton, Iowa

Legend:

- Monitoring Well/Piezometer Location
- Staff Gauge Location
- Concrete Pad (Note 1)
- Proposed Soil Boring Areas (Note 2)
- Manufacturer's Ditch
- Property Boundary (Approximate)

NOTE:

1. Actual sample locations and number beneath the concrete areas will be determined during the Pre- Soil Investigation Assessment based on potential migration through cracks.

2. Number and location of soil borings will be determined during the Pre- Soil Investigation Assessment based on potential migration via runoff.

NORTH

0 50 100
Feet

BB&E

JMP - 01/03/2013

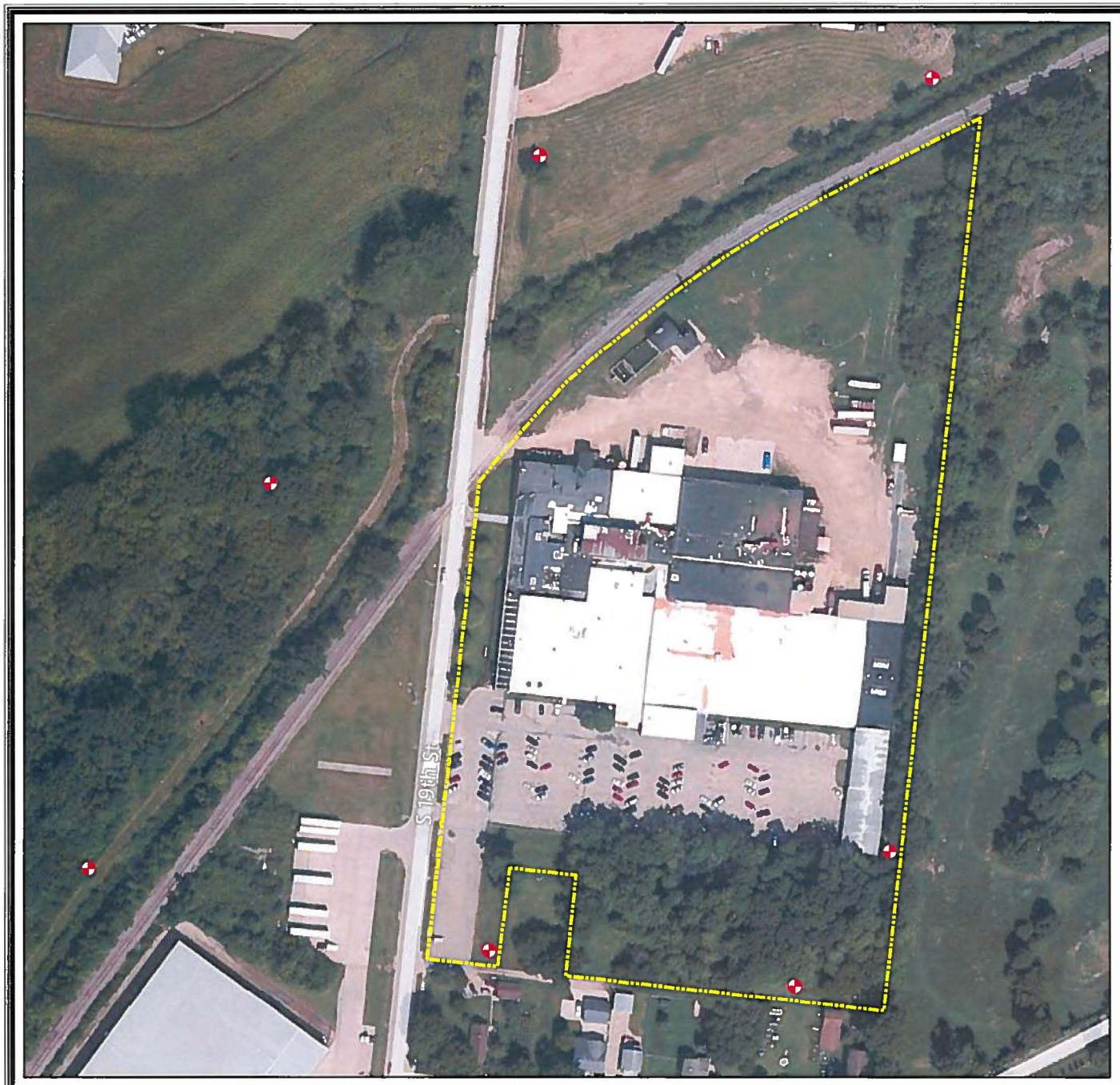


Figure 3

Proposed Background Sample Locations

Collis, Inc. Manufacturing Facility
Clinton, Iowa

Legend

- Proposed Background Sample Locations
- Property Boundary

NORTH

0 150 300
Feet

BB&E

JMP - 01/28/2013

APPENDIX A

Regional Screening Level (RSL) Industrial Soil Table November 2012

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		1.4E+09		ALAR	1596-84-5	1.6E+02	2.4E+02	3.3E+06	9.6E+01	1.5E+05	2.3E+05		9.2E+04
8.7E-03	I			4.0E-03	I					1	0.1		1.4E+09		Acephate	30560-19-1	3.3E+02	5.0E+02		2.0E+02	4.1E+03	6.2E+03		2.5E+03
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	1.4E+09	9.4E+03	Acetaldehyde	75-07-0			5.2E+01	5.2E+01			3.7E+02	3.7E+02
				2.0E-02	I					1	0.1		1.4E+09		Acetochlor	34256-82-1					2.0E+04	3.1E+04		1.2E+04
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	1.4E+09	1.5E+04	Acetone	67-64-1					9.2E+05		2.0E+06	6.3E+05
						2.0E-03	X	V		1		1.1E+05	1.4E+09	2.6E+04	Acetone Cyanohydrin	75-86-5							2.2E+02	2.2E+02
						6.0E-02	I	V		1		1.3E+05	1.4E+09	1.4E+04	Acetonitrile	75-05-8							3.7E+03	3.7E+03
				1.0E-01	I			V		1		2.5E+03	1.4E+09	6.4E+04	Acetophenone	98-86-2					1.0E+05			1.0E+05
3.8E+00	C	1.3E-03	C							1	0.1		1.4E+09		Acetylaminofluorene, 2-	53-96-3	7.5E-01	1.1E+00	1.3E+04	4.5E-01				
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	1.4E+09	7.4E+03	Acrolein	107-02-8					5.1E+02		6.5E-01	6.5E-01
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		1.4E+09		Acrylamide	79-06-1	5.7E+00	8.7E+00	1.7E+05	3.4E+00	2.0E+03	3.1E+03	3.6E+07	1.2E+03
				5.0E-01	I	1.0E-03	I			1	0.1		1.4E+09		Acrylic Acid	79-10-7					5.1E+05	7.7E+05	6.0E+06	2.9E+05
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	1.4E+09	8.3E+03	Acrylonitrile	107-13-1	5.3E+00		1.5E+00	1.2E+00	4.1E+04		7.2E+01	7.2E+01
						6.0E-03	P			1	0.1		1.4E+09		Adiponitrile	111-69-3							3.6E+07	3.6E+07
5.6E-02	C			1.0E-02	I					1	0.1		1.4E+09		Alachlor	15972-60-8	5.1E+01	7.7E+01		3.1E+01	1.0E+04	1.5E+04		6.2E+03
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb	116-06-3					1.0E+03	1.5E+03		6.2E+02
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb Sulfone	1646-88-4					1.0E+03	1.5E+03		6.2E+02
										1	0.1		1.4E+09		Aldicarb sulfoxide	1646-87-3								
1.7E+01	I	4.9E-03	I	3.0E-05	I					1	0.1		1.4E+09		Aldrin	309-00-2	1.7E-01	2.6E-01	3.4E+03	1.0E-01	3.1E+01	4.6E+01		1.8E+01
				2.5E-01	I					1	0.1		1.4E+09		Ally	74223-64-6					2.6E+05	3.9E+05		1.5E+05
				5.0E-03	I	1.0E-04	X			1	0.1		1.4E+09		Allyl Alcohol	107-18-6					5.1E+03	7.7E+03	6.0E+05	3.1E+03
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	1.4E+09	1.7E+03	Allyl Chloride	107-05-1	1.4E+02		3.5E+00	3.4E+00			7.5E+00	7.5E+00
				1.0E+00	P	5.0E-03	P			1			1.4E+09		Aluminum	7429-90-5					1.0E+06		3.0E+07	9.9E+05
				4.0E-04	I					1			1.4E+09		Aluminum Phosphide	20859-73-8					4.1E+02			4.1E+02
				3.0E-04	I					1	0.1		1.4E+09		Amdro	67485-29-4					3.1E+02	4.6E+02		1.8E+02
				9.0E-03	I					1	0.1		1.4E+09		Ametryn	834-12-8					9.2E+03	1.4E+04		5.5E+03
2.1E+01	C	6.0E-03	C							1	0.1		1.4E+09		Aminobiphenyl, 4-	92-67-1	1.4E-01	2.1E-01	2.8E+03	8.2E-02				
				8.0E-02	P					1	0.1		1.4E+09		Aminophenol, m-	591-27-5					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	P					1	0.1		1.4E+09		Aminophenol, p-	123-30-8					2.0E+04	3.1E+04		1.2E+04
				2.5E-03	I					1	0.1		1.4E+09		Amitraz	33089-61-1					2.6E+03	3.9E+03		1.5E+03
						1.0E-01	I			1					Ammonia	7664-41-7								
				2.0E-01	I					1			1.4E+09		Ammonium Sulfamate	7773-06-0					2.0E+05			2.0E+05
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		1.4E+09		Aniline	62-53-3	5.0E+02	7.6E+02	1.0E+07	3.0E+02	7.2E+03	1.1E+04	6.0E+06	4.3E+03
4.0E-02	P			2.0E-03	X					1	0.1		1.4E+09		Anthraquinone, 9,10-	84-65-1	7.2E+01	1.1E+02		4.3E+01	2.0E+03	3.1E+03		1.2E+03
				4.0E-04	I					0.15			1.4E+09		Antimony (metallic)	7440-36-0					4.1E+02			4.1E+02
				5.0E-04	H					0.15			1.4E+09		Antimony Pentoxide	1314-60-9					5.1E+02			5.1E+02
				9.0E-04	H					0.15			1.4E+09		Antimony Potassium Tartrate	11071-15-1					9.2E+02			9.2E+02
				4.0E-04	H					0.15			1.4E+09		Antimony Tetroxide	1332-81-6					4.1E+02			4.1E+02
						2.0E-04	I			0.15			1.4E+09		Antimony Trioxide	1309-64-4							1.2E+06	1.2E+06
				1.3E-02	I					1	0.1		1.4E+09		Apollo	74115-24-5					1.3E+04	2.0E+04		8.0E+03
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		1.4E+09		Aramite	140-57-8	1.1E+02	1.7E+02	2.3E+06	6.9E+01	5.1E+04	7.7E+04		3.1E+04
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		1.4E+09		Arsenic, Inorganic	7440-38-2	1.9E+00	9.6E+00	3.9E+03	1.6E+00	3.1E+02	1.5E+03	8.9E+04	2.6E+02
				3.5E-06	C	5.0E-05	I			1			1.4E+09		Arsine	7784-42-1					3.6E+00		3.0E+05	3.6E+00
				9.0E-03	I					1	0.1		1.4E+09		Assure	76578-14-8					9.2E+03	1.4E+04		5.5E+03
				5.0E-02	I					1	0.1		1.4E+09		Asulam	3337-71-1					5.1E+04	7.7E+04		3.1E+04
2.3E-01	C			3.5E-02	I					1	0.1		1.4E+09		Atrazine	1912-24-9	1.2E+01	1.9E+01		7.5E+00	3.6E+04	5.4E+04		2.2E+04
8.8E-01	C	2.5E-04	C							1	0.1		1.4E+09		Auramine	492-80-8	3.3E+00	4.9E+00	6.7E+04	2.0E+00				
				4.0E-04	I					1	0.1		1.4E+09		Avermectin B1	65195-55-3					4.1E+02	6.2E+02		2.5E+02
1.1E-01	I	3.1E-05	I					V		1			1.4E+09	5.6E+05	Azobenzene	103-33-3	2.6E+01		2.2E+02	2.3E+01				
				2.0E-01	I	5.0E-04	H			0.07			1.4E+09		Barium	7440-39-3					2.0E+05		3.0E+06	1.9E+05
				4.0E-03	I					1	0.1		1.4E+09		Baygon	114-26-1					4.1E+03	6.2E+03		2.5E+03
				3.0E-02	I					1	0.1		1.4E+09		Bayleton	43121-43-3					3.1E+04	4.6E+04		1.8E+04
				2.5E-02	I					1	0.1		1.4E+09		Baythroid	68359-37-5					2.6E+04	3.9E+04		1.5E+04
				3.0E-01	I					1	0.1		1.4E+09		Benefin	1861-40-1					3.1E+05	4.6E+05		1.8E+05
				5.0E-02	I					1	0.1		1.4E+09		Benomyl	17804-35-2					5.1E+04	7.7E+04		3.1E+04
				3.0E-02	I					1	0.1		1.4E+09		Bentazon	25057-89-0					3.1E+04	4.6E+04		1.8E+04
				1.0E-01	I			V		1		1.2E+03	1.4E+09	2.4E+04	Benzaldehyde	100-52-7					1.0E+05			1.0E+05
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	1.4E+09	3.8E+03	Benzene	71-43-2	5.2E+01		6.0E+00	5.4E+00	4.1E+03		5.0E+02	4.5E+02
				2.0E-04	X					1	0.1		1.4E+09		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1					2.0E+02	3.1E+02		1.2E+02
				1.0E-03	P			V		1		1.3E+03	1.4E+09	2.1E+04	Benzenethiol	108-98-5					1.0E+03			1.0E+03
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		1.4E+09		Benzidine	92-87-5	1.2E-02	1.9E-02	2.5E+02	7.5E-03	3.1E+03	4.6E+03		1.8E+03
				4.0E+00	I					1	0.1		1.4E+09		Benzoic Acid	65-85-0					4.1E+06	6.2E+06		2.5E+06
1.3E+01	I							V		1		3.2E+02	1.4E+09	7.3E+04	Benzotrichloride	98-07-7	2.2E-01			2.2E-01				
				1.0E-01	P					1	0.1		1.4E+09		Benzyl Alcohol	100-51-6					1.0E+05	1.5E+05		6.2E+04
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	1.4E+09	2.7E+04	Benzyl Chloride	100-44-7	1.7E+01		6.9E+00	4.9E+00	2.0E+03		1.2E+02	1.1E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			1.4E+09		Beryllium and compounds	7440-41-7			6.9E+03	6.9E+03	2.0E+03		1.2E+05	2.0E+03
				1.0E-04	I					1	0.1		1.4E+09		Bidrin	141-66-2					1.0E+02	1.5E+02		6.2E+01
				9.0E-03	P					1	0.1		1.4E+09		Bifenox	42576-02-3					9.2E+03	1.4E+04		5.5E+03
				1.5E-02	I					1	0.1		1.4E+09		Biphenthrin	82657-04-3					1.5E+04	2.3E+04		9.2E+03
8.0E-03	X			5.0E-02	I	4.0E-04	X	V		1			1.4E+09	1.2E+05	Biphenyl, 1,1'-	92-52-4	3.6E+02			3.6E+02	5.1E+04		2.1E+02	2.1E+02
7.0E-02	H	1.0E-05	H	4.0E-02	I			V		1		1.0E+03	1.4E+09	3.8E+04	Bis(2-chloro-1-methylethyl) ether	108-60-1	4.1E+01		4.6E+01	2.2E+01	4.1E+04			4.1E+04
				3.0E-03	P					1	0.1		1.4E+09		Bis(2-chloroethoxy)methane	111-91-1					3.1E+03	4.6E+03		1.8E+03
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	1.4E+09	4.6E+04	Bis(2-chloroethyl)ether	111-44-4	2.6E+00		1.7E+00	1.0E+00				
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		1.4E+09		Bis(2-ethylhexyl)phthalate	117-81-7	2.0E+02	3.1E+02	6.9E+06	1.2E+02	2.0E+04	3.1E+04		1.2E+04
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	1.4E+09	2.0E+03	Bis(chloromethyl)ether	542-88-1	1.3E-02		4.0E-04	3.9E-04				
				5.0E-02	I					1	0.1		1.4E+09		Bisphenol A	80-05-7					5.1E+04	7.7E+04		3.1E+04
				2.0E-01	I	2.0E-02	H			1			1.4E+09		Boron And Borates Only	7440-42-8					2.0E+05		1.2E+08	2.0E+05
				2.0E+00	P	2.0E-02	P		M	1			1.4E+09		Boron Trichloride	10294-34-5					2.0E+06		1.2E+08	2.0E+06
				4.0E-02	C	1.3E-02	C			1			1.4E+09		Boron Trifluoride	7637-07-2					4.1E+04		7.7E+07	4.1E+04
7.0E-01	I			4.0E-03	I					1			1.4E+09		Bromate	15541-45-4	4.1E+00			4.1E+00	4.1E+03			4.1E+03
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	1.4E+09	6.4E+03	Bromo-2-chloroethane, 1-	107-04-0	1.4E+00		1.3E-01	1.2E-01				
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	1.4E+09	9.0E+03	Bromobenzene	108-86-1					8.2E+03		2.4E+03	1.8E+03
						4.0E-02	X	V		1		4.0E+03	1.4E+09	3.9E+03	Bromochloromethane	74-97-5							6.8E+02	6.8E+02
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	1.4E+09	4.3E+03	Bromodichloromethane	75-27-4	4.6E+01		1.4E+00	1.4E+00	2.0E+04			2.0E+04
7.9E-03	I	1.1E-06	I	2.0E-02	I					1	0.1		1.4E+09		Bromoform	75-25-2	3.6E+02	5.5E+02	1.5E+07	2.2E+02	2.0E+04	3.1E+04		1.2E+04
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	1.4E+09	1.5E+03	Bromomethane	74-83-9					1.4E+03		3.3E+01	3.2E+01
				5.0E-03	H					1	0.1		1.4E+09		Bromophos	2104-96-3					5.1E+03	7.7E+03		3.1E+03
				2.0E-02	I					1	0.1		1.4E+09		Bromoxynil	1689-84-5					2.0E+04	3.1E+04		1.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Bromoxynil Octanoate	1689-99-2					2.0E+04	3.1E+04		1.2E+04
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	1.4E+09	9.3E+02	Butadiene, 1,3-	106-99-0	8.4E-01		3.8E-01	2.6E-01			8.2E+00	8.2E+00
				1.0E-01	I					1	0.1		1.4E+09		Butanol, N-	71-36-3					1.0E+05	1.5E+05		6.2E+04
1.9E-03	P			2.0E-01	I					1	0.1		1.4E+09		Butyl Benzyl Phthlate	85-68-7	1.5E+03	2.3E+03		9.1E+02	2.0E+05	3.1E+05		1.2E+05
				2.0E+00	P	3.0E+01	P			1	0.1		1.4E+09		Butyl alcohol, sec-	78-92-2					2.0E+06	3.1E+06	1.8E+11	1.2E+06
				5.0E-02	I					1	0.1		1.4E+09		Butylate	2008-41-5					5.1E+04	7.7E+04		3.1E+04
2.0E-04	C	5.7E-08	C							1	0.1		1.4E+09		Butylated hydroxyanisole	25013-16-5	1.4E+04	2.2E+04	2.9E+08	8.6E+03				
				5.0E-02	P			V		1		1.1E+02	1.4E+09	8.8E+03	Butylbenzene, n-	104-51-8					5.1E+04			5.1E+04
				1.0E+00	I					1	0.1		1.4E+09		Butylphthalyl Butylglycolate	85-70-1					1.0E+06	1.5E+06		6.2E+05
				2.0E-02	A					1	0.1		1.4E+09		Cacodylic Acid	75-60-5					2.0E+04	3.1E+04		1.2E+04
		1.8E-03	I	1.0E-03	I	2.0E-05	C			0.025	0.001		1.4E+09		Cadmium (Diet)	7440-43-9			9.3E+03	9.3E+03	1.0E+03	3.9E+03	1.2E+05	8.0E+02
		1.8E-03	I	5.0E-04	I	2.0E-05	C			0.05	0.001				Cadmium (Water)	7440-43-9								
				5.0E-01	I					1	0.1		1.4E+09		Caprolactam	105-60-2					5.1E+05	7.7E+05		3.1E+05
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		1.4E+09		Captafol	2425-06-1	1.9E+01	2.9E+01	3.9E+05	1.1E+01	2.0E+03	3.1E+03		1.2E+03
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		1.4E+09		Captan	133-06-2	1.2E+03	1.9E+03	2.5E+07	7.5E+02	1.3E+05	2.0E+05		8.0E+04
				1.0E-01	I					1	0.1		1.4E+09		Carbaryl	63-25-2					1.0E+05	1.5E+05		6.2E+04
				5.0E-03	I					1	0.1		1.4E+09		Carbofuran	1563-66-2					5.1E+03	7.7E+03		3.1E+03
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	1.4E+09	1.3E+03	Carbon Disulfide	75-15-0					1.0E+05		3.9E+03	3.7E+03
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	1.4E+09	1.6E+03	Carbon Tetrachloride	56-23-5	4.1E+01		3.3E+00	3.0E+00	4.1E+03		7.0E+02	6.0E+02
				1.0E-02	I					1	0.1		1.4E+09		Carbosulfan	55285-14-8					1.0E+04	1.5E+04		6.2E+03
				1.0E-01	I					1	0.1		1.4E+09		Carboxin	5234-68-4					1.0E+05	1.5E+05		6.2E+04
						9.0E-04	I			1			1.4E+09		Ceric oxide	1306-38-3							5.4E+06	5.4E+06
				1.0E-01	I					1	0.1		1.4E+09		Chloral Hydrate	302-17-0					1.0E+05	1.5E+05		6.2E+04
				1.5E-02	I					1	0.1		1.4E+09		Chloramben	133-90-4					1.5E+04	2.3E+04		9.2E+03
4.0E-01	H									1	0.1		1.4E+09		Chloranil	118-75-2	7.1E+00	1.1E+01		4.3E+00				
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I			1	0.04		1.4E+09		Chlordane	12789-03-6	8.2E+00	3.1E+01	1.7E+05	6.5E+00	5.1E+02	1.9E+03	4.2E+06	4.0E+02
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		1.4E+09		Chlordecone (Kepone)	143-50-0	2.9E-01	4.3E-01	3.6E+03	1.7E-01	3.1E+02	4.6E+02		1.8E+02
				7.0E-04	A					1	0.1		1.4E+09		Chlorfenvinphos	470-90-6					7.2E+02	1.1E+03		4.3E+02
				2.0E-02	I					1	0.1		1.4E+09		Chlorimuron, Ethyl-	90982-32-4					2.0E+04	3.1E+04		1.2E+04
				1.0E-01	I	1.5E-04	A			1			1.4E+09		Chlorine	7782-50-5					1.0E+05		8.6E+05	9.1E+04
				3.0E-02	I	2.0E-04	I			1			1.4E+09		Chlorine Dioxide	10049-04-4					3.1E+04		1.2E+06	3.0E+04
				3.0E-02	I					1			1.4E+09		Chlorite (Sodium Salt)	7758-19-2					3.1E+04			3.1E+04
						5.0E+01	I	V		1		1.2E+03	1.4E+09	1.1E+03	Chloro-1,1-difluoroethane, 1-	75-68-3							2.4E+05	2.4E+05
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.5E+02	1.4E+09	1.2E+03	Chloro-1,3-butadiene, 2-	126-99-8			4.7E-02	4.7E-02	2.0E+04		1.0E+02	1.0E+02
4.6E-01	H									1	0.1		1.4E+09		Chloro-2-methylaniline HCl, 4-	3165-93-3	6.2E+00	9.4E+00		3.7E+00				
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		1.4E+09		Chloro-2-methylaniline, 4-	95-69-2	2.9E+01	4.3E+01	2.2E+05	1.7E+01	3.1E+03	4.6E+03		1.8E+03
2.7E-01	X							V		1	0.1	2.8E+04	1.4E+09	2.0E+04	Chloroacetaldehyde, 2-	107-20-0	1.1E+01	1.6E+01		6.4E+00				
				2.0E-03	H					1	0.1		1.4E+09		Chloroacetic Acid	79-11-8					2.0E+03	3.1E+03		1.2E+03
						3.0E-05	I			1	0.1		1.4E+09		Chloroacetophenone, 2-	532-27-4							1.8E+05	1.8E+05
2.0E-01	P			4.0E-03	I					1	0.1		1.4E+09		Chloroaniline, p-	106-47-8	1.4E+01	2.2E+01		8.6E+00	4.1E+03	6.2E+03		2.5E+03
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	1.4E+09	6.9E+03	Chlorobenzene	108-90-7					2.0E+04		1.5E+03	1.4E+03
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		1.4E+09		Chlorobenzilate	510-15-6	2.6E+01	3.9E+01	5.4E+05	1.6E+01	2.0E+04	3.1E+04		1.2E+04

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				3.0E-02	X					1	0.1		1.4E+09		Chlorobenzoic Acid, p-	74-11-3					3.1E+04	4.6E+04		1.8E+04
				3.0E-03	P	3.0E-01	P	V		1		1.2E+02	1.4E+09	7.3E+03	Chlorobenzotrifluoride, 4-	98-56-6					3.1E+03		9.6E+03	2.3E+03
				4.0E-02	P			V		1		7.3E+02	1.4E+09	1.9E+03	Chlorobutane, 1-	109-69-3					4.1E+04			4.1E+04
						5.0E+01	I	V		1		1.7E+03	1.4E+09	1.0E+03	Chlorodifluoromethane	75-45-6							2.2E+05	2.2E+05
				2.0E-02	P				M	1	0.1		1.4E+09		Chloroethanol, 2-	107-07-3					2.0E+04	3.1E+04		1.2E+04
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	1.4E+09	2.8E+03	Chloroform	67-66-3	9.2E+01		1.5E+00	1.5E+00	1.0E+04		1.2E+03	1.1E+03
						9.0E-02	I	V		1		1.3E+03	1.4E+09	1.3E+03	Chloromethane	74-87-3							5.0E+02	5.0E+02
2.4E+00	C	6.9E-04	C					V		1		2.6E+04	1.4E+09	5.7E+03	Chloromethyl Methyl Ether	107-30-2	1.2E+00		1.0E-01	9.4E-02				
				8.0E-02	I			V		1			1.4E+09	8.6E+04	Chloronaphthalene, Beta-	91-58-7					8.2E+04			8.2E+04
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		1.4E+09		Chloronitrobenzene, o-	88-73-3	9.5E+00	1.4E+01		5.7E+00	3.1E+03	4.6E+03	6.0E+04	1.8E+03
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		1.4E+09		Chloronitrobenzene, p-	100-00-5	4.5E+02	6.9E+02		2.7E+02	1.0E+03	1.5E+03	3.6E+06	6.2E+02
				5.0E-03	I			V		1		2.2E+04	1.4E+09	1.3E+05	Chlorophenol, 2-	95-57-8					5.1E+03			5.1E+03
						4.0E-04	C	V		1		6.2E+02	1.4E+09	5.0E+03	Chloropicrin	76-06-2							8.8E+00	8.8E+00
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		1.4E+09		Chlorothalonil	1897-45-6	9.2E+02	1.4E+03	1.9E+07	5.6E+02	1.5E+04	2.3E+04		9.2E+03
				2.0E-02	I			V		1		9.1E+02	1.4E+09	8.7E+03	Chlorotoluene, o-	95-49-8					2.0E+04			2.0E+04
				2.0E-02	X			V		1		2.5E+02	1.4E+09	7.9E+03	Chlorotoluene, p-	106-43-4					2.0E+04			2.0E+04
2.4E+02	C	6.9E-02	C							1	0.1		1.4E+09		Chlorozotocin	54749-90-5	1.2E-02	1.8E-02	2.4E+02	7.2E-03				
				2.0E-01	I					1	0.1		1.4E+09		Chlorpropham	101-21-3					2.0E+05	3.1E+05		1.2E+05
				1.0E-03	A					1	0.1		1.4E+09		Chlorpyrifos	2921-88-2					1.0E+03	1.5E+03		6.2E+02
				1.0E-02	H					1	0.1		1.4E+09		Chlorpyrifos Methyl	5598-13-0					1.0E+04	1.5E+04		6.2E+03
				5.0E-02	I					1	0.1		1.4E+09		Chlorsulfuron	64902-72-3					5.1E+04	7.7E+04		3.1E+04
				8.0E-04	H					1	0.1		1.4E+09		Chlorthiophos	60238-56-4					8.2E+02	1.2E+03		4.9E+02
				1.5E+00	I					0.013			1.4E+09		Chromium(III), Insoluble Salts	16065-83-1					1.5E+06			1.5E+06
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			1.4E+09		Chromium(VI)	18540-29-9	5.7E+00		2.0E+02	5.6E+00	3.1E+03		6.0E+05	3.1E+03
										0.013			1.4E+09		Chromium, Total	7440-47-3								
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			1.4E+09		Cobalt	7440-48-4			1.9E+03	1.9E+03	3.1E+02		3.6E+04	3.0E+02
		6.2E-04	I						M	1	0.1				Coke Oven Emissions	8007-45-2								
				4.0E-02	H					1			1.4E+09		Copper	7440-50-8					4.1E+04			4.1E+04
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, m-	108-39-4					5.1E+04	7.7E+04	3.6E+09	3.1E+04
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, o-	95-48-7					5.1E+04	7.7E+04	3.6E+09	3.1E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresol, p-	106-44-5					1.0E+05	1.5E+05	3.6E+09	6.2E+04
				1.0E-01	A					1	0.1		1.4E+09		Cresol, p-chloro-m-	59-50-7					1.0E+05	1.5E+05		6.2E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresols	1319-77-3					1.0E+05	1.5E+05	3.6E+09	6.2E+04
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	1.4E+09	2.0E+04	Crotonaldehyde, trans-	123-73-9	1.5E+00			1.5E+00	1.0E+03			1.0E+03
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	1.4E+09	6.7E+03	Cumene	98-82-8					1.0E+05		1.2E+04	1.1E+04
2.2E-01	C	6.3E-05	C							1	0.1		1.4E+09		Cupferron	135-20-6	1.3E+01	2.0E+01	2.6E+05	7.8E+00				
8.4E-01	H			2.0E-03	H					1	0.1		1.4E+09		Cyanazine	21725-46-2	3.4E+00	5.2E+00		2.1E+00	2.0E+03	3.1E+03		1.2E+03
															Cyanides									
				1.0E-03	I					1			1.4E+09		~Calcium Cyanide	592-01-8					1.0E+03			1.0E+03
				5.0E-03	I					1			1.4E+09		~Copper Cyanide	544-92-3					5.1E+03			5.1E+03
				6.0E-04	I	8.0E-04	S	V		1		1.0E+07	1.4E+09	5.0E+04	~Cyanide (CN-)	57-12-5					6.1E+02		1.8E+02	1.4E+02
				1.0E-03	I			V		1			1.4E+09		~Cyanogen	460-19-5					1.0E+03			1.0E+03
				9.0E-02	I			V		1			1.4E+09		~Cyanogen Bromide	506-68-3					9.2E+04			9.2E+04
				5.0E-02	I			V		1			1.4E+09		~Cyanogen Chloride	506-77-4					5.1E+04			5.1E+04
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	1.4E+09	5.6E+04	~Hydrogen Cyanide	74-90-8					6.1E+02		2.0E+02	1.5E+02
				2.0E-03	I					1			1.4E+09		~Potassium Cyanide	151-50-8					2.0E+03			2.0E+03
				5.0E-03	I					0.04			1.4E+09		~Potassium Silver Cyanide	506-61-6					5.1E+03			5.1E+03
				1.0E-01	I					0.04			1.4E+09		~Silver Cyanide	506-64-9					1.0E+05			1.0E+05
				1.0E-03	I					1			1.4E+09		~Sodium Cyanide	143-33-9					1.0E+03			1.0E+03
				2.0E-04	X					1			1.4E+09		~Thiocyanate	463-56-9					2.0E+02			2.0E+02
				5.0E-02	I					1			1.4E+09		~Zinc Cyanide	557-21-1					5.1E+04			5.1E+04
						6.0E+00	I	V		1		1.2E+02	1.4E+09	1.1E+03	Cyclohexane	110-82-7							2.9E+04	2.9E+04
2.3E-02	H									1	0.1		1.4E+09		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	1.2E+02	1.9E+02		7.5E+01				
				5.0E+00	I	7.0E-01	P			1	0.1		1.4E+09		Cyclohexanone	108-94-1					5.1E+06	7.7E+06	4.2E+09	3.1E+06
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	1.4E+09	1.4E+03	Cyclohexene	110-83-8					5.1E+03		6.3E+03	2.8E+03
				2.0E-01	I					1	0.1		1.4E+09		Cyclohexylamine	108-91-8					2.0E+05	3.1E+05		1.2E+05
				5.0E-03	I					1	0.1		1.4E+09		Cyhalothrin/karate	68085-85-8					5.1E+03	7.7E+03		3.1E+03
				1.0E-02	I					1	0.1		1.4E+09		Cypermethrin	52315-07-8					1.0E+04	1.5E+04		6.2E+03
				7.5E-03	I					1	0.1		1.4E+09		Cyromazine	66215-27-8					7.7E+03	1.2E+04		4.6E+03
2.4E-01	I	6.9E-05	C							1	0.1		1.4E+09		DDD	72-54-8	1.2E+01	1.8E+01	2.4E+05	7.2E+00				
3.4E-01	I	9.7E-05	C							1	0.1		1.4E+09		DDE, p,p'-	72-55-9	8.4E+00	1.3E+01	1.7E+05	5.1E+00				
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		1.4E+09		DDT	50-29-3	8.4E+00	4.3E+01	1.7E+05	7.0E+00	5.1E+02	2.6E+03		4.3E+02
				1.0E-02	I					1	0.1		1.4E+09		Dacthal	1861-32-1					1.0E+04	1.5E+04		6.2E+03
				3.0E-02	I					1	0.1		1.4E+09		Dalapon	75-99-0					3.1E+04	4.6E+04		1.8E+04
7.0E-04	I			7.0E-03	I					1	0.1		1.4E+09		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.1E+03	6.2E+03		2.5E+03	7.2E+03	1.1E+04		4.3E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				4.0E-05	I					1	0.1		1.4E+09		Demeton	8065-48-3					4.1E+01	6.2E+01		2.5E+01
1.2E-03	I			6.0E-01	I					1	0.1		1.4E+09		Di(2-ethylhexyl)adipate	103-23-1	2.4E+03	3.6E+03		1.4E+03	6.1E+05	9.3E+05		3.7E+05
6.1E-02	H									1	0.1		1.4E+09		Diallate	2303-16-4	4.7E+01	7.1E+01		2.8E+01				
				7.0E-04	A					1	0.1		1.4E+09		Diazinon	333-41-5					7.2E+02	1.1E+03		4.3E+02
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	1.4E+09	3.4E+04	Dibromo-3-chloropropane, 1,2-	96-12-8	3.6E+00		7.0E-02	6.9E-02	2.0E+02		3.0E+01	2.6E+01
				1.0E-02	I					1	0.1		1.4E+09		Dibromobenzene, 1,4-	106-37-6					1.0E+04	1.5E+04		6.2E+03
8.4E-02	I	2.7E-05	C	2.0E-02	I			V		1	0.1	8.0E+02	1.4E+09	8.6E+03	Dibromochloromethane	124-48-1	3.4E+01	5.2E+01	3.9E+00	3.3E+00	2.0E+04	3.1E+04		1.2E+04
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	1.4E+09	9.3E+03	Dibromoethane, 1,2-	106-93-4	1.4E+00		1.9E-01	1.7E-01	9.2E+03		3.7E+02	3.5E+02
				1.0E-02	H	4.0E-03	X	V		1		2.8E+03	1.4E+09	6.1E+03	Dibromomethane (Methylene Bromide)	74-95-3					1.0E+04		1.1E+02	1.1E+02
				1.0E-01	I					1	0.1		1.4E+09		Dibutyl Phthalate	84-74-2					1.0E+05	1.5E+05		6.2E+04
				3.0E-04	P					1	0.1		1.4E+09		Dibutyltin Compounds	NA					3.1E+02	4.6E+02		1.8E+02
				3.0E-02	I					1	0.1		1.4E+09		Dicamba	1918-00-9					3.1E+04	4.6E+04		1.8E+04
		4.2E-03	P					V		1		5.2E+02	1.4E+09	1.2E+04	Dichloro-2-butene, 1,4-	764-41-0			3.5E-02	3.5E-02				
		4.2E-03	P					V		1	0.1	5.2E+02	1.4E+09	1.2E+04	Dichloro-2-butene, cis-1,4-	1476-11-5			3.5E-02	3.5E-02				
		4.2E-03	P					V		1	0.1	7.6E+02	1.4E+09	1.2E+04	Dichloro-2-butene, trans-1,4-	110-57-6			3.5E-02	3.5E-02				
5.0E-02	I			4.0E-03	I					1	0.1		1.4E+09		Dichloroacetic Acid	79-43-6	5.7E+01	8.7E+01		3.4E+01	4.1E+03	6.2E+03		2.5E+03
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	1.4E+09	1.3E+04	Dichlorobenzene, 1,2-	95-50-1					9.2E+04		1.1E+04	9.8E+03
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			1.4E+09	1.1E+04	Dichlorobenzene, 1,4-	106-46-7	5.3E+02		1.3E+01	1.2E+01	7.2E+04		3.9E+04	2.5E+04
4.5E-01	I	3.4E-04	C							1	0.1		1.4E+09		Dichlorobenzidine, 3,3'-	91-94-1	6.4E+00	9.6E+00	4.9E+04	3.8E+00				
				9.0E-03	X					1	0.1		1.4E+09		Dichlorobenzophenone, 4,4'-	90-98-2					9.2E+03	1.4E+04		5.5E+03
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	1.4E+09	9.1E+02	Dichlorodifluoromethane	75-71-8					2.0E+05		4.0E+02	4.0E+02
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	1.4E+09	2.2E+03	Dichloroethane, 1,1-	75-34-3	5.0E+02		1.7E+01	1.7E+01	2.0E+05			2.0E+05
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	1.4E+09	4.9E+03	Dichloroethane, 1,2-	107-06-2	3.1E+01		2.3E+00	2.2E+00	6.1E+03		1.5E+02	1.5E+02
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	1.4E+09	1.2E+03	Dichloroethylene, 1,1-	75-35-4					5.1E+04		1.1E+03	1.1E+03
				9.0E-03	H			V		1		1.3E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0					9.2E+03			9.2E+03
				2.0E-03	I			V		1		2.4E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2-cis-	156-59-2					2.0E+03			2.0E+03
				2.0E-02	I	6.0E-02	P	V		1		1.7E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2-trans-	156-60-5					2.0E+04		7.1E+02	6.9E+02
				3.0E-03	I					1	0.1		1.4E+09		Dichlorophenol, 2,4-	120-83-2					3.1E+03	4.6E+03		1.8E+03
				1.0E-02	I					1	0.05		1.4E+09		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					1.0E+04	3.1E+04		7.7E+03
				8.0E-03	I					1	0.1		1.4E+09		Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6					8.2E+03	1.2E+04		4.9E+03
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	1.4E+09	4.1E+03	Dichloropropane, 1,2-	78-87-5	7.9E+01		5.0E+00	4.7E+00	9.2E+04		7.1E+01	7.1E+01
				2.0E-02	P			V		1		1.5E+03	1.4E+09	7.3E+03	Dichloropropane, 1,3-	142-28-9					2.0E+04			2.0E+04
				3.0E-03	I					1	0.1		1.4E+09		Dichloropropanol, 2,3-	616-23-9					3.1E+03	4.6E+03		1.8E+03
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	1.4E+09	3.8E+03	Dichloropropene, 1,3-	542-75-6	2.9E+01		1.2E+01	8.3E+00	3.1E+04		3.4E+02	3.3E+02
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		1.4E+09		Dichlorvos	62-73-7	9.9E+00	1.5E+01	2.0E+05	5.9E+00	5.1E+02	7.7E+02	3.0E+06	3.1E+02
				8.0E-03	P	7.0E-03	P	V		1			1.4E+09	4.4E+03	Dicyclopentadiene	77-73-6					8.2E+03		1.4E+02	1.3E+02
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		1.4E+09		Dieldrin	60-57-1	1.8E-01	2.7E-01	3.6E+03	1.1E-01	5.1E+01	7.7E+01		3.1E+01
		3.0E-04	C			5.0E-03	I			1	0.1				Diesel Engine Exhaust	NA								
				2.0E-03	P	2.0E-04	P			1	0.1		1.4E+09		Diethanolamine	111-42-2					2.0E+03	3.1E+03	1.2E+06	1.2E+03
				8.0E-01	I					1	0.1		1.4E+09		Diethyl Phthalate	84-66-2					8.2E+05	1.2E+06		4.9E+05
				3.0E-02	P	1.0E-04	P			1	0.1		1.4E+09		Diethylene Glycol Monobutyl Ether	112-34-5					3.1E+04	4.6E+04	6.0E+05	1.8E+04
				6.0E-02	P	3.0E-04	P			1	0.1		1.4E+09		Diethylene Glycol Monoethyl Ether	111-90-0					6.1E+04	9.3E+04	1.8E+06	3.6E+04
				1.0E-03	P					1	0.1		1.4E+09		Diethylformamide	617-84-5					1.0E+03	1.5E+03		6.2E+02
3.5E+02	C	1.0E-01	C							1	0.1		1.4E+09		Diethylstilbestrol	56-53-1	8.2E-03	1.2E-02	1.7E+02	4.9E-03				
				8.0E-02	I					1	0.1		1.4E+09		Difenzoquat	43222-48-6					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	I					1	0.1		1.4E+09		Diflubenzuron	35367-38-5					2.0E+04	3.1E+04		1.2E+04
						4.0E+01	I	V		1		1.4E+03	1.4E+09	1.2E+03	Difluoroethane, 1,1-	75-37-6							2.2E+05	2.2E+05
4.4E-02	C	1.3E-05	C					V		1	0.1		1.4E+09	1.3E+03	Dihydrosafrole	94-58-6	6.5E+01	9.9E+01	1.3E+00	1.2E+00				
						7.0E-01	P	V		1		2.3E+03	1.4E+09	3.3E+03	Diisopropyl Ether	108-20-3							1.0E+04	1.0E+04
				8.0E-02	I			V		1		5.3E+02	1.4E+09	3.1E+04	Diisopropyl Methylphosphonate	1445-75-6					8.2E+04			8.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Dimethipin	55290-64-7					2.0E+04	3.1E+04		1.2E+04
				2.0E-04	I					1	0.1		1.4E+09		Dimethoate	60-51-5					2.0E+02	3.1E+02		1.2E+02
1.4E-02	H									1	0.1		1.4E+09		Dimethoxybenzidine, 3,3'-	119-90-4	2.0E+02	3.1E+02		1.2E+02				
1.7E-03	P			6.0E-02	P					1	0.1		1.4E+09		Dimethyl methylphosphonate	756-79-6	1.7E+03	2.6E+03		1.0E+03	6.1E+04	9.3E+04		3.7E+04
4.6E+00	C	1.3E-03	C							1	0.1		1.4E+09		Dimethylamino azobenzene [p-]	60-11-7	6.2E-01	9.4E-01	1.3E+04	3.7E-01				
5.8E-01	H									1	0.1		1.4E+09		Dimethylaniline HCl, 2,4-	21436-96-4	4.9E+00	7.5E+00		3.0E+00				
2.0E-01	P			2.0E-03	X					1	0.1		1.4E+09		Dimethylaniline, 2,4-	95-68-1	1.4E+01	2.2E+01		8.6E+00	2.0E+03	3.1E+03		1.2E+03
				2.0E-03	I			V		1		8.3E+02	1.4E+09	3.4E+04	Dimethylaniline, N,N-	121-69-7					2.0E+03			2.0E+03
1.1E+01	P									1	0.1		1.4E+09		Dimethylbenzidine, 3,3'-	119-93-7	2.6E-01	3.9E-01		1.6E-01				
				1.0E-01	P	3.0E-02	I			1	0.1		1.4E+09		Dimethylformamide	68-12-2					1.0E+05	1.5E+05	1.8E+08	6.2E+04
				1.0E-04	X	2.0E-06	X			1	0.1		1.4E+09		Dimethylhydrazine, 1,1-	57-14-7					1.0E+02	1.5E+02	1.2E+04	6.1E+01
5.5E+02	C	1.6E-01	C							1	0.1		1.4E+09		Dimethylhydrazine, 1,2-	540-73-8	5.2E-03	7.9E-03	1.0E+02	3.1E-03				
				2.0E-02	I					1	0.1		1.4E+09		Dimethylphenol, 2,4-	105-67-9					2.0E+04	3.1E+04		1.2E+04
				6.0E-04	I					1	0.1		1.4E+09		Dimethylphenol, 2,6-	576-26-1					6.1E+02	9.3E+02		3.7E+02
				1.0E-03	I					1	0.1		1.4E+09		Dimethylphenol, 3,4-	95-65-8					1.0E+03	1.5E+03		6.2E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				1.0E-01	I			V		1			1.4E+09	2.3E+04	Dimethylterephthalate	120-61-6					1.0E+05			1.0E+05
4.5E-02	C	1.3E-05	C					V		1	0.1	1.1E+03	1.4E+09	1.1E+03	Dimethylvinylchloride	513-37-1	6.4E+01	9.6E+01	1.0E+00	1.0E+00				
				8.0E-05	X					1	0.1		1.4E+09		Dinitro-o-cresol, 4,6-	534-52-1					8.2E+01	1.2E+02		4.9E+01
				2.0E-03	I					1	0.1		1.4E+09		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					2.0E+03	3.1E+03		1.2E+03
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,2-	528-29-0					1.0E+02	1.5E+02		6.2E+01
				1.0E-04	I					1	0.1		1.4E+09		Dinitrobenzene, 1,3-	99-65-0					1.0E+02	1.5E+02		6.2E+01
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,4-	100-25-4					1.0E+02	1.5E+02		6.2E+01
				2.0E-03	I					1	0.1		1.4E+09		Dinitrophenol, 2,4-	51-28-5					2.0E+03	3.1E+03		1.2E+03
6.8E-01	I									1	0.1		1.4E+09		Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	4.2E+00	6.4E+00		2.5E+00				
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		1.4E+09		Dinitrotoluene, 2,4-	121-14-2	9.2E+00	1.4E+01	1.9E+05	5.5E+00	2.0E+03	3.0E+03		1.2E+03
				1.0E-03	P					1	0.099		1.4E+09		Dinitrotoluene, 2,6-	606-20-2					1.0E+03	1.6E+03		6.2E+02
				2.0E-03	S					1	0.006		1.4E+09		Dinitrotoluene, 2-Amino-4,6-	35572-78-2					2.0E+03	5.2E+04		2.0E+03
				2.0E-03	S					1	0.009		1.4E+09		Dinitrotoluene, 4-Amino-2,6-	19406-51-0					2.0E+03	3.4E+04		1.9E+03
				1.0E-03	I					1	0.1		1.4E+09		Dinoseb	88-85-7					1.0E+03	1.5E+03		6.2E+02
1.0E-01	I	7.7E-06	C	3.0E-02	I	3.0E+00	C			1	0.1		1.4E+09		Dioxane, 1,4-	123-91-1	2.9E+01	4.3E+01	2.2E+06	1.7E+01	3.1E+04	4.6E+04	1.8E+10	1.8E+04
															Dioxins									
6.2E+03	I	1.3E+00	I							1	0.03		1.4E+09		~Hexachlorodibenzo-p-dioxin, Mixture	NA	4.6E-04	2.3E-03	1.3E+01	3.9E-04				
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C			1	0.03		1.4E+09		~TCDD, 2,3,7,8-	1746-01-6	2.2E-05	1.1E-04	4.4E-01	1.8E-05	7.2E-04	3.6E-03	2.4E+02	6.0E-04
				3.0E-02	I					1	0.1		1.4E+09		Diphenamid	957-51-7					3.1E+04	4.6E+04		1.8E+04
				8.0E-04	X					1	0.1		1.4E+09		Diphenyl Sulfone	127-63-9					8.2E+02	1.2E+03		4.9E+02
				2.5E-02	I					1	0.1		1.4E+09		Diphenylamine	122-39-4					2.6E+04	3.9E+04		1.5E+04
8.0E-01	I	2.2E-04	I							1	0.1		1.4E+09		Diphenylhydrazine, 1,2-	122-66-7	3.6E+00	5.4E+00	7.6E+04	2.2E+00				
				2.2E-03	I					1	0.1		1.4E+09		Diquat	85-00-7					2.2E+03	3.4E+03		1.4E+03
7.4E+00	C	2.1E-03	C							1	0.1		1.4E+09		Direct Black 38	1937-37-7	3.9E-01	5.9E-01	7.9E+03	2.3E-01				
7.4E+00	C	2.1E-03	C							1	0.1		1.4E+09		Direct Blue 6	2602-46-2	3.9E-01	5.9E-01	7.9E+03	2.3E-01				
6.7E+00	C	1.9E-03	C							1	0.1		1.4E+09		Direct Brown 95	16071-86-6	4.3E-01	6.5E-01	8.8E+03	2.6E-01				
				4.0E-05	I					1	0.1		1.4E+09		Disulfoton	298-04-4					4.1E+01	6.2E+01		2.5E+01
				1.0E-02	I			V		1	0.1		1.4E+09	4.6E+04	Dithiane, 1,4-	505-29-3					1.0E+04	1.5E+04		6.2E+03
				2.0E-03	I					1	0.1		1.4E+09		Diuron	330-54-1					2.0E+03	3.1E+03		1.2E+03
				4.0E-03	I					1	0.1		1.4E+09		Dodine	2439-10-3					4.1E+03	6.2E+03		2.5E+03
				2.5E-02	I			V		1			1.4E+09	1.3E+05	EPTC	759-94-4					2.6E+04			2.6E+04
				6.0E-03	I					1	0.1		1.4E+09		Endosulfan	115-29-7					6.1E+03	9.3E+03		3.7E+03
				2.0E-02	I					1	0.1		1.4E+09		Endothall	145-73-3					2.0E+04	3.1E+04		1.2E+04
				3.0E-04	I					1	0.1		1.4E+09		Endrin	72-20-8					3.1E+02	4.6E+02		1.8E+02
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	1.4E+09	2.0E+04	Epichlorohydrin	106-89-8	2.9E+02		2.1E+02	1.2E+02	6.1E+03		8.9E+01	8.8E+01
						2.0E-02	I	V		1		1.5E+04	1.4E+09	8.2E+03	Epoxybutane, 1,2-	106-88-7							7.2E+02	7.2E+02
				5.0E-03	I					1	0.1		1.4E+09		Ethephon	16672-87-0					5.1E+03	7.7E+03		3.1E+03
				5.0E-04	I					1	0.1		1.4E+09		Ethion	563-12-2					5.1E+02	7.7E+02		3.1E+02
				1.0E-01	P	6.0E-02	P			1	0.1		1.4E+09		Ethoxyethanol Acetate, 2-	111-15-9					1.0E+05	1.5E+05	3.6E+08	6.2E+04
				4.0E-01	H	2.0E-01	I			1	0.1		1.4E+09		Ethoxyethanol, 2-	110-80-5					4.1E+05	6.2E+05	1.2E+09	2.5E+05
				9.0E-01	I			V		1		1.1E+04	1.4E+09	9.3E+03	Ethyl Acetate	141-78-6					9.2E+05			9.2E+05
4.8E-02	H							V		1		2.5E+03	1.4E+09	6.8E+03	Ethyl Acrylate	140-88-5	6.0E+01			6.0E+01				
						1.0E+01	I	V		1		2.1E+03	1.4E+09	1.4E+03	Ethyl Chloride	75-00-3							6.1E+04	6.1E+04
				2.0E-01	I			V		1		1.0E+04	1.4E+09	3.4E+03	Ethyl Ether	60-29-7					2.0E+05			2.0E+05
				9.0E-02	H	3.0E-01	P	V		1		1.1E+03	1.4E+09	6.2E+03	Ethyl Methacrylate	97-63-2					9.2E+04		8.2E+03	7.5E+03
				1.0E-05	I					1	0.1		1.4E+09		Ethyl-p-nitrophenyl Phosphonate	2104-64-5					1.0E+01	1.5E+01		6.2E+00
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	1.4E+09	6.1E+03	Ethylbenzene	100-41-4	2.6E+02		3.0E+01	2.7E+01	1.0E+05		2.7E+04	2.1E+04
				7.0E-02	P					1	0.1		1.4E+09		Ethylene Cyanohydrin	109-78-4					7.2E+04	1.1E+05		4.3E+04
				9.0E-02	P					1	0.1		1.4E+09		Ethylene Diamine	107-15-3					9.2E+04	1.4E+05		5.5E+04
				2.0E+00	I	4.0E-01	C			1	0.1		1.4E+09		Ethylene Glycol	107-21-1					2.0E+06	3.1E+06	2.4E+09	1.2E+06
				1.0E-01	I	1.6E+00	I			1	0.1		1.4E+09		Ethylene Glycol Monobutyl Ether	111-76-2					1.0E+05	1.5E+05	9.5E+09	6.2E+04
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	1.4E+09	6.6E+03	Ethylene Oxide	75-21-8	9.2E+00		9.1E-01	8.3E-01			8.6E+02	8.6E+02
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		1.4E+09		Ethylene Thiourea	96-45-7	6.4E+01	9.6E+01	1.3E+06	3.8E+01	8.2E+01	1.2E+02		4.9E+01
6.5E+01	C	1.9E-02	C					V		1	0.1	1.5E+05	1.4E+09	2.6E+04	Ethyleneimine	151-56-4	4.4E-02	6.7E-02	1.7E-02	1.0E-02				
				3.0E+00	I					1	0.1		1.4E+09		Ethylphthalyl Ethyl Glycolate	84-72-0					3.1E+06	4.6E+06		1.8E+06
				8.0E-03	I					1	0.1		1.4E+09		Express	101200-48-0					8.2E+03	1.2E+04		4.9E+03
				2.5E-04	I					1	0.1		1.4E+09		Fenamiphos	22224-92-6					2.6E+02	3.9E+02		1.5E+02
				2.5E-02	I					1	0.1		1.4E+09		Fenpropathrin	39515-41-8					2.6E+04	3.9E+04		1.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Fluometuron	2164-17-2					1.3E+04	2.0E+04		8.0E+03
				4.0E-02	C	1.3E-02	C			1			1.4E+09		Fluoride	16984-48-8					4.1E+04		7.7E+07	4.1E+04
				6.0E-02	I	1.3E-02	C			1			1.4E+09		Fluorine (Soluble Fluoride)	7782-41-4					6.1E+04		7.7E+07	6.1E+04
				8.0E-02	I					1	0.1		1.4E+09		Fluridone	59756-60-4					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	I					1	0.1		1.4E+09		Flurprimidol	56425-91-3					2.0E+04	3.1E+04		1.2E+04
				6.0E-02	I					1	0.1		1.4E+09		Flutolanil	66332-96-5					6.1E+04	9.3E+04		3.7E+04
				1.0E-02	I					1	0.1		1.4E+09		Fluvalinate	69409-94-5					1.0E+04	1.5E+04		6.2E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C$_{sat}$ (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
3.5E-03	I			1.0E-01	I					1	0.1		1.4E+09		Folpet	133-07-3	8.2E+02	1.2E+03		4.9E+02	1.0E+05	1.5E+05		6.2E+04
1.9E-01	I									1	0.1		1.4E+09		Fomesafen	72178-02-0	1.5E+01	2.3E+01		9.1E+00				
				2.0E-03	I					1	0.1		1.4E+09		Fonofos	944-22-9					2.0E+03	3.1E+03		1.2E+03
		1.3E-05	I	2.0E-01	I	9.8E-03	A			1	0.1		1.4E+09		Formaldehyde	50-00-0			1.3E+06	1.3E+06	2.0E+05	3.1E+05	5.8E+07	1.2E+05
				9.0E-01	P	3.0E-04	X			1	0.1		1.4E+09		Formic Acid	64-18-6					9.2E+05	1.4E+06	1.8E+06	4.2E+05
				3.0E+00	I					1	0.1		1.4E+09		Fosetyl-AL	39148-24-8					3.1E+06	4.6E+06		1.8E+06
															Furans									
				1.0E-03	X			V		1			1.4E+09	2.1E+05	~Dibenzofuran	132-64-9					1.0E+03			1.0E+03
				1.0E-03	I			V		1		6.2E+03	1.4E+09	2.8E+03	~Furan	110-00-9					1.0E+03			1.0E+03
				9.0E-01	I	2.0E+00	I	V		1	0.1	1.7E+05	1.4E+09	1.3E+04	~Tetrahydrofuran	109-99-9					9.2E+05	1.4E+06	1.2E+05	9.5E+04
3.8E+00	H									1	0.1		1.4E+09		Furazolidone	67-45-8	7.5E-01	1.1E+00		4.5E-01				
				3.0E-03	I	5.0E-02	H			1	0.1		1.4E+09		Furfural	98-01-1					3.1E+03	4.6E+03	3.0E+08	1.8E+03
1.5E+00	C	4.3E-04	C							1	0.1		1.4E+09		Furium	531-82-8	1.9E+00	2.9E+00	3.9E+04	1.1E+00				
3.0E-02	I	8.6E-06	C							1	0.1		1.4E+09		Furmecyclox	60568-05-0	9.5E+01	1.4E+02	1.9E+06	5.7E+01				
				4.0E-04	I					1	0.1		1.4E+09		Glufosinate, Ammonium	77182-82-2					4.1E+02	6.2E+02		2.5E+02
						8.0E-05	C			1	0.1		1.4E+09		Glutaraldehyde	111-30-8							4.8E+05	4.8E+05
				4.0E-04	I	1.0E-03	H			1	0.1		1.4E+09		Glycidyl	765-34-4					4.1E+02	6.2E+02	6.0E+06	2.5E+02
				1.0E-01	I					1	0.1		1.4E+09		Glyphosate	1071-83-6					1.0E+05	1.5E+05		6.2E+04
				3.0E-03	I					1	0.1		1.4E+09		Goal	42874-03-3					3.1E+03	4.6E+03		1.8E+03
				3.0E-03	A	1.0E-02	A			1	0.1		1.4E+09		Guthion	86-50-0					3.1E+03	4.6E+03	6.0E+07	1.8E+03
				5.0E-05	I					1	0.1		1.4E+09		Haloxyfop, Methyl	69806-40-2					5.1E+01	7.7E+01		3.1E+01
				1.3E-02	I					1	0.1		1.4E+09		Harmony	79277-27-3					1.3E+04	2.0E+04		8.0E+03
4.5E+00	I	1.3E-03	I	5.0E-04	I					1	0.1		1.4E+09		Heptachlor	76-44-8	6.4E-01	9.6E-01	1.3E+04	3.8E-01	5.1E+02	7.7E+02		3.1E+02
9.1E+00	I	2.6E-03	I	1.3E-05	I					1	0.1		1.4E+09		Heptachlor Epoxide	1024-57-3	3.1E-01	4.8E-01	6.4E+03	1.9E-01	1.3E+01	2.0E+01		8.0E+00
				2.0E-03	I					1	0.1		1.4E+09		Hexabromobenzene	87-82-1					2.0E+03	3.1E+03		1.2E+03
				2.0E-04	I					1	0.1		1.4E+09		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2					2.0E+02	3.1E+02		1.2E+02
1.6E+00	I	4.6E-04	I	8.0E-04	I					1	0.1		1.4E+09		Hexachlorobenzene	118-74-1	1.8E+00	2.7E+00	3.6E+04	1.1E+00	8.2E+02	1.2E+03		4.9E+02
7.8E-02	I	2.2E-05	I	1.0E-03	P					1	0.1		1.4E+09		Hexachlorobutadiene	87-68-3	3.7E+01	5.6E+01	7.6E+05	2.2E+01	1.0E+03	1.5E+03		6.2E+02
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		1.4E+09		Hexachlorocyclohexane, Alpha-	319-84-6	4.5E-01	6.9E-01	9.3E+03	2.7E-01	8.2E+03	1.2E+04		4.9E+03
1.8E+00	I	5.3E-04	I							1	0.1		1.4E+09		Hexachlorocyclohexane, Beta-	319-85-7	1.6E+00	2.4E+00	3.1E+04	9.6E-01				
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		1.4E+09		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	2.6E+00	9.9E+00	5.4E+04	2.1E+00	3.1E+02	1.2E+03		2.4E+02
1.8E+00	I	5.1E-04	I							1	0.1		1.4E+09		Hexachlorocyclohexane, Technical	608-73-1	1.6E+00	2.4E+00	3.3E+04	9.6E-01				
				6.0E-03	I	2.0E-04	I			1	0.1		1.4E+09		Hexachlorocyclopentadiene	77-47-4					6.1E+03	9.3E+03	1.2E+06	3.7E+03
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I			1	0.1		1.4E+09		Hexachloroethane	67-72-1	7.2E+01	1.1E+02	1.5E+06	4.3E+01	7.2E+02	1.1E+03	1.8E+08	4.3E+02
				3.0E-04	I					1	0.1		1.4E+09		Hexachlorophene	70-30-4					3.1E+02	4.6E+02		1.8E+02
1.1E-01	I			3.0E-03	I					1	0.015		1.4E+09		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	2.6E+01	2.6E+02		2.4E+01	3.1E+03	3.1E+04		2.8E+03
						1.0E-05	I	V		1		5.2E+03	1.4E+09	3.2E+05	Hexamethylene Diisocyanate, 1,6-	822-06-0							1.4E+01	1.4E+01
				4.0E-04	P					1	0.1		1.4E+09		Hexamethylphosphoramide	680-31-9					4.1E+02	6.2E+02		2.5E+02
				6.0E-02	H	7.0E-01	I	V		1		1.4E+02	1.4E+09	8.9E+02	Hexane, N-	110-54-3					6.1E+04		2.7E+03	2.6E+03
				2.0E+00	P					1	0.1		1.4E+09		Hexanedioic Acid	124-04-9					2.0E+06	3.1E+06		1.2E+06
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	1.4E+09	1.4E+04	Hexanone, 2-	591-78-6					5.1E+03		1.9E+03	1.4E+03
				3.3E-02	I					1	0.1		1.4E+09		Hexazinone	51235-04-2					3.4E+04	5.1E+04		2.0E+04
3.0E+00	I	4.9E-03	I			3.0E-05	P			1			1.4E+09		Hydrazine	302-01-2	9.5E-01		3.4E+03	9.5E-01			1.8E+05	1.8E+05
3.0E+00	I	4.9E-03	I							1			1.4E+09		Hydrazine Sulfate	10034-93-2	9.5E-01		3.4E+03	9.5E-01				
						2.0E-02	I			1			1.4E+09		Hydrogen Chloride	7647-01-0							1.2E+08	1.2E+08
				4.0E-02	C	1.4E-02	C			1			1.4E+09		Hydrogen Fluoride	7664-39-3					4.1E+04		8.3E+07	4.1E+04
						2.0E-03	I			1			1.4E+09		Hydrogen Sulfide	7783-06-4							1.2E+07	1.2E+07
6.0E-02	P			4.0E-02	P					1	0.1		1.4E+09		Hydroquinone	123-31-9	4.8E+01	7.2E+01		2.9E+01	4.1E+04	6.2E+04		2.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Imazalil	35554-44-0					1.3E+04	2.0E+04		8.0E+03
				2.5E-01	I					1	0.1		1.4E+09		Imazaquin	81335-37-7					2.6E+05	3.9E+05		1.5E+05
				1.0E-02	A					1			1.4E+09		Iodine	7553-56-2					1.0E+04			1.0E+04
				4.0E-02	I					1	0.1		1.4E+09		Iprodione	36734-19-7					4.1E+04	6.2E+04		2.5E+04
				7.0E-01	P					1			1.4E+09		Iron	7439-89-6					7.2E+05			7.2E+05
				3.0E-01	I					1	0.1		1.4E+09		Isobutyl Alcohol	78-83-1					3.1E+05	4.6E+05		1.8E+05
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		1.4E+09		Isophorone	78-59-1	3.0E+03	4.6E+03		1.8E+03	2.0E+05	3.1E+05	1.2E+10	1.2E+05
				1.5E-02	I					1	0.1		1.4E+09		Isopropalin	33820-53-0					1.5E+04	2.3E+04		9.2E+03
						7.0E+00	C			1	0.1		1.4E+09		Isopropanol	67-63-0							4.2E+10	4.2E+10
				1.0E-01	I					1	0.1		1.4E+09		Isopropyl Methyl Phosphonic Acid	1832-54-8					1.0E+05	1.5E+05		6.2E+04
				5.0E-02	I					1	0.1		1.4E+09		Isoxaben	82558-50-7					5.1E+04	7.7E+04		3.1E+04
						3.0E-01	A	V		1			1.4E+09		JP-7	NA							1.8E+09	1.8E+09
				7.5E-02	I					1	0.1		1.4E+09		Kerb	23950-58-5					7.7E+04	1.2E+05		4.6E+04
				2.0E-03	I					1	0.1		1.4E+09		Lactofen	77501-63-4					2.0E+03	3.1E+03		1.2E+03
															Lead Compounds									
2.8E-01	C	8.0E-05	C							1	0.1		1.4E+09		~Lead acetate	301-04-2	1.0E+01	1.5E+01	2.1E+05	6.2E+00				
										1			1.4E+09		~Lead and Compounds	7439-92-1								8.0E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR ($\mu g/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
3.8E-02	C	1.1E-05	C							1	0.1		1.4E+09		~Lead subacetate	1335-32-6	7.5E+01	1.1E+02	1.5E+06	4.5E+01				
				1.0E-07	I					1	0.1		1.4E+09		~Tetraethyl Lead	78-00-2					1.0E-01	1.5E-01		6.2E-02
				2.0E-03	I					1	0.1		1.4E+09		Linuron	330-55-2					2.0E+03	3.1E+03		1.2E+03
				2.0E-03	P					1			1.4E+09		Lithium	7439-93-2					2.0E+03			2.0E+03
				2.0E-01	I					1	0.1		1.4E+09		Londax	83055-99-6					2.0E+05	3.1E+05		1.2E+05
				5.0E-04	I					1	0.1		1.4E+09		MCPA	94-74-6					5.1E+02	7.7E+02		3.1E+02
				1.0E-02	I					1	0.1		1.4E+09		MCPB	94-81-5					1.0E+04	1.5E+04		6.2E+03
				1.0E-03	I					1	0.1		1.4E+09		MCPP	93-65-2					1.0E+03	1.5E+03		6.2E+02
				2.0E-02	I					1	0.1		1.4E+09		Malathion	121-75-5					2.0E+04	3.1E+04		1.2E+04
				1.0E-01	I	7.0E-04	C			1	0.1		1.4E+09		Maleic Anhydride	108-31-6					1.0E+05	1.5E+05	4.2E+06	6.1E+04
				5.0E-01	I					1	0.1		1.4E+09		Maleic Hydrazide	123-33-1					5.1E+05	7.7E+05		3.1E+05
				1.0E-04	P					1	0.1		1.4E+09		Malononitrile	109-77-3					1.0E+02	1.5E+02		6.2E+01
				3.0E-02	H					1	0.1		1.4E+09		Mancozeb	8018-01-7					3.1E+04	4.6E+04		1.8E+04
				5.0E-03	I					1	0.1		1.4E+09		Maneb	12427-38-2					5.1E+03	7.7E+03		3.1E+03
				1.4E-01	I	5.0E-05	I			1					Manganese (Diet)	7439-96-5								
				2.4E-02	S	5.0E-05	I			0.04			1.4E+09		Manganese (Non-diet)	7439-96-5					2.5E+04		3.0E+05	2.3E+04
				9.0E-05	H					1	0.1		1.4E+09		Mephosfolan	950-10-7					9.2E+01	1.4E+02		5.5E+01
				3.0E-02	I					1	0.1		1.4E+09		Mepiquat Chloride	24307-26-4					3.1E+04	4.6E+04		1.8E+04
															Mercury Compounds									
				3.0E-04	I	3.0E-04	S			0.07			1.4E+09		~Mercuric Chloride (and other Mercury salts)	7487-94-7					3.1E+02		1.8E+06	3.1E+02
						3.0E-04	I	V		1		3.1E+00	1.4E+09	3.2E+04	~Mercury (elemental)	7439-97-6							4.3E+01	4.3E+01
				1.0E-04	I					1			1.4E+09		~Methyl Mercury	22967-92-6					1.0E+02			1.0E+02
				8.0E-05	I					1	0.1		1.4E+09		~Phenylmercuric Acetate	62-38-4					8.2E+01	1.2E+02		4.9E+01
				3.0E-05	I					1	0.1		1.4E+09		Merphos	150-50-5					3.1E+01	4.6E+01		1.8E+01
				3.0E-05	I					1	0.1		1.4E+09		Merphos Oxide	78-48-8					3.1E+01	4.6E+01		1.8E+01
				6.0E-02	I					1	0.1		1.4E+09		Metalaxyl	57837-19-1					6.1E+04	9.3E+04		3.7E+04
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	1.4E+09	7.3E+03	Methacrylonitrile	126-98-7					1.0E+02		9.6E+02	9.2E+01
				5.0E-05	I					1	0.1		1.4E+09		Methamidophos	10265-92-6					5.1E+01	7.7E+01		3.1E+01
				5.0E-01	I	4.0E+00	C			1	0.1		1.4E+09		Methanol	67-56-1					5.1E+05	7.7E+05	2.4E+10	3.1E+05
				1.0E-03	I					1	0.1		1.4E+09		Methidathion	950-37-8					1.0E+03	1.5E+03		6.2E+02
				2.5E-02	I					1	0.1		1.4E+09		Methomyl	16752-77-5					2.6E+04	3.9E+04		1.5E+04
4.9E-02	C	1.4E-05	C							1	0.1		1.4E+09		Methoxy-5-nitroaniline, 2-	99-59-2	5.8E+01	8.8E+01	1.2E+06	3.5E+01				
				5.0E-03	I					1	0.1		1.4E+09		Methoxychlor	72-43-5					5.1E+03	7.7E+03		3.1E+03
				8.0E-03	P	1.0E-03	P			1	0.1		1.4E+09		Methoxyethanol Acetate, 2-	110-49-6					8.2E+03	1.2E+04	6.0E+06	4.9E+03
				5.0E-03	P	2.0E-02	I			1	0.1		1.4E+09		Methoxyethanol, 2-	109-86-4					5.1E+03	7.7E+03	1.2E+08	3.1E+03
				1.0E+00	X			V		1		2.9E+04	1.4E+09	8.7E+03	Methyl Acetate	79-20-9					1.0E+06			1.0E+06
				3.0E-02	H	2.0E-02	P	V		1		6.8E+03	1.4E+09	7.5E+03	Methyl Acrylate	96-33-3					3.1E+04		6.6E+02	6.4E+02
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	1.4E+09	1.3E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3					6.1E+05		2.9E+05	2.0E+05
		1.0E-03	X	1.0E-03	P	2.0E-05	X			1	0.1		1.4E+09		Methyl Hydrazine	60-34-4			1.7E+04	1.7E+04	1.0E+03	1.5E+03	1.2E+05	6.1E+02
				8.0E-02	H	3.0E+00	I	V		1		3.4E+03	1.4E+09	1.1E+04	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1					8.2E+04		1.5E+05	5.3E+04
						1.0E-03	C	V		1	0.1	1.7E+04	1.4E+09	4.8E+03	Methyl Isocyanate	624-83-9							2.1E+01	2.1E+01
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	1.4E+09	6.8E+03	Methyl Methacrylate	80-62-6					1.4E+06		2.1E+04	2.1E+04
				2.5E-04	I					1	0.1		1.4E+09		Methyl Parathion	298-00-0					2.6E+02	3.9E+02		1.5E+02
				6.0E-02	X					1	0.1		1.4E+09		Methyl Phosphonic Acid	993-13-5					6.1E+04	9.3E+04		3.7E+04
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	1.4E+09	1.2E+04	Methyl Styrene (Mixed Isomers)	25013-15-4					6.1E+03		2.0E+03	1.5E+03
9.9E-02	C	2.8E-05	C							1	0.1		1.4E+09		Methyl methanesulfonate	66-27-3	2.9E+01	4.4E+01	6.0E+05	1.7E+01				
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	1.4E+09	5.3E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.6E+03		2.5E+02	2.2E+02			6.9E+04	6.9E+04
				2.0E-04	X					1	0.1		1.4E+09		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2					2.0E+02	3.1E+02		1.2E+02
9.0E-03	P			2.0E-02	X					1	0.1		1.4E+09		Methyl-5-Nitroaniline, 2-	99-55-8	3.2E+02	4.8E+02		1.9E+02	2.0E+04	3.1E+04		1.2E+04
8.3E+00	C	2.4E-03	C							1	0.1		1.4E+09		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	3.4E-01	5.2E-01	6.9E+03	2.1E-01				
1.3E-01	C	3.7E-05	C							1	0.1		1.4E+09		Methylaniline Hydrochloride, 2-	636-21-5	2.2E+01	3.3E+01	4.5E+05	1.3E+01				
				1.0E-02	A					1	0.1		1.4E+09		Methylarsonic acid	124-58-3					1.0E+04	1.5E+04		6.2E+03
				2.0E-04	X					1	0.1		1.4E+09		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7					2.0E+02	3.1E+02		1.2E+02
				2.0E-04	X					1	0.1		1.4E+09		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9					2.0E+02	3.1E+02		1.2E+02
2.2E+01	C	6.3E-03	C						M	1	0.1		1.4E+09		Methylcholanthrene, 3-	56-49-5	1.3E-01	2.0E-01	2.6E+03	7.8E-02				
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	1.4E+09	2.4E+03	Methylene Chloride	75-09-2	1.4E+03		2.9E+03	9.6E+02	6.1E+03		6.2E+03	3.1E+03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		1.4E+09		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.9E+01	4.3E+01	3.9E+04	1.7E+01	2.0E+03	3.1E+03		1.2E+03
4.6E-02	I	1.3E-05	C							1	0.1		1.4E+09		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	6.2E+01	9.4E+01	1.3E+06	3.7E+01				
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		1.4E+09		Methylenebisbenzenamine, 4,4'-	101-77-9	1.8E+00	2.7E+00	3.6E+04	1.1E+00				
						6.0E-04	I			1	0.1		1.4E+09		Methylenediphenyl Diisocyanate	101-68-8							1.2E+08	1.2E+08
				7.0E-02	H			V		1		5.0E+02	1.4E+09	1.4E+04	Methylstyrene, Alpha-	98-83-9							3.6E+06	3.6E+06
				1.5E-01	I					1	0.1		1.4E+09		Metolachlor	51218-45-2					7.2E+04			7.2E+04
				2.5E-02	I					1	0.1		1.4E+09		Metribuzin	21087-64-9					1.5E+05	2.3E+05		9.2E+04
				3.0E+00	P			V		1	0.1	3.4E-01	1.4E+09	1.1E+03	Mineral oils	8012-95-1					2.6E+04	3.9E+04		1.5E+04
1.8E+01	C	5.1E-03	C	2.0E-04	I					1	0.1		1.4E+09		Mirex	2385-85-5	1.6E-01	2.4E-01	3.3E+03	9.6E-02	3.1E+06	4.6E+06		1.8E+06
																						2.0E+02	3.1E+02		1.2E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				2.0E-03	I					1	0.1		1.4E+09		Molinate	2212-67-1					2.0E+03	3.1E+03		1.2E+03
				5.0E-03	I					1			1.4E+09		Molybdenum	7439-98-7					5.1E+03			5.1E+03
				1.0E-01	I					1			1.4E+09		Monochloramine	10599-90-3					1.0E+05			1.0E+05
				2.0E-03	P					1	0.1		1.4E+09		Monomethylaniline	100-61-8					2.0E+03	3.1E+03		1.2E+03
				3.0E-04	X					1	0.1		1.4E+09		N,N'-Diphenyl-1,4 benzenediamine	74-31-7					3.1E+02	4.6E+02		1.8E+02
				2.0E-03	I					1	0.1		1.4E+09		Naled	300-76-5					2.0E+03	3.1E+03		1.2E+03
				3.0E-02	X	1.0E-01	P	V		1			1.4E+09		Naphtha, High Flash Aromatic (HFAN)	64724-95-6					3.1E+04		6.0E+08	3.1E+04
1.8E+00	C	0.0E+00	C							1	0.1		1.4E+09		Naphthylamine, 2-	91-59-8	1.6E+00	2.4E+00		9.6E-01				
				1.0E-01	I					1	0.1		1.4E+09		Napropamide	15299-99-7					1.0E+05	1.5E+05		6.2E+04
				5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Carbonyl	13463-39-3					5.1E+04		3.0E+05	4.4E+04
				5.0E-02	C	1.0E-04	C			1			1.4E+09		Nickel Oxide	1313-99-1					5.1E+04		6.0E+05	4.7E+04
		2.4E-04	I	5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Refinery Dust	NA			6.9E+04	6.9E+04	5.1E+04		3.0E+05	4.4E+04
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			1.4E+09		Nickel Soluble Salts	7440-02-0			6.4E+04	6.4E+04	2.0E+04		5.4E+05	2.0E+04
1.7E+00	C	4.8E-04	I	5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Subsulfide	12035-72-2	1.7E+00		3.5E+04	1.7E+00	5.1E+04		3.0E+05	4.4E+04
				1.6E+00	I					1			1.4E+09		Nitrate	14797-55-8					1.6E+06			1.6E+06
										1			1.4E+09		Nitrate + Nitrite (as N)	NA								
				1.0E-01	I					1			1.4E+09		Nitrite	14797-65-0					1.0E+05			1.0E+05
				1.0E-02	X	5.0E-05	X			1	0.1		1.4E+09		Nitroaniline, 2-	88-74-4					1.0E+04	1.5E+04	3.0E+05	6.0E+03
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		1.4E+09		Nitroaniline, 4-	100-01-6	1.4E+02	2.2E+02		8.6E+01	4.1E+03	6.2E+03	3.6E+07	2.5E+03
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	1.4E+09	7.9E+04	Nitrobenzene	98-95-3			2.4E+01	2.4E+01	2.0E+03		3.1E+03	1.2E+03
				3.0E+03	P					1	0.1		1.4E+09		Nitrocellulose	9004-70-0					3.1E+09	4.6E+09		1.8E+09
				7.0E-02	H					1	0.1		1.4E+09		Nitrofurantoin	67-20-9					7.2E+04	1.1E+05		4.3E+04
1.3E+00	C	3.7E-04	C							1	0.1		1.4E+09		Nitrofurazone	59-87-0	2.2E+00	3.3E+00	4.5E+04	1.3E+00				
1.7E-02	P			1.0E-04	P					1	0.1		1.4E+09		Nitroglycerin	55-63-0	1.7E+02	2.6E+02		1.0E+02	1.0E+02	1.5E+02		6.2E+01
				1.0E-01	I					1	0.1		1.4E+09		Nitroguanidine	556-88-7					1.0E+05	1.5E+05		6.2E+04
		9.0E-06	P			2.0E-02	P	V		1		1.8E+04	1.4E+09	1.8E+04	Nitromethane	75-52-5			2.5E+01	2.5E+01			1.6E+03	1.6E+03
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	1.4E+09	1.4E+04	Nitropropane, 2-	79-46-9			6.4E-02	6.4E-02			1.2E+03	1.2E+03
2.7E+01	C	7.7E-03	C						M	1	0.1		1.4E+09		Nitroso-N-ethylurea, N-	759-73-9	1.1E-01	1.6E-01	2.2E+03	6.4E-02				
1.2E+02	C	3.4E-02	C						M	1	0.1		1.4E+09		Nitroso-N-methylurea, N-	684-93-5	2.4E-02	3.6E-02	4.9E+02	1.4E-02				
5.4E+00	I	1.6E-03	I					V		1			1.4E+09	2.1E+05	Nitroso-di-N-butylamine, N-	924-16-3	5.3E-01		1.6E+00	4.0E-01				
7.0E+00	I	2.0E-03	C							1	0.1		1.4E+09		Nitroso-di-N-propylamine, N-	621-64-7	4.1E-01	6.2E-01	8.3E+03	2.5E-01				
2.8E+00	I	8.0E-04	C							1	0.1		1.4E+09		Nitrosodiethanolamine, N-	1116-54-7	1.0E+00	1.5E+00	2.1E+04	6.2E-01				
1.5E+02	I	4.3E-02	I						M	1	0.1		1.4E+09		Nitrosodiethylamine, N-	55-18-5	1.9E-02	2.9E-02	3.9E+02	1.1E-02				
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X		M	1	0.1		1.4E+09		Nitrosodimethylamine, N-	62-75-9	5.6E-02	8.5E-02	1.2E+03	3.4E-02	8.2E+00	1.2E+01	2.4E+05	4.9E+00
4.9E-03	I	2.6E-06	C							1	0.1		1.4E+09		Nitrosodiphenylamine, N-	86-30-6	5.8E+02	8.8E+02	6.4E+06	3.5E+02				
2.2E+01	I	6.3E-03	C							1	0.1		1.4E+09		Nitrosomethylethylamine, N-	10595-95-6	1.3E-01	2.0E-01	2.6E+03	7.8E-02				
6.7E+00	C	1.9E-03	C							1	0.1		1.4E+09		Nitrosomorpholine [N-]	59-89-2	4.3E-01	6.5E-01	8.8E+03	2.6E-01				
9.4E+00	C	2.7E-03	C							1	0.1		1.4E+09		Nitrosopiperidine [N-]	100-75-4	3.0E-01	4.6E-01	6.2E+03	1.8E-01				
2.1E+00	I	6.1E-04	I							1	0.1		1.4E+09		Nitrosopyrrolidine, N-	930-55-2	1.4E+00	2.1E+00	2.7E+04	8.2E-01				
				1.0E-04	X					1	0.1		1.4E+09		Nitrotoluene, m-	99-08-1					1.0E+02	1.5E+02		6.2E+01
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	1.4E+09	1.5E+05	Nitrotoluene, o-	88-72-2	1.3E+01			1.3E+01	9.2E+02			9.2E+02
1.6E-02	P			4.0E-03	P					1	0.1		1.4E+09		Nitrotoluene, p-	99-99-0	1.8E+02	2.7E+02		1.1E+02	4.1E+03	6.2E+03		2.5E+03
				3.0E-04	X	2.0E-01	P	V		1		6.9E+00	1.4E+09	1.1E+03	Nonane, n-	111-84-2					3.1E+02		9.8E+02	2.3E+02
				4.0E-02	I					1	0.1		1.4E+09		Norflurazon	27314-13-2					4.1E+04	6.2E+04		2.5E+04
				7.0E-04	I					1	0.1		1.4E+09		Nustar	85509-19-9					7.2E+02	1.1E+03		4.3E+02
				3.0E-03	I					1	0.1		1.4E+09		Octabromodiphenyl Ether	32536-52-0					3.1E+03	4.6E+03		1.8E+03
				5.0E-02	I					1	0.006		1.4E+09		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0					5.1E+04	1.3E+06		4.9E+04
				2.0E-03	H					1	0.1		1.4E+09		Octamethylpyrophosphoramide	152-16-9					2.0E+03	3.1E+03		1.2E+03
				1.2E-02	P					1	0.1		1.4E+09		Octyl Phthalate, di-N-	117-84-0					1.2E+04	1.9E+04		7.4E+03
				5.0E-02	I					1	0.1		1.4E+09		Oryzalin	19044-88-3					5.1E+04	7.7E+04		3.1E+04
				5.0E-03	I					1	0.1		1.4E+09		Oxadiazon	19666-30-9					5.1E+03	7.7E+03		3.1E+03
				2.5E-02	I					1	0.1		1.4E+09		Oxamyl	23135-22-0					2.6E+04	3.9E+04		1.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Paclobutrazol	76738-62-0					1.3E+04	2.0E+04		8.0E+03
				4.5E-03	I					1	0.1		1.4E+09		Paraquat Dichloride	1910-42-5					4.6E+03	7.0E+03		2.8E+03
				6.0E-03	H					1	0.1		1.4E+09		Parathion	56-38-2					6.1E+03	9.3E+03		3.7E+03
				5.0E-02	H					1	0.1		1.4E+09		Pebulate	1114-71-2					5.1E+04	7.7E+04		3.1E+04
				4.0E-02	I					1	0.1		1.4E+09		Pendimethalin	40487-42-1					4.1E+04	6.2E+04		2.5E+04
				2.0E-03	I					1	0.1		1.4E+09		Pentabromodiphenyl Ether	32534-81-9					2.0E+03	3.1E+03		1.2E+03
				1.0E-04	I					1	0.1		1.4E+09		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					1.0E+02	1.5E+02		6.2E+01
				8.0E-04	I					1	0.1		1.4E+09		Pentachlorobenzene	608-93-5					8.2E+02	1.2E+03		4.9E+02
9.0E-02	P									1	0.1		1.4E+09		Pentachloroethane	76-01-7	3.2E+01	4.8E+01		1.9E+01				
2.6E-01	H			3.0E-03	I					1	0.1		1.4E+09		Pentachloronitrobenzene	82-68-8	1.1E+01	1.7E+01		6.6E+00	3.1E+03	4.6E+03		1.8E+03
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		1.4E+09		Pentachlorophenol	87-86-5	7.2E+00	4.3E+00	3.3E+06	2.7E+00	5.1E+03	3.1E+03		1.9E+03
4.0E-03	X			2.0E-03	P					1	0.1		1.4E+09		Pentaerythritol tetranitrate (PETN)	78-11-5	7.2E+02	1.1E+03		4.3E+02	2.0E+03	3.1E+03		1.2E+03
						1.0E+00	P	V		1		3.9E+02	1.4E+09	8.4E+02	Pentane, n-	109-66-0							3.7E+03	3.7E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
															Perchlorates									
				7.0E-04	I					1			1.4E+09		~Ammonium Perchlorate	7790-98-9					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Lithium Perchlorate	7791-03-9					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Perchlorate and Perchlorate Salts	14797-73-0					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Potassium Perchlorate	7778-74-7					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Sodium Perchlorate	7601-89-0					7.2E+02			7.2E+02
				5.0E-02	I					1	0.1		1.4E+09		Permethrin	52645-53-1					5.1E+04	7.7E+04		3.1E+04
2.2E-03	C	6.3E-07	C							1	0.1		1.4E+09		Phenacetin	62-44-2	1.3E+03	2.0E+03	2.6E+07	7.8E+02				
				2.5E-01	I					1	0.1		1.4E+09		Phenmedipham	13684-63-4					2.6E+05	3.9E+05		1.5E+05
				3.0E-01	I	2.0E-01	C			1	0.1		1.4E+09		Phenol	108-95-2					3.1E+05	4.6E+05	1.2E+09	1.8E+05
				5.0E-04	X					1	0.1		1.4E+09		Phenothiazine	92-84-2					5.1E+02	7.7E+02		3.1E+02
				6.0E-03	I					1	0.1		1.4E+09		Phenylenediamine, m-	108-45-2					6.1E+03	9.3E+03		3.7E+03
4.7E-02	H									1	0.1		1.4E+09		Phenylenediamine, o-	95-54-5	6.1E+01	9.2E+01		3.7E+01				
				1.9E-01	H					1	0.1		1.4E+09		Phenylenediamine, p-	106-50-3					1.9E+05	2.9E+05		1.2E+05
1.9E-03	H									1	0.1		1.4E+09		Phenylphenol, 2-	90-43-7	1.5E+03	2.2E+03		8.9E+02				
				2.0E-04	H					1	0.1		1.4E+09		Phorate	298-02-2					2.0E+02	3.1E+02		1.2E+02
						3.0E-04	I	V		1		1.6E+03	1.4E+09	1.1E+03	Phosgene	75-44-5							1.4E+00	1.4E+00
				2.0E-02	I					1	0.1		1.4E+09		Phosmet	732-11-6					2.0E+04	3.1E+04		1.2E+04
															Phosphates, Inorganic									
				4.9E+01	P					1			1.4E+09		~Aluminum metaphosphate	13776-88-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Ammonium polyphosphate	68333-79-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Calcium pyrophosphate	7790-76-3					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Diammonium phosphate	7783-28-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dicalcium phosphate	7757-93-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dimagnesium phosphate	7782-75-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dipotassium phosphate	7758-11-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Disodium phosphate	7558-79-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monoaluminum phosphate	13530-50-2					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monoammonium phosphate	7722-76-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monocalcium phosphate	7758-23-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monomagnesium phosphate	7757-86-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monopotassium phosphate	7778-77-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monosodium phosphate	7558-80-7					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Polyphosphoric acid	8017-16-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Potassium tripolyphosphate	13845-36-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium acid pyrophosphate	7758-16-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (acidic)	7785-88-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (anhydrous)	10279-59-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium hexametaphosphate	10124-56-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium polyphosphate	68915-31-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium trimetaphosphate	7785-84-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium tripolyphosphate	7758-29-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tetrapotassium phosphate	7320-34-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tetrasodium pyrophosphate	7722-88-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tricalcium phosphate	7758-87-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trimagnesium phosphate	7757-87-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tripotassium phosphate	7778-53-2					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trisodium phosphate	7601-54-9					5.0E+07			5.0E+07
				3.0E-04	I	3.0E-04	I			1			1.4E+09		Phosphine	7803-51-2					3.1E+02		1.8E+06	3.1E+02
				4.9E+01	P	1.0E-02	I			1			1.4E+09		Phosphoric Acid	7664-38-2					5.0E+07		6.0E+07	2.7E+07
				2.0E-05	I					1			1.4E+09		Phosphorus, White	7723-14-0					2.0E+01			2.0E+01
				1.0E+00	H					1	0.1		1.4E+09		Phthalic Acid, P-	100-21-0					1.0E+06	1.5E+06		6.2E+05
				2.0E+00	I	2.0E-02	C			1	0.1		1.4E+09		Phthalic Anhydride	85-44-9					2.0E+06	3.1E+06	1.2E+08	1.2E+06
				7.0E-02	I					1	0.1		1.4E+09		Picloram	1918-02-1					7.2E+04	1.1E+05		4.3E+04
				1.0E-04	X					1	0.1		1.4E+09		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					1.0E+02	1.5E+02		6.2E+01
				1.0E-02	I					1	0.1		1.4E+09		Pirimiphos, Methyl	29232-93-7					1.0E+04	1.5E+04		6.2E+03
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		1.4E+09		Polybrominated Biphenyls	59536-65-1	9.5E-02	1.4E-01	1.9E+03	5.7E-02	7.2E+00	1.1E+01		4.3E+00
															Polychlorinated Biphenyls (PCBs)									
7.0E-02	S	2.0E-05	S	7.0E-05	I					1	0.14		1.4E+09		~Aroclor 1016	12674-11-2	4.1E+01	4.4E+01	8.3E+05	2.1E+01	7.2E+01	7.7E+01		3.7E+01
2.0E+00	S	5.7E-04	S					V		1	0.14	7.6E+02	1.4E+09	9.2E+04	~Aroclor 1221	11104-28-2	1.4E+00	1.5E+00	2.0E+00	5.4E-01				
2.0E+00	S	5.7E-04	S					V		1	0.14	7.3E+01	1.4E+09	9.2E+04	~Aroclor 1232	11141-16-5	1.4E+00	1.5E+00	2.0E+00	5.4E-01				
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1242	53469-21-9	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1248	12672-29-6	1.4E+00	1.5E+00	2.9E+04	7.4E-01				

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR ($\mu g/m^3$)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
2.0E+00	S	5.7E-04	S	2.0E-05	I					1	0.14		1.4E+09		~Aroclor 1254	11097-69-1	1.4E+00	1.5E+00	2.9E+04	7.4E-01	2.0E+01	2.2E+01		1.1E+01
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1260	11096-82-5	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+03	E	1.1E+00	E	3.3E-08	E	1.3E-06	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	7.3E-04	7.9E-04	1.5E+01	3.8E-04	3.4E-02	3.7E-02	7.9E+03	1.8E-02
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
1.3E+04	E	3.8E+00	E	1.0E-08	E	4.0E-07	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	2.2E-04	2.4E-04	4.4E+00	1.1E-04	1.0E-02	1.1E-02	2.4E+03	5.3E-03
2.0E+00	I	5.7E-04	I							1	0.14		1.4E+09		~Polychlorinated Biphenyls (high risk)	1336-36-3	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
4.0E-01	I	1.0E-04	I							1	0.14				~Polychlorinated Biphenyls (low risk)	1336-36-3								
7.0E-02	I	2.0E-05	I							1	0.14				~Polychlorinated Biphenyls (lowest risk)	1336-36-3								
1.3E+01	E	3.8E-03	E	1.0E-05	E	4.0E-04	E			1	0.14		1.4E+09		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	2.2E-01	2.4E-01	4.4E+03	1.1E-01	1.0E+01	1.1E+01	2.4E+06	5.3E+00
3.9E+01	E	1.1E-02	E	3.3E-06	E	1.3E-04	E			1	0.14		1.4E+09		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	7.3E-02	7.9E-02	1.5E+03	3.8E-02	3.4E+00	3.7E+00	7.9E+05	1.8E+00
						6.0E-04	I			1	0.1		1.4E+09		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							3.6E+06	3.6E+06
															Polynuclear Aromatic Hydrocarbons (PAHs)									
				6.0E-02	I			V		1	0.13		1.4E+09	1.5E+05	~Acenaphthene	83-32-9					6.1E+04	7.1E+04		3.3E+04
				3.0E-01	I			V		1	0.13		1.4E+09	5.6E+05	~Anthracene	120-12-7					3.1E+05	3.6E+05		1.7E+05
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benz[a]anthracene	56-55-3	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
1.2E+00	C	1.1E-04	C							1	0.13		1.4E+09		~Benzo(j)fluoranthene	205-82-3	2.4E+00	2.8E+00	1.5E+05	1.3E+00				
7.3E+00	I	1.1E-03	C						M	1	0.13		1.4E+09		~Benzo[a]pyrene	50-32-8	3.9E-01	4.6E-01	1.5E+04	2.1E-01				
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benzo[b]fluoranthene	205-99-2	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
7.3E-02	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benzo[k]fluoranthene	207-08-9	3.9E+01	4.6E+01	1.5E+05	2.1E+01				
7.3E-03	E	1.1E-05	C						M	1	0.13		1.4E+09		~Chrysene	218-01-9	3.9E+02	4.6E+02	1.5E+06	2.1E+02				
7.3E+00	E	1.2E-03	C						M	1	0.13		1.4E+09		~Dibenz[a,h]anthracene	53-70-3	3.9E-01	4.6E-01	1.4E+04	2.1E-01				
1.2E+01	C	1.1E-03	C							1	0.13		1.4E+09		~Dibenzo(a,e)pyrene	192-65-4	2.4E-01	2.8E-01	1.5E+04	1.3E-01				
2.5E+02	C	7.1E-02	C						M	1	0.13		1.4E+09		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	1.1E-02	1.3E-02	2.3E+02	6.2E-03				
				4.0E-02	I					1	0.13		1.4E+09		~Fluoranthene	206-44-0					4.1E+04	4.8E+04		2.2E+04
				4.0E-02	I			V		1	0.13		1.4E+09	3.0E+05	~Fluorene	86-73-7					4.1E+04	4.8E+04		2.2E+04
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Indeno[1,2,3-cd]pyrene	193-39-5	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
2.9E-02	P			7.0E-02	A			V		1	0.13		1.4E+09	6.3E+04	~Methylnaphthalene, 1-	90-12-0	9.9E+01	1.2E+02		5.3E+01	7.2E+04	8.3E+04		3.9E+04
				4.0E-03	I			V		1	0.13		1.4E+09	6.2E+04	~Methylnaphthalene, 2-	91-57-6					4.1E+03	4.8E+03		2.2E+03
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		1.4E+09	5.0E+04	~Naphthalene	91-20-3			1.8E+01	1.8E+01	2.0E+04	2.4E+04	6.6E+02	6.2E+02
1.2E+00	C	1.1E-04	C							1	0.13		1.4E+09		~Nitropyrene, 4-	57835-92-4	2.4E+00	2.8E+00	1.5E+05	1.3E+00				
				3.0E-02	I			V		1	0.13		1.4E+09	2.6E+06	~Pyrene	129-00-0					3.1E+04	3.6E+04		1.7E+04
1.5E-01	I			9.0E-03	I					1	0.1		1.4E+09		Prochloraz	67747-09-5	1.9E+01	2.9E+01		1.1E+01	9.2E+03	1.4E+04		5.5E+03
				6.0E-03	H					1	0.1		1.4E+09		Profluralin	26399-36-0					6.1E+03	9.3E+03		3.7E+03
				1.5E-02	I					1	0.1		1.4E+09		Prometon	1610-18-0					1.5E+04	2.3E+04		9.2E+03
				4.0E-03	I					1	0.1		1.4E+09		Prometryn	7287-19-6					4.1E+03	6.2E+03		2.5E+03
				1.3E-02	I					1	0.1		1.4E+09		Propachlor	1918-16-7					1.3E+04	2.0E+04		8.0E+03
				5.0E-03	I					1	0.1		1.4E+09		Propanil	709-98-8					5.1E+03	7.7E+03		3.1E+03
				2.0E-02	I					1	0.1		1.4E+09		Propargite	2312-35-8					2.0E+04	3.1E+04		1.2E+04
				2.0E-03	I					1	0.1		1.4E+09		Propargyl Alcohol	107-19-7					2.0E+03	3.1E+03		1.2E+03
				2.0E-02	I					1	0.1		1.4E+09		Propazine	139-40-2					2.0E+04	3.1E+04		1.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Propham	122-42-9					2.0E+04	3.1E+04		1.2E+04
				1.3E-02	I					1	0.1		1.4E+09		Propiconazole	60207-90-1					1.3E+04	2.0E+04		8.0E+03
						8.0E-03	I	V		1		3.3E+04	1.4E+09	9.6E+03	Propionaldehyde	123-38-6							3.4E+02	3.4E+02
				1.0E-01	X	1.0E+00	X	V		1	0.1	2.6E+02	1.4E+09	7.5E+03	Propyl benzene	103-65-1					1.0E+05	1.5E+05	3.3E+04	2.1E+04
						3.0E+00	C	V		1	0.1	3.5E+02	1.4E+09	7.6E+02	Propylene	115-07-1							1.0E+04	1.0E+04
				2.0E+01	P					1	0.1		1.4E+09		Propylene Glycol	57-55-6					2.0E+07	3.1E+07		1.2E+07
						2.7E-04	A			1	0.1		1.4E+09		Propylene Glycol Dinitrate	6423-43-4							1.6E+06	1.6E+06
				7.0E-01	H					1	0.1		1.4E+09		Propylene Glycol Monoethyl Ether	1569-02-4					7.2E+05	1.1E+06		4.3E+05
				7.0E-01	H	2.0E+00	I			1	0.1		1.4E+09		Propylene Glycol Monomethyl Ether	107-98-2					7.2E+05	1.1E+06	1.2E+10	4.3E+05
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	1.4E+09	1.1E+04	Propylene Oxide	75-56-9	1.2E+01		3.7E+01	9.0E+00			1.5E+03	1.5E+03
				2.5E-01	I					1	0.1		1.4E+09		Pursuit	81335-77-5					2.6E+05	3.9E+05		1.5E+05
				2.5E-02	I					1	0.1		1.4E+09		Pydrin	51630-58-1					2.6E+04	3.9E+04		1.5E+04
				1.0E-03	I			V		1		5.3E+05	1.4E+09	6.0E+04	Pyridine	110-86-1					1.0E+03			1.0E+03
				5.0E-04	I					1	0.1		1.4E+09		Quinalphos	13593-03-8					5.1E+02	7.7E+02		3.1E+02
3.0E+00	I									1	0.1		1.4E+09		Quinoline	91-22-5	9.5E-01	1.4E+00		5.7E-01				
						3.0E-02	A			1			1.4E+09		Refractory Ceramic Fibers	NA							1.8E+08	1.8E+08
				3.0E-02	I					1	0.1		1.4E+09		Resmethrin	10453-86-8					3.1E+04	4.6E+04		1.8E+04
				5.0E-02	H					1	0.1		1.4E+09		Ronnel	299-84-3					5.1E+04	7.7E+04		3.1E+04

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				4.0E-03	I					1	0.1		1.4E+09		Rotenone	83-79-4					4.1E+03	6.2E+03		2.5E+03
2.2E-01	C	6.3E-05	C						M	1	0.1		1.4E+09		Safrole	94-59-7	1.3E+01	2.0E+01	2.6E+05	7.8E+00				
				2.5E-02	I					1	0.1		1.4E+09		Savey	78587-05-0					2.6E+04	3.9E+04		1.5E+04
				5.0E-03	I					1			1.4E+09		Selenious Acid	7783-00-8					5.1E+03			5.1E+03
				5.0E-03	I	2.0E-02	C			1			1.4E+09		Selenium	7782-49-2					5.1E+03		1.2E+08	5.1E+03
				5.0E-03	C	2.0E-02	C			1			1.4E+09		Selenium Sulfide	7446-34-6					5.1E+03		1.2E+08	5.1E+03
				9.0E-02	I					1	0.1		1.4E+09		Sethoxydim	74051-80-2					9.2E+04	1.4E+05		5.5E+04
						3.0E-03	C			1			1.4E+09		Silica (crystalline, respirable)	7631-86-9							1.8E+07	1.8E+07
				5.0E-03	I					0.04			1.4E+09		Silver	7440-22-4					5.1E+03			5.1E+03
1.2E-01	H			5.0E-03	I					1	0.1		1.4E+09		Simazine	122-34-9	2.4E+01	3.6E+01		1.4E+01	5.1E+03	7.7E+03		3.1E+03
				1.3E-02	I					1	0.1		1.4E+09		Sodium Acifluorfen	62476-59-9					1.3E+04	2.0E+04		8.0E+03
				4.0E-03	I					1			1.4E+09		Sodium Azide	26628-22-8					4.1E+03			4.1E+03
2.7E-01	H			3.0E-02	I					1	0.1		1.4E+09		Sodium Diethyldithiocarbamate	148-18-5	1.1E+01	1.6E+01		6.4E+00	3.1E+04	4.6E+04		1.8E+04
				5.0E-02	A	1.3E-02	C			1			1.4E+09		Sodium Fluoride	7681-49-4					5.1E+04		7.7E+07	5.1E+04
				2.0E-05	I					1	0.1		1.4E+09		Sodium Fluoroacetate	62-74-8					2.0E+01	3.1E+01		1.2E+01
				1.0E-03	H					1			1.4E+09		Sodium Metavanadate	13718-26-8					1.0E+03			1.0E+03
2.4E-02	H			3.0E-02	I					1	0.1		1.4E+09		Stirofos (Tetrachlorovinphos)	961-11-5	1.2E+02	1.8E+02		7.2E+01	3.1E+04	4.6E+04		1.8E+04
				6.0E-01	I					1			1.4E+09		Strontium, Stable	7440-24-6					6.1E+05			6.1E+05
				3.0E-04	I					1	0.1		1.4E+09		Strychnine	57-24-9					3.1E+02	4.6E+02		1.8E+02
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	1.4E+09	1.0E+04	Styrene	100-42-5					2.0E+05		4.4E+04	3.6E+04
				1.0E-03	P	2.0E-03	P			1	0.1		1.4E+09		Sulfolane	126-33-0					1.0E+03	1.5E+03	1.2E+07	6.2E+02
				8.0E-04	P					1	0.1		1.4E+09		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					8.2E+02	1.2E+03		4.9E+02
						1.0E-03	C			1			1.4E+09		Sulfuric Acid	7664-93-9							6.0E+06	6.0E+06
				2.5E-02	I					1	0.1		1.4E+09		Systhane	88671-89-0					2.6E+04	3.9E+04		1.5E+04
				3.0E-02	H					1	0.1		1.4E+09		TCMTB	21564-17-0					3.1E+04	4.6E+04		1.8E+04
				7.0E-02	I					1	0.1		1.4E+09		Tebuthiuron	34014-18-1					7.2E+04	1.1E+05		4.3E+04
				2.0E-02	H					1	0.1		1.4E+09		Temephos	3383-96-8					2.0E+04	3.1E+04		1.2E+04
				1.3E-02	I					1	0.1		1.4E+09		Terbacil	5902-51-2					1.3E+04	2.0E+04		8.0E+03
				2.5E-05	H					1	0.1		1.4E+09		Terbufos	13071-79-9					2.6E+01	3.9E+01		1.5E+01
				1.0E-03	I					1	0.1		1.4E+09		Terbutryn	886-50-0					1.0E+03	1.5E+03		6.2E+02
				1.0E-04	I					1	0.1		1.4E+09		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					1.0E+02	1.5E+02		6.2E+01
				3.0E-04	I					1	0.1		1.4E+09		Tetrachlorobenzene, 1,2,4,5-	95-94-3					3.1E+02	4.6E+02		1.8E+02
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	1.4E+09	6.1E+03	Tetrachloroethane, 1,1,1,2-	630-20-6	1.1E+02		1.0E+01	9.3E+00	3.1E+04			3.1E+04
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	1.4E+09	1.6E+04	Tetrachloroethane, 1,1,2,2-	79-34-5	1.4E+01		3.4E+00	2.8E+00	2.0E+04			2.0E+04
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	1.4E+09	2.5E+03	Tetrachloroethylene	127-18-4	1.4E+03		1.2E+02	1.1E+02	6.1E+03		4.4E+02	4.1E+02
				3.0E-02	I					1	0.1		1.4E+09		Tetrachlorophenol, 2,3,4,6-	58-90-2					3.1E+04	4.6E+04		1.8E+04
2.0E+01	H									1	0.1		1.4E+09		Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	1.4E-01	2.2E-01		8.6E-02				
				5.0E-04	I					1	0.1		1.4E+09		Tetraethyl Dithiopyrophosphate	3689-24-5					5.1E+02	7.7E+02		3.1E+02
						8.0E+01	I	V		1		1.1E+03	1.4E+09	1.3E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2							4.6E+05	4.6E+05
				4.0E-03	P					1	0.1		1.4E+09		Tetryl (Trinitrophenylmethylnitramine)	479-45-8					4.1E+03	6.2E+03		2.5E+03
				7.0E-06	X					1			1.4E+09		Thallium (I) Nitrate	10102-45-1					7.2E+00			7.2E+00
				1.0E-05	X					1			1.4E+09		Thallium (Soluble Salts)	7440-28-0					1.0E+01			1.0E+01
				6.0E-06	X					1			1.4E+09		Thallium Acetate	563-68-8					6.1E+00			6.1E+00
				2.0E-05	X					1			1.4E+09		Thallium Carbonate	6533-73-9					2.0E+01			2.0E+01
				6.0E-06	X					1			1.4E+09		Thallium Chloride	7791-12-0					6.1E+00			6.1E+00
				2.0E-05	X					1			1.4E+09		Thallium Sulfate	7446-18-6					2.0E+01			2.0E+01
				1.0E-02	I					1	0.1		1.4E+09		Thiobencarb	28249-77-6					1.0E+04	1.5E+04		6.2E+03
				7.0E-02	X					1	0.008		1.4E+09		Thiodiglycol	111-48-8					7.2E+04	1.4E+06		6.8E+04
				3.0E-04	H					1	0.1		1.4E+09		Thiofanox	39196-18-4					3.1E+02	4.6E+02		1.8E+02
				8.0E-02	I					1	0.1		1.4E+09		Thiophanate, Methyl	23564-05-8					8.2E+04	1.2E+05		4.9E+04
				5.0E-03	I					1	0.1		1.4E+09		Thiram	137-26-8					5.1E+03	7.7E+03		3.1E+03
				6.0E-01	H					1			1.4E+09		Tin	7440-31-5					6.1E+05			6.1E+05
						1.0E-04	A			1			1.4E+09		Titanium Tetrachloride	7550-45-0							6.0E+05	6.0E+05
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	1.4E+09	4.6E+03	Toluene	108-88-3					8.2E+04		1.0E+05	4.5E+04
				6.0E-01	H					1	0.1		1.4E+09		Toluene-2,5-diamine	95-70-5					6.1E+05	9.3E+05		3.7E+05
3.0E-02	P			4.0E-03	X					1	0.1		1.4E+09		Toluidine, p-	106-49-0	9.5E+01	1.4E+02		5.7E+01	4.1E+03	6.2E+03		2.5E+03
1.1E+00	I	3.2E-04	I							1	0.1		1.4E+09		Toxaphene	8001-35-2	2.6E+00	3.9E+00	5.2E+04	1.6E+00				
				7.5E-03	I					1	0.1		1.4E+09		Tralomethrin	66841-25-6					7.7E+03	1.2E+04		4.6E+03
				3.0E-04	A					1	0.1		1.4E+09		Tri-n-butyltin	688-73-3					3.1E+02	4.6E+02		1.8E+02
				8.0E+01	X				M	1	0.1		1.4E+09		Triacetin	102-76-1					8.2E+07	1.2E+08		4.9E+07
				1.3E-02	I					1	0.1		1.4E+09		Triallate	2303-17-5					1.3E+04	2.0E+04		8.0E+03
				1.0E-02	I					1	0.1		1.4E+09		Triasulfuron	82097-50-5					1.0E+04	1.5E+04		6.2E+03
				5.0E-03	I					1	0.1		1.4E+09		Tribromobenzene, 1,2,4-	615-54-3					5.1E+03	7.7E+03		3.1E+03
9.0E-03	P			1.0E-02	P					1	0.1		1.4E+09		Tributyl Phosphate	126-73-8	3.2E+02	4.8E+02		1.9E+02	1.0E+04	1.5E+04		6.2E+03
				3.0E-04	P					1	0.1		1.4E+09		Tributyltin Compounds	NA					3.1E+02	4.6E+02		1.8E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				3.0E-04	I					1	0.1		1.4E+09		Tributyltin Oxide	56-35-9					3.1E+02	4.6E+02		1.8E+02
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	1.4E+09	1.4E+03	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					3.1E+07		1.8E+05	1.8E+05
7.0E-02	I			2.0E-02	I					1	0.1		1.4E+09		Trichloroacetic Acid	76-03-9	4.1E+01	6.2E+01		2.5E+01	2.0E+04*	3.1E+04		1.2E+04
2.9E-02	H									1	0.1		1.4E+09		Trichloroaniline HCl, 2,4,6-	33663-50-2	9.9E+01	1.5E+02		5.9E+01				
7.0E-03	X			3.0E-05	X					1	0.1		1.4E+09		Trichloroaniline, 2,4,6-	634-93-5	4.1E+02	6.2E+02		2.5E+02	3.1E+01	4.6E+01		1.8E+01
				8.0E-04	X			V		1	0.1		1.4E+09	3.5E+04	Trichlorobenzene, 1,2,3-	87-61-6					8.2E+02	1.2E+03		4.9E+02
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	1.4E+09	3.2E+04	Trichlorobenzene, 1,2,4-	120-82-1	9.9E+01			9.9E+01	1.0E+04		2.8E+02	2.7E+02
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	1.4E+09	1.8E+03	Trichloroethane, 1,1,1-	71-55-6					2.0E+06		3.9E+04	3.8E+04
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	1.4E+09	7.8E+03	Trichloroethane, 1,1,2-	79-00-5	5.0E+01		6.0E+00	5.3E+00	4.1E+03		6.8E+00	6.8E+00
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	1.4E+09	2.4E+03	Trichloroethylene	79-01-6	6.2E+01		7.1E+00	6.4E+00	5.1E+02		2.1E+01	2.0E+01
				3.0E-01	I	7.0E-01	H	V		1		1.2E+03	1.4E+09	1.1E+03	Trichlorofluoromethane	75-69-4					3.1E+05		3.4E+03	3.4E+03
				1.0E-01	I					1	0.1		1.4E+09		Trichlorophenol, 2,4,5-	95-95-4					1.0E+05	1.5E+05		6.2E+04
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		1.4E+09		Trichlorophenol, 2,4,6-	88-06-2	2.6E+02	3.9E+02	5.4E+06	1.6E+02	1.0E+03	1.5E+03		6.2E+02
				1.0E-02	I					1	0.1		1.4E+09		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					1.0E+04	1.5E+04		6.2E+03
				8.0E-03	I					1	0.1		1.4E+09		Trichlorophenoxypropionic acid, -2,4,5	93-72-1					8.2E+03	1.2E+04		4.9E+03
				5.0E-03	I			V		1		1.3E+03	1.4E+09	1.6E+04	Trichloropropane, 1,1,2-	598-77-6					5.1E+03			5.1E+03
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	1.4E+09	1.7E+04	Trichloropropane, 1,2,3-	96-18-4	9.5E-02			9.5E-02	4.1E+03		2.2E+01	2.2E+01
				3.0E-03	X	3.0E-04	P	V		1		4.5E+02	1.4E+09	2.5E+03	Trichloropropene, 1,2,3-	96-19-5					3.1E+03		3.3E+00	3.3E+00
				3.0E-03	I					1	0.1		1.4E+09		Tridiphane	58138-08-2					3.1E+03	4.6E+03		1.8E+03
						7.0E-03	I	V		1		2.8E+04	1.4E+09	1.7E+04	Triethylamine	121-44-8							5.2E+02	5.2E+02
7.7E-03	I			7.5E-03	I					1	0.1		1.4E+09		Trifluralin	1582-09-8	3.7E+02	5.6E+02		2.2E+02	7.7E+03	1.2E+04		4.6E+03
2.0E-02	P			1.0E-02	P					1	0.1		1.4E+09		Trimethyl Phosphate	512-56-1	1.4E+02	2.2E+02		8.6E+01	1.0E+04	1.5E+04		6.2E+03
						5.0E-03	P	V		1		2.9E+02	1.4E+09	1.0E+04	Trimethylbenzene, 1,2,3-	526-73-8							2.2E+02	2.2E+02
						7.0E-03	P	V		1		2.2E+02	1.4E+09	8.5E+03	Trimethylbenzene, 1,2,4-	95-63-6							2.6E+02	2.6E+02
				1.0E-02	X			V		1		1.8E+02	1.4E+09	7.1E+03	Trimethylbenzene, 1,3,5-	108-67-8					1.0E+04			1.0E+04
				3.0E-02	I					1	0.019		1.4E+09		Trinitrobenzene, 1,3,5-	99-35-4					3.1E+04	2.4E+05		2.7E+04
3.0E-02	I			5.0E-04	I					1	0.032		1.4E+09		Trinitrotoluene, 2,4,6-	118-96-7	9.5E+01	4.5E+02		7.9E+01	5.1E+02	2.4E+03		4.2E+02
				2.0E-02	P					1	0.1		1.4E+09		Triphenylphosphine Oxide	791-28-6					2.0E+04	3.1E+04		1.2E+04
				1.0E-02	X				M	1	0.1		1.4E+09		Tris(1-chloro-2-propyl)phosphate	13674-84-5					1.0E+04	1.5E+04		6.2E+03
2.0E-02	P			7.0E-03	P					1	0.1		1.4E+09		Tris(2-chloroethyl)phosphate	115-96-8	1.4E+02	2.2E+02		8.6E+01	7.2E+03	1.1E+04		4.3E+03
3.2E-03	P			1.0E-01	P					1	0.1		1.4E+09		Tris(2-ethylhexyl)phosphate	78-42-2	8.9E+02	1.4E+03		5.4E+02	1.0E+05	1.5E+05		6.2E+04
				3.0E-03	I					1			1.4E+09		Uranium (Soluble Salts)	NA					3.1E+03			3.1E+03
1.0E+00	C	2.9E-04	C						M	1	0.1		1.4E+09		Urethane	51-79-6	2.9E+00	4.3E+00	5.7E+04	1.7E+00				
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			1.4E+09		Vanadium Pentoxide	1314-62-1			2.0E+03	2.0E+03	9.2E+03		4.2E+04	7.5E+03
				5.0E-03	S					1			1.4E+09		Vanadium and Compounds	NA					5.2E+03			5.2E+03
				1.0E-03	I					1	0.1		1.4E+09		Vernolate	1929-77-7					1.0E+03	1.5E+03		6.2E+02
				2.5E-02	I					1	0.1		1.4E+09		Vinclozolin	50471-44-8					2.6E+04	3.9E+04		1.5E+04
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	1.4E+09	4.7E+03	Vinyl Acetate	108-05-4					1.0E+06		4.1E+03	4.1E+03
		3.2E-05	H			3.0E-03	I	V		1		3.4E+03	1.4E+09	1.5E+03	Vinyl Bromide	593-60-2			5.6E-01	5.6E-01			1.9E+01	1.9E+01
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	1.4E+09	1.0E+03	Vinyl Chloride	75-01-4	4.0E+00		2.9E+00	1.7E+00	3.1E+03		4.5E+02	3.9E+02
				3.0E-04	I					1	0.1		1.4E+09		Warfarin	81-81-2					3.1E+02	4.6E+02		1.8E+02
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	6.0E+03	Xylene, P-	106-42-3					2.0E+05		2.6E+03	2.6E+03
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	5.9E+03	Xylene, m-	108-38-3					2.0E+05		2.6E+03	2.5E+03
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	1.4E+09	7.0E+03	Xylene, o-	95-47-6					2.0E+05		3.0E+03	3.0E+03
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	1.4E+09	6.3E+03	Xylenes	1330-20-7					2.0E+05		2.7E+03	2.7E+03
				3.0E-04	I					1			1.4E+09		Zinc Phosphide	1314-84-7					3.1E+02			3.1E+02
				3.0E-01	I					1			1.4E+09		Zinc and Compounds	7440-66-6					3.1E+05			3.1E+05
				5.0E-02	I					1	0.1		1.4E+09		Zineb	12122-67-7					5.1E+04	7.7E+04		3.1E+04
				8.0E-05	P					1			1.4E+09		Zirconium	7440-67-7					8.2E+01			8.2E+01

Appendix C

Quality Assurance Project Plan

Docket No. RCRA-07-2012-0014

Collis, Inc.
2005 South 19th Street
Clinton, Iowa 52732

FINAL QUALITY ASSURANCE PROJECT PLAN

Collis SSW • 2005 South 19th Street in Clinton, Iowa • February 2013

BB&E
CONSULTING ENGINEERS
& PROFESSIONALS

A1. TITLE AND APPROVAL PAGE

2013
QUALITY ASSURANCE PROJECT PLAN

COLLIS INCORPORATED FACILITY
CLINTON, IOWA

PREPARED BY

BB&E, LLC
FARMINGTON HILLS, MI

SUBMITTED: February 20, 2013

QUALITY ASSURANCE PROJECT PLAN

FOR THE

SAMPLING WORK PLAN

FOR

FOCUSED SOIL INVESTIGATION

COLLIS INC., CLINTON, IOWA

Approved by:

Mr. Kevin Snowden, Project Manager, USEPA Region VII — **Date** 02/27/2013

Diane Harris

Ms. Diane E. Harris, Regional Quality Assurance Manager, USEPA, Region VII — **Date** 02/27/2013

Mr. Brian Calhoun, Corporate Safety and Environmental Director, SSW Holding Company Inc. — **Date** 2/20/13

Mr. Jim Colmer, Project Manager, BB&E, LLC — **Date** 2/20/2013

Mr. Tom Barzyk, Quality Assurance Manager, BB&E, LLC — **Date** 2/20/13

A2. TABLE OF CONTENTS

TABLES

ATTACHMENTS

LIST OF ACRONYMS AND SHORT FORMS

ALS	ALS Laboratories
AWMD	Air and Waste Management Division
%R	Percent Recovery
ANSI	American National Standards Institute
BB&E	BB&E, LLC
BTV	Background Threshold Value
CAFO	Consent Agreement and Final Order
COC	Chain of Custody
CSA	Container Storage Area
cu yd	cubic yard
CVAAS	Cold Vapor Atomic Absorption Spectrometer
DQOs	Data Quality Objectives
EDD	Electronic Data Deliverables
GC	Gas Chromatography
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICP	Inductively Coupled Plasma
Inc	Incorporated
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MS	Mass Spectroscopy
MS/ MSD	Matrix Spike/ Matrix Spike Duplicate
MSSL	Medium Specific Screening Level
NPDES	National Pollution Discharge Elimination System
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PCB	Polychlorinated Biphenyls
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RQAM	Regional Quality Assurance Manager
RSL or RSLs	Regional Screening Levels
Site	Collis Inc.
SOPs	Standard Operating Procedures
SM&A	St. John-Mittelhauser & Associates
SRM	Standard Reference Materials
SSW	SSW Holding Company Incorporated
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
SW-846	"Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods", EPA SW-846, 3rd Edition with Updates I through III,

	November 1986
TCE	Trichloroethylene/Trichloroethene
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WEMM	Waste Enforcement and Materials Management Branch

The following Quality Assurance Project Plan (QAPP) presents the organization, objectives, planned activities, and specific QAPP procedures associated with the BB&E, LLC (BB&E) *Sampling Work Plan for Focused Soil Investigation, February 2013,* for the Collis Incorporated (Inc) Manufacturing Facility (site) located in Clinton, Clinton County, Iowa. The investigation is in response to requirements of the Consent Agreement and Final Order (CAFO) Docket Number: RCRA-07-2012-0014. Specific protocols for sampling, sample handling and storage, chain-of-custody (COC), and laboratory and field analysis are described within this plan. This QAPP has been prepared as requested for the United States Environmental Protection Agency (USEPA) Region VII in support of the planned sampling activities associated with the Focused Soil Investigation at Collis Inc.

This QAPP has been prepared in accordance with the USEPA Region VII QAPP policy as presented in USEPA Resource Conservation and Recovery Act (RCRA) QAPP Instruction. This QAPP has been prepared in accordance with the USEPA QAPP guidance documents, "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001, "EPA Guidance for Quality Assurance Project Plans", EPA QA/G-5, December 2002, and "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs", American National Standard Institute (ANSI)/ASQC E4-1994. In accordance with these documents, there are four basic sections of elements that must be included in a QAPP. These four major section, the associated elements, and QAPP Sections are as follows:

- Section A - Project Management. The elements in this section include all aspects of project management, project objectives, project history, task organization, and documentation and records.
- Section B – Data Generation and Acquisition. The elements in this section include descriptions of the sampling process design, sampling methods and handling, instrument controls, and data acquisition.
- Section C – Assessment/Oversight. The elements in this section encompass the procedures used to ensure proper implementation of the QAPP.

- Section D – Data Validation and Usability. The elements in this section cover the quality assurance (QA) activities that occur after the data collection phase of the project is completed.

A3. DISTRIBUTION LIST

The following individuals will receive copies of the approved QAPP and subsequent revisions/addenda at their request:

- Kevin Snowden, Project Manager, USEPA Region VII
- Diane E. Harris, Regional Quality Assurance Manager (RQAM), USEPA Region VII
- Brian Calhoun, Corporate Safety and Environmental Director, SSW Holding Company. Inc.
- Jim Colmer, Project Manager, BB&E
- Thomas Barzyk, QA Manager, BB&E
- Jason Cabra, Field Team Leader, BB&E
- Joseph Ribar, Laboratory Project Manager, ALS Laboratories (ALS)

A4. PROJECT/ TASK ORGANIZATION

The responsibilities of management, QA personnel, field personnel, and laboratory personnel are provided in the following subsections.

A4.1 Management Responsibilities

BB&E has technical responsibility for implementing the investigative activities at the Site. BB&E's Project Manager is ultimately responsible for ensuring that the project objectives are achieved. BB&E's Project Manager has selected a project team consisting of BB&E's technical personnel (engineering, chemistry, and data management), BB&E's QA personnel, and fixed location analytical laboratories. The task organization chart is provided in Attachment E. The individuals participating in the project and their specific roles and responsibilities are discussed below:

Kevin Snowden – Project Manager – USEPA Region VII

- Oversight of the investigation to ensure that it is completed in accordance with the CAFO and USEPA-approved plans;
- Reviewing and approving the QAPP and subsequent revisions in terms of program specific requirements; and
- Reviewing reports and ensuring plans are implemented according to the schedule..

The USEPA Region VII project coordinator of the Air and Waste Management Division (AWMD) under the Waste Enforcement and Materials Management Branch (WEMM) is responsible for overview of this project. He also is responsible for submitting this QAPP and any subsequent revisions or amendments to the appropriate USEPA personnel for review and approval and for providing approval of the QAPP. Kevin Snowden is the USEPA Region VII project coordinator for activities at the Site.

Brian Calhoun – Corporate Safety and Environmental Director – SSW Holding Company Inc.

- Owner/operator site contact and overall project management;
- Orient all field leaders and support staff concerning the project's special considerations;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task project;
- May delegate select tasks to the following groups, who will be responsible for review and/or preparation of the various technical reports in support of the work activities, including:
    - -Collis Senior Management
    - -Collis Outside Counsel
    - -Collis Facility Engineering.

Jim Colmer, P.E. – Project Manager – BB&E

- Overview of field activities;
- Overview of laboratory activities;
- Advise on corrective actions;
- Prepare and review reports;
- Coordinate BB&E's technical group;

- Final evidence file custodian; and
- Approve the QAPP.

Jason Cabra, CHMM – Field Team Leader – BB&E

- Select the field sampling team;
- Distribute the approved QAPP and subsequent revisions to the members of the field sampling team;
- Conduct the field activities per the approved QAPP and supervise the field sampling team; and
- Report problems in the field to the project manager.

Field Team Technicians – BB&E

- These individual will perform the actual field work per the QAPP and at the direction of the field team leader. The field team can consist of one or up to several members and will be named at a later date by the field team leader.

Joe Ribar – Analytical Laboratory Project Manager – ALS

- Ensure all resources of the laboratory are available on an as-required basis;
- Review of final analytical reports; and
- Approve final reports prior to submission to Collis and BB&E.

The analytical laboratory's Project Manager is responsible for ensuring that the project objectives are achieved by the laboratory. The laboratory selected for this project is ALS. Laboratory services shall be provided by ALS's Holland laboratory, located at 3352 128th Avenue, Holland, Michigan 49424, telephone number (616) 399-6070 for the USEPA Method 6020A, and ALS's Kelso laboratory, located at 1317 South 13th Ave, Kelso, Washington 98626, phone number (800) 695-7222 for USEPA Method 7471B. Should it become necessary to utilize other analytical laboratories for the analysis of environmental samples collected at the Collis facility for CAFO compliance, a Collis representative will notify USEPA Region VII and will provide the laboratory with a copy of this QAPP.

A4.2 Quality Assurance Responsibilities

Project team members with QA responsibilities include the USEPA RQAM, BB&E's QA

Manager, BB&E's Field QA Manager, and the Laboratories' QA Managers. These individuals and their specific responsibilities are the following:

Diane E. Harris – RQAM – USEPA Region VII

- The USEPA Region VII RQAM is responsible for reviewing and providing final approval of the QAPP.

Tom Barzyk, P.E. – QA Manager – BB&E

- Overview and review field QA/quality control (QC);
- Review laboratory QA/QC;
- Coordinate data validation and assessment;
- Advise on laboratory corrective action procedures;
- Prepare and review QA reports;
- QA/QC representation of project activities; and
- Approve the QAPP.

Jim Colmer, P.E. – Field QA Manager – BB&E

- Management of field activities and field QA/QC;
- Field data assessment;
- Internal field technical system audits;
- Technical representation of field activities;
- Prepare standard operating procedures (SOPs) for field activities;
- Implement and document field corrective actions, if necessary; and
- Approve the QAPP.

Laboratory QA Manager

- Coordinate and overview of laboratory systems audits;
- Overview of QA/QC documentation;
- Conduct detailed data review;
- Implement and document laboratory corrective actions, if required;
- Technical representation of laboratory QA procedures; and
- Oversee preparation of laboratory SOPs.

A4.3 Laboratory Responsibilities

The specific responsibilities of laboratory personnel involved in the project are the following:

Laboratory Operations Manager

- Coordinate laboratory analyses;
- Supervise in-house COC;
- Schedule sample analyses;
- Oversee data review; and
- Oversee preparation of analytical reports.

Laboratory Sample Custodian

- Receive and inspect the incoming sample containers;
- Record the condition of the incoming sample containers;
- Verify correctness of COC documentation;
- Notify project manager of any non-conformances identified during sample receipt and inspection;
- Assign a unique identification number and customer number, and enter each into the sample receiving log;
- Initiate transfer of the samples to appropriate lab sections; and
- Control and monitor access/storage of samples and extracts.

A4.4 Project Organization

The project organization chart that identifies the lines of communication among the participants in the Site Investigation activities is contained in Attachment E.

A5. PROBLEM DEFINITION/BACKGROUND

The purposes of the Site investigation activities and background information for the Site are presented in the following sections.

A5.1 Site Description

Collis Inc. is located in the northeast 1/4, of the southeast ¼ of Section 14, township 81 North, Range 6 East of the Fifth Principal Meridian. The site is located at latitude 41°40'30" north and longitude 90°13'50" west. The 12.5-acre site is located approximately two miles north and west of the main channel of the Mississippi River in Clinton, Clinton County, Iowa. The Collis Manufacturing Facility site location and site features figures are contained in Attachment A as Figures 1 and 2, respectively. The property boundaries of the site are depicted in Figure 2.

Collis Inc. is engaged in the manufacturing of interior shelving, baskets, and accessories for major home appliance manufacturers, including General Electric, Whirlpool, Maytag, Amana, and Subzero. The plant is located at 2005 South 19th Street in Clinton, Clinton County, Iowa. The assigned EPA identification number is #IAD047303771.

A5.2 Site History

Prior to occupancy of the site in 1915 by O.D. Collis, the site had been used for the manufacturing of wagon wheels. O.D. Collis or Collis Manufacturing Company manufactured various wire and metal products, silos, and windmills for the agricultural industry until it began to manufacture refrigerator-shelving items. In 1964, Chamberlain Manufacturing Corporation purchased the facility and continued producing refrigerator-shelving items. In 1984, Collis Inc. purchased certain assets of the Collis Division from Chamberlain Manufacturing Corporation. This included the Clinton facility. Since its acquisition of the Clinton facility, Collis Inc. has continued to manufacture shelving and other items for various home appliance manufacturers.

In 1970, wastewater treatment facilities regulated under the National Pollutant Discharge Elimination System (NPDES) permit were constructed at a Collis plant. From 1970 to 1979, chrome plating wastewater treatment sludge was transported up to six unlined lagoons located on plant property. An estimated total of 1,090 cubic yards (cu yd) of sludge was disposed of in these lagoons. In 1979, modifications were made to the wastewater treatment facility and the placement of treatment sludge in the on-site lagoons was halted. From 1979 to current, treatment sludge has been disposed of as hazardous waste at an approved landfill. Releases associated with on-site disposal activities as well as various on-site manufacturing processes and equipment has

resulted in the presence of soil and groundwater contamination at the site. These releases are being addressed under a 1993 Consent Order. A number of facility investigations and remedial actions (RAs) have been conducted as part of the November 10, 1993, Consent Order. The Consent order was revised on April 3, 1998. Previous investigations performed at the site are outlined in Section A5.3 below.

A5.3 Previous Investigations

Issues identified on-site are summarized in the Revised Final RCRA Facility Investigation (RFI) Report of November 30, 2010. In general, low concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyl (PCBs), and metals were identified in the soil at various locations across the Site. Trichloroethylene (TCE) exceeded the USEPA Medium Specific Screening Levels (MSSLs) immediately north of the building, near former acid and cleaner storage tanks (western portion of solid waste management unit [SWMU] #2). Figure 5 in Attachment A illustrates the SWMUs at the site. SVOCs and inorganic constituents were identified in soil samples collected in each of the seven SWMUs at concentrations exceeding their respective MSSL. VOCs were detected in groundwater samples collected at the Site, primarily along the northern property line and immediately north of Manufacturer's Ditch. Naphthalene, total lead, and amenable cyanide were also identified in the groundwater samples collected at the Site, some of which exceeded MSSLs.

In June 2010, the Site was visited for a routine RCRA inspection by a USEPA contractor. During that inspection, an area near the filter building was identified that stored totes of process acids and caustics. The Container Storage Area (CSA) and filter building are depicted in Attachment A – Figure 3. The USEPA is interested in determining whether any releases occurred from the totes that were observed during the 2010 inspection in excess of the EPA Screening Levels (RSLs) for metals in industrial soils. The USEPA has requested shallow soil sampling to investigate for RCRA 8 (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) metals in excess of Industrial Soils -RSLs. The *Sampling Work Plan for Focused Soil Investigation, February 2013,* has been developed to conduct a focused soil investigation of this area.

A5.4 Current Status

For a more detailed current status of the site, refer to the *Collis, Inc. – Corrective Measures Work Plan, Final October – December 2012 Fourth Quarterly – Groundwater Sampling Monitoring Report* submitted to the USEPA Region VII on January 23, 2013.

A6. PROJECT/ TASK DESCRIPTION AND SCHEDULE

A shallow soil investigation will determine if the former CSA, which stored acid and caustic materials, was impacted by possible leaking totes/storage containers. The soil investigation will occur in the vicinity of the filter building concrete pads. Attachment A, Figure 3 illustrates the former CSA of the totes with acidic and caustic contents and the possible impacted areas. Per section 3.0 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* a total of eight discrete shallow soil samples are to be collected at the transition area from the concrete pad to the grassy area (four locations adjacent to each concrete pad). The final sample locations will be determined by the field team, approved by the BB&E project manager with the assistance of the USEPA project manager, as part of the Pre-Soil Investigation Assessment to be completed by the field team. This Site Assessment will allow the field team to initially assess the current condition of the former CSA and adjacent concrete pads. Any areas with residual surface staining or other visual observations indicating possible contaminant exposure will be noted. These areas in the concrete to grassy transition area will be sampled by the field team. Additional discrete shallow soil samples are expected to be collected from underneath the pavement at identified cracks, other penetrations in the concrete slab area, or other potential pathways of possible contaminant exposure to the soil. Up to three soil samples per concrete slab are anticipated, however the final number of soil samples will be determined after the field team's observation of the CSA during the Pre-Soil Investigation Assessment. Per section 3.1 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* a total of seven discrete shallow soil samples are to be collected on the site's property and adjacent areas for establishing site-specific background concentrations of the pre-determined analytes, if required. Background samples will only be analyzed should any analyte(s) from the CSA area shallow soil samples exhibit a concentration greater than RSLs for RCRA 8 metals in industrial soil. Should the results of the CSA area shallow soil samples collected be below RSLs for RCRA 8 metals in

industrial soil then the background samples will not be analyzed. Background sampling locations are illustrated on Attachment A – Figure 4.

In the 2010 *RCRA Final Facility Investigation Report* prepared by St. John-Mittelhauser & Associates (SM&A) for this site, seven (7) background samples were collected during the background study for arsenic in soil. A statistical analysis software program, ProUCL, was used to generate background threshold values for contaminants of potential concerns (Arsenic).

As reviewed with the USEPA in a 15 February 2013 Conference Call, for the purpose of determining an appropriate number of background samples to be collected during the Focused Soil Investigation, seven (7) soil samples were also deemed adequate for this sampling event. Appropriate random sample locations will be collected from background areas. The background sample locations were selected in areas that were not expected to be impacted as a result of current or former operations at the Site, therefore resulting in metals levels in the soil that are indicative of the area background concentrations. During the collection background samples, the field technician, with input from the USEPA, will make an effort to collect soils that are similar in type to the soil samples collected off-slab and sub-slab. If any USEPA representatives on-site request a change of location during the background sampling event based on dissimilar soil types, a new location will be selected.

All sampling locations in non-paved areas will be marked with wooden stakes, and sampling locations in paved areas will be marked with paint. The wooden stakes will be placed approximately one foot south of the actual sampling locations to prevent any contamination from the stake from possibly impacting the shallow soil samples. Paint marking the locations for soil samples beneath the pavement will not contaminate the soil samples since a coring machine will be utilized to remove the pavement to access the covered soil. The coring machine will remove the appropriate section of pavement marked by the paint, and the paint and pavement will be removed prior to the shallow soil sampling.

The background soil sample results will be used to estimate the mean background threshold value(s) (BTVs). The background sample results will be entered into ProUCL which has

statistical methods to compute a 95% upper confidence Limit (UCL) of the mean. The BTVs will be used to compare the mean of the off-slab and sub-slab soil sample results. Should this background analysis need to be conducted, the results and statistical discussion will be presented in the Focused Investigation Summary Report which is subject to review and approval by the USEPA.

A summary of the sampling and analysis program associated with the focused soil investigation activities is provided in Table 1. Table 2 provides a parameter list and targeted quantization limits for soil samples. Per the schedule proposed in the *Sampling Work Plan for Focused Soil Investigation, February 2013,* the investigation is scheduled to be completed in March 2013. Section 10 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* contains the site investigation and associated activities, USEPA notifications of field work, draft and final summary report completion dates and schedule.

Analytical results (and duplicates) will be compared to USEPA Industrial Soil RSLs and calculated background concentrations, if required. If exceedances occur, additional investigation and/or remedy actions will be required, and recommendations will be submitted in the Sampling Final Report following the sampling activities.

A7. QUALITY OBJECTIVES FOR DATA AND CRITERIA

The data quality objectives (DQOs) and measurement performance criteria for the Site activities are presented in the following subsections.

A7.1 Data Quality Objectives

DQOs are qualitative and quantitative statements derived from the outputs of each step of the DQO process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. The DQO objectives are presented in Table 3.

There are seven steps in the DQO process, which include:

1. Stating the task;
2. Identifying the decision;
3. Identifying inputs to the decision;
4. Defining the boundaries of the study;
5. Developing a decision rule;
6. Specifying limits on decision errors; and
7. Optimizing the design for obtaining data.

The details of DQO process for the Site activities are provided below:

The task is to compile substantial data regarding additional source evaluation as well as source control measures that can currently be defined for the Site.

The current Method Detection Limits (MDLs), reporting limits (RL), and acceptability criteria presented in Table 4 are sufficiently sensitive to support the clean-up criteria.

The limits on decision errors primarily relate to the level of accuracy of the environmental measurements as they are compared to the criteria provided in Attachment B in the laboratory SOPs. Currently, Laboratory SOPs for USEPA Method 6020A and USEPA Method 7471B are contained in Attachment B. Error can be introduced during the sample collection, handling, preparation, analysis, data reduction, or data handling phases of the data collection process. The acceptable levels of measurement performance criteria are provided in Attachment B for laboratory precision, accuracy, compatibility, and completeness. Data will be evaluated through the verification and validation process to ensure that suitable levels of precision, accuracy, compatibility, and completeness are achieved for the measurement data. Professional judgment will be used to determine practical versus statistical significance of test results.

A7.2 Measurement Performance Criteria

The measurement performance criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) are provided in the following subsections.

A7.2.1 Precision

Precision is a measure of the degree to which two or more measurements of the same characteristic (i.e., analyte, parameter) under the same or similar conditions are in agreement.

A7.2.1.1 Field Precision Criteria

Precision of the field sample collection procedures will be assessed by the data from analysis of field duplicate samples. Relative percent differences (RPDs) will be calculated for detected analytes from field duplicate sample sets. Field duplicate samples will be collected at a minimum frequency of 1 per 10 investigative samples. The equation to be used to determine precision from a sample and the duplicate is presented in Section D2.3 of this QAPP. Samples and sample duplicates will be compared to USEPA RSLs November 2012 Tables. Exceedances of samples or sample duplicates may trigger further action at a later date and recommendations will be included in the summary report. Section D.3 further describes additional actions that may be required by analytical exceedances. A field precision acceptance criterion for the calculated RPD is a maximum of 30% using the formula in Section D2.3.

A7.2.1.2 Laboratory Precision Criteria

Laboratory precision will be assessed through the calculation of RPDs for replicate/duplicate sample analyses. In general, these will be matrix spike/matrix spike duplicate (MS/MSD) for soil samples. The equation to be used to determine precision and the current laboratory precision control limits for the analyses are presented in Attachment B in the laboratory SOPs of this QAPP. If analytical acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A7.2.2 Accuracy

Accuracy is the extent of agreement between an observed value (i.e., sample result) and the accepted or true value for the parameter being measured.

A7.2.2.1 Field Accuracy Criteria

The criteria for accuracy of the field sample collection procedures will be to ensure that samples are not affected by sources external to the sample, such as sample contamination by ambient conditions or inadequate equipment decontamination procedures. Field sampling accuracy will

be assessed by the data from field duplicates and equipment rinsate blanks in various subsections of Section B2.2..

A7.2.2.2 Laboratory Accuracy Criteria

Laboratory accuracy will be assessed by determining percent recoveries from the analysis of laboratory control samples (LCSs) or standard reference materials (SRMs). Accuracy relative to the sample matrix will be assessed by determining percent recoveries from the analysis of MS/MSD samples. MS/MSD samples will be collected/designated for the analyses at a minimum frequency of 1 per 20 or fewer samples. The equation to be used to determine accuracy for this project is presented in the SOPs of Attachment B. Current laboratory accuracy control limits are presented in the laboratory SOPs in Attachment B. If analytical acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A7.2.3 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental condition of a site. Representativeness also reflects the ability of the sample team to collect samples and laboratory personnel to analyze those samples in such a manner that the data generated accurately and precisely reflect the conditions at a site.

A7.2.3.1 Field Representativeness Criteria

Representativeness is dependent upon the proper design of the sampling program. The representativeness criteria for field sampling will be to ensure that the sampling locations are properly established at the site and that the sampling procedures are followed. The sampling programs were designed to provide data representative of Site conditions. During development of these programs, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and any inherent constraints.

A7.2.3.2 Laboratory Representativeness Criteria

The representativeness criteria for laboratory data will be to ensure that the proper analytical procedures are used for sample preparation (e.g., homogenizing the sample prior to sampling), sample analysis, and that sample holding times are met. Additionally, the accuracy and precision of the laboratory data affect representativeness. The laboratory representativeness criteria will include achieving the accuracy and precision criteria for the sample analyses. If analytical

acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A7.2.4 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another.

A7.2.4.1 Field Comparability Criteria

The criteria for field comparability will be to ensure and document that the sampling procedures designed for the Site investigation activities are properly implemented and that sampling procedures are followed for the duration of the sampling programs.

A7.2.4.2 Laboratory Comparability Criteria

The criteria for laboratory data comparability will be to ensure that the analytical methods used for the sampling and analysis events are comparable to the methods used for previous sampling events. The analytical methods identified in Section D2.7 of this QAPP are comparable to the methods used to generate data for previous investigations. The previous QAPP for the *RCRA Facility Investigation*, January 2008, identified previous laboratory equipment that was utilized for analytical purposes. The laboratory equipment utilized during the previous soil sampling event to evaluate analyte concentrations is comparable to the laboratory equipment which will be utilized for determining the analyte concentrations from the proposed soil samples in the *Sampling Work Plan for Focused Soil Investigation, February 2013*. If analytical acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A7.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

A7.2.5.1 Field Completeness Criteria

The criteria for field completeness will be that a minimum of 90 percent of the field-measured data are valid. The procedure for determining field data validity is provided in Section D2 of this QAPP. The equation for calculating completeness is presented in Section D2.6 of this QAPP.

A7.2.5.2 Laboratory Completeness Criteria

The criteria for laboratory completeness will be that a minimum of 90 percent of the laboratory data will be determined to be valid (usable) for the intended purpose. The procedure for determining laboratory data validity is provided in Section D2 of this QAPP. The equation for calculating completeness is presented in Section D2.6 of this QAPP. If analytical acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A7.2.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

A7.2.6.1 Field Sensitivity Criteria

No field sensitivity criteria exist for the shallow soil sampling event since no field equipment will be utilized during the sample collection. Refer to Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013.*

A7.2.6.2 Laboratory Sensitivity Criteria

The sensitivity requirements for the laboratory analyses are defined by the RLs and MDLs which are provided in the laboratory SOPs of Attachment B and Table 4. The analytical methods are sufficiently sensitive for the project. The MDLs and RLs are lower than the USEPA RSLs Industrial Soil November 2012 Table criteria; therefore, adequate sensitivity exists for the analytical methods performed by the laboratory equipment to determine if soil samples are below or exceeding criteria. If analytical acceptance criteria are not met, corrective actions in the laboratory SOPs in Attachment B will be conducted.

A8. SPECIAL TRAINING REQUIREMENTS/ CERTIFICATION

BB&E field sampling team members are required to have received the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) safety training and annual 8-hour refresher courses required by 29 CFR Parts 1910 and 1926. All BB&E team member's HAZWOPWER records are maintained at the BB&E office in Farmington Hills, Michigan, and can be requested from the QA Manager at any time. The QA Manager's phone number is (248) 489-9636.

Laboratory personnel training records are maintained at the laboratories. No special training or certification requirements are required for the laboratory for this project.

A9. DOCUMENTS AND RECORDS

The documents, records, and reports generated during the Site investigation activities are identified in the following subsections.

A9.1 Field and Laboratory Records

Documents and records generated during the project include sample collection records, QC sample records, field measurement records, laboratory records, and data handling records. A brief description of these documents and records are provided below. Detailed information on these records is provided in this section and Section A9.2 of this QAPP.

Sample collection records that will be used during the sampling activities include field logbooks, stratigraphic logs, sample labels, COC records, and shipping papers.

QC sample records that will be used during the project to document the generation of QC samples include field logbooks for recording field duplicate samples, equipment rinsate samples, and MS/MSD samples. The Laboratories will maintain appropriate documentation of sample preparationand sample integrity information. Records of sample preservation will be maintained in field logbooks and by the Laboratories.

Field measurements will be recorded in bound logbooks or on standard forms. Calibration data, where applicable, will also be recorded in these logbooks.

Laboratory records that will be maintained for the project include sample receipt documentation, field and laboratory COC documentation, sample container cleanliness certifications, reagent and SRM certifications, sample preparation records, sample analysis records (e.g., run logs), instrument/raw data, QC data, calibration data, corrective action reports, and final reports.

Data handling records that will be maintained include verification of computer programs used to manipulate or reduce raw data into final results and data validation reports. The Laboratories will maintain documentation of data verification and reduction procedures as necessary for the analyses used during the Site activities. BB&E will maintain checklists, notes, and reports generated during the external data validation process.

The BB&E Project Manager has the responsibility to ensure all individuals listed on the distribution list in Section A3 have the most recent revision of the QAPP. If an updated revision is produced, the BB&E Project Manager will provide the updated text, figures, tables, or other document constituents to all individuals listed in Section A3. The BB&E Project Manager will follow up with each individual on the distribution list to verify the revisions were received.

A9.2 Data Reporting Format

Field data will be recorded in bound logbooks or on standard forms (i.e., stratigraphic logs, soil boring logs). The details for recording field data are provided in Section B3.2.1 of this QAPP. Field data will be primarily generated consist of field readings (e.g., depth of sample) or observations. This data will be tabulated and included in project reports or submittals.

Laboratory reports for the Site sampling activities include an ALS Level II QC analytical package which is comparable to an USEPA Level II. This report's data deliverables are described below:

<u>Summary Reports - Reduced Data Validation</u>

i) Title Page

- Project name and number;
- Laboratory project or lot number;
- Signature of the Laboratory QA Manager or his designee; and
- Date issued.

ii) Table of Contents - laboratory report contents

iii) Case Narrative

- Number of samples and respective matrices;
- Laboratory analysis performed;
- Any deviations from intended analytical strategy;
- Definition of data qualifiers used;
- QC procedures utilized and references to the acceptance criteria;
- Condition of samples "as received";
- Discussion of whether or not sample holding times were met;
- Discussion of technical problems or other observations which may have created analytical difficulties; and
- Discussion of laboratory QC checks which failed to meet project criteria.

iv) Analytical Methods Summary - methods of sample preparation and analyses for samples.

v) Analytical Sample Summary - cross-reference table of laboratory sample to project sampled

vi) Shipping and Receiving Documents

- Sample container documentation; and
- Sample reception information and original COC record.

vii) Chemistry Data Package by Analysis

- Sample Results;
- BB&E and laboratory sample identification numbers;
- Dates and times of sample collection, reception, preparation, and/or analysis;
- Sample specific quantitation (report) limits (RL), reporting MDL;
- Estimated values between the RL and MDL;
- Methods of sample preparation and analyses for samples; and
- Dilution factors.

viii) QC Summary Data with Current Control Limits

- Method blank results;
- MS/MSD recoveries;

- LCSs (laboratory control duplicates): and
- Matrix duplicate RPDs.

Laboratory QC summary data deliverables will be provided to Collis and BB&E within 14 days from the date of sample log-in for analysis at the laboratory.

A9.3 Data Archiving and Retrieval

A 10-year maintenance period is required following completion of the RA. All records will be maintained for a period of seven years following the 10-year maintenance period. USEPA Region VII is to be notified 90 days prior to disposal or destruction of records.

B1. SAMPLING PROCESS DESIGN

A shallow soil investigation was designed to determine if the former CSA, which stored acid and caustic materials, was impacted by possible leaking totes/storage containers. The soil investigation will occur in the vicinity of the filter building concrete pads. Attachment A, Figure 3 illustrates the former CSA of the totes with acidic and caustic contents and the possible impacted areas. Per section 3.0 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* a total of eight discrete shallow soil samples are to be collected at the transition area from the concrete pad to the grassy area (four locations adjacent to each concrete pad). The final sample locations will be determined by the field team, approved by the BB&E project manager with the assistance of the USEPA project manager, as part of the Pre-Soil Investigation Assessment to be completed by the field team. This Site Assessment will allow the field team to initially assess the current condition of the former CSA and adjacent concrete pads. Any areas with residual surface staining or other visual observations indicating possible contaminant exposure will be noted. These areas in the concrete to grassy transition area will be sampled by the field team. Additional discrete shallow soil samples are expected to be collected from underneath the pavement at identified cracks, other penetrations in the concrete slab area, or other potential pathways of possible contaminant exposure to the soil. Up to three soil samples per concrete slab are anticipated, however the final number of soil samples will be determined after the field team's observation of the CSA during the Pre-Soil Investigation Assessment. Per section 3.1 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* a total of seven discrete shallow soil samples are proposed on the site's property and adjacent areas for establishing site-specific background concentrations of the pre-determined analytes (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), if required. Background samples will only be analyzed should any analyte(s) from the possible impacted area exhibit a concentration greater than RSLs for RCRA 8 metals in industrial soil. Should the results of the shallow soil samples collected be below RSLs for RCRA 8 metals in industrial soil then no background samples will be required for analysis. Background sample locations are illustrated in Attachment A – Figure 4. Section A6 describes the rationale for selecting or modifying background sample locations..

All final sampling locations will be determined by the field team after the Pre-Soil Investigation Assessment has been performed prior to any soil sampling activities with authorization of the BB&E program manager and assistance from the USEPA project manager. The selection of the locations will be biased. The selected locations will be determined by cracks or penetrations in the concrete pad or at adjacent areas where possible releases may have occurred. All sampling collection processes at the possible impacted area and background samples are contained in Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013.*

B2. SAMPLING METHODS REQUIREMENTS

The following sections outline the specific sampling protocols and techniques used during soil sampling at Collis, Inc.

B2.1 Soil Sampling Procedures and Protocols

Standard field sampling guidelines for soil sampling per the USEPA guideline, SESC PROC-300-R2, "USEPA Soil Sampling Operating Procedure, December 2011, will be followed for all soil sampling events. SESC PROC-300-R2 has been included in the SOPs of Attachment B. This document describes specific procedures and methods and equipment to be used and observed when collecting soil samples for laboratory analysis. Section 4.0 of SESC PROC-300-R2describes the processes/methods which will be utilized to collect the shallow soil samples. Sampling personnel will be familiar with procedures and requirements of the QAPP, and the samplers will have a copy of the current sampling procedures in their possession, readily available for reference during soil sampling events. Also, refer to Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* for additional details of the upcoming soil sampling event.

Sampling equipment and materials to be used during the collection of shallow soil samples may include: metal spoon, metal hand auger, metal hand shovel, pre-cleaned sample containers, and nitrile gloves.

The soil sampling procedure is describes below:

- Decontaminate all sampling equipment in accordance with Section B2.4 prior to collecting soil samples.
- Remove surface materials (asphalt, concrete, or vegetation) from the boring location.
- An approved technician will advance the soil penetration equipment (hand auger, metal hand shovel) to the desired sampling depth .
- Fill all sample containers using a decontaminated or dedicated sampling implement (metal spoon).
- Decontaminate all non-dedicated down hole equipment in accordance with Section B2.4.
- Backfill the borehole at each sampling location with boring cuttings or if required, clean soil and repair the surface with like materials, as required.

Field personnel performing the shallow soil sampling will be utilizing the following personnel protection equipment (PPE) – Modified Level D protection:

- Steel toed safety shoes
- Safety glasses or equivalent eye protection
- Nitrile gloves
- Appropriate clothing

B2.1.1 Soil Sampling Order

Sampling at the site will be performed from expected clean areas to the areas of potentially impacted soils by contaminants of concern. The background sample locations were selected in areas that were not expected to be impacted as a result of current or former operations at the Site, therefore resulting in metals levels in the soil that are indicative of the area background concentrations. The shallow soil samples at the former CSA are potentially impacted by contaminants. Shallow soil background samples will be collected prior to the shallow soil samples collected at the former CSA to minimize potential for cross contamination of samples. Sampling performed at the former CSA area will first be conducted at the transition area from concrete to grass, as this area is expected to be potentially less impacted than soils directly underneath the concrete pads where the totes were stored. Refer to Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* for additional details of the soil sampling event.

B2.1.2 Field Readings

No equipment field readings will be taken during the soil sampling event as no field meters/instruments will be utilized. Visual soil observations by field team members will be recorded in field logs. Refer to Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013*.Examples of field data sheets and field note forms are given in Attachment C for soil boring visual observations.

B2.2 Field QC Sampling Collection/ Preparation and Identification Procedures

During the sampling event one duplicate per 10 samples, one MS/MSD pair per 20 samples, and one equipment rinsate blank per 10 samples will be collected and analyzed for the same parameters as the samples from the borings. Refer to subsections in B2.2 for additional information on the QC samples listed previously. Table 1 contains the sampling and analysis program which includes the total number of samples and QC samples. Per the Table 1 notes, the total number of QC samples collected will be determined during the soil sampling event based on the number of soil samples collected. The number of soil samples to be collected will be determined after the Pre-Soil Investigation Assessment is completed by the sampling team with approval from the BB&E project manager, with the assistance and approval of the USEPA Region VII project manager.

Field QC samples are collected to assess the quality of the analytical data and to evaluate sampling and analytical reproducibility (precision). Field QC samples will consist of duplicate samples and rinsate blanks. Acceptance criteria for these samples will be in accordance with the current version of the laboratory QA manual.

B2.2.1 Field Duplicates

Field duplicate samples will be collected 1 per 10 samples or less, and will be prepared by utilizing one sample location for two soil samples, the shallow soil sample and the shallow soil sample duplicate. The results will be used to evaluate analytical reproducibility (precision). Points where duplicate samples are to be collected will be selected by the field personnel, and will consist of possibly contaminated areas to provide a range of expected contamination concentrations in the field and will be submitted as duplicates to the laboratory. A field duplicate will be collected using the same equipment as the samples, e.g., hand auger, trowels,

spoons, etc, as described in Section B2.1. All sampling equipment, including internal components, will be decontaminated before use and between samples, using water collected from sources described in Section B2.4. Specific information concerning decontamination procedures is presented in Section B2.4. Decontaminated equipment will be air-dried, wrapped in a non-plastic material (aluminum foil), and stored in a manner that reduces the potential for accidental contamination. All field duplicates will be collected by the procedure described in Section 2.1.Field duplicate samples will be labeled as "COL-MC-LOC-YY(X-X')-DUP," where COL identifies the site, MC identifies the sample matrix code ("SB" – soil boring), LOC identifies the sample location ("CSA" – container storage area), "Y" signifies a specific sampling numeric location ("2" – second sample collected), and "X" signifies the depth interval of the sample (" 0' – 1' " – sample from 0 ft to 1 ft below ground surface). Therefore, a duplicate labeled COL-SB-CSA-01(0 - 1')-DUP, would indicate it was collected at the Collis facility, a duplicate soil sample from a soil boring, the first sample collected at the CSA at 0 – 1 ft bgs. Refer to section B3.2.1 for sample acronym identifiers.

Duplicate analytical results will be compared to USEPA Industrial Soil RSLs and calculated background concentrations, if required. If exceedances occur, additional investigation and/or remedy actions will be required, and recommendations will be submitted in the Sampling Final Report following the sampling activities.

B2.2.2 Equipment Rinsate Blanks

Equipment rinsate blanks will be collected 1 per 10 samples or less. Equipment rinsate blanks will be collected and analyzed to assess procedural errors in sampling and equipment decontamination. . . An equipment rinsate will be collected after the tenth soil sample has been collected and the appropriate decontamination procedures have been completed. The PPE utilized to collect equipment rinsate samples includes nitrile gloves and eye protection. Only the analyte-free water and equipment rinsate sample container will be used during the sample collection process. Equipment rinsate samples will be handled and packaged in the same manner as soil samples, as described in Section B3.2.1.

All sampling equipment, including internal components, will be decontaminated before use and between samples, using water collected from sources described in Section B2.4. Specific

information concerning decontamination procedures is presented in Section B2.4. Decontaminated equipment will be air-dried, wrapped in a non-plastic material (aluminum foil), and stored in a manner that reduces the potential for accidental contamination.

Once equipment has undergone decontamination procedures detailed in Section B2.4 an equipment rinsate blank will be collected using the following procedure:

- Sampling equipment will be decontaminated per section B2.4 prior to the equipment rinsate blank sampling;
- Analyte-free water will be discharged onto the sampling equipment;
- The analyte-free water will be in contact with the surface of the piece of sampling equipment (previously decontaminated, refer to section B2.4); and

The analyte-free water will be collected into a sample container identical to the samples by gravity flow. Analyte free water will be slowly poured from the analyte-free source onto the field equipment and the field equipment water drip/discharge point will be position into the sample container. Only rinsate fluids in direct contact with the field equipment will be collected into the sample container. The equipment rinsate blank will be analyzed for the same contaminants as the shallow soil samples collected. The purpose of this sample is to evaluate background contamination resulting from the field equipment or sampling procedures.

Equipment rinsate samples will be labeled as "COL-MC-YY," where COL identifies the site, MC identifies the sample matrix code ("RB" – rinsate blank), "Y" signifies a specific sampling numeric order collected ("1" – numerical rinsate blank collected). Therefore, a equipment rinsate blank labeled COL-RB-02, would indicate it was collected at the Collis facility, the second rinsate blank sample collected. Refer to section B3.2.1 for sample acronym identifiers.

B2.2.3 Matrix Spike/Matrix Spike Duplicate

MS/MSDs will be collected 1 per 20 samples or less. MS/MSD samples will be analyzed to provide information about the effect of the sample matrix on the digestion and measurement methodology. Points where MS/MSD samples are to be collected will be selected by the field personnel and with the sampling location identified. A MS/MSD will be collected immediately after the primary soil sample. A MS/MSD will be collected using the same equipment as the samples, e.g., hand auger, trowels, spoons, etc, as described in Section B2.1. All sampling

equipment, including internal components, will be decontaminated before use and between samples, using water collected from sources described in Section B2.4. Specific information concerning decontamination procedures is presented in Section B2.4. Decontaminated equipment will be air-dried, wrapped in a nonplastic material (aluminum foil), and stored in a manner that reduces the potential for accidental contamination. All field duplicates will be collected by the procedure similar to Section 2.1.

A MS/MSD sample will be labeled as "COL-MC-LOC-YY(X-X') MS/MSD". COL identifies the site, MC identifies the sample matrix code ("SB" – soil boring), LOC identifies the sample location ("CSA" – container storage area), "Y" signifies a specific sampling numeric location ("2" – second sample collected), and "X" signifies the depth interval of the sample (" 0' – 1' " – sample from 0 ft to 1 ft below ground surface). Therefore, a MS/MSD labeled COL-SB-CSA-01(0 - 1')-MS/MSD, would indicate it was collected at the Collis facility, a MS/MSD soil sample from a soil boring, the first sample collected at the CSA at 0 – 1 ft bgs. Refer to section B3.2.1 for sample acronym identifiers.

B2.3 Soil Sampling Procedures and Protocols

SESC PROC-300-R2, "USEPA Soil Sampling Operating Procedure, December 2011, will be followed for all soil sampling events. This SOP is contained in Attachment B of the QAPP. Refer to Section 3 of the *Sampling Work Plan for Focused Soil Investigation, February 2013,* for additional site investigation details.

B2.4 Field Equipment and Sample Container Cleaning Procedures

Sample containers will be provided by the Laboratories. All containers will be precleaned in accordance with the U.S. EPA guidance document entitled "Specifications and Guidance for Contaminant-Free Sample Containers", EPA 540/R-93/051. Certificates of analysis for each lot of containers will be maintained by the laboratory.

Personnel protective equipment (PPE) will be utilized during decontamination activities. Nitrile gloves will be worn on hands and eye protection will be required during all decontamination activities.

The materials and equipment utilized during the decontamination of sampling equipment are: potable tap water, distilled water, Alconox (or other phosphate free detergent), 5-gallon buckets, scrub brushes, squirt bottles (one bottle with Alconox and water and one bottle with distilled water). All equipment will be purchased locally at retail stores. The decontamination processes which will be utilized during soil sampling activities are described below: .

- Each 5 gallon bucket utilized at the decontamination stations will first be decontaminated. An Alconox solution and scrub brush will be utilized to clean the interior of each bucket. Each bucket will be triple rinsed with tap water, then each bucket will be triple rinsed with distilled water.
- Establish an Alconox solution decontamination station (utilizing a 5 gallon bucket, Alconox, and tap water). Establish a tap water rinse decontamination station (utilizing a 5 gallon bucket and tap water) Establish a distilled water rinse decontamination station (utilizing a 5 gallon bucket and distilled water). Each station should have a minimum distance to ensure no liquid from one decontamination station can interfere with another station.
- First, wash all sampling equipment surfaces that contacted the potentially contaminated soil in the Alconox solution, using a brush as needed to remove particulate matter and surface films in the Alconox solution decontamination station. An Alconox solution squirt bottle may be utilized to clean the sampling equipment also. Attempt to remove excess Alconox by using a distilled water squirt bottle. Remove excess water from the sampling equipment without physically contacting the surfaces being decontaminated.
- Second, rinse all the sampling equipment surfaces that contacted the potentially contaminated soil in the tap water rinse decontamination station. Attempt to remove excess tap water from the sampling equipment without physically contacting the surfaces being decontaminated.
- Thirdly, rinse all the sampling equipment surfaces that contacted potentially contaminated soil in the distilled water rinse decontamination station. Attempt to remove excess distilled water from the sampling equipment without physically contacted the surfaces being decontaminated. Allow the sampling equipment to air dry.

- Wrap the sampling equipment in aluminum foil and properly store the equipment to ensure no contaminants are exposed to the decontaminated sampling equipment surfaces until the next use.

B2.5 Field Equipment Maintenance, Testing, and Inspection Requirements

No field equipment will acquired from local rental vendors or will be used during the soil investigation. Equipment purchased for use in soil sampling activities will be inspected and tested prior to being shipped to the field. Prior to use in the field, the equipment is checked again.

B2.6 Inspection and Acceptance Requirements for Supplies and Sample Containers

Soil sampling tools (e.g., trowels, spoons, and knives), which contact soils, will be cleaned with a solution of laboratory-grade soap (Alconox®) prior to each sample and rinsed with distilled water. Refer to section B2.4 for full field decontamination procedures.

Chemical preservatives and sample containers will be provided by the Laboratories. The Laboratories will maintain documentation of the purity/cleanliness for these materials. The Laboratory QA Managers are ultimately responsible for ensuring that these materials are acceptable for the project. The acceptability of these materials for use will be evaluated by reviewing lot analysis certificates (distilled water, chemical preservatives, and containers). Water, preservatives, and containers that do not meet the Laboratories acceptability requirements will not be shipped to the field.

B3. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The procedures for sample handling, labeling, shipping, and COC documentation are provided in the subsections that follow.

B3.1 Sample Handling

Samples must be handled in a particular and specific manner to maintain the integrity of the sample from the point and time of collection completely through the analysis activities. The method of selecting the proposed sampling locations and method of marking the locations are

discussed in Section A.6. The sampling utensils and procedures used to collect the samples are provided in Section B2.1 and Sections 3.0 and 3.1 of the *Sampling Work Plan for Focused Soil Investigation, February 2013*. Sample aliquots will be containerized in order of decreasing analyte volatility. Samples collected during the soil investigations will be analyzed only for RCRA 8 metals. Table 1 contains the sampling and analysis program. Table 2 contains the requirements for container type (material of construction), preservation, holding time periods for the analyses associated with each sampling program.

Discrete samples will be collected during the soil investigation at the Collis site. Utilizing previously mentioned sampling equipment, the sample of soil will be directly collected from the shallow soil boring and placed into the laboratory provided sample container.

PPE utilized during the sample collection is contained in Section B2.1

Samples collected for off-Site analysis will be placed in shipping coolers containing bagged, cubed ice immediately following collection. The samples will be grouped in the shipping cooler by the order in which the samples are collected, and transferred to the laboratory. Packaging procedures are contained in Section B3.2.1 – Step 4.

All soil samples will be collected from the Collis site by the BB&E field team, and the samples will be shipped to the laboratory by the laboratory's courier service. A scheduled pickup time will be coordinated with the ALS project manager prior to the sampling event to expedite the sample delivery to the laboratory. The samples will be picked up from the BB&E field team as soon as possible to be transported to the laboratory. Samples will be analyzed by the laboratory prior to the exceedance of the designated hold times. Hold times are contained in Table 2.

B3.2 Sample Custody

COC is the sequence of possession of an item. An item (such as a sample or final evidence file) is considered to be in custody if the item is in actual possession of a person, the item is in the view of the person after being in his/her actual possession, or the item was in a person's physical possession but was placed in a secure area by that person. Field, laboratory, and final evidence files custody procedures are described in the subsections that follow.

B3.2.1 Field Custody Procedures

Logbooks will be used to record field data collection activities. Entries i to field logbooks will be described in as much detail as possible to ensure that a particular situation could be reconstructed solely from logbook entries. Field logbooks will be bound field survey books or notebooks with consecutively numbered pages. Logbooks will be assigned to field personnel and will be stored at BB&E's Farmington Hills, Michigan office when not in use. Each logbook will be identified by the project-specific document number (02028006).

The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned;
- Logbook number;
- Project name;
- Project start date; and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of individuals visiting the site or field sampling team and the purpose of their visit will also be recorded in the field logbook.

All field measurements obtained and samples collected will be recorded. All logbook entries will be made in ink, signed, and dated with no erasures. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark, which is initialed and dated by the person making the erroneous entry. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook. Photographs taken at a location, if any, will also be noted in the

logbook. All equipment used to obtain field measurements will be recorded in the field logbook or standardized field sheet.

Samples will be collected following the sampling procedures documented in the Site Work Plan. The equipment used to collect samples, time of sample collection, sample description, volume and number of containers, preservatives added (if applicable) will be recorded in the field logbook. Each sample will be uniquely identified using the sample numbering system provided below:

COL-MC-LOC-YY(X-X')

COL – Property owner designation
MC (matrix code) – SB – soil boring
LOC (location) – site location
(i.e. – CSA – container storage area, BKGD – background)
YY – sequential number for event
X – X – depth interval below ground surface

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the COC intact:

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.
2. All sample containers will be identified by using sample labels that include the sample identification number, sample type, sampler, and date of collection and analyses to be performed. Sample labels will be completed for each sample using waterproof ink.
3. Samples will be accompanied by a properly completed COC form. The sample identification numbers and required analyses will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving the

samples will sign and record the date and time on the form. The COC form documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.

4. Samples must be properly packaged prior to shipment. The container lids will be verified to be securely tightened and the proper identification and label information of the sample was completed. Each sample container will be individually placed in a Ziploc ® bag. A heavy duty plastic bag will be placed inside the cooler. The cooler will be filled with ice and the samples will be placed in the cooler. Each sample container will be placed within the ice to ensure maximum surface exposure to the ice and not contacting other sample containers in the cooler. The cooler will not be overfilled with samples. Additional ice will be added to completely fill a cooler. The heavy duty plastic bag will be sealed by removing the access air in the bag and twisting the top section of the trash bag. Once the top heavy duty plastic bag is twisted securely, it will be J-sealed using packaging tape. Samples will be properly packaged for shipment and dispatched to the laboratory for analysis with a separate signed COC form enclosed in and secured to the inside top of each shipping cooler. Shipping coolers will be secured with custody tape for shipment to the laboratory. Custody seals are carefully placed intact over the cooler lid openings (front and side). The custody tape and custody seal are then covered with clear plastic tape to prevent accidental damage to the custody tape.
5. If samples are collocated with a government agency or other entity, it is the responsibility of that entity to prepare its own COC form for the samples. Information regarding the identity of the entity and the samples that are being collected will be recorded in the field logbook.
6. All sample shipments will be accompanied by the COC form identifying its contents. The COC form is a four-part carbonless-copy form. The form is completed by the sampling team, which, after signing and relinquishing custody to the shipper, retains the bottom (goldenrod) copy. The shipper, if different than the sampling team members, retains the pink copy after relinquishing custody to the laboratory. The yellow copy is retained by the laboratory and the fully executed white copy is returned as part of the data deliverables package.

7. If the samples are sent by common carrier, a bill of lading (e.g., FedEx air bill) will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the COC form as long as the form is sealed inside the sample cooler and the custody tape remains intact.

B3.2.2 Laboratory Custody Procedures

Laboratory sample custody begins when the samples are received at the laboratory. The Laboratories' sample custodian will assign a unique laboratory sample identification number to each incoming sample. The field sample identification numbers, laboratory sample identification numbers, date and time of sample collection, date and time of sample receipt, and requested analyses will be entered into the sample receiving log. The Laboratories' sample log-in, custody, and document control procedures are detailed in the appropriate SOPs in Attachment B.

Following log-in, all samples will be stored within an access-controlled location and will be maintained properly preserved until completion of all laboratory analyses. Unused sample aliquots and sample extracts/digestates/distillates will be maintained properly preserved for a minimum of 60 days following receipt of the final report by BB&E. The Laboratories will be responsible for the disposal of unused sample aliquots, sample containers, and sample extracts/digestates/distillates in accordance with all applicable local, state, and federal regulations. Sample tags will be retained by the Laboratories until completion of the analysis; if requested, they can be returned to BB&E with the laboratory final analytical report.

The Laboratories will be responsible for maintaining analytical logbooks and laboratory data. Raw laboratory data files will be inventoried and maintained by the laboratory for a period of five years, at which time BB&E will advise the laboratory regarding the need for additional storage.

B3.2.3 Final Evidence Files Custody Procedures

The final evidence file for the project will be maintained by BB&E and will consist of the following:

1. Project plan;
2. Project logbooks;

3. Field data records;
4. Sample identification documents;
5. COC records;
6. Correspondence;
7. References, literature;
8. Final data packages;
9. Miscellaneous - photos, maps, drawings, etc.; and
10. Final report.

The final evidence file materials will be the responsibility of the evidentiary file custodian (BB&E's Project Manager) with respect to maintenance and document removal. All records will be maintained for a period of seven years following completion of the 10-year maintenance period as noted in the laboratory SOPs of Attachment B. USEPA Region VII is to be notified 90 days prior to disposal or destruction of records after the six-year maintenance period following completion of the RA has expired.

B4. ANALYTICAL METHODS

The field and laboratory analytical methods that will be used during the Site investigation activities are detailed in the following subsections.

B4.1 Field Analytical Methods

No field analytical methods will need to be performed during this Focused Soil Investigation.

B4.2 Laboratory Analytical Methods

The analytical methods that will be used by the Laboratories for analyzing the project samples are presented in Table 2. Associated target detection limits and designated analytical methods from the USEPA's RSLs Industrial Soil Table November 2012 are provided in Attachment F. The Laboratories SOPs for the analytical methods are presented in Attachment B. Method

validation and detection limit study information for the analyses is included in the Laboratories' SOPs.

The quantities and types of QC samples for the investigation program are included in Table 1.

B5. QUALITY CONTROL REQUIREMENTS

The field and laboratory QC requirements for the Site investigation activities are discussed in the following subsections. Specific QC checks employed and frequency of analyses are provided in the field and laboratory SOPs in Attachment B.

B5.1 Field Sampling Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks. The shallow soil sampling will not require field equipment calibration since no monitoring will be performed in accordance with the work plan. Field QC samples for this project include field duplicate samples to assess the overall precision of the analysis event and equipment rinsate samples to monitor cross-contamination of samples. The frequencies of collection of these field QC samples were provided in Table 1 and Section A6.2.2.2 of this QAPP. The evaluation of field QC data is provided in Section A7 of this QAPP.

B5.2 Analytical Quality Control

The laboratory QC requirements for metals and mercury analyses to be performed on-site samples include analyzing mass tuning standards, method blanks, instrument blanks, initial calibration standards, continuing calibration verification standards, MS/MSDs, and LCSs. The acceptance criteria for all these QC checks except MS/MSD samples and LCSs are in the Laboratories' SOPs.

The laboratory QC requirements for metals analyses to be performed on-site samples include analyzing preparation blanks, initial calibration blanks, continuing calibration blanks, initial calibration verification standards, continuing calibration verification standards, interference check standards, internal standards, serial dilution samples, MS/MSD samples, and LCSs. The

analysis frequency for these QC samples is included in the applicable SOPs in Attachment B. The acceptance criteria for all these QC checks are in the Laboratories' SOPs.

The laboratory QC requirements for inorganic analyses to be performed on-site samples include analyzing method blanks, initial calibration standards, calibration check standards, MS/MSDs (if applicable), and LCSs. The acceptance criteria for all these QC checks are in the Laboratories' SOPs.

Laboratory QC batch control analyte MS/MSD and LCS acceptance criteria are provided in the laboratory SOPs of Attachment B of this QAPP. These acceptance criteria and the acceptance criteria for "all analyte" QC checks are included in the SOPs of Attachment B. The QC acceptance criteria and the MDLs included in this QAPP are updated by the laboratory on a periodic basis. The acceptance criteria in effect when the samples are analyzed will be identified in the laboratory final analytical reports, which may be different than those identified in the QAPP.

B6. INSTRUMENTATION/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

The procedures used to verify that instruments and equipment are functional and properly maintained are described in the following subsections.

B6.1 Field Instrument Maintenance

The field equipment for this project includes hand augers, trowels, spoons, and knives. Soil sampling tools which contact soils will be cleaned with a solution of laboratory-grade soap prior to each sample and rinsed with distilled water.

B6.2 Laboratory Instrument Maintenance

As part of their QA/QC program, the Laboratories conduct routine preventive maintenance to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance

that is performed will be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

The Laboratories' SOPs in Attachment B provide complete details for instrument preventive maintenance.

B7. INSTRUMENT CALIBRATION & FREQUENCY

The procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses are described in the following subsections. These instruments and equipment will be calibrated prior to each use or according to a periodic schedule.

B7.1 Field Instruments/Equipment

Calibration of field instrument equipment will not be required or be performed since no field screening equipment will be utilized.

B7.2 Laboratory Instruments

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit.

For all instruments, the laboratory will maintain a properly trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of calibration will be kept as follows:

1. If possible, each instrument will have record of calibration permanently affixed with an assigned record number.

2. A logbook will be assigned to each instrument showing description, manufacturer, model numbers, date of last calibration and the signature of the person who calibrated the instrument, due date of next calibration and compensation or correction figures, as appropriate.
3. A written stepwise calibration procedure will be available for each piece of test and measurement equipment.
4. Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag or will otherwise be removed from service, as appropriate.

Specific calibration procedures and frequencies are detailed in the Laboratories' SOPs in Attachment B.

B8. INSPECTION/ACCEPTANCE CRITERIA FOR SUPPLIES AND CONSUMABLES

The procedures that will be used to ensure that supplies and consumables used in the field and laboratory will be available as needed and free of contaminants are detailed in the following subsections.

B8.1 Laboratory Supplies and Consumables

The lot numbers of reagents and standards are recorded and dates of receipt, first use, and expiration are documented. Certificates of analysis are maintained on file to document reagent/standard purity.

The Laboratories' SOPs provide details on identifying contaminants in reagents and standards, determining deterioration of reagents and standards, and the corrective actions required if contaminants or deterioration are identified. The laboratory QA Manager is ultimately responsible for the ensuring the acceptability of supplies and consumables.

B9. DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Historical data for the Site were generated during the various studies and monitoring events identified in Section A4.4.

B10. DATA MANAGEMENT

The procedures for managing data from generation to final use and storage are detailed in subsections that follow.

B10.1 Data Recording

Field data (visual observations) will be recorded in field logbooks or on standard. Field staff is responsible for recording field data and the Field QA Manager is responsible for identifying and correcting recording errors.

Laboratory data are recorded in a variety of formats. Data from instruments are recorded on magnetic media, strip charts, or bench sheets. The Laboratories' SOPs provide the data-recording requirement for each preparation and analysis method.

B10.2 Data Validation

Validation of field data for this project will primarily consist of checking for transcription errors and review of data recorded in field logbooks. Data transcribed from the field logbook into summary tables for reporting purposes will be verified for correctness by the Field QA Manager or his designee. Limitations on the use of field data will be included in the specific Site reports.

Validation of the analytical data will be performed by ALS based on the relevant and applicable evaluation criteria outlined in ""USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review", USEPA-540-R-10-011, January 2010. The evaluation and action criteria specified in these documents (referred to hereafter as the National Functional Guidelines) will be used for validating the data. However, the acceptance limits for QC data will be the control limits determined statistically by the laboratory, not the control limits specified in the National Functional Guidelines. Qualifiers assigned to the data will be consistent

with the data qualifiers specified in the National Functional Guidelines.

The following deliverables will be evaluated for all samples:

i) Technical holding times;
ii) Blanks;
iii) System monitoring compounds;
iv)MS/MSD results;
v) LCSs; and
vi) Field duplicates.

The results of the data validation process will be documented in a memorandum that specifies all limitations on the usability of the analytical data.

B10.3 Data Transformation/Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented for laboratory data. No direct reading instrumentation will be employed in the field

Laboratory data reduction procedures will be followed according to the following protocol:

1. Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst.
2. The area supervisor or senior chemist reviews the data for attainment of QC criteria established by the QAPP.
3. The area supervisor will decide whether sample re-analysis is required.
4. Upon completion of all reviews and acceptance of the raw data by the area supervisor, a report will be generated and sent to the laboratory Project Manager.
5. The laboratory Project Manager will complete a thorough inspection of all reports.
6. Following review and approval of the preliminary report by the laboratory Project Manager, final reports will be generated and signed by the laboratory Project Manager.

Specific equations used for data reduction are contained in the Laboratories' SOPs in Attachment B.

B10.4 Data Transmittal/Transfer

Field data from surveying will be entered into standard Microsoft Excel spreadsheet format. BB&E's Field QA Manager or designee is responsible for verifying the correctness of the field data after the data are transferred to a spreadsheet format. The geographical data are maintained in a database that is described below.

The Laboratories will provide electronic data deliverables (EDDs) in a database product. The laboratory data are downloaded into the EDDs directly from the LCS (LIMS), thus eliminating the possibility of manual transcription errors. The EDDs are imported and the data are maintained in the database for manipulation and presentation.

BB&E's QA Manager is responsible for verifying the correctness of the analytical database after the laboratory data for each event have been imported. This is accomplished by comparing the data from the database to the hardcopy analytical reports for a minimum of 10 percent of the sample results. If discrepancies between the database and hardcopy analytical reports are detected, a complete verification of the database will be performed or a new EDD will be submitted, imported, and verified as described previously.

B10.5 Data Analysis

The data from the Site investigation activities will be compared to the USEPA Industrial Soil RSLs and calculated background concentrations, if required.

B10.6 Data Assessment

Assessment of laboratory data by the Laboratories will be performed using the procedures detailed in the SOP entitled "Statistical Evaluation of Data and Control Charts". Specific data assessment for each analytical method is provided in the Laboratories' SOPs. These assessments included determining the mean, standard deviation, relative standard deviation, percent difference, RPD, and percent recovery (%R) for certain QC elements.

Assessment of QC data for data validation purposes will include determining the %R, RPD, and percent completeness. The statistical equations to determine these parameters are provided in Section D of this QAPP and laboratory SOPs.

B10.7 Data Tracking

Data generated in the field will be recorded in field logbooks or on standard forms. Survey data will be generated by the surveying subcontractor and provided to BB&E. There are no unique or special tracking requirements for these data. The data will be transcribed for analysis and reporting as discussed in Section B10.4, and the original survey data and field logbooks will be maintained in the final evidence file.

Laboratory data tracking procedures are provided in the Laboratories' SOPs. These SOPs provide the procedures for tracking data from generation to reporting. The Laboratories' LIMS also provides a means for tracking data in the laboratory. The laboratory Operations Manager is ultimately responsible for data tracking in the laboratory.

Tracking of analytical data in the database includes recording the laboratory generating the data, the date when EDD was received and imported, the date when qualifiers were applied to the results, and the level of data validation performed. BB&E's Project Manager is ultimately responsible for tracking data from entry into the database to reporting.

B10.8 Data Storage and Retrieval

Laboratory data will be stored by the Laboratories in hardcopy format at their facilities. Data are archived on-site for a period of 5 years, after which time the data are warehoused off site. Electronic instrument data are maintained on magnetic media (i.e., magnetic tape) for this same time period.

BB&E's Project Manager is responsible for project data storage and retrieval. Field logbooks and the final evidence file upon completion of the RA will be maintained in BB&E's Farmington Hills, Michigan office.

B10.9 Data Security

Laboratory data security is the responsibility of the Laboratories' records manager. Archived data cannot be accessed without authorization and the name and purpose of personnel accessing archived data are recorded. The Laboratories' LIMS are password protected and access rights are restricted by job function.

BB&E's data security procedures include limiting project database access to database analysts and general building security procedures.

C1. ASSESSMENTS AND RESPONSE ACTIONS

Assessments consisting of internal and external audits may be performed during the project. Internal technical system audits of both field and laboratory procedures will be conducted to verify that sampling and analysis are being performed in accordance with the procedures established in the QAPP. External field and laboratory audits may be conducted by the USEPA Region VII.

An internal field technical system audit of field activities, including sampling and field measurements, will be conducted by the Field QA Manager or his designee at the beginning of the field sampling activities to identify deficiencies in the field sampling and documentation procedures. The field technical system audit will include examining field sampling records and COC documentation. In addition, sample collection, handling, and packaging in compliance with the established procedures will be reviewed during the field audit. Any deficiencies identified will be documented and corrective actions will be taken to rectify the deficiencies.

Corrective action resulting from internal field technical system audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The Field QA Manager will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field QA Manager and field team. Corrective action will be documented in the field logbook and/or the project file. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in this QAPP are maintained throughout the project.

An external field technical system audit may be conducted by the USEPA Region VII any time during the field operations. These audits may or may not be announced and are conducted at the discretion of USEPA Region VII.

An internal laboratory technical system audit will be conducted by the Laboratories' QA Manager or designee. The laboratory technical system audit is conducted on an annual basis and

includes examining laboratory documentation regarding sample receiving, sample log-in, storage and tracking, COC procedures, sample preparation and analysis, instrument operating records, data handling and management, data tracking and control, and data reduction and verification. The laboratory QA Manager will evaluate the results of the audit and provide a final report to section managers and the Operations Manager that includes any deficiencies and/or noteworthy observations.

Corrective action resulting from deficiencies identified during the internal laboratory technical system audit will be implemented immediately. The Operations Manager or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QA/QC Officer will ensure implementation and documentation of the corrective action. All problems requiring corrective action and the corrective action taken will be reported to the laboratory Project Manager. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in the QAPP are maintained throughout the project.

An external laboratory audit may be conducted by USEPA Region VII personnel. These audits may or may not be announced and are at the discretion of the USEPA Region VII. The external laboratory audits will include, but not be limited to, reviewing laboratory analytical procedures, laboratory on-site audits, and/or submitting performance evaluation samples to the laboratory for analysis.

An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities.

C2. REPORTS TO MANAGEMENT

QA Management Reports will be prepared during the Site investigation activities. These QA Management Reports will be included with the progress reports that are submitted to the USEPA Region VII when data gathering or assessment activities are being conducted. Minimally, these reports will include project status, results of performance evaluations and system audits, results

of periodic data quality validation and assessment and data use limitations, and any significant QA problems identified and corrective actions taken.

BB&E's QA Manager will be responsible within the organizational structure for preparing these reports. BB&E's Project Manager will be provided with these reports for distribution with quarterly progress reports. The specific Site Reports will also include a separate QA/QC section that will summarize data quality information contained in the periodic QA Management Reports and provides an overall data quality assessment compared to the DQOs outlined in this QAPP.

D1. DATA VERIFICATION/VALIDATION AND USABILITY

The QA activities that will be performed to ensure that the data are scientifically defensible, properly documented, of known quality, and meet the project objectives are described in the following sections.

D2. DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

All field and laboratory data will be reviewed and verified/validated. The procedures and criteria used to verify and validate field and laboratory data will consist of evaluating the data to the measurement performance criteria in Section A7 of this QAPP. Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling procedures, and sample handling, were fulfilled. Acceptable departures from the planned sampling program, such as collecting a sample from an adjacent location because of a subsurface obstruction, will not impact the data usability.

Sample collection procedures will be reviewed for compliance with the requirements of the Site Work Plan(s) and QAPP. If alternate sampling procedures were used, the acceptability of the procedure will be evaluated to determine the effect on the usability of the data. Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in Section A7 of this QAPP. Acceptable alternate sampling procedures include collecting soil samples with a drill rig instead of a direct-push sampling device. However, data generated from sampling procedures that do not provide representative samples will be rejected.

Sample handling records will be reviewed to ensure that sample integrity remained intact from collection to laboratory receipt and that samples were properly preserved. COC documentation and sample condition upon laboratory receipt will be reviewed. The data from samples for which the COC or sample identification cannot be verified will be rejected. The data for samples that were not properly preserved will be qualified or rejected depending on the severity of the

deviation from the requirements of the Work Plan and QAPP. The criteria for rejecting improperly preserved samples will be that the sample has been rendered unsuitable for analysis. An example of this situation is preserving a water sample designated for cyanide analysis with acid. If minor pH adjustments are required at the laboratory to account for sample buffering affects, data qualification may be required. The criteria for qualifying or rejecting data for samples that are received at the laboratory without being properly preserved, but not rendered unsuitable for analysis, will be based on the sample holding time period evaluation criteria for unpreserved samples specified in the National Functional Guidelines. Data qualification will be consistent with the action specified in the National Functional Guidelines.

Field and laboratory data will be verified to ensure that the methods used to analyze the samples were consistent with the requirements of this QAPP. Data generated from the use of unapproved methods will be rejected.

QC data will be reviewed to determine compliance with the acceptance criteria in Section B5 of this QAPP. QC data that do not meet the acceptance criteria will result in sample data qualification. Significant departures from the QC acceptance criteria may result in rejected data. Situations that result in data rejection include samples analyzed beyond twice the technical holding time period, internal standard recoveries less than 10 percent for non-detected analytes quantitated with that internal standard, inorganic LCS analyte recoveries less than 50 percent if the analyte is not detected in the associated samples, and inorganic MS analyte recoveries less than 30 percent if the analyte is not detected in the associated sample set.

D2.1 Verification and Validation Methods

Field data will be verified by reviewing field documentation and COC records. The Laboratories will internally verify the laboratory data by reviewing and documenting sample receipt, sample preparation, sample analysis (including internal QC checks), data reduction and reporting. Any deviations from the acceptance criteria, corrective actions taken, and data determined to be of limited usability (i.e., laboratory-qualified data) will be noted in the case narrative of the laboratory report.

Data validation will be conducted by BB&E QA Manager consistent with the procedure

identified in Section D2 of this QAPP. The data verification/validation procedure will identify data as being acceptable, of limited usability (qualified as estimated), or rejected. The conditions that result in data being qualified as estimated or rejected are identified in Section D2 of this QAPP. The results of the data verification/validation will be provided in data validation memoranda that are provided to BB&E's QA Manager.

Data determined to be unusable may require that corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether the data are critical for project DQOs to be achieved. Should the BB&E QA Manager identify a situation requiring corrective action during data verification/validation, BB&E's Project Manager will be responsible for approving the implementation of the corrective action.

D2.2 Usability/Reconciliation with DQOs

The overall usability of the data for the Site investigation activities will be assessed by evaluating the PARCCS of the data set to the measurement performance criteria in Section A7 and the following sections of this QAPP using basic statistical quantities as applicable. The procedures and statistical formulas to be used for these evaluations are presented in the following subsections.

D2.3 Precision

Project precision will be evaluated by assessing the RPD data from field duplicate samples. Analytical precision will be evaluated by assessing the RPD data from either duplicate spiked sample analyses or duplicate sample analyses. The RPD between two measurements is calculated using the following simplified formula:

$$RPD = \frac{|R_1 - R_2|}{\left(\frac{R_1 + R_2}{2}\right)} \times 100$$

Where:

R1 = value of first result

R2 = value of second result

Overall precision for the sampling programs will be determined by calculating the mean RPD for all field duplicates in a given sampling program. This will provide an evaluation of the overall variability attributable to the sampling procedure, sample matrix, and laboratory procedures in each sampling program. All analytical acceptance criteria are contained in the laboratory SOPs in Attachment B.

The overall precision requirement will be the same as the project precision. It should be noted that the RPD of two measurements can be very high when the data approach the quantitation limit of an analysis. The calculation of the mean RPD will only include the RPD values for field duplicate sample analyte data that are greater than or equal to 5 times the quantitation limit for an analysis.

D2.4 Accuracy/Bias

The data from method/preparation equipment rinsate samples, field duplicate samples, MS/MSD samples, and LCSs will be used to determine accuracy and potential bias of the sample data.

The data from method/preparation blank samples provide an indication of laboratory contamination that may result in bias of sample data. Sample data associated with method/preparation blank contamination will have been identified during the data verification/validation process. Sample data associated with method/preparation blank contamination are evaluated during data validation procedure to determine if analytes detected in the samples and the associated method/preparation blanks are "real" or are the result of laboratory contamination. The procedure for this evaluation involves comparing the concentration of the analyte in the sample to the concentration in the method/preparation blank taking into account adjustments for sample dilutions and dry-weight reporting. In general, the sample data are qualified as not detected if the sample concentration is less than 5 times (10 times for common laboratory contaminants) the method/preparation blank concentration. Typically, the quantitation limit for the affected analyte is elevated to the concentration detected in the sample.

The %R data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

MS sample data provide information regarding the accuracy/bias of the analytical methods relative to the sample matrix. MS samples are field samples that have been fortified with target analytes prior to sample preparation and analysis. The %R data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

Analytical accuracy/bias will be determined by evaluating the %R data of LCSs. LCSs are artificial samples prepared in the laboratory using a blank matrix that is fortified with analytes from a SRM that is independent of the calibration standards. LCSs are prepared and analyzed in the same manner as the field samples. The data from LCS analyses will provide an indication of the accuracy and bias of the analytical method for each target analyte.

%R is calculated using the following formula:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

SSR = Spiked Sample Result
SR = Sample Result or Background
SA = Spike Added

The %R of LCSs is determined by dividing the measured value by the true value and multiplying by 100.

Overall accuracy/bias for the sampling events will be determined by calculating the percent of accuracy measurements that meet the measurement performance criteria in overall accuracy criteria discussed later in this section of this QAPP. Overall accuracy will be considered acceptable if the LCS percent recoveries are met for all the samples and the MS/MSD percent

recoveries are met for at least 75 percent of the samples. All analytical acceptance criteria are contained in the laboratory SOPs in Attachment B.

D2.5 Sample Representativeness

Representativeness of the samples will be assessed by reviewing the results of field audits and the data from field duplicate samples. Overall sample representativeness will be determined by calculating the percent of field duplicate sample data that achieved the RPD criteria specified in Section A7.2 of this QAPP. Overall sample representativeness will be considered acceptable if the results of field audits indicate that the approve sampling methods or alternate acceptable sampling methods were used to collect the samples and the field duplicate RPD data are acceptable for at least 75 percent of the samples.

D2.6 Completeness

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\%\ Completeness = \frac{Number\ of\ Valid\ (usable)\ measurements}{Number\ of\ Measurements\ Planned} \times 100$$

Overall completeness will be assessed by calculating the mean percent completeness for the entire set of data obtained for each sampling program. The overall completeness for the soil investigation will be calculated when all sampling and analysis is concluded. Overall completeness will be considered acceptable if at least 90 percent of the data are determined to be valid. All analytical acceptance criteria are contained in the laboratory SOPs in Attachment B.

D2.7 Comparability

Split samples are not anticipated and will not be performed during the Collis site soil investigation. Comparability data sets will not be evaluated and analyzed since no split samples will be performed. No data validation or data verification will be performed for split samples since they will not be performed.

D2.8 Sensitivity and Quantitation Limits

The quantitation limits for the sample data will be reviewed to ensure that the sensitivity of the analyses was sufficient to achieve the generic clean-up criteria for the soil investigation. The method/preparation blank sample data and LCSs %R data will be reviewed to assess compliance with the measurement performance criteria specified in the laboratory SOPs. If analytical results MDLs are greater than the USEPA RSL Tables additional laboratory analysis may be required. If laboratory analysis cannot provide quantitation below USEPA RSL Table values, another laboratory may be required to provide another round of analyses to verify sensitivity compliance. All analytical acceptance criteria are contained in the laboratory SOPs in Attachment B.

Overall sensitivity will be assessed by comparing the sensitivity for each monitoring program (i.e., soil investigation/verification) to the detectability requirements for the analyses. The overall sensitivity for the soil investigation will be assessed when all sampling and analysis is concluded. The overall sensitivity will be assessed at the conclusion of the monitoring event. Overall sensitivity will be considered acceptable if quantitation limits for the samples are less than the applicable evaluation criteria.

It should be noted that quantitation limits may be elevated as a result of high concentrations of target compounds, non-target compounds, and matrix interferences (collectively known as sample matrix effects). In these cases, the sensitivity of the analyses will be evaluated on an individual sample basis relative to the applicable evaluation criteria. The need to investigate the use of alternate analytical methods may be required if the sensitivity of the analytical methods identified in this QAPP cannot achieve the evaluation criteria as a result of sample matrix effects.

D2.9 Data Limitations and Actions

Data use limitations will be identified in data quality assessment reports. Data that do not meet the measurement performance criteria specified in this QAPP will be identified and the impact on the project quality objectives will be assessed and discussed in these reports. Specific actions for data that do not meet the measurement performance criteria depends on the use of the data, and may require that additional samples are collected or the use of the data be restricted.

Data quality assessment reports will be prepared at the conclusion of each sampling event. Determination of the overall data quality for a specific sampling program will be conducted at the completion of the program. Data quality assessment reports will be included with the project reports identified in the Work Plan.

D3. RECONCILIATION WITH USER REQUIREMENTS

An evaluation of the analytical results will be conducted by the BB&E project manager and QA manager. The analytical results received from the Laboratory(ies) for the shallow soil samples at Collis will be compared to the USEPA RSLs Industrial Soil November 2012 Tables. The results of the analytical report (including analyte exceedances, detections, and non-detections) will be summarized in the Sampling Final Report. The Sampling Final Report will summarize all samples collected, information obtained, and laboratory data provided.

The laboratory shall be instructed to hold samples designated as background pending the results of the shallow soil samples collected under the Sampling Work Plan. Should the results of the shallow soil samples collected under the Sampling Work Plan be below USEPA RSLs Industrial Soil November 2012 Tables for metals in industrial soils then no background samples will be required for analysis. Should any analyte(s) exhibit a concentration greater than RSLs for metals in industrial soils then all background samples will be analyzed for those analytes and evaluated statistically using ProUCL.

If any exceedances are detected above Collis site-specific metals background concentrations and above USEPA RSLs Industrial Soil November 2012 Tables, additional recommendations will be included in the Sampling Final Report submitted to the USEPA after the focused soil investigation. Examples of recommendations would include: additional sampling, removal of soils, etc. If any associated analytes are identified to be below USEPA's RSLs Industrial Soil Table November 2012, the CSA investigated will be identified as not impacted by the associated analytes.

E0. REFERENCES

ALS Laboratory [ALS] 2012a. "Metals By ICP-MS", Standard Operating Procedure HN-MET-008-R05, EPA 200.8 R5.5/SW846 6020A, July 2012.

ALS 2012b. "Mercury – Solid", Standard Operating Procedures HN-MET-006-R05, SW846 7471B, July 2012.

ANSI/ASQC E4-1994 "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs", ANSI/ASQC E4-1994, January 1995.

Collis Inc. RCRA Facility Investigation. January 2008.

EPA 540/R-93/051 "Specifications and Guidance for Contaminant-Free Sample Containers", EPA 540/R-93/051, 1993.

EPA QA/G-5 "EPA Guidance for Quality Assurance Project Plans", EPA QA/G-5, December 2002.

EPA QA/R-5 "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001.

EPA SW-846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA SW-846, 3rd Edition with Updates I through III, November 1986.

USEPA-540-R-10-011 "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review", USEPA-540-R-10-011, January 2010.

"Sampling Work Plan for Focused Soil Investigation – Collis Manufacturing Facility", February 2013.

SESCPROC-300-R2 "EPA Soil Sampling Operating Procedure", USEPA Region IV, Science and Ecosystem Support Division, December 2011.

TABLES

TABLE 1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
COLLIS SSW
CLINTON, IOWA

Management Units	Number of Discrete Soil Samples (per boring)	Analytes	Total Number of Proposed Samples	QA Samples			Total Number of Samples Per Unit
				MS/MSD (1 per 20)	Field Duplicate (1 per 10)	Equipment Rinsate Blank (1 per 10)	
Container Storage Area (concrete to grassy transition area)[1]							
SSW - SB - CSA - 01	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 02	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 03	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 04	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 05	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 06	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 07	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 08	1	RCRA 8 Metals, Mercury	8				1
Container Storage Area (underneath concrete pavement)[1]							
SSW - SB - CSA - 09	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 10	1	RCRA 8 Metals, Mercury		1	1	1	4
SSW - SB - CSA - 11	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 12	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 13	1	RCRA 8 Metals, Mercury					1
SSW - SB - CSA - 14	1	RCRA 8 Metals, Mercury	6				1
Background Locations[2]							
SSW - SB - BKGD - 1	1	RCRA 8 Metals, Mercury					1
SSW - SB - BKGD - 2	1	RCRA 8 Metals, Mercury					1
SSW - SB - BKGD - 3	1	RCRA 8 Metals, Mercury					1
SSW - SB - BKGD - 4	1	RCRA 8 Metals, Mercury					1
SSW - SB - BKGD - 5	1	RCRA 8 Metals, Mercury					1
SSW - SB - BKGD - 6	1	RCRA 8 Metals, Mercury		1	1	1	4
SSW - SB - BKGD - 7	1	RCRA 8 Metals, Mercury	7				1

Notes:

1 - The total number of samples collected will be determined during the soil sampling event after the initial on-site walkthrough has been completed by the sampling team, with approval from the BB&E project manager and with assistance and concurrence from the USEPA Region VII Project Manager

2 - Background soil samples will only be analyzed for the purpose of determining site-specific background concentrations for metals, as necessary. Should the results of the shallow soil samples collected be below RSLs for metals in industrial soils then no background samples will be required for analysis. Should any analyte(s) exhibit a concentration greater than RSLs for metals in industrial soils then background samples will be analyzed for those analytes.

3 - Soil locations associated with soil sampling labels will be decided by field personnel at the site.

BKGD - background
CSA - container storage area
MS/MSD - matrix spike/matrix spike duplicate
RCRA - Resource Conservation and Recovery Act
SB - soil boring
SSW - Strait, Steel, and Wire Holding Company

TABLE 2

SOIL TARGET LABORATORY PARAMETERS
COLLIS SSW
CLINTON, IOWA

Sample Matrix	Analytes	Analytical Method	Analytical Equipment Utilized	Laboratory Preparation SOP	Current Method Detection Limits	Sample Container	Sample Preservative	Field Hold Time[3]	Laboratory Hold Time	Laboratory
Soil	RCRA 8 Metals[1,2]	USEPA Method SW-846 6020A	ICP-MS	HN-MET-008-R05	ALS Laboratory SOP HN-MET-008-R05, Effective 07/01/2012	Plastic jar 4 oz	< 4° C	48 hours	6 months	ALS Holland
	Mercury[2]	USEPA Method SW-846 7471B	CVAAS	MET-7471-R16	ALS Laboratory SOP MET-7471-R16, Effective 01/31/2013	Glass jar 8 oz	< 4° C	48 hours	28 days	ALS Kelso
Water	RCRA 8 Metals[1,4]	USEPA Method SW-846 6020A	ICP-MS	HN-MET-008-R05	ALS Laboratory SOP HN-MET-008-R05, Effective 07/01/2012	Plastic jar 4 oz	HCL	48 hours	6 months	ALS Holland

Notes:
1 - RCRA 8 Metals - arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
2 - Total fraction of analyte
3 - Field hold time is the maximum sample will be held onsite prior to delivery to the laboratory
4 - Only analysis run on equipment rinsate blank

ALS - ALS Laboratories
° C - degrees Celsius
CVAAS - cold vapor atomic absorption spectrometry
ICP-MS - inductively coupled plasma-mass spectrometry
RCRA - Resource Conservation and Recovery Act
SOP - standard operating procedures
SW - solid waste
USEPA - United States Environmental Protection Agency

TABLE 3

DATA QUALITY OBJECTIVES
COLLIS SSW
CLINTON, IOWA

Matrix	Project Objectives	Specific Objectives	Task(s)	Field Measurements	Laboratory Measurements
Soil	Identify any COCs within soil matrix	1 - Develop sampling regime	Evaluate historical information to determine where additional data points are required	None	None
		2 - Hand auger shallow soil sampling	Collect soil samples from interval exhibiting highest degree of impact, the soil samples near the ground surface will be submitted for analysis	Visual observations	See Table 3
		3 - Compare sample analytical results to cleanup criteria	Compare sample analytical results to cleanup criteria (USEPA Regional Screening Levels Industrial Soil November 2012)	None	None

COC - contaminants of concern

TABLE 4

ALS METHOD DETECTION LIMITS (MDL), REPORTING LIMITS (RL) AND ACCEPTABILITY CRITERIA
COLLIS SSW
CLINTON, IOWA

	Metals by 6020A In Soil (mg/Kg)				
			Accuracy		*Precision*
Analyte	**MDL**	**RL**	**Lower Contol Limit %**	**Upper Control Limit %**	**RPD %**
Arsenic	0.03	0.25	80	120	20
Barium	0.009	0.25	80	120	20
Cadmium	0.001	0.1	80	120	20
Chromium	0.007	0.25	80	120	20
Lead, Total	0.001	0.25	80	120	20
Selenium	0.018	0.25	80	120	20
Silver	0.001	0.25	80	120	20

	Mercury by 7471B Soil (mg/Kg)				
			Accuracy		*Precision*
Analyte	**MDL**	**RL**	**Lower Contol Limit %**	**Upper Control Limit %**	**RPD %**
Mercury	0.002	0.02	71	128	20

ATTACHMENTS

ATTACHMENT A

COLLIS FIGURES

Attachment A – List of Figures:

Figure 1 – Site Location Map
Figure 2 – Site Features Map
Figure 3 – Sample Location Map
Figure 4 – Proposed Background Sample Locations Map
Figure 5 – Solid Waste Management Unit Site Features Map

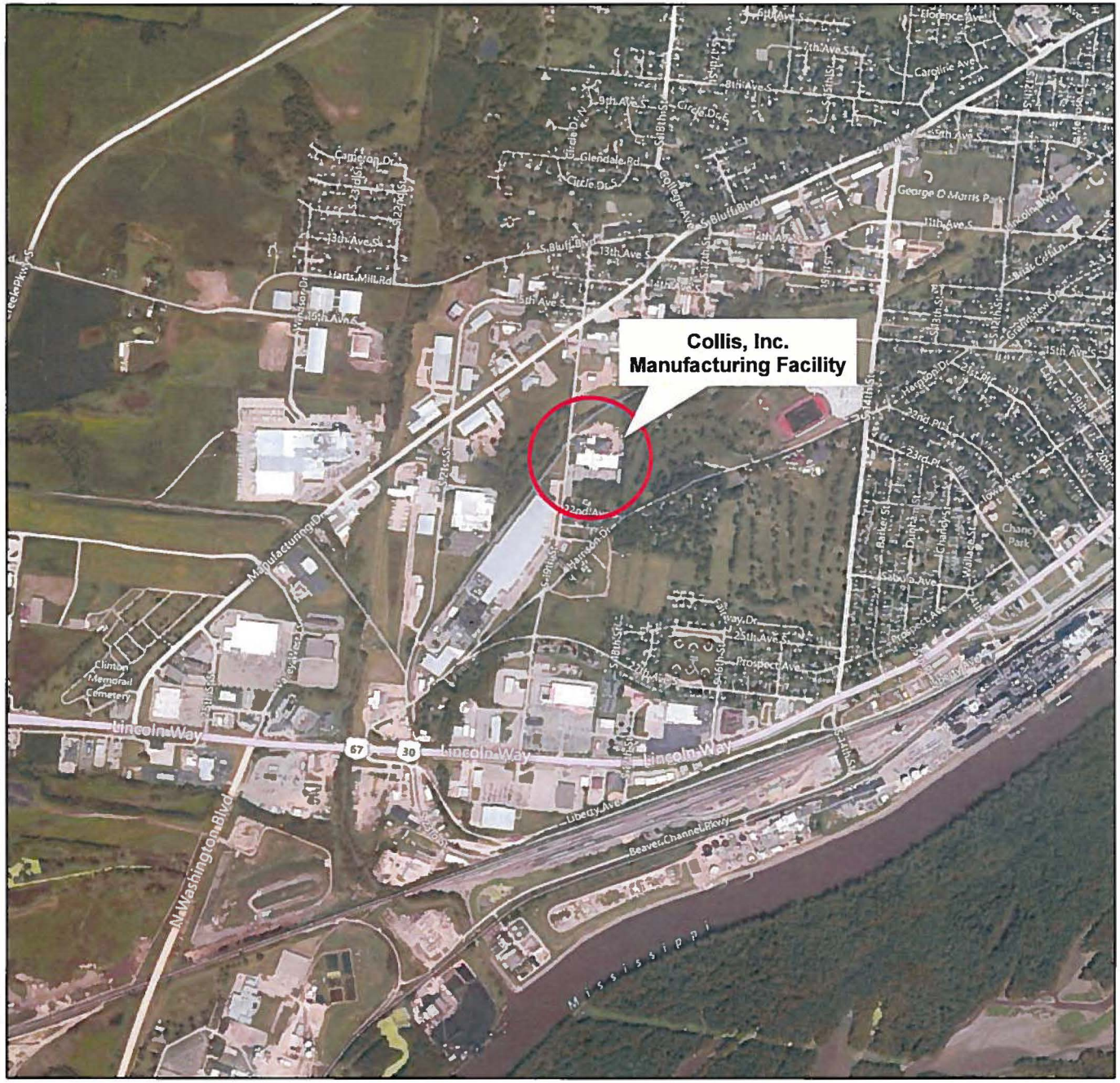


FIGURE 1

Site Location Map

Collis, Inc. Manufacturing Facility
Clinton, Iowa

BB&E

JMP - 04/12/2012

FIGURE 2

Site Features Map

Collis, Inc. Manufacturing Facility
Clinton, Iowa

Legend:

- Monitoring Well/Piezometer Location (Sampled During this Quarter)
- Monitoring Well/Piezometer Location (Not Sampled During this Quarter)
- Staff Gauge Location
- Manufacturer's Ditch
- Property Boundary (Approximate)

NORTH

0 100 200
Feet

BB&E

JMP - 12/19/2012

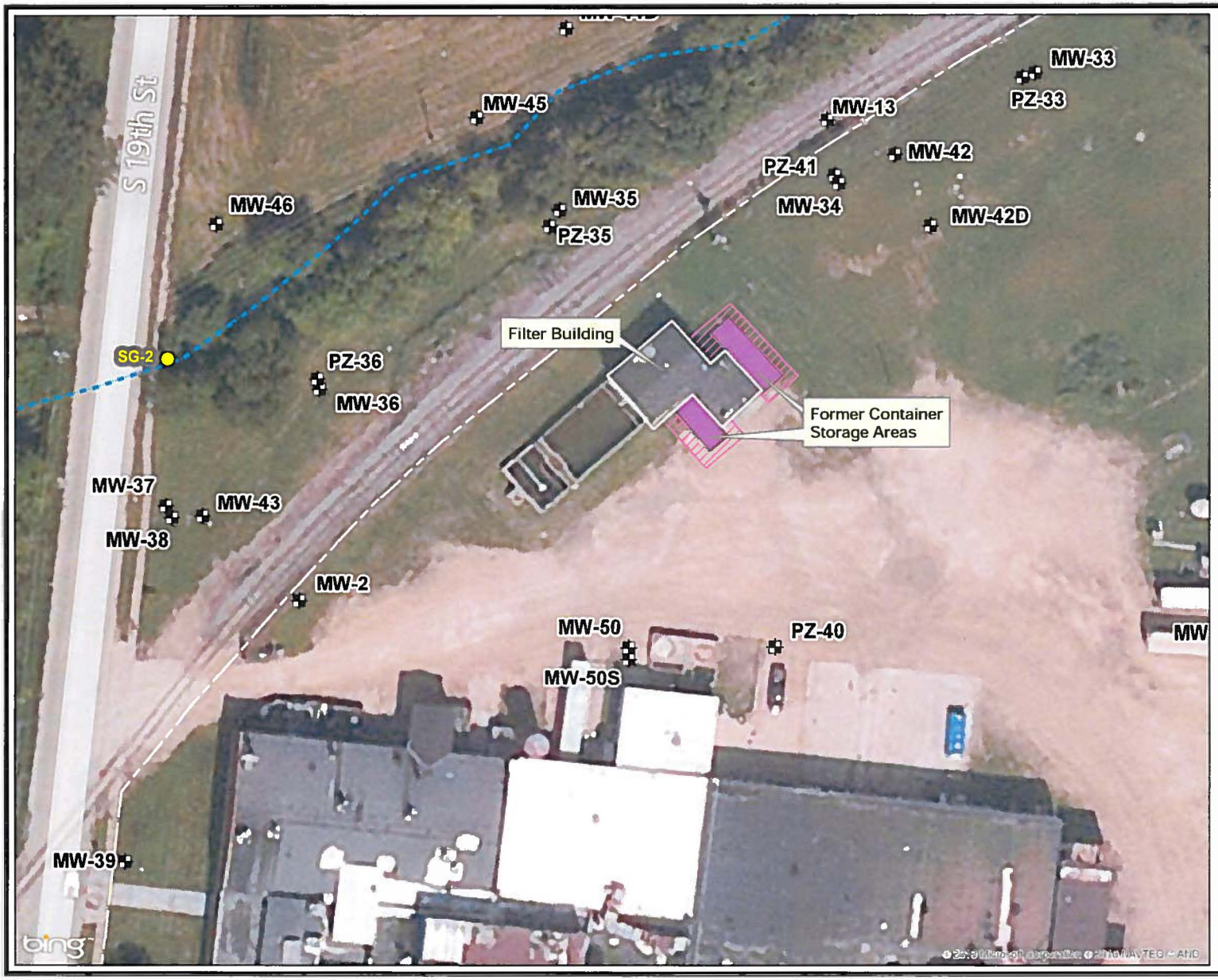


FIGURE 3

Sample Location Map

Limited Shallow
Soil Investigation

Collis, Inc. Manufacturing Facility
Clinton, Iowa

Legend:

- Monitoring Well/Piezometer Location
- Staff Gauge Location
- Concrete Pad - Former Storage Area (Note 1)
- Proposed Soil Boring Areas (Note 2)
- Manufacturer's Ditch
- Property Boundary (Approximate)

NOTE:

1. Actual sample locations and number beneath the concrete areas will be determined during the Pre- Soil Investigation Assessment based on potential migration through cracks.

2. Number and location of soil borings will be determined during the Pre- Soil Investigation Assessment based on potential migration via runoff.

NORTH

0 50 100
Feet

BB&E

JMP - 02/05/2013

FIGURE 4

Proposed Background Sample Locations

Collis, Inc. Manufacturing Facility
Clinton, Iowa

Legend

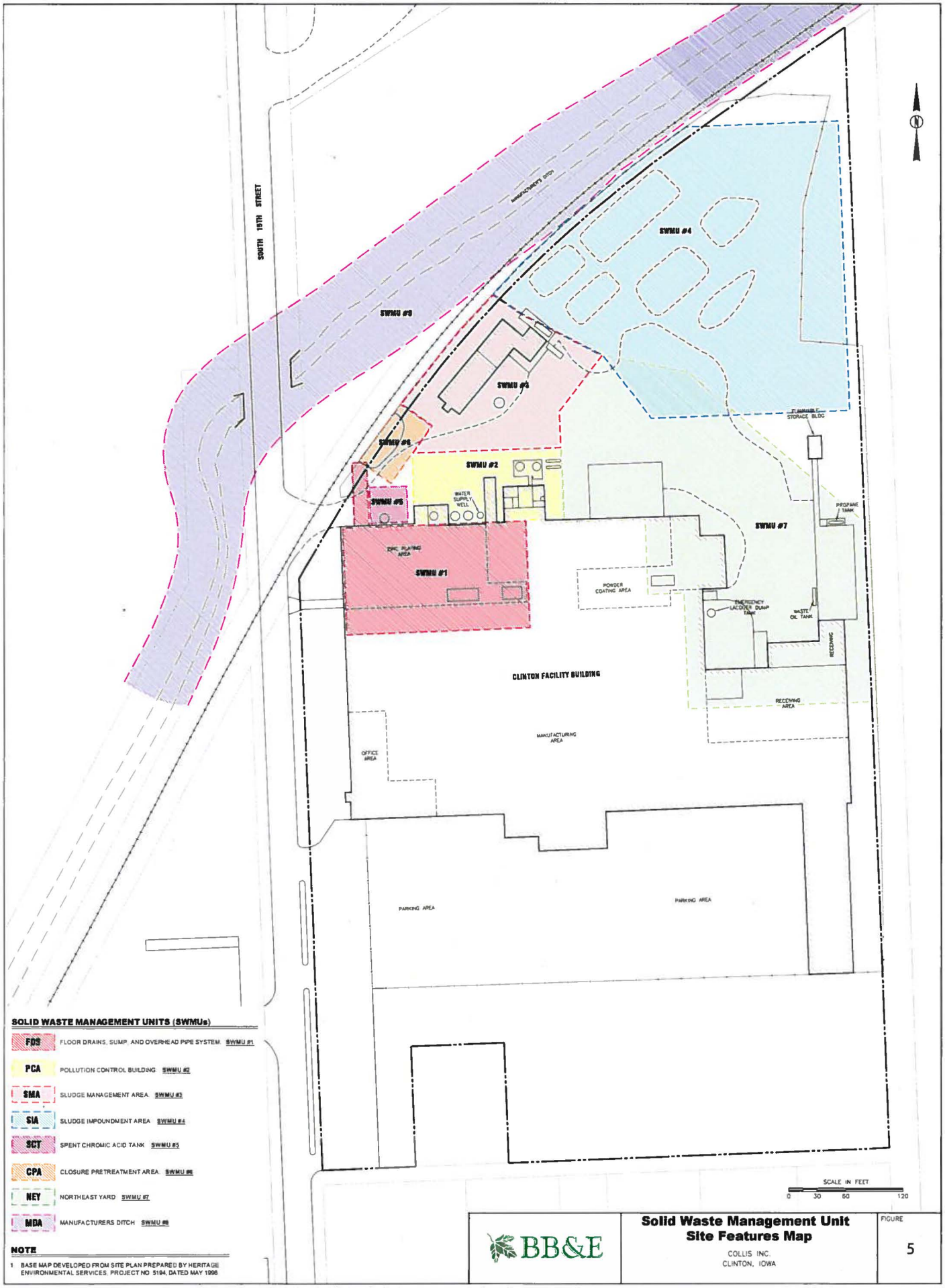
- Proposed Background Sample Locations
- Property Boundary

NORTH

0 150 300
Feet

BB&E

JMP - 01/28/2013



SOLID WASTE MANAGEMENT UNITS (SWMUs)

- FDS — FLOOR DRAINS, SUMP, AND OVERHEAD PIPE SYSTEM SWMU #1
- PCA — POLLUTION CONTROL BUILDING SWMU #2
- SMA — SLUDGE MANAGEMENT AREA SWMU #3
- SIA — SLUDGE IMPOUNDMENT AREA SWMU #4
- SCT — SPENT CHROMIC ACID TANK SWMU #5
- CPA — CLOSURE PRETREATMENT AREA SWMU #6
- NEY — NORTHEAST YARD SWMU #7
- MDA — MANUFACTURERS DITCH SWMU #8

NOTE

1 BASE MAP DEVELOPED FROM SITE PLAN PREPARED BY HERITAGE ENVIRONMENTAL SERVICES, PROJECT NO 5194, DATED MAY 1996

BB&E

Solid Waste Management Unit Site Features Map

COLLIS INC.
CLINTON, IOWA

FIGURE 5

Base Map obtained from the 2010 Resource Conservation and Recovery Act (RCRA) Final Facility Investigation Report prepared by St. John-Mittelhauser & Associates, Inc.

ATTACHMENT B

SOPS

Attachment B – SOPs:

BB&E:
EPA Soil Sampling Operating Procedure, EPA Science and Ecosystem Support Division, December 2011.

ALS Laboratory Holland

HN-MET-008-R05	Analysis of Metals Using ICP-MS (EPA 200.9 R5.5/SW846 6020A), 07/01/2012

ALS Laboratory Washington

MET-7471-R16	Mercury in Solid or Semisolid Waste (EPA SW846 7471A/B), 01/31/2013

COPY

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Soil Sampling**

Effective Date: December 20, 2011 | **Number:** SESDPROC-300-R2

Authors

Name: Fred Sloan
Title: Environmental Engineer, Regional Expert
Signature: [signature] Date: 12/19/2011

Approvals

Name: Archie Lee
Title: Chief, Enforcement and Investigations Branch
Signature: [signature] Date: 12/19/11

Name: Bobby Lewis
Title: Field Quality Manager, Science and Ecosystem Support Division
Signature: [signature] Date: 12/19/11

COPY

Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Document Control Coordinator.

History	Effective Date
SESDPROC-300-R2, *Soil Sampling*, replaces SESDPROC-300-R1. **General:** Corrected any typographical, grammatical and/or editorial errors. **Title Page:** Updated the Enforcement and Investigations Branch Chief to Archie Lee, and the Field Quality Manager to Bobby Lewis. **Revision History:** On the third sentence, replaced Field Quality Manager with Document Control Coordinator. **Section 1.2:** Added the following statement: Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use. **Section 1.3:** Revised the last sentence to reflect that the official copy of this procedure resides on the SESD local area network (LAN), and that the Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the LAN. **Section 1.4:** Unused references removed. Reference to Method 5035 added. Alphabetized. **Section 1.5.2:** Added bullets #8 and #9. (Bullet #8 – Discussion of sampling in landscaped areas. Bullet #9 – Discussion of sampling in non-landscaped areas.) **Section 2:** The discussion of Method 5035 has been moved to its own Section (Section 3) for clarity. Subsequent Sections were re-numbered. **Section 4.1:** Added paragraphs #2 and #3. (The information on these paragraphs originally appeared as bullets #2 and #3 in Section 4.2.1.) In addition, determining the initial sampling depth is now defined in paragraph #2. **Section 4.2.1:** As mentioned above, deleted bullets #2 and #3 from this Section and moved this information to paragraphs #2 and #3 in Section 4.1. **Section 5.1:** On paragraph #1, rewrote sentences #2 and #3 for clarity. Added the last sentence. Added paragraph #2.	December 20, 2011

Section 5.3: Rewrote the last sentence in the paragraph to clarify that, "although the Macro-Core® sampler can be used as an open-barrel sampler, in SESD usage, the piston point is always used to prevent the collection of slough from the borehole sides." **Section 5.5:** Rewrote bullet #1 to clarify acceptable materials for liners. Rewrote bullet #3 (Core Catchers) to clarify that, given the limited sample contact that core-catchers have with the sample material, most standard core-catchers available for a tool system will be acceptable. Added bullets #4 (Decontamination) and #5 (Decommissioning). **Section 6.1:** Added paragraph #2 to this section. (Determining the initial sampling depth is now defined.) **Section 7.1:** Added paragraph #2 to this section. (Determining the initial sampling depth is now defined.) **Section 8.1:** Added paragraph #2 to this section. (Determining the initial sampling depth is now defined.)	
SESDPROC-300-R1, *Soil Sampling*, replaces SESDPROC-300-R0. **General** Corrected any typographical, grammatical and/or editorial errors. **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. **Section 1.3** Updated information to reflect that the procedure is located on the H: drive of the LAN. Clarified Field Quality Manager (FQM) responsibilities. **Section 1.4** Updated referenced operating procedures due to changes in title names. Alphabetized and revised the referencing style for consistency. **Section 1.5.1** Corrected the title of the Safety, Health, and Environmental Management Program Procedures and Policy Manual. **Section 1.5.2, 4th bullet** Added references to the CFR and IATA's Dangerous Goods Regulations. **Section 2.7** Updated referenced operating procedures due to changes in title names.	November 1, 2007
SESDPROC-300-R0, Soil Sampling, Original Issue	February 05, 2007

COPY

TABLE OF CONTENTS

TABLES

1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting soil samples for field screening or laboratory analysis.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling soil samples in the field. On the occasion that SESD field personnel determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to obtain a soil sample, the variant procedure will be documented in the field logbook and subsequent investigation report, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on the LAN, and for maintaining records of review conducted prior to its issuance.

1.4 References

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version

SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

SESD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC, SESDPROC-206, Most Recent Version

SESD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

SESD Operating Procedure for Field X-Ray Fluorescence (XRF) Measurement, SESDPROC-107, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

Title 49 Code of Federal Regulations, Pts. 171 to 179, Most Recent Version

US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846, Most Recent Version (Method 5035)

US EPA. Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when collecting soil samples. Refer to the SESD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASP) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.5.2 Procedural Precautions

The following precautions should be considered when collecting soil samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.

- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader in the project files.
- Sampling in landscaped areas: When sampling in landscaped areas, cuttings should be placed on plastic sheeting and returned to the borehole upon completion of the sample collection. Any 'turf plug' generated during the sampling process should be returned to the borehole.
- Sampling in non-landscaped areas: Return any unused sample material back to the auger, drill or push hole from which the sample was collected.

2 Special Sampling Considerations

2.1 Special Precautions for Trace Contaminant Soil Sampling

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different sample is collected and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Sample containers for samples suspected of containing high concentrations of contaminants shall be collected, handled and stored separately.
- All background samples shall be segregated from obvious high-concentration or waste samples. Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area. Samples of waste or highly-contaminated media must not be placed in the same ice chest as environmental (i.e., containing low contaminant levels) or background samples.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out tags, etc., while the other member(s) collect the samples.
- Samplers must use new, verified/certified-clean disposable or non-disposable equipment cleaned according to procedures contained in the SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205), for collection of samples for trace metals or organic compound analyses.

2.2 Sample Homogenization

1. If sub-sampling of the primary sample is to be performed in the laboratory, transfer the entire primary sample directly into an appropriate, labeled sample container(s). Proceed to step 4.

2. If sub-sampling the primary sample in the field or compositing multiple primary samples in the field, place the sample into a glass or stainless steel homogenization container and mix thoroughly. Each aliquot of a composite sample should be of the same approximate volume.

3. All soil samples must be thoroughly mixed to ensure that the sample is as representative as possible of the sample media. ***Samples for VOC analysis are not homogenized.*** The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

- The material in the sample pan should be divided into quarters and each quarter should be mixed individually.
- Two quarters should then be mixed to form halves.
- The two halves should be mixed to form a homogenous matrix.

  This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

4. Place the sample into an appropriate, labeled container(s) by using the alternate shoveling method and secure the cap(s) tightly. The alternate shoveling method involves placing a spoonful of soil in each container in sequence and repeating until the containers are full or the sample volume has been exhausted. Threads on the container and lid should be cleaned to ensure a tight seal when closed.

2.3 Dressing Soil Surfaces

Any time a vertical or near vertical surface is sampled, such as achieved when shovels or similar devices are used for subsurface sampling, the surface should be dressed (scraped) to remove smeared soil. This is necessary to minimize the effects of contaminant migration interferences due to smearing of material from other levels.

2.4 Quality Control

If possible, a control sample should be collected from an area not affected by the possible contaminants of concern and submitted with the other samples. This control sample should be collected as close to the sampled area as possible and from the same soil type. Equipment blanks should be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by sampling tools. SESD Operating Procedure for Field Sampling Quality Control (SESDPROC-011) contains other procedures that may be applicable to soil sampling investigations.

2.5 Records

Field notes, recorded in a bound field logbook, will be generated, as well as chain-of-custody documentation, as described in the SESD Operating Procedure for Logbooks (SESDPROC-010) and the SESD Operating Procedure for Sample and Evidence Management (SESDPROC-005).

3 Method 5035

The procedures outlined here are summarized from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846, Method 5035.*

3.1 Soil Samples for Volatile Organic Compounds (VOC) Analysis

If samples are to be analyzed for volatile organic compounds, they should be collected in a manner that minimizes disturbance of the sample. For example, when sampling with an auger bucket, the sample for VOC analysis should be collected directly from the auger bucket (preferred) or from minimally disturbed material immediately after an auger bucket is emptied into the pan. The sample shall be containerized by filling an En Core® Sampler or other Method 5035 compatible container. ***Samples for VOC analysis are not homogenized.*** Preservatives may be required for some samples with certain variations of Method 5035. Consult the method or the principal analytical chemist to determine if preservatives are necessary.

3.2 Soil Sampling (Method 5035)

The following sampling protocol is recommended for site investigators assessing the extent of volatile organic compounds (VOCs) in soils at a project site. Because of the large number of options available, careful coordination between field and laboratory personnel is needed. The specific sampling containers and sampling tools required will depend upon the detection levels and intended data use. Once this information has been established, selection of the appropriate sampling procedure and preservation method best applicable to the investigation can be made.

3.2.1 Equipment

Soil for VOC analyses may be retrieved using any of the SESD soil sampling methods described in Sections 4 through 8 of this procedure. Once the soil has been obtained, the En Core® Sampler, syringes, stainless steel spatula, standard 2-oz. soil VOC container, or pre-prepared 40 mL vials may be used/required for sub-sampling. The specific sample containers and the sampling tools required will depend upon the data quality objectives established for the site or sampling investigation. The various sub-sampling methods are described below.

3.2.2 Sampling Methodology - Low Concentrations (<200 µg/kg)

When the total VOC concentration in the soil is expected to be less than 200 µg/kg, the samples may be collected directly with the En Core® Sampler or syringe. If using the syringes, the sample must be placed in the sample container (40 mL pre-prepared vial) immediately to reduce volatilization losses. The 40 mL

vials should contain 10 mL of organic-free water for an un-preserved sample or approximately 10 mL of organic-free water and a preservative. It is recommended that the 40 mL vials be prepared and weighed by the laboratory (commercial sources are available which supply preserved and tared vials). When sampling directly with the En Core® Sampler, the vial must be immediately capped and locked.

A soil sample for VOC analysis may also be collected with conventional sampling equipment. A sample collected in this fashion must either be placed in the final sample container (En Core® Sampler or 40 mL pre-prepared vial) immediately or the sample may be immediately placed into an intermediate sample container with no head space. If an intermediate container (usually 2-oz. soil jar) is used, the sample must be transferred to the final sample container (En Core® Sampler or 40 mL pre-prepared vial) as soon as possible, not to exceed 30 minutes.

NOTE: After collection of the sample into either the En Core® Sampler or other container, the sample must immediately be stored in an ice chest and cooled.

Soil samples may be prepared for shipping and analysis as follows:

En Core® Sampler - the sample shall be capped, locked, and secured in the original foil bag. All foil bags containing En Core® samplers are then placed in a plastic bag and sealed with custody tape, if required.

Syringe - Add about 3.7 cc (approximately 5 grams) of sample material to 40-mL pre-prepared containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag. Note: When using the syringes, it is important that no air is allowed to become trapped behind the sample prior to extrusion, as this will adversely affect the sample.

Stainless Steel Laboratory Spatulas - Add between 4.5 and 5.5 grams (approximate) of sample material to 40 mL containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag.

3.2.3 Sampling Methodology - High Concentrations (>200 µg/kg)

Based upon the data quality objectives and the detection level requirements, this high level method may also be used. Specifically, the sample may be packed into a single 2-oz. glass container with a screw cap and septum seal. The sample container must be filled quickly and completely to eliminate head space. Soils\sediments containing high total VOC concentrations may also be collected as described in Section 3.2.2, Sampling Methodology - Low Concentrations, and preserved using 10 mL methanol.

3.2.4 Special Techniques and Considerations for Method 5035

Effervescence

If low concentration samples effervesce from contact with the acid preservative, then either a test for effervescence must be performed prior to sampling, or the investigators must be prepared to collect each sample both preserved or un-preserved, as needed, or all samples must be collected unpreserved.

To check for effervescence, collect a test sample and add to a pre-preserved vial. If preservation (acidification) of the sample results in effervescence (rapid formation of bubbles) then preservation by acidification is not acceptable, and the sample must be collected un-preserved.

If effervescence occurs and only pre-preserved sample vials are available, the preservative solution may be placed into an appropriate hazardous waste container and the vials triple rinsed with organic free water. An appropriate amount of organic free water, equal to the amount of preservative solution, should be placed into the vial. The sample may then be collected as an un-preserved sample. Note that the amount of organic free water placed into the vials will have to be accurately measured.

Sample Size

While this method is an improvement over earlier ones, field investigators must be aware of an inherent limitation. Because of the extremely small sample size and the lack of sample mixing, sample representativeness for VOCs may be reduced compared to samples with larger volumes collected for other constituents. The sampling design and objectives of the investigation should take this into consideration.

Holding Times

Sample holding times are specified in the Analytical Support Branch *Laboratory Operations and Quality Assurance Manual* (ASBLOQAM), Most Recent Version. Field investigators should note that the holding time for an un-preserved VOC soil/sediment sample on ice is 48 hours. Arrangements should be made to ship the soil/sediment VOC samples to the laboratory by overnight delivery the day they are collected so the laboratory may preserve and/or analyze the sample within 48 hours of collection.

Percent Moisture and Preservative Compatibility (MOICA)

Samplers must ensure that the laboratory has sufficient material to determine percent moisture in the VOC soil/sediment sample to correct the analytical results to dry weight. If other analyses requiring percent moisture determination are

being performed upon the sample, these results may be used. If not, a separate sample (minimum of 2 oz.) for percent moisture determination will be required. The sample collected for percent moisture may also be used by the laboratory to check for preservative compatibility.

Safety

Methanol is a toxic and flammable liquid. Therefore, methanol must be handled with all required safety precautions related to toxic and flammable liquids. Inhalation of methanol vapors must be avoided. Vials should be opened and closed quickly during the sample preservation procedure. Methanol must be handled in a ventilated area. Use protective gloves when handling the methanol vials. Store methanol away from sources of ignition such as extreme heat or open flames. The vials of methanol should be stored in a cooler with ice at all times.

Shipping

Methanol and sodium bisulfate are considered dangerous goods, therefore shipment of samples preserved with these materials by common carrier is regulated by the U.S. Department of Transportation and the International Air Transport Association (IATA). The rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179) and the current edition of the IATA Dangerous Goods Regulations must be followed when shipping methanol and sodium bisulfate. Consult the above documents or the carrier for additional information. Shipment of the quantities of methanol and sodium bisulfate used for sample preservation falls under the exemption for small quantities.

The summary table on the following page lists the options available for compliance with SW846 Method 5035. The advantages and disadvantages are noted for each option. SESD's goal is to minimize the use of hazardous material (methanol and sodium bisulfate) and minimize the generation of hazardous waste during sample collection.

Table 1: Method 5035 Summary

OPTION	PROCEDURE	ADVANTAGES	DISADVANTAGES
1	Collect two 40 mL vials with ≈ 5 grams of sample, and one 2 oz. glass jar w/septum lid for screening, % moisture and preservative compatibility.	Screening conducted by lab.	Presently a 48-hour holding time for unpreserved samples. Sample containers must be tared.
2	Collect three En Core® samplers, and one 2 oz. glass jar w/septum lid for screening, % moisture and preservative compatibility.	Lab conducts all preservation/preparation procedures.	Presently a 48- hour holding time for preparation of samples.
3	Collect two 40 mL vials with 5 grams of sample and preserve w/methanol or sodium bisulfate, and one 2-oz. glass jar w/septum lid for screening, % moisture and preservative compatibility.	High level VOC samples may be composited. Longer holding time.	Hazardous materials used in the field. Sample containers must be tared.
4	Collect one 2-oz. glass jar w/septum lid for analysis, % moisture and preservative compatibility (high level VOC only).	Lab conducts all preservation/preparation procedures.	May have significant VOC loss.

4 Manual Soil Sampling Methods

4.1 General

These methods are used primarily to collect surface and shallow subsurface soil samples. Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface. The most common interval is 0 to 6 inches; however, the data quality objectives of the investigation may dictate another interval, such as 0 to 3 inches for risk assessment purposes. The shallow subsurface interval may be considered to extend from approximately 12 inches below ground surface to a site-specific depth at which sample collection using manual collection methods becomes impractical.

If a thick, matted root zone, gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

When compositing, make sure that each composite location (aliquot) consist of equal volumes, i.e., same number of equal spoonfuls.

4.2 Spoons

Stainless steel spoons may be used for surface soil sampling to depths of approximately 6 inches below ground surface where conditions are generally soft and non-indurated, and there is no problematic vegetative layer to penetrate.

4.2.1 Special Considerations When Using Spoons

- When using stainless steel spoons, consideration must be given to the procedure used to collect the volatile organic compound sample. If the soil being sampled is cohesive and holds its in situ texture in the spoon, the En Core® Sampler or syringe used to collect the sub-sample for Method 5035 should be plugged directly from the spoon. If, however, the soil is not cohesive and crumbles when removed from the ground surface for sampling, consideration should be given to plugging the sample for Method 5035 directly from the ground surface at a depth appropriate for the investigation Data Quality Objectives.

4.3 Hand Augers

Hand augers may be used to advance boreholes and collect soil samples in the surface and shallow subsurface intervals. Typically, 4-inch stainless steel auger buckets with cutting heads are used. The bucket is advanced by simultaneously pushing and turning using an attached handle with extensions (if needed).

4.3.1 Surface Soil Sampling

When conducting surface soil sampling with hand augers, the auger buckets may be used with a handle alone or with a handle and extensions. The bucket is advanced to the appropriate depth and the contents are transferred to the homogenization container for processing. Observe precautions for volatile organic compound sample collection found in Section 3, Method 5035.

4.3.2 Subsurface Soil Sampling

Hand augers are the most common equipment used to collect shallow subsurface soil samples. Auger holes are advanced one bucket at a time until the sample depth is achieved. When the sample depth is reached, the bucket used to advance the hole is removed and a clean bucket is attached. The clean auger bucket is then placed in the hole and filled with soil to make up the sample and removed.

The practical depth of investigation using a hand auger depends upon the soil properties and depth of investigation. In sand, augering is usually easily performed, but the depth of collection is limited to the depth at which the sand begins to flow or collapse. Hand augers may also be of limited use in tight clays or cemented sands. In these soil types, the greater the depth attempted, the more difficult it is to recover a sample due to increased friction and torqueing of the hand auger extensions. At some point these problems become so severe that power equipment must be used.

4.3.3 Special Considerations for Soil Sampling with the Hand Auger

- Because of the tendency for the auger bucket to scrape material from the sides of the auger hole while being extracted, the top several inches of soil in the auger bucket should be discarded prior to placing the bucket contents in the homogenization container for processing.
- Observe precautions for volatile organic compound sample collection found in Section 3, Method 5035. Collect the VOC sample directly from the auger bucket, if possible.
- Power augers, such as the Little Beaver® and drill rigs may be used to advance boreholes to depths for subsurface soil sampling with the hand auger. They may not be used for sample collection. When power augers are used to advance a borehole to depth for sampling, care must be taken that exhaust fumes, gasoline and/or oil do not contaminate the borehole or area in the immediate vicinity of sampling.
- When moving to a new sampling location, the entire hand auger assembly must be replaced with a properly decontaminated hand auger assembly.

5 Direct Push Soil Sampling Methods

5.1 General

These methods are used primarily to collect shallow and deep subsurface soil samples. Three samplers are available for use within the Division's direct push tooling inventory. All of the sampling tools involve the collection and retrieval of the soil sample within a thin-walled liner. The following sections describe each of the specific sampling methods that can be accomplished using direct push techniques, along with details specific to each method. While SESD currently uses the sample tooling described, tooling of similar design and materials is acceptable.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

5.2 Large Bore® Soil Sampler

The Large Bore® (LB) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of depth-discrete subsurface soil samples. The sample barrel is approximately 30-inches (762 mm) long and has a 1.5-inch (38 mm) outside diameter. The LB® sampler is capable of recovering a discrete sample core 22 inches x 1.0 inch (559 mm x 25 mm) contained inside a removable liner. The resultant sample volume is a maximum of 283 mL.

After the LB® sample barrel is equipped with the cutting shoe and liner, the piston-rod point assembly is inserted, along with the drive head and piston stop assembly. The assembled sampler is driven to the desired sampling depth, at which time the piston stop pin is removed, freeing the push point. The LB® sampler is then pushed into the soil a distance equal to the length of the LB® sample barrel. The probe rod string, with the LB® sampler attached, is then removed from the subsurface. After retrieval, the LB® sampler is then removed from the probe rod string. The drive head is then removed to allow removal of the liner and soil sample.

5.3 Macro-Core® Soil Sampler

The Macro-Core® (MC) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of either continuous or depth-discrete subsurface soil samples. Although other lengths are available, the standard MC® sampler has an assembled length of approximately 52 inches (1321 mm) with an outside diameter of 2.2 inches (56 mm). The MC® sampler is capable of recovering a discrete sample core 45 inches x 1.5 inches (1143 mm x 38 mm) contained inside a removable liner. The resultant sample volume is a maximum of 1300 mL. The MC® sampler may be used in either an open-tube or closed-point configuration. Although the

MC® sampler can be used as an open-barrel sampler, in SESD usage, the piston point is always used to prevent the collection of slough from the borehole sides.

5.4 Dual Tube Soil Sampling System

The Dual Tube 21 soil sampling system is a direct push system for collecting continuous core samples of unconsolidated materials from within a sealed outer casing of 2.125-inch (54 mm) OD probe rod. The samples are collected within a liner that is threaded onto the leading end of a string of 1.0-inch diameter probe rod. Collected samples have a volume of up to 800 mL in the form of a 1.125-inch x 48-inch (29 mm x 1219 mm) core. Use of this method allows for collection of continuous core inside a cased hole, minimizing or preventing cross-contamination between different intervals during sample collection. The outer casing is advanced, one core length at a time, with only the inner probe rod and core being removed and replaced between samples. If the sampling zone of interest begins at some depth below ground surface, a solid drive tip must be used to drive the dual tube assembly and core to its initial sample depth.

5.5 Special Considerations When Using Direct Push Sampling Methods

- *Liner Use and Material Selection* – Direct Push Soil Samples are collected within a liner to facilitate removal of sample material from the sample barrel. The liners may only be available in a limited number of materials for a given sample tool, although overall, liners are available in brass, stainless steel, cellulose acetate butyrate (CAB), polyethylene terepthalate glycol (PETG), polyvinyl chloride (PVC) and Teflon®. For most SESD investigations, the standard polymer liner material for a sampling tool will be acceptable. When the study objectives require very low reporting levels or unusual contaminants of concern, the use of more inert liner materials such as Teflon® or stainless steel may be necessary.

- *Sample Orientation* – When the liners and associated sample are removed from the sample tubes, it is important to maintain the proper orientation of the sample. This is particularly important when multiple sample depths are collected from the same push. It is also important to maintain proper orientation to define precisely the depth at which an aliquot was collected. Maintaining proper orientation is typically accomplished using vinyl end caps. Convention is to place red caps on the top of the liner and black caps on the bottom to maintain proper sample orientation. Orientation can also be indicated by marking on the exterior of the liner with a permanent marker.

- *Core Catchers* – Occasionally the material being sampled lacks cohesiveness and is subject to crumbling and falling out of the sample liner. In cases such as these, the use of core catchers on the leading end of the sampler may help retain the sample until it is retrieved to the surface. Core catchers may only be available in specific materials and should be evaluated for suitability.

However, given the limited sample contact that core-catchers have with the sample material, most standard core-catchers available for a tool system will be acceptable.

- *Decontamination* – The cutting shoe and piston rod point are to be decontaminated between each sample, using the procedures specified for the collection of trace organic and inorganic compounds found in Field Equipment and Decontamination – SESDPROC-205, most recent version. Within a borehole, the sample barrel, rods, and drive head may be subjected to an abbreviated cleaning to remove obvious and loose material, but must be cleaned between boreholes using the procedures specified for downhole drilling equipment in Field Equipment and Decontamination – SESDPROC-205, most recent version.

- *Decommissioning* – Boreholes must be decommissioned after the completion of sampling. Boreholes less than 10 feet depth that remain open and do not approach the water table may be decommissioned by pouring 30% solids bentonite grout from the surface, or pouring bentonite pellets from the surface, hydrating the pellets in lifts. Boreholes deeper than 10 feet, or any borehole that intercepts groundwater, must be decommissioned by pressure grouting with 30% solids bentonite grout, either through a re-entry tool string or through tremie pipe introduced to within several feet of the borehole bottom.

- *VOC Sample Collection* – Observe precautions for volatile organic compound sample collection found in Section 3 of this procedure.

6 Split Spoon/Drill Rig Methods

6.1 General

Split spoon sampling methods are used primarily to collect shallow and deep subsurface soil samples. All split spoon samplers, regardless of size, are basically split cylindrical barrels that are threaded on each end. The leading end is held together with a beveled threaded collar that functions as a cutting shoe. The other end is held together with a threaded collar that serves as the sub used to attach the spoon to the string of drill rod. Two basic methods are available for use, including the smaller diameter standard split spoon, driven with the drill rig safety hammer, and the larger diameter continuous split spoon, advanced inside and slightly ahead of the lead auger during hollow stem auger drilling. The following sections describe each of the specific sampling methods, along with details specific to each method.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

6.2 Standard Split Spoon

A drill rig is used to advance a borehole to the target depth. The drill string is then removed and a standard split spoon is attached to a string of drill rod. Split spoons used for soil sampling must be constructed of stainless steel and are typically 2.0-inches OD (1.5-inches ID) and 18-inches to 24-inches in length. Other diameters and lengths are common and may be used if constructed of the proper material. After the spoon is attached to the string of drill rod, it is lowered into the borehole. The safety hammer is then used to drive the split spoon into the soil at the bottom of the borehole. After the split spoon has been driven into the soil, filling the spoon, it is retrieved to the surface, where it is removed from the drill rod string and opened for sample acquisition.

6.3 Continuous Split Spoon

The continuous split spoon is a large diameter split spoon that is advanced into the soil column inside a hollow stem auger. Continuous split spoons are typically 3 to 5 inches in diameter and either 5 feet or 10 feet in length, although the 5-foot long samplers are most common. After the auger string has been advanced into the soil column a distance equal to the length of the sampler being used it is returned to the surface. The sampler is removed from inside the hollow stem auger and the threaded collars are removed. The split spoon is then opened for sampling.

6.4 Special Considerations When Using Split Spoon Sampling Methods

- Always discard the top several inches of material in the spoon before removing any portion for sampling. This material normally consists of borehole wall material that has sloughed off of the borehole wall after removal of the drill string prior to and during inserting the split spoon.
- Observe precautions for volatile organic compound sample collection found in Section 3, Method 5035.

7 Shelby Tube/Thin-Walled Sampling Methods

7.1 General

Shelby tubes, also referred to generically as thin-walled push tubes or Acker thin-walled samplers, are used to collect subsurface soil samples in cohesive soils and clays during drilling activities. In addition to samples for chemical analyses, Shelby tubes are also used to collect relatively undisturbed soil samples for geotechnical analyses, such as hydraulic conductivity and permeability, to support hydrogeologic characterizations at hazardous waste and other sites.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with this device.

7.2 Shelby Tube Sampling Method

A typical Shelby tube is 30 inches in length and has a 3.0-inch OD (2.875-inch ID) and may be constructed of steel, stainless steel, galvanized steel, or brass. They also typically are attached to push heads that are constructed with a ball-check to aid in holding the contained sample during retrieval. If used for collecting samples for chemical analyses, it must be constructed of stainless steel. If used for collecting samples for standard geotechnical parameters, any material is acceptable.

To collect a sample, the tube is attached to a string of drill rod and is lowered into the borehole, where the sampler is then pressed into the undisturbed material by hydraulic force. After retrieval to the surface, the tube containing the sample is then removed from the sampler head. If samples for chemical analyses are needed, the soil contained inside the tube is then removed for sample acquisition. If the sample is collected for geotechnical parameters, the tube is typically capped, maintaining the sample in its relatively undisturbed state, and shipped to the appropriate geotechnical laboratory.

7.3 Special Considerations When Using Split Spoon Sampling Methods

Observe precautions for volatile organic compound sample collection found in Section 3, Method 5035.

8 Backhoe Sampling Method

8.1 General

Backhoes may be used in the collection of surface and shallow subsurface soil samples. The trenches created by excavation with a backhoe offer the capability of collecting samples from very specific intervals and allow visual correlation with vertically and horizontally adjacent material. If possible, the sample should be collected without entering the trench. Samples may be obtained from the trench wall or they may be obtained directly from the bucket at the surface. The following sections describe various techniques for safely collecting representative soil samples with the aid of a backhoe.

The depth measurement for the sample begins at the top of the soil horizon.

8.2 Scoop-and-Bracket Method

If a sample interval is targeted from the surface, it can be sampled using a stainless steel scoop and bracket. First a scoop and bracket are affixed to a length of conduit and is lowered into the backhoe pit. The first step is to take the scoop and scrape away the soil comprising the surface of the excavated wall. This material likely represents soil that has been smeared by the backhoe bucket from adjacent material. After the smeared material has been scraped off, the original stainless steel scoop is removed and a clean stainless steel scoop is placed on the bracket. The clean scoop can then be used to remove sufficient volume of soil from the excavation wall to make up the required sample volume.

8.3 Direct-from-Bucket Method

It is also possible to collect soil samples directly from the backhoe bucket at the surface. Some precision with respect to actual depth or location may be lost with this method but if the soil to be sampled is uniquely distinguishable from the adjacent or nearby soils, it may be possible to characterize the material as to location and depth. In order to ensure representativeness, it is also advisable to dress the surface to be sampled by scraping off any smeared material that may cross-contaminate the sample.

8.4 Special Considerations When Sampling with a Backhoe

- Do not physically enter backhoe excavations to collect a sample. Use either procedure 8.2, Scoop-and-Bracket Method, or procedure 8.3, Direct-from-Bucket Method to obtain soil for sampling.
- Smearing is an important issue when sampling with a backhoe. Measures must be taken, such as dressing the surfaces to be sampled (see Section 2.3), to mitigate problems with smearing.

- Paint, grease and rust must be removed and the bucket decontaminated prior to sample collection.
- Observe precautions for volatile organic compound sample collection found in Section 3, Method 5035.

Uncontrolled Copy

ALS Environmental

DOCUMENT TITLE:	*METALS BY ICP-MS*
REFERENCED METHOD:	*EPA 200.8 R5.5 / SW846 6020A*
SOP ID:	*HN-MET-008*
REV. NUMBER:	*R05*
EFFECTIVE DATE:	*07/01/2012*

Uncontrolled Copy

METALS BY ICP-MS

EPA 200.8 R5.5 / SW846 6020A

SOPID:	HN-MET-008	Rev. Number:	R05	Effective Date:	07/01/2012

Approved By: _____ Date: 6/22/12
Department Supervisor – Royce Hughes

Approved By: _____ Date: 6/30/12
Operations Manager – Joe Ribar

Approved By: _____ for Date: 6/29/12
Quality Assurance – Dan Delinger

Approved By: _____ Date: 6/29/12
Laboratory Director – Jeff Glaser

Archival Date:	_____	Doc Control ID#:	_____	Editor:	_____

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO PROCEDURAL CHANGES HAVE BEEN MADE TO THE SOP SINCE THE APPROVAL DATE ABOVE. THIS SOP IS VALID FOR TWELVE ADDITIONAL MONTHS FROM DATE OF THE LAST SIGNATURE UNLESS INACTIVATED OR REPLACED BY SUBSEQUENT REVISIONS.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

TABLE OF CONTENTS

METALS BY ICP-MS

1) Scope and Applicability

1.1 Inductively coupled plasma-mass spectrometry (ICP-MS) is applicable to the determination of a large number of elements as either dissolved (aqueous only) or total metals.

1.2 This method is applicable to a variety of matrices including: drinking water, non-potable water, solid/chemical materials, and biological tissue.

1.3 ICP-MS has been applied to the determination of over 60 elements in various matrices. The method is applicable to analytical ranges of approximately 0.005 mg/L to 900 mg/L for aqueous matrices and 0.5 mg/kg to 900 mg/kg for solid matrices.

1.4 Method detection limits, quantitation limits, and linear ranges will vary with matrices, instrumentation, and operating conditions.

1.5 SW-846 Method 6020A is used to determine the analytes listed in Tables 20.1-A. This table lists more elements than the current version of Method 6020A. The additional elements are included based upon results of demonstrations of precision and accuracy and completion of method detection limit studies for aqueous and solid matrix.

1.6 Method 200.8 is used to determine the analytes listed in Table 20.1-B.

1.7 Internal standards are used for each analyte determined by ICP-MS. The internal standard mix used consists of ^{6}Li, ^{45}Sc, ^{89}Y, ^{115}In, ^{159}Tb, ^{165}Ho, and ^{209}Bi. ^{89}Y is used for analysis in helium gas mode.

2) Summary of Procedure

2.1 Prior to analysis, samples that require total ("acid-leachable") values must be digested using appropriate sample preparation methods as specified in SOP HN-MET-009 and HN-MET-010, *Metal Digestion in Solid and Aqueous Matrices for ICPMS.*

2.2 Analyte species originating in a liquid are nebulized and the resulting aerosol transported by argon gas into the plasma torch. Ions are produced by radio frequency inductively coupled plasma, entrained in the plasma gas, and introduced into a mass spectrometer. The ions are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. Interferences must be assessed and valid corrections applied. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

3) Definitions

3.1 DI Water: De-ionized (DI) water meeting purity characteristics of ASTM Type II or greater

3.2 Laboratory Control Sample (LCS): A clean matrix spiked with known concentrations of compound(s) representative of the target analytes and carried throughout the preparative process.

3.3 Matrix: The component or substrate (e.g., surface water, groundwater, soil) containing the analytes of interest.

3.4 Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s) and carried throughout the entire preparative process.

3.5 Matrix Spike Duplicate (MSD): A duplicate sample spiked with identical concentrations of target analyte(s) and carried throughout the preparative process.

3.6 Method Blank (MBLK): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing and carried through the complete sample preparation and analytical procedure.

3.7 Standard Curve: A plot of concentrations of known analyte standards versus the instrument response to the analyte.

3.8 Internal Standard: A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the analytical test method.

3.9 Linear Dynamic Range (LDR): The concentration range through which the instrument response is linear.

3.10 Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

3.11 Method Quantitation Limit (MQL): Lowest concentration level at which an analyte may be reliably reported. The MQL may also be referred to as the Method Report Limit (MRL), Practical Reporting Limit (PQL), or Required Reporting Limit (RRL).

3.12 Low-Level Quality Control sample (LLQC): A clean matrix sample spiked at the MQL and carried through the entire preparation and analysis process.

3.13 Low-Level Initial Calibration Verification (LLICV): A sample spiked at the MQL, used to validate the lower end of the initial calibration.

3.14 Low-Level Continuing Calibration Verification (LLCCV): A sample spiked at the MQL and analyzed periodically throughout an analytical sequence, monitoring continued performance of the lower end of a calibration.

4) Health and Safety Warnings

4.1 Lab Safety

4.1.1 Due to various hazards in the laboratory, safety glasses, disposable gloves, and laboratory coats or aprons must be worn when working with unknown samples. In addition, heavy-duty gloves and a face shield are recommended when dealing with toxic, caustic, and/or flammable chemicals.

4.1.2 The toxicity or carcinogenicity of each reagent used has not been precisely defined. However, each chemical used must be treated as a potential health hazard and exposure reduced to the lowest possible level. The laboratory maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets (MSDS) is available to all personnel involved in these analyses.

4.2 Waste Disposal

4.2.1 Procedures for sample disposal are documented in SOP HN-SAF-001, *Waste Disposal Procedures.*

4.2.2 Samples must be disposed according to Federal, State, and local regulations.

4.3 Pollution Prevention

4.3.1 The quantities of chemicals purchased, when possible, must be based on the expected usage during its shelf life.

4.3.2 Standards and reagents must be prepared in volumes consistent with laboratory use to minimize the volume of expired standards or reagents to be disposed.

5) Cautions

5.1 Routine preventative maintenance must be performed as scheduled and documented to assure optimum instrument performance. Typical routine maintenance includes inspection and replacement of sample delivery tubing. Maintenance performed shall be recorded in a dedicated instrument maintenance logbook. Refer to HN-EQ-004 for additional information.

6) Interferences

6.1 Isobaric elemental interferences in ICP-MS are caused by isotopes of different elements forming ions with the same nominal mass-to-charge ratio (m/z) as those being monitored. A data system must be used to correct for these interferences. This involves determining the signal for another isotope of the interfering element and subtracting the appropriate signal from the analyte isotope signal. Such corrections will only be as accurate as the accuracy of the isotope ratio used in the elemental equation for data calculations. Isotope ratios should be established prior to the application of any corrections.

6.2 Isobaric molecular and double-charged ion interferences in ICP-MS are caused by ions consisting of more than one atom or charge, respectively. Most isobaric interferences that could affect ICP-MS determinations have been identified in the literature [3,4]. Examples include $ArCl^+$ ions on the ^{75}As signal and MoO^+ ions on the cadmium isotopes. While the approach used to correct for molecular isobaric interferences is demonstrated below using the natural isotope abundances from the literature [5], the most precise coefficients for an instrument can be determined from the ratio of the net isotope signals observed for a standard solution at a concentration providing suitable (<1 percent) counting statistics. Because the ^{35}Cl natural abundance of 75.77 percent is 3.13 times the ^{37}Cl abundance of 24.23 percent, the chloride correction for arsenic can be calculated (approximately) as follows (where the $^{38}Ar^{37}Cl^+$ contribution at m/z 75 is a negligible 0.06 percent of the $^{40}Ar^{35}Cl^+$ signal): corrected arsenic signal (using natural isotopes abundances for coefficient approximations) = (m/z 75 signal) - (3.13) (m/z 77 signal) + (2.73) (m/z 82 signal), (where the final term adjusts for any selenium contribution at 77 m/z).

NOTE: Arsenic values can be biased high by this type of equation when the net signal at m/z 82 is caused by ions other than $^{82}Se^+$, (e.g., $^{81}BrH^+$ from bromine wastes [6]).

6.3 The accuracy of these types of equations is based upon the constancy of the OBSERVED isotopic ratios for the interfering species. Corrections that presume a constant fraction of a molecular ion relative to the "parent" ion have not been found to be reliable, e.g., oxide levels can vary. If a correction for an oxide ion is based upon the ratio of parent-to-oxide ion intensities, the correction must be adjusted for the degree of oxide formation by the use of an appropriate oxide internal standard previously demonstrated to form a similar level of oxide as the interferent. This type of correction has been reported for oxide-ion corrections using ThO^+/Th^+ for the determination of rare earth elements. The use of aerosol de-solvation and/or mixed plasma has been shown to greatly reduce molecular interferences. These techniques can be used provided that method detection limits, accuracy, and precision requirements for analysis of the samples can be met.

6.4 Physical interferences can be associated with sample nebulization and transport processes as well as with ion-transmission efficiencies. Nebulization and transport processes can be affected if a matrix component causes a change in surface tension viscosity. Changes in matrix composition can cause significant signal suppression or enhancement. Dissolved solids can deposit on the nebulizer tip of a pneumatic nebulizer and on the interface skimmers (reducing the orifice size and the instrument performance). Total solid levels below 0.2% (2,000 mg/L) have been currently recommended to minimize solid deposition. An internal standard can be used to correct for physical interferences, if it is carefully matched to the analyte so that the two elements are similarly affected by matrix changes. When completing analysis by Method 6020A, if the intensity level of an internal standard falls below 70 percent of the intensity of the calibration standard used for reference, the sample must be reanalyzed after a fivefold (1+4) or greater dilution has been performed. When completing analysis by Method 200.8 and the intensity of the internal standard is less than 60 percent or greater than 125 percent of the intensity of the calibration standard used for reference, the sample must be reanalyzed after a fivefold (1+4) or greater dilution has been performed.

6.5 Memory interferences can occur when there are large concentration differences between samples or standards that are analyzed sequentially. Sample deposition on the sampler or skimmer cone, spray chamber design, and the type of nebulizer affects the extent of the memory interferences that are observed. The rinse period between samples must be long enough to eliminate significant memory interference.

7) Personnel Qualifications and Responsibilities

7.1 General Responsibilities - This method is restricted to use by or under the supervision of analysts experienced in the method. A four-year science or technical degree is recommended.

7.2 Analyst - It is the responsibility of the analyst(s) to:

7.2.1 Read, understand, and follow this SOP as written.
7.2.2 Produce contractually compliant data that meets all quality requirements using this procedure and HN-QAQC-009 *Data Reduction, Review and Validation.*
7.2.3 Complete the required demonstration of proficiency prior to performing this procedure without supervision.
7.2.4 Create a data entry batch in e-LIMS for peer review.

7.3 Section Supervisor - It is the responsibility of the section supervisor to:

7.3.1 Ensure that all analysts have the technical ability and have received adequate training required to perform this procedure.
7.3.2 Ensure analysts have completed the required demonstration of proficiency before performing this procedure without supervision.
7.3.3 Produce contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP.

8) Sample Collection, Handling, and Preservation

8.1 Aqueous samples shall be collected in 500 ml plastic containers and preserved to a pH of <2 with HNO_3.

8.2 Dissolved metal analyses shall be field filtered through a 0.45µ filter and preserved to a pH of <2 with HNO_3. Filtering should be completed in the field at time of sampling.

8.3 Sample pH should be verified at time of sample receipt and adjusted if necessary.

8.3.1 If adjusted at time of receipt, the sample shall be stored for a period of 16 hours after which the pH adjustment will be verified.

8.4 Soil samples should be collected in 4 oz wide mouth plastic containers.

8.5 Samples may be stored at room temperature. The holding time is six months for aqueous and solid matrices.

9) Equipment and Supplies

9.1 Inductively coupled plasma-mass spectrometer (Agilent 7500ce): Capable of providing resolution, better than or equal to 1.0 amu at 5% peak height. The system must have a mass range from at least 5 to 250 amu and a data system that allows for corrections of isobaric interferences and the application of the internal standard technique. Use of a mass-flow controller for the nebulizer argon/helium and a peristaltic pump for the sample solution is required.

9.2 Various Class A volumetric flasks: 10.0, 25, 50, 100, 250, etc.

9.3 Variable volume pipettes: 1.0 and 5.0 ml.

10) Standards and Reagents

10.1 Argon gas supply: High-purity grade (99.99%).

10.2 Helium gas supply: High-purity grade (99.99%).

10.3 Nitric acid, concentrated (trace metal grade)

10.4 Hydrochloric acid, concentrated (trace metal grade)

Note: Acids used in the preparation of standards and samples for ICP-MS must be of high purity. Re-distilled acids are recommended due to the high sensitivity of the instrumentation.

10.5 Diluent Solution

10.5.1 Prepare as a solution containing 5% HNO3 - 1% HCl.

10.5.2 Prepare fresh daily.

10.6 Stock Spike Standards:

10.6.1 Metals Mix standard w/ Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Li, Mn, Mo, Ni, Pb, Sb, Se, Sr, Sn, Tl, V, and Zn @ 10 mg/L **and** Fe, K, Ca, Na, and Mg @ 1000 mg/L **and** B at 50 mg/L. (available from VHG ZALSLAB901-500 or equivalent)

10.6.2 Ti and Si Spike Stock @ 1000 ppm (available from Environmetal Express)

10.6.2.1 Single Element Working Spike Ti @ 10 mg/L and Si @ 50 mg/L.

10.6.2.1.1 Add 5 ml Ti and 25 ml SI Stock to 300 ml DI water in a 500 ml volumetric flask.
10.6.2.1.2 Acidify with 10 ml Nitric and 5 ml Hydrochloric acid.
10.6.2.1.3 Bring to final volume with DI water.

10.6.3 Low-level Metals Mix Standard I w/ As, Ba, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, Sr, Tl, and V @ 0.5 mg/L **and** Be and Cd @ 0.2 mg/L **and** Al, Li, and Zn @ 1.0 mg/L **and** B @ 2.0 mg/L **and** Fe @ 8.0 mg/L **and** Mg, K, and Na @ 20 mg/L **and** Ca @ 50 mg/L. (available from VHG ZALSLAB1103-100 or equivalent)

10.6.4 Low-level Metals Mix Standard II w/ Sn @ 0.2 mg/L **and** Sb, Mo, and Ti @ 0.5 mg/L. (available from VHG ZALSLAB1104-100 or equivalent)

10.7 Initial Calibration Stock Standards (available from SPEX or equivalent):

10.7.1 Stock 1: 20 mg/L - Ag, Al, As, Ba, Be, Cd, Co, Cu, Cr, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn,
10.7.2 Stock 2: 1,000 mg/L - B
10.7.3 Stock 3: 1,000 mg/L - Fe, K, Ca, Na, Mg
10.7.4 Stock 4: 1,000 mg/L _ Sr
10.7.5 Stock 5: 1,000 mg/L - Ti
10.7.6 Stock 6: 1,000 mg/L - Sn
10.7.7 Stock 7: 1,000 mg/L - Li
10.7.8 Stock 8: 1,000 mg/L - Si
10.7.9 Stability of stock standards shall be consistent with the manufacturer's expiration date.

10.8 Intermediate Stock Standard for B and Si @ 100 mg/L and Sr, Ti, Sn @ 10 mg/L and Li @ 50 mg/L:

10.8.1 Add approximately 40 mL of DI water to (3) 50 mL volumetric flasks. Acidify each using 2 mL Nitric acid and 0.5 mL Hydrochloric acid.
10.8.2 Quantitatively add 0.5 mL each of Stock 4, 5, and 6 (from Section 10.7) to first flask.
10.8.3 Quantitatively add 5.0 mL of Stock 2 and 8 (from Section 10.7) to the second flask.
10.8.4 Quantitatively add 2.5 mL of Stock 7 (from Section 10.7) to the third flask.
10.8.5 Bring each to a final volume of 50 ml with DI water.
10.8.6 The intermediate stock standard is stable for a period of 6 months. The expiration date may not exceed that of any parent solution.

10.9 Working Initial Calibration Standards:

10.9.1 Working Calibration Stock Standard

10.9.1.1 Add approximately 125 ml of DI water to a 200 ml Class A volumetric flask. Acidify with 8 ml Nitric acid and 2 ml Hydrochloric acid.
10.9.1.2 Add 10 ml of Stock 3 (Section 10.7.3), 10 ml of Sr, Ti, Sn, intermediate stock (Section 10.8.2), 5 ml of B, Si intermediate stock (Section 10.8.3), 2 ml of Li intermediate stock (section 10.8.4), and 5 ml of Stock 1 (Section 10.7.1).
10.9.1.3 Bring to a final volume of 200 ml with DI water.
10.9.1.4 The working standard must be replaced weekly and the expiration date may not exceed that of any parent solution.

10.9.2 Calibration Standards

10.9.2.1 Prepare, at a minimum, five (5) initial calibration standards from the Working Calibration Stock Standard (Section 10.9.1) as detailed in Table 10.9.2.
10.9.2.2 Calibration Standards are to be prepared on a daily basis.

Table 10.9.2

Standard (Note 1)	Amount of Working Calibration Stock	Final Volume (Note 2)	Final Concentration
Level I	0 ml	50 ml	0 µg/L
Level II	1.0 mL of Level V	50 ml	0.2 µg/L
Level III	1.0 ml of Level VII	50 ml	2 µg/L
Level IV	2.5 ml of Level VII	50 ml	5 µg/L
Level V	5.0 ml of Level VII	50 ml	10 µg/L
Level VI	5 ml	50 ml	50 µg/L
Level VII	10 ml	50 ml	100 µg/L
Level VIII	20 ml	50 ml	200 µg/L

Note (1): Additional standards may be added to extend the calibration range.
Note (2): All standards must be adjusted to a final acid concentration of 4% HNO_3 and 1% HCl solution.

10.10 Stock Calibration Check Solutions (ICS):

10.10.1 ICS1: Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V, Zn @ 10 mg/L. (available from SPEX)
10.10.2 ICS3: Ca, Fe, K, Mg, Na @ 200 mg/L. (available from SPEX)
10.10.3 ICS5: Mo, Sn, Sr, Ti @ 10 mg/L. (available from SPEX)
10.10.4 Boron and Si @ 1,000 mg/L. (available from Environmental Express or equivalent)

10.10.4.1 Boron and Si Working Solution @ 50 mg/L

10.10.4.1.1 Add approximately 40 ml of DI water to a 50 ml Class A volumetric flask. Acidify with 2 ml Nitric acid and 0.5 ml Hydrochloric acid.
10.10.4.1.2 Add 2.5 ml of the 1,000 mg/L Boron standard and 2.5 ml of the 1,000 mg/L Si standard (Section 10.10.4).
10.10.4.1.3 Bring to a final volume of 50 ml with DI water.

10.10.4.1.4 Solution is stable for a period of 6 months

10.10.5 Lithium @ 1,000 mg/L. (available from Environmental Express or equivalent)

10.10.5.1 Lithium Working Solution @ 10mg/L

10.10.5.1.1 Add approximately 40 ml of DI water to a 50 ml Class A volumetric flask. Acidify with 2 ml Nitric acid and 0.5 ml Hydrochloric acid.
10.10.5.1.2 Add 0.5 ml of the 1,000 mg/L Lithium standard (section 10.10.5).
10.10.5.1.3 Bring to a final volume of 50 mL with DI water.
10.10.5.1.4 Solution is stable for a period of 6 months.

10.11 Initial Calibration Verification (ICV/CCV) Solution:

10.11.1 Working ICV/CCV Solution @ 100/10000/100/500 ug/L for ORS Method and 80/8000/80/400 for CLP Method ICV only.

10.11.1.1 Add 500 µl ICS1 (Section10.10.1), 2.5 ml ICS3 (Section 10.10.2), 500 µl ICS5 (Section 10.10.3), 500 µl of boron/silica working solution (Section 10.10.4.1), and 500 µl Lithium working solution (Section 10.10.5.1) to a 50 ml Class A volumetric flask. All of these spike volumes are reduced by 80% for CLP Method.
10.11.1.2 Bring to volume with diluent solution (Section 10.5)
10.11.1.3 Prepare fresh daily.

10.11.2 The stock standard(s) for the ICV solution must be obtained from a second source supplier or, if purchased from the same supplier, be a different solution warrantied to be prepared from a different lot of parent constituents.

10.12 Low-Level Initial Calibration Verification solution (LLICV/CCV) spike @ MQL:

10.12.1 Add approximately 40 mL DI water to a 50 mL volumetric flask and acidify with 2 mL Nitric acid and 0.5 mL Hydrochloric acid.
10.12.2 Pipet 0.5 mL Low-Level Metals mix standard I (section 10.6.3) and 0.5 mL Low-Level Metals mix standard II (section 10.6.4)
10.12.3 Bring to volume with DI water.
10.12.4 Prepare fresh daily

10.13 Initial Calibration Blank (ICB):

10.13.1 Prepare reagent water with a 4% HNO_3 & 1% HCl content.

10.14 Interference Check Sample A (ICSA) Stock Standard – Available from SPEX: Cl @ 10,000 mg/L; C @ 2,000 mg/L; Al, Ca, Fe, K, Mg, NA, S @ 1,000 mg/L; Mo, Ti @ 20 mg/L.

10.15 Interference Check Sample A (ICSA) Working Standard

10.15.1 Add 2.5 ml of ICSA (Section 10.14) to a 50 ml Class A volumetric flask.
10.15.2 Dilute to 50 ml with diluent solution (Section 10.5).
10.15.3 Prepare weekly.

10.16 Interference Check Sample AB (ICSAB) Working Standard

10.16.1 Prepare same as CCV (Section 10.11.1) not bringing to final volume.
10.16.2 Add 2.5 ml ICSA (Section 10.14)
10.16.3 Dilute to 50 ml with diluent solution (Section 10.5).
10.16.4 Prepare weekly.

10.17 Linear Dynamic Range (LDR) Check Solution

10.17.1 Add 10 ml Stock Spike (Section 10.6.1 and 10.6.2) to a 50 ml Class A volumetric flask.
10.17.2 Bring to volume with diluent (Section 10.5).
10.17.3 This solution should be replaced weekly or if degradation is noted. The expiration date may not exceed that of any parent solution.

10.18 Continuing Calibration Blank:

10.18.1 Same as Section 10.13.

10.19 Continuing Calibration Verification:

10.19.1 Same as Section 10.11.

10.20 Low-Level Continuing Calibration Verification:

10.20.1 Same as Section 10.12.

10.21 Internal Standard Stock Standard:

10.21.1 Yttrium @ 1000 mg/L. Available from Environmental Express.
10.21.2 Multi-Element Mix containing Li, Sc, Y, In, Tb, Ho, and Bi @ 10 mg/L. Available from VHG Labs.

10.22 Internal Standard – Working Solution:

10.22.1 Add 5 ml of Multi-Element Mix (Section 10.21.2) and 500 µl of Y standard (Section 10.21.1) to a 50 ml Class A volumetric flask.
10.22.2 Bring to volume with diluent (Section 10.5).
10.22.3 This solution should be replaced if degradation is noted. The expiration date may not exceed that of any parent solution.

10.23 ICP-MS Tune Stock Solution:

10.23.1 Tuning solution containing 10 mg/L of Be, Mg, Co, In, Ba, Ce, Li, Rh, Tl, U, Y, and Pb.

10.24 ICP-MS Working Tune Solution @ 10 ppb:

10.24.1 Dilute 1 ml of the ICP-MS tune stock solution (Section 10.23.1) to 1 L.
10.24.2 Working tune solution must be replaced every 6 months or if degradation is noted. The expiration date of this solution may not exceed that of its parent.
10.24.3 ICPMS2 may use a further 10x dilution of this tune @ 1ppb due to the enhanced sensitivity.

10.25 Stock Spiking Solution:

Multi-element standards documented in Sections 10.6.1 and 10.6.2 shall be used for spiking.

10.25.1 Soil Spike:

10.25.1.1 A 500 µl volume of each spike solution is added to 0.5 gram of solid after transfer to the digestion vessel. Following digestion (HN-MET-009), the digestate is brought to a final volume of 50 ml. Theoretical spike value is the 100 mg/kg for the trace metals, 1000 mg/kg for Ca/Fe/Mg/Na/K, and 25 mg/kg for B and Si.

10.25.2 Water Spike:

10.25.2.1 A 500µl volume of spike solutions 10.6.1 and 10.6.2 is added to the 50.0 ml volume of aqueous sample after transfer to the digestion vessel. Following digestion (HN-MET-010), the digestate is brought to a final volume of 50.0 ml. Theoretical spike value is 0.1 mg/L for the trace metals, 10 mg/L for Ca/Fe/Mg/Na/K, and 0.5 mg/L for B and Si.

11) Method Calibration

11.1 Start-up Procedure

11.1.1 Visual check of instrument:

11.1.1.1 Inspect auto-sampler tubing; peristaltic pump tubing should be replaced daily.
11.1.1.2 Inspect sampling cone and skimmer cone for deposit build up; if build up is noticed, either clean or replace cone.
11.1.1.3 Verify argon gas flow; ensure there is 100 PSI coming into the instrument.
11.1.1.4 Check vacuum pressure and oil levels.
11.1.1.5 Check that the heat exchanger unit is turned on.
11.1.1.6 Record maintenance in routine maintenance logbook.

11.1.2 Turn plasma on and let the instrument stabilize for approximately 30-45 minutes.

11.1.3 During stabilization, verify basic instrument operating parameters. These parameters should be set at approximately:

11.1.3.1 RF power = 1500V
11.1.3.2 RF matching = 1.8V
11.1.3.3 Peristaltic Pump = 0.1 rps
11.1.3.4 S/C Temp = 2° C.
11.1.3.5 Small adjustments to the EM voltage and/or maintenance may be required to meet subsequent tuning specification. This may be done using the Autotune function in the software.

11.1.4 After instrument stabilization, perform an instrument tune using the ICP-MS Tune solution (Section 10.24). This is a preliminary tune to evaluate performance across the operating mass range of the instrument.

11.1.4.1 Analyze the ICP-MS tune solution in 5 replicates prior to the initial calibration.
11.1.4.2 Adjust mass calibration such that the unit mass falls within ± 0.1 amu of the expected value.
11.1.4.3 Acceptance Criteria:

11.1.4.3.1 Resolution should be ~ 0.75 amu at 5% peak height, and **must** be <0.90 amu.
11.1.4.3.2 Mass calibration must be +/- 0.1 amu from the true value.
11.1.4.3.3 Relative standard deviations (RSD) of absolute signals from the five replicates must be < 5% for all analytes.
11.1.4.3.4 Internal standard criteria are not applicable to the ICP-MS tune solution.

11.1.5 A P/A factor update shall be performed utilizing the 10ug/L standard incorporated in the initial calibration curve. This should be updated on a regular basis when a calibration curve begins to fail, a new calibration curve is used, and after instrument maintenance.
11.1.6 A five-point calibration (minimally) must be conducted daily utilizing a calibration blank and four calibration standards (Section 10.9.2).

11.1.6.1 All measurements must be based upon at least three integrations.
11.1.6.2 Reported values must use the average of the multiple integrations.
11.1.6.3 Results of the calibration blank must be < 3 times the current IDL for each element.
11.1.6.4 Internal standard criteria must be achieved for all analyses.

11.2 Initial Calibration Curve:

11.2.1 A linear regression (first order fit) of the instrument response versus the concentration of the standards is employed for subsequent quantitation. The instrument response is treated as the dependent variable (y) and the concentration as the independent variable (x). The regression will produce the slope and intercept terms for a linear equation in the form:

$$y = ax + b$$

Where:
y = instrument response (peak area)
a = slope of the line (coefficient of x)
x = concentration of the calibration standard
b = blank intercept

11.2.2 The analyst should not force the line through the origin, but have the intercept calculated from the five data points.
11.2.3 The regression calculation correlation coefficient (r) must be ≥ 0.998.

11.3 Initial Calibration Verification (ICV):

11.3.1 The initial calibration must be verified utilizing a second source calibration verification standard at a concentration below the mid-point of the calibration

curve (Section 10.11).

11.3.2 The ICV must be run after each new initial calibration curve.
11.3.3 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
11.3.4 Internal standard criteria must be achieved for the ICV analysis.

11.4 Low-Level Initial Calibration Verification (LLICV):

11.4.1 The LLICV is analyzed at the laboratory MQL to verify the lower end of the initial calibration. (Section 10.12)
11.4.2 The LLICV must be run after each new initial calibration
11.4.3 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
11.4.4 Internal standard criteria must be achieved for the LLICV analysis.

11.5 Interference Check Solutions (ICS):

11.5.1 The ICS (Section 10.15 & 10.16) must be analyzed at the beginning of an analytical sequence and every 8 hours during the analytical run.
11.5.2 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
11.5.3 Internal standard criteria must be achieved for each ICS analysis.

11.6 Continuing Calibration Verification (CCV):

11.6.1 A same source standard must be analyzed at the beginning of each daily batch, after a maximum of 10 samples run (including the Method Blank, LCS, and MS/MSD), and at the end of the analytical run.
11.6.2 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
11.6.3 Internal standard criteria must be achieved for each CCV analysis.

11.7 Low-Level Continuing Calibration Verification (LLCCV):

11.7.1 A low-level sample (section 10.20) must be analyzed at the beginning of each daily batch, after a maximum of 10 samples run (including QC), and at the end of the analytical sequence.
11.7.2 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
11.7.3 Internal standard criteria must be achieved for each LLCCV analysis.

12) Sample Preparation/Analysis

12.1 Digestion procedures are presented in the applicable sample preparation SOP (HN-MET-009 and HN-MET-010).

12.2 When internal standard response falls outside acceptance criteria (<70% for 6020A and <60% or >125% for 200.8), dilute the sample and reanalyze.

12.3 Typical Analytical Sequence:

12.3.1 Initial Calibration curve, minimum four standards and a blank
12.3.2 Initial Calibration Verification standards (once daily)
12.3.3 Initial Calibration Verification Blank (once daily)

12.3.4 Low-Level Initial Calibration Verification Standard (once daily)
12.3.5 Interference Check Sample A (ICSA)
12.3.6 Interference Check Sample AB (ICSAB)
12.3.7 Continuing Calibration Verification (CCV)
12.3.8 Low-Level Continuing Calibration Verification Standard (LLCCV)
12.3.9 Continuing Calibration Blank (CCB)
12.3.10 Method blank (one MB per preparation batch of 20 or less)
12.3.11 Low-Level Quailty Control Sample (one LLQC per preparation batch of 20 or less)
12.3.12 Laboratory Control Sample (one per preparation batch of 20 or less)
12.3.13 Client sample(s)
12.3.14 Matrix spike

12.3.14.1 For Method 200.8, prepare at a 10% frequency (one per every 10 samples)
12.3.14.2 For Method 6020A, prepare at a 5% frequency (one per preparation batch of 20 or less)

12.3.15 Matrix spike duplicate

12.3.15.1 For Method 200.8, prepare at a 10% frequency (one per every 10 samples)
12.3.15.2 For Method 6020A, prepare at a 5% frequency (one per preparation batch of 20 or less)

12.3.16 Continuing Calibration Verification Standard (CCV after every 10 samples)
12.3.17 Continuing Calibration Blank (CCB after every ten samples)
12.3.18 Low-Level Continuing Calibration Verification Standard (LLCCV after every 10 samples)
12.3.19 Client samples and batch QC samples (dilution test sample, PDS, MB, LCS and MS) - total of ten or less samples
12.3.20 Continuing Calibration Verification Standard (CCV at end of analytical sequence)
12.3.21 Continuing Calibration Blank (CCB at end of analytical sequence)
12.3.22 Low-Level Continuing Calibration Verification Standard (LLCCV at end of analytical sequence)

12.4 Dilution test:

12.4.1 If the analyte concentration is within the linear dynamic range of the instrument and sufficiently high (minimally, a factor of at least 100 times greater than the concentration in the reagent blank), an analysis of a fivefold dilution must agree within ± 10% of the original determination. If not, an interference effect must be suspected.

12.5 Post-Digestion Spike (PDS) Addition:

12.5.1 An analyte spike added to a portion of a prepared sample should fall within the laboratory derived acceptance criteria.
12.5.2 The spike addition should be based on the indigenous concentration of each element of interest in the sample.
12.5.3 If the spike is not recovered within the specified limits, the sample should be diluted and reanalyzed to compensate for the matrix effect.

12.5.4 Results must agree to within 10% of the original determination.
12.5.5 The use of a standard-addition analysis procedure may also be used if the dilution technique proves inconclusive.
12.5.6 Post Digestion Preparation:

12.5.6.1 To a 10 ml portion of digestion sample, add 100 µl of Metals mix standard I. (Section 10.6.1)
12.5.6.2 The theoretical spike is 100 ug/L for the trace metals, 10,000 ug/L for minerals, and 500 ug/L for Boron.

12.6 Method of Standard Additions (MSA):

12.6.1 When MS/MSD and PDS criteria are not met, the method of standard additions may be used to determine an accurate analyte level.
12.6.2 The MSA is an extension of the PDS where three PDS are performed on the same sample.

12.6.2.1 Ideally, the first PDS is spiked at approximately 50% of the estimated analyte concentration. The second PDS is spiked at ~100% and the third at ~150%.

12.6.3 The MSA analyte concentration is determined using linear regression using the four data points. An MS Excel spreadsheet calculation is employed to calculate results from MSA.

13) Troubleshooting

13.1 Refer to Agilent 7500ce hardware manual for specific technical troubleshooting guidance.

14) Data Acquisition

14.1 Create a prep batch (as applicable) in LIMS.

14.2 The data acquired is transferred via Chemstation™ to LIMS electronically. Calculations are performed by Chemstation™ software and LIMS.

14.3 Analyst review of data is performed on the raw data and in LIMS prior to being validated. If results are above the analytes detectable range, it will be reported as "----------". Appropriate dilutions must be performed to generate reportable data.

15) Calculation, and Data Reduction Requirements

15.1 Calculation of Linear Regression Correlation Coefficient, r

$$r = \frac{\Sigma XY - \frac{\Sigma X \Sigma Y}{n}}{\sqrt{(\Sigma X^2 - \frac{(\Sigma X)^2}{n})(\Sigma Y^2 - \frac{(\Sigma Y)^2}{n})}}$$

Where:
X = individual values for independent variable
Y = individual values for dependent variable
n = number of pairs of data.
df = n-2

15.2 Calculation of the CCV % drift:

15.2.1 % Drift= [(Calculated conc - Theoretical conc) x 100] / Theoretical conc

15.3 The calibration curve versus sample response data produces the metal concentration in solution.

15.3.1 Equation for water samples:

$$Concentration(ug/L) = Sample\,Response(ug/L) x\ Dilution\ Factor\ (If\ Applicable)$$

15.3.2 Equation for soil samples (external calibration):

$$Concentration(ug/kg) = \frac{Sample\ Response(ug/L) x FV}{Weight\ of\ Sample\ (g)}\ x\ Dil.\ Factor\ (If\ Applicable)$$

where FV = final volume of digestion, ml

15.3.3 If additional dilutions are used, the result must be multiplied by the total dilution factor.

15.4 QC Calculations: Calculate the percent recovery for various QC samples (MS, MSD, LCS) according to the following equations:

15.4.1 % Recovery, %R (for MS/MSD and LCS)

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

Where:
SSR = Spiked Sample Result (mg/L or mg/kg).
SR = Sample Result (unspiked)
SA = Spike Amount Added (mg/L or mg/kg).

15.4.2 % Recovery, %R (for standards and CCV)

$$\%R = \frac{(SSR)}{SA} \times 100$$

Where:

SSR = Spiked Sample Result (mg/L or mg/kg).
SA = Spike Amount Added (mg/L or mg/kg).

15.4.3 % RPD (for precision or replication evaluation)

$$\%\text{RPD} = \frac{|\text{SR}_1 - \text{SR}_2|}{½(\text{SR}_1 + \text{SR}_2)} \times 100$$

Where:

SR_1 = Sample result for replicate 1.
SR_2 = Sample result for replicate 2.

16) Quality Control, Data Assessment and Corrective Action

16.1 Instrument Detection Limit (IDL)

16.1.1 IDL determinations should be determined every three months and maintained with the instrument logbook.
16.1.2 IDL determinations are to be completed by averaging the standard deviations of seven measurements of a reagent blank, over a minimum of three non-sequential analytical runs.

16.2 Initial Calibration:

16.2.1 A calibration curve must be generated daily or whenever ICV/CCV fail to achieve acceptance criteria.
16.2.2 Acceptance Criteria:

16.2.2.1 Curve must be determined from a minimum of four standards and a calibration blank.
16.2.2.2 The regression coefficient "r" must be ≥0.998
16.2.2.3 All responses must be based upon the average of three integrations at a minimum

16.2.3 Curve Failure Corrective Action:

16.2.3.1 Check standards and/or perform maintenance as necessary to correct problem.
16.2.3.2 Process a new initial calibration curve

16.3 Initial Calibration Verification (ICV):

16.3.1 Perform daily after generation of the initial calibration curve.
16.3.2 Acceptance criteria:

16.3.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.3.3 ICV Failure Corrective Action:

16.3.3.1 Evaluate condition and age of standards being used and/or perform any needed system maintenance.
16.3.3.2 Reanalyze the ICV and /or generate a new calibration curve as necessary to achieve acceptable calibration criteria.

16.4 Low-Level Initial Calibration Verification (LLICV):

16.4.1 Perform daily after generation of the initial calibration curve.
16.4.2 Acceptance criteria:

16.4.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.4.3 ICV Failure Corrective Action:

16.4.3.1 Evaluate condition and age of standards being used and/or perform any needed system maintenance.
16.4.3.2 Reprocess the LLICV and /or generate a new calibration curve as necessary to achieve acceptable calibration criteria.

16.5 Continuing Calibration Verification (CCV):

16.5.1 The CCV must be run prior to sample analysis, after every 10 samples (including QC samples), and at the end of the analytical sequence.
16.5.2 Acceptance Criteria:

16.5.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.5.3 CCV failure Corrective Action:

16.5.3.1 If the calibration does not meet the criteria, re-analyze the standard.
16.5.3.2 If subsequent analysis is outside of criteria, perform a new calibration curve.
16.5.3.3 All samples processed following the last acceptable CCV must be re-analyzed.

16.6 Low-Level Continuing Calibration Verification (LLCCV):

16.6.1 The LLCCV must be run prior to sample analysis, after every 10 samples (including QC samples), and at the end of the analytical sequence.
16.6.2 Acceptance Criteria:

16.6.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.6.3 LLCCV failure Corrective Action:

16.6.3.1 If the calibration does not meet the criteria, re-analyze the standard.
16.6.3.2 If subsequent analysis remains outside of criteria, perform a new calibration curve.
16.6.3.3 All samples of similar concentration, processed following the last acceptable LLCCV must be re-analyzed.

16.7 Continuing Calibration Blank (CCB):

16.7.1 The calibration blank must be run prior to sample analysis, after every 10 samples (including QC samples), and at the end of the analytical sequence.
16.7.2 Acceptance Criteria:

16.7.2.1 All analytes are must be less than three times the IDL.

16.7.3 CCB failure Corrective Action:

16.7.3.1 If the calibration blank does not meet the criteria, re-analyze the blank.
16.7.3.2 If subsequent analysis falls outside of criteria, perform any necessary maintenance and perform a new calibration curve.
16.7.3.3 All samples processed following the last acceptable CCB must be re-analyzed.

16.8 Linear Dynamic Range (LDR) Assessment

16.8.1 A LDR sample must be processed to assess linearity above the highest calibration standard.
16.8.2 Acceptance Criteria:

16.8.2.1 All analytes are must be within 10% of the true value of the LDR standard.
16.8.2.2 Sample concentrations greater than 90% of the LDR must be diluted and re-analyzed.
16.8.2.3 The LDR should be verified every 6 months (minimally) or whenever a modification in instrument hardware or operating conditions presents the potential for a change in the LDR.

16.8.3 LDR assessment failure Corrective Action:

16.8.3.1 If the LDR does not meet criteria for an analyte, no data for that analyte falling between the highest calibration standard and the LDR standard can be reported.

16.9 Blanks:

16.9.1 Rinse Blank(s)

16.9.1.1 Rinse blanks should be used to flush system components between blanks, standards, and samples.
16.9.1.2 Allow sufficient time to remove traces of the previous sample prior to new sample introduction.
16.9.1.3 Rinse blanks are not to be routinely run before QC samples. If carryover is an issue, rinse-out times may need to be addressed.

16.9.2 Calibration Blank(s)

16.9.2.1 See Section 16.7.

16.9.3 Method Blank(s)

16.9.3.1 A method blank must be processed with each batch of 20 or less samples of the same matrix and prepared on the same working shift.
16.9.3.2 Acceptance Criteria:

16.9.3.2.1 All analytes of interest should be less than one half the MDL and must be less than the MDL.
16.9.3.2.2 Method blank values exceeding the MDL indicate laboratory/reagent contamination and should be considered suspect.
16.9.3.2.3 Method blank values exceeding the MDL may be considered useable if:

16.9.3.2.3.1 The blank analyte concentration is < 5% of the sample analyte concentration,
16.9.3.2.3.2 less than 5% of the regulatory limit,
16.9.3.2.3.3 or less than 3 times the MDL (whichever is greater),
16.9.3.2.3.4 All associated samples are appropriately qualified, and Project Management notification/approval is completed.

16.9.3.2.4 Other approved QA program requirements must be followed when the acceptable blank contamination specified in the approved QA project plan differs from the above.

16.9.3.3 Corrective Action:

16.9.3.3.1 If the method blank results do not meet the acceptance criteria above, then the laboratory must take corrective action to locate and reduce the source of the contamination.
16.9.3.3.2 All samples associated with the contaminated method blank must be reprocessed.
16.9.3.3.3 If samples cannot be reprocessed due to insufficient sample volume or other similar circumstances, a non-conformance must be documented in the data checklist for the analytical run. This must provide sufficient detail for project narration and to ensure all appropriate data flags are entered into LIMS.
16.9.3.3.4 Data reported with an associated contaminated method

blank must be flagged with a "B".

16.10 Laboratory Control Sample (LCS):

16.10.1 The LCS must be processed with each batch of 20 or less samples of the same matrix and processed on the same shift.

16.10.2 Acceptance Criteria:

16.10.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.10.3 LCS Corrective Action:

16.10.3.1 If the LCS recovery does not meet acceptance criteria, the sample batch must be reprocessed.

16.10.3.2 If samples cannot be reprocessed due to insufficient sample volume or other similar circumstances, a non-conformance must be documented in the data checklist for the analytical run. This must provide sufficient detail for project narration and to ensure all appropriate data flags are entered into LIMS.

16.10.3.3 Data reported with a failed LCS must be flagged and narrated as to potential bias characteristics.

16.11 Low-level Quality Control Sample (LLQC):

16.11.1 The LLQC must be processed with each batch of 20 or less samples of the same matrix and processed on the same shift.

16.11.2 Acceptance Criteria:

16.11.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.11.3 LLQC Corrective Action:

16.11.3.1 If the LLQC recovery does not meet acceptance criteria, samples of a similar concentration within the sample batch must be reprocessed.

16.11.3.2 If samples cannot be reprocessed due to insufficient sample volume or other similar circumstances, a non-conformance must be documented in the data checklist for the analytical run. This must provide sufficient detail for project narration and to ensure all appropriate data flags are entered into LIMS.

16.11.3.3 Data reported with a failed LLQC must be flagged and narrated as to potential bias characteristics.

16.12 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

16.12.1 A MS/MSD pair must be processed at a 10% frequency for Method 200.8 and at a 5% frequency for Method 6020A. MS/MSD samples must be of the same matrix and processed during the same working shift.

16.12.2 Acceptance Criteria:

16.12.2.1 Must meet accuracy and precision performance criteria as outlined in the applicable LIMS test code.

16.12.2.2 Recovery values should not be evaluated if the spike concentration is less than 25% of the parent concentration.

16.12.3 MS/MSD Corrective Action:

16.12.3.1 If the MS/MSD pair generates recovery values outside acceptance criteria, the deviation may be due to matrix effects. The LCS, internal standard recoveries, and calibration results must all be evaluated in order to determine if matrix interference is present. (Note that the MS/MSD are used to evaluate the matrix effect, not to control the analytical process.) If both the MS/MSD fall outside accuracy criteria for the same analyte, a matrix effect is suspected, assuming the LCS achieves accuracy criteria, and all internal standard recoveries are consistent.

As an example, if the matrix spikes exhibit low recovery but good precision, laboratory control samples exhibit acceptable accuracy, and internal standard recovery is consistent, the presence of matrix interference is probable.

16.12.3.2 If the MS/MSD pair generates inconsistent recovery values and/or suspect LCS values are present, laboratory error (and not matrix inference) is suspected.

As an example, if precision between the MS/MSD pair is poor and the LCS presents divergent results, the presence of laboratory error is probable.

16.12.4 MS/MSD Corrective Action:

16.12.4.1 If the MS/MSD fails acceptance criteria, the data must be evaluated for error or possible matrix effect.

16.12.4.2 If laboratory error is indicated, all associated samples must be reprocessed. If samples cannot be reprocessed due to limited sample volume or other similar circumstances, all reported values must be qualified and narrated as to potential bias or usability.

16.12.4.3 If matrix interference is indicated, associated samples may be reported with appropriate qualification and narration.

16.12.4.4 A non-conformance must be documented in the data checklist for either scenario and must contain sufficient detail for project narration and to ensure all appropriate data qualifiers have been entered into LIMS.

16.13 Internal Standards (IS):

16.13.1 Internal standards must be added to all samples with the exception of the ICPMS tuning solution. We utilize an automatic internal standard introduction system via a peristaltic pump.

16.13.2 Acceptance Criteria:

16.13.2.1 For samples processed according to USEPA 6020A, the IS results must be >70% of the original response in the initial calibration.
16.13.2.2 For samples processed according to USEPA 200.8, the IS results must fall between 60%-125% of the original response in the initial calibration.
16.13.2.3 Analytical results associated with IS failures may not be reported.

16.13.3 IS failure corrective action:

16.13.3.1 If criteria are not met, the cause of the problem must be determined, corrected, and the samples re-analyzed.
16.13.3.2 The sample must undergo a five-fold (1+4) dilution to alleviate potential matrix interference. Note: Greater dilutions may be necessary for samples contributing significant matrix interference.
16.13.3.3 Samples undergoing a necessary dilution due to IS failure must be notated as such if the target analyte concentration falls below the reporting limit.
16.13.3.4 If samples cannot be re-analyzed, all associated results must be qualified as "Unusable".

16.14 Reported Analyte Concentration

16.14.1 Reported concentrations for applicable analytes must be reported from the least dilute analysis that achieves all required quality control parameters.

16.15 Interference Check Solution:

16.15.1 The interference check solutions must be processed at the beginning of each analytical sequence and every 8 hours during an analytical run.
16.15.2 Acceptance Criteria:

16.15.2.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
16.15.2.2 All internal standard criteria must be achieved for the interference check solution analysis.

16.15.3 Interference Check Solution Failure

16.15.3.1 All samples associated with a failure of the ICS must be reprocessed.
16.15.3.2 If samples cannot be re-analyzed, all sample results must be qualified as unusable.

16.16 Dilution Test Check

16.16.1 If the sample analyte concentration is within the linear dynamic range and sufficiently high (>100 times the reagent blank), a sample dilution test should be completed at a five-fold dilution.
16.16.2 Acceptance Criteria

16.16.2.1 Must meet precision performance criteria as outlined in the applicable LIMS test code.

16.16.3 Dilution Test Failure

16.16.3.1 In the event of a dilution test failure, the sample must be closely inspected for indications of matrix interference.
16.16.3.2 A post digestion spike or standard addition should be completed on the failed sample to verify matrix interference.

16.17 Post Digestion spike requirements

16.17.1 One post digestion spike (PDS) must be completed for each batch of $\leq$ 20 samples.
16.17.2 The PDS should be spiked at the same level as the MS/MSD.
16.17.3 Acceptance Criteria

16.17.3.1 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.17.4 PDS Failure

16.17.4.1 If the spike is not recovered within the recommended limits, the sample must be diluted and reanalyzed.
16.17.4.2 The results of the diluted re-analysis must agree within $\pm$ 10% of the original determination.
16.17.4.3 If the PDS fails the various acceptance criteria, the sample should be processed using standard additions as detailed In Section 12.6.

17) Data Records Management

17.1 All data shall be stored both electronically and in hard copy.

17.1.1 Hard copy documentation must be maintained via logbooks for standard/chemical tracking, sample preparation procedures, and instrument maintenance.
17.1.2 All raw data and logbooks must be maintained for a period of no less than 7 years.
17.1.3 Electronic records shall be maintained for a period of no less than 7 years.

17.2 Prior to uploading into LIMS, the primary analyst must review all raw data for acceptability. The primary analyst must date/initial the hardcopy documentation verifying this review and the data acceptability.

17.3 A peer review of uploaded analytical data must be completed prior to validation. The secondary analyst must date/initial the hardcopy documentation verifying the secondary review and acceptability.

17.4 An analytical sequence may contain more than one sample preparation batch. LIMS assigns the preparation batch ID created by the analyst performing the preparation. Data from a sequence is transferred into LIMS by sequence. Each sequence has a sequence batch ID assigned by LIMS to track calibration results. Sample and QC Sample (LCS, LLQC, MS, MSD, Method blank) raw data are assigned the preparation batch ID.

The reported sequence and associated sample batches contain the completed review checklist.

17.5 Finalized data shall be stored in a designated section of the laboratory. After approximately two months from analysis date, data shall be transferred to the QA department for archival.

17.6 All signals produced by the detector(s) during analysis are collected via analog to digital converter and stored on the designated hard drive. Data from each analysis is stored in a separate file whose name corresponds to a run number recorded in an instrument specific logbook. Erasure of any electronic record is prohibited.

18) Quality Assurance and Quality Control

18.1 Logbooks must be reviewed monthly by the department supervisor.

18.2 Logbooks must be reviewed quarterly by the QA Staff.

18.3 The QA Staff must conduct periodic internal audits to evaluate compliance with this SOP.

19) Contingencies for Handling Out of Control Data

19.1 When method required QC failures occur, the source of the QC failure must be determined, corrected, and sample reanalysis carried out when possible.

19.2 When affected sample analysis cannot be repeated due to limitations on sample availability, or if reanalysis can only be performed after expiration of a sample hold time, the reporting of data associated with failed QC data must be appropriately flagged and narrated as necessary. Narration must be sufficient to define what effect the error has upon data quality and usability.

19.3 All analysts must report sufficient comments in LIMS such that project management can narrate and ensure appropriate data qualifiers are properly assigned.

19.4 Non-conformances must be documented in the data checklist for the analytical run.

19.5 When system or data quality deviations are noted, they must be documented in the NC/CA database for further evaluation.

20) Method Performance

20.1 Demonstration of Proficiency:

20.1.1 Initial Demonstration of Proficiency

20.1.1.1 The laboratory must determine linear dynamic range, method detection limits, and evaluation of quality control samples prior to sample analysis by this procedure.

20.1.2 Routine Demonstration of Proficiency

20.1.2.1 Each analyst must demonstrate initial proficiency with sample preparation and/or analytical determination by generating 4 sets of data of acceptable accuracy and precision for target analytes in a clean matrix.

20.1.2.2 Each analyst must demonstrate ongoing proficiency annually with each sample preparation and/or analytical determination method by generating 4 sets of data of acceptable accuracy and precision for target analytes in a clean matrix or by passing performance in approved PT evaluations.

20.2 Method Detection Limits (MDLs) must be determined on an annual basis (at minimum) or whenever major modifications are performed on instrumentation (ex: change detector, auto-sampler, etc.).

20.3 On-going laboratory performance must be documented via performance evaluation studies and must be completed approximately every 6 months.

21) Summary of Changes

Table 21.1 Summary of Changes

Revision Number	Effective Date	Document Editor	Description of Changes
R05	7/1/12	CES	Formatting / Compliance

22) References and Related Documents

22.1 Environmental Protection Agency, "Method 6020A Inductively Coupled Plasma Mass Spectrometry", Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Revision 1, February 2007.

22.2 U.S. Environmental Protection Agency, "Method 200.8, Inductively Coupled Plasma – Mass Spectrometry," Methods for Chemical Analysis of Water and Wastes, EPA-821-R-99-017, Revision 5.5, 1999.

22.3 ALS Environmental Quality Assurance Manual, Revision 6.0 (or most current)

22.4 Table 20.1-A - ICP-MS Analyte Listing for SW 846-6020A

22.5 Table 20.1-B - ICP-MS Analyte Listing for Method 200.8

22.6 Table 20.2 - LCS Acceptance Criteria

22.7 Table 20.3-A - Internal Standard Criteria for CLP SW 846-6020A

22.8 Table 20.3-B - Internal Standard Criteria for CLP Method 200.8

22.9 Table 20.3-C - Internal Standard Criteria for ORS Method SW846-6020A

22.10 Table 20.3-D - Internal Standard Criteria for ORS Method 200.8

22.11 Table 20.4 - Calibration and QC Summary

Table 20.1-A

Analyte List: SW 846-6020A

Aluminum	(Al)	7429-90-5
Antimony	(Sb)	7440-36-0
Arsenic	(As)	7440-38-2
Barium	(Ba)	7440-39-3
Beryllium	(Be)	7440-41-7
Cadmium	(Cd)	7440-43-9
Calcium	(Ca)	7440-70-2
Chromium	(Cr)	7440-47-3
Cobalt	(Co)	7440-48-4
Copper	(Cu)	7440-50-8
Iron	(Fe)	7439-89-6
Lead	(Pb)	7439-92-1
Magnesium	(Mg)	7439-95-4
Manganese	(Mn)	7439-96-5
Molybdenum	(Mo)	7439-98-7
Nickel	(Ni)	7440-02-0
Potassium	(K)	7440-09-7
Selenium	(Se)	7782-49-2
Silver	(Ag)	7440-22-4
Sodium	(Na)	7440-23-5
Thallium	(Tl)	7440-28-0
Vanadium	(V)	7440-62-2
Zinc	(Zn)	7440-66-6

(Additional analytes may be added based upon appropriate performance data.)

Table 20.1-B

Analyte List: Method 200.8

Aluminum	(Al)	7429-90-5
Antimony	(Sb)	7440-36-0
Arsenic	(As)	7440-38-2
Barium	(Ba)	7440-39-3
Beryllium	(Be)	7440-41-7
Cadmium	(Cd)	7440-43-9
Calcium	(Ca)	7440-70-2
Chromium	(Cr)	7440-47-3
Cobalt	(Co)	7440-48-4
Copper	(Cu)	7440-50-8
Iron	(Fe)	7439-89-6
Lead	(Pb)	7439-92-1
Magnesium	(Mg)	7439-95-4
Manganese	(Mn)	7439-96-5
Molybdenum	(Mo)	7439-98-7
Nickel	(Ni)	7440-02-0
Potassium	(K)	7440-09-7
Selenium	(Se)	7782-49-2
Silver	(Ag)	7440-22-4
Sodium	(Na)	7440-23-5
Thallium	(Tl)	7440-28-0
Vanadium	(V)	7440-62-2
Zinc	(Zn)	7440-66-6

(Additional analytes may be added based upon appropriate performance data.)

TABLE 20.2 - LCS ACCEPTANCE CRITERIA FOR METALS ANALYSIS BY ICP/MS

Analyte	Water Spike Amt, mg/L	6020A Water Lower %R Limit	6020A Water Upper %R Limit	200.8 Water Lower % R Limit	200.8 Water Upper % R Limit	Soil Spike Amt, mg/Kg	Soil Lower % R Limit	Soil upper % R Limit
Aluminum	0.1	80	120	85.0	115	5	80	120
Antimony	0.1	80	120	85.0	115	5	80	120
Arsenic	0.1	80	120	85.0	115	5	80	120
Barium	0.1	80	120	85.0	115	5	80	120
Beryllium	0.1	80	120	85.0	115	5	80	120
Cadmium	0.1	80	120	85.0	115	5	80	120
Calcium	10.0	80	120	85.0	115	500	80	120
Chromium	0.1	80	120	85.0	115	5	80	120
Cobalt	0.1	80	120	85.0	115	5	80	120
Copper	0.1	80	120	85.0	115	5	80	120
Iron	10.0	80	120	85.0	115	500	80	120
Lead	0.1	80	120	85.0	115	5	80	120
Potassium	10.0	80	120	85.0	115	500	80	120
Magnesium	10.0	80	120	85.0	115	500	80	120
Manganese	0.1	80	120	85.0	115	5	80	120
Molybdenum	0.1	80	120	85.0	115	5	80	120
Nickel	0.1	80	120	85.0	115	5	80	120
Selenium	0.1	80	120	85.0	115	5	80	120
Silver	0.1	80	120	85.0	115	5	80	120
Sodium	10.0	80	120	85.0	115	500	80	120
Strontium	0.1	80	120	85.0	115	5	80	120
Thallium	0.1	80	120	85.0	115	5	80	120
Tin	0.1	80	120	85.0	115	5	80	120
Titanium	0.1	80	120	85.0	115	5	80	120
Vanadium	0.1	80	120	85.0	115	5	80	120
Zinc	0.1	80	120	85.0	115	5	80	120

Table 20.3-A
Metals Analysis by ICP/MS: SW 846-6020A
Internal Standard Criteria for CCV, CCB and samples; Determined by CLP Method

CCV & CCB	Isotope	Ref IS	Lower %	Upper %	Samples and QC samples	Isotope	Ref IS	Lower %	Upper %
Li	7	Sc	-	-	Li	7	Sc	-	-
Be	9	Sc	-	-	Be	9	Sc	-	-
B	11	Sc	-	-	B	11	Sc	-	-
Na	23	Y	-	-	Na	23	Y	-	-
Mg	24	Y	-	-	Mg	24	Y	-	-
Al	27	Y	-	-	Al	27	Y	-	-
K	39	Y	-	-	K	39	Y	-	-
Ca	44	Y	-	-	Ca	44	Y	-	-
Sc (IS)	45	-	80	120	Sc (IS)	45	-	70	-
Ti	47	Y	-	-	Ti	47	Y	-	-
V	51	Y	-	-	V	51	Y	-	-
Cr	53	Y	-	-	Cr	53	Y	-	-
Mn	55	Y	-	-	Mn	55	Y	-	-
Fe	56	Y	-	-	Fe	56	Y	-	-
Co	59	Y	-	-	Co	59	Y	-	-
Ni	60	Y	-	-	Ni	60	Y	-	-
Cu	63	Y	-	-	Cu	63	Y	-	-
Zn	66	Y	-	-	Zn	66	Y	-	-
As	75	Y			As	75	Y	-	-
Se	82	Y	-	-	Se	82	Y	-	-
Sr	87	Y	-	-	Sr	87	Y	-	-
Y (IS)	89	-	80	120	Y (IS)	89	-	70	-
Mo	98	Y	-	-	Mo	98	Y	-	-
Ag	107	In (2), Y (3)	-	-	Ag	107	In (2), Y (3)	-	-
Cd	111	In	-	-	Cd	111	In	-	-
In (IS)	115	-	80	120	In (IS)	115	-	70	-
Sn	118	In	-	-	Sn	118	In	-	-
Sb	121	In (2), Y (3)	-	-	Sb	121	In (2), Y (3)	-	-
Ba	135	In	-	-	Ba	135	In	-	-
Tl	203	Bi	-	-	Tl	203	Bi	-	-
Pb	207	Bi	-	-	Pb	207	Bi	-	-
Bi (IS)	209	-	80	120	Bi (IS)	209	-	70	-

Table 20.3-B
Metals Analysis by ICP/MS: Method 200.8
Internal Standard Criteria for CCV, CCB and samples; Determined by CLP Method

CCV & CCB	Isotope	Ref IS	Lower %	Upper %	Samples and QC samples	Isotope	Ref IS	Lower %	Upper %
Li	7	Sc	-	-	Li	7	Sc	-	-
Be	9	Sc	-	-	Be	9	Sc	-	-
B	11	Sc	-	-	B	11	Sc	-	-
Na	23	Y	-	-	Na	23	Y	-	-
Mg	24	Y	-	-	Mg	24	Y	-	-
Al	27	Y	-	-	Al	27	Y	-	-
K	39	Y	-	-	K	39	Y	-	-
Ca	44	Y	-	-	Ca	44	Y	-	-
Sc (IS)	45	-	80	120	Sc (IS)	45	-	60	125
Ti	47	Y	-	-	Ti	47	Y	-	-
V	51	Y	-	-	V	51	Y	-	-
Cr	53	Y	-	-	Cr	53	Y	-	-
Mn	55	Y	-	-	Mn	55	Y	-	-
Fe	56	Y	-	-	Fe	56	Y	-	-
Co	59	Y	-	-	Co	59	Y	-	-
Ni	60	Y	-	-	Ni	60	Y	-	-
Cu	63	Y	-	-	Cu	63	Y	-	-
Zn	66	Y	-	-	Zn	66	Y	-	-
As	75	Y			As	75	Y	-	-
Se	82	Y	-	-	Se	82	Y	-	-
Sr	87	Y	-	-	Sr	87	Y	-	-
Y (IS)	89	-	80	120	Y (IS)	89	-	60	125
Mo	98	Y	-	-	Mo	98	Y	-	-
Ag	107	In (2), Y (3)	-	-	Ag	107	In (2), Y (3)	-	-
Cd	111	In	-	-	Cd	111	In	-	-
In (IS)	115	-	80	120	In (IS)	115	-	60	125
Sn	118	In	-	-	Sn	118	In	-	-
Sb	121	In (2), Y (3)	-	-	Sb	121	In (2), Y (3)	-	-
Ba	135	In	-	-	Ba	135	In	-	-
Tl	203	Bi	-	-	Tl	203	Bi	-	-
Pb	207	Bi	-	-	Pb	207	Bi	-	-
Bi (IS)	209	-	80	120	Bi (IS)	209	-	60	125

Table 20.3-C
Metals Analysis by ICP/MS: SW 846-6020A
Internal Standard Criteria for CCV, CCB and samples; Determined by ORS Method

CCV & CCB	Isotope	Ref IS	Lower %	Upper %	Samples and QC samples	Isotope	Ref IS	Lower %	Upper %
Li (IS)	6	-	80	120	Li	6	-	70	-
Li	7	Li	-	-	Li	7	Li	-	-
Be	9	Li	-	-	Be	9	Li	-	-
B	11	Li	-	-	B	11	Li	-	-
Na	23	Ge	-	-	Na	23	Ge	-	-
Mg	24	Ge	-	-	Mg	24	Ge	-	-
Al	27	Ge	-	-	Al	27	Ge	-	-
K	39	Ge	-	-	K	39	Ge	-	-
Ca	44	Ge	-	-	Ca	44	Ge	-	-
Ti	47	Ge	-	-	Ti	47	Ge	-	-
V	51	Ge	-	-	V	51	Ge	-	-
Cr	53	Ge	-	-	Cr	53	Ge	-	-
Mn	55	Ge	-	-	Mn	55	Ge	-	-
Fe	56	Ge	-	-	Fe	56	Ge	-	-
Co	59	Ge	-	-	Co	59	Ge	-	-
Ni	60	Ge	-	-	Ni	60	Ge	-	-
Cu	63	Ge	-	-	Cu	63	Ge	-	-
Zn	66	Ge	-	-	Zn	66	Ge	-	-
Ge (IS)	72	-	80	120	Ge (IS)	72	-	70	-
As	75	Ge			As	75	Ge	-	-
Se	82	Ge	-	-	Se	82	Ge	-	-
Sr	87	Ge	-	-	Sr	87	Ge	-	-
Mo	98	Ge	-	-	Mo	98	Ge	-	-
Ag	107	In(2) Ge(3)	-	-	Ag	107	In(2) Ge(3)	-	-
Cd	111	In	-	-	Cd	111	In	-	-
In (IS)	115	-	80	120	In (IS)	115	-	70	-
Sn	118	In	-	-	Sn	118	In	-	-
Sb	121	In(2) Ge(3)	-	-	Sb	121	In(2) Ge(3)	-	-
Ba	135	In	-	-	Ba	135	In	-	-
Tl	203	Bi	-	-	Tl	203	Bi	-	-
Pb	207	Bi	-	-	Pb	207	Bi	-	-
Bi (IS)	209	-	80	120	Bi (IS)	209	-	70	-

Table 20.3-D
Metals Analysis by ICP/MS: Method 200.8
Internal Standard Criteria for CCV, CCB and samples; Determined by ORS Method

CCV & CCB	Isotope	Ref IS	Lower %	Upper %	Samples and QC samples	Isotope	Ref IS	Lower %	Upper %
Li (IS)	6	-	80	120	Li	6	-	60	125
Li	7	Li	-	-	Li	7	Li	-	-
Be	9	Li	-	-	Be	9	Li	-	-
B	11	Li	-	-	B	11	Li	-	-
Na	23	Ge	-	-	Na	23	Ge	-	-
Mg	24	Ge	-	-	Mg	24	Ge	-	-
Al	27	Ge	-	-	Al	27	Ge	-	-
K	39	Ge	-	-	K	39	Ge	-	-
Ca	44	Ge	-	-	Ca	44	Ge	-	-
Ti	47	Ge	-	-	Ti	47	Ge	-	-
V	51	Ge	-	-	V	51	Ge	-	-
Cr	53	Ge	-	-	Cr	53	Ge	-	-
Mn	55	Ge	-	-	Mn	55	Ge	-	-
Fe	56	Ge	-	-	Fe	56	Ge	-	-
Co	59	Ge	-	-	Co	59	Ge	-	-
Ni	60	Ge	-	-	Ni	60	Ge	-	-
Cu	63	Ge	-	-	Cu	63	Ge	-	-
Zn	66	Ge	-	-	Zn	66	Ge	-	-
Ge (IS)	72	-	80	120	Ge (IS)	72	-	60	125
As	75	Ge			As	75	Ge	-	-
Se	82	Ge	-	-	Se	82	Ge	-	-
Sr	87	Ge	-	-	Sr	87	Ge	-	-
Mo	98	Ge	-	-	Mo	98	Ge	-	-
Ag	107	In(2) Ge(3)	-	-	Ag	107	In(2) Ge(3)	-	-
Cd	111	In	-	-	Cd	111	In	-	-
In (IS)	115	-	80	120	In (IS)	115	-	60	125
Sn	118	In	-	-	Sn	118	In	-	-
Sb	121	In(2) Ge(3)	-	-	Sb	121	In(2) Ge(3)	-	-
Ba	135	In	-	-	Ba	135	In	-	-
Tl	203	Bi	-	-	Tl	203	Bi	-	-
Pb	207	Bi	-	-	Pb	207	Bi	-	-
Bi (IS)	209	-	80	120	Bi (IS)	209	-	60	125

Table 20.4 Summary of Calibration and QC Procedures for Method 200.8 & 6020A			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action[a]**
ICPMS tuning sample.	Prior to initial calibration and calibration verification.	RSD < 5%. Amu +/- 0.1 true value.	Retune instrument then reanalyze tuning solution.
Initial calibration (minimum 4 standards and a blank).	Daily initial calibration prior to sample analysis.	r > 0.998.	N/A.
Initial Calibration verification (second source).	Daily after initial calibration,	All analytes within ±10% of expected value.	Correct problem and repeat initial calibration.
Calibration blank.	Before beginning a sample run, after every 10 samples and at end of the analysis sequence.	No analytes detected > 3 x IDL.	Correct problem then analyze calibration blank and previous 10 samples.
Calibration verification (Instrument Check Standard).	Before beginning a sample run, after every 10 samples and at the end of the analysis sequence.	All analyte(s) within ±10% of expected value.	Correct problem then repeat calibration and reanalyze all samples since last successful calibration.
Demonstrate ability to generate acceptable accuracy and precision using four replicate LCS analyses.	Once per analyst.	All analyte(s) within ± 20% of the expected value.	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria.
Method blank.	One per preparation batch.	No analytes detected > 3 x MDL.	Correct problem, re-digest and analyze method blank and all samples processed with the contaminated blank.

Table 20.4
Summary of Calibration and QC Procedures for Method 200.8 & 6020A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]
Interference check solutions (ICS-A and ICS-AB).	At the beginning of an analytical run and every 8 hours.	ICS-A: All non-spiked analytes < ½ MQL; Spiked analytes within ±20% of true value. ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all affected samples.
LCS for the analyte.	One LCS per preparation batch.	All analytes within ± 15% of the expected value for 200.8 and +/- 20% for 6020A.	Correct problem, re-digest and reanalyze the LCS and all samples in the affected preparation batch.
Dilution test.	Each preparatory batch.	5X dilution must agree within ±10% of the original determination for analytes present at concentrations > 100x concentrations found in reagent blank.	Perform post digestion spike addition for failed analytes.
Post digestion spike addition.	When dilution test fails.	Recovery within 80%-120% of expected results.	Dilute the sample; reanalyze post digestion spike addition.
MS/MSD	5% frequency for 6020A, 10% frequency for 200.8.	QC advisory acceptance criteria, 70% - 130% for 200.8. 75% - 125% for 6020A.	Describe in Laboratory Review Checklist.
Internal Standards (ISs).	Every sample.	Sample IS intensity: *SW 846-6020a samples must meet >70% criteria. EPA 200.8 samples must meet 60-125% criteria.*	Perform corrective action and/or dilution and reprocess all effected samples.
MDL study.	Performed Annually	Detection limits established shall be < 1/3 the MQLs in Tables 21.1	None.

Table 20.4
Summary of Calibration and QC Procedures for Method 200.8 & 6020A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]
IDL study.	Performed Quarterly	Average of standard deviation of reagent blank analyzed 7 times on at least 3 non-consecutive days.	None.
Low-level Initial Calibration Verification (LLICV)	Performed daily after intial calibration	70%-130% of expected value spike at MQL.	Correct problem and repeat initial calibration.
Low-level Continuing Calibration Verification (LLCCV)	Performed before analysis of samples and after every 10 samples in the sequence.	70%-130% of expected value spike at MQL.	Correct problem then repeat calibration and reanalyze all samples of similar concentration since last successful calibration verification.
Low-level Quality Control Sample (LLQC)	One LLQC per preparation batch.	70%-130% of expected value spike at MQL. Carried through entire preparation process.	Correct problem, re-digest and reanalyze the LCS and all samples in the affected preparation batch.

STANDARD OPERATING PROCEDURE

ALS Environmental

DOCUMENT TITLE:	***MERCURY IN SOLID OR SEMISOLID WASTE***
REFERENCED METHOD:	***EPA 7471A/B***
SOP ID:	***MET- 7471***
REV. NUMBER:	***16***
EFFECTIVE DATE:	***1/31/2013***

MERCURY IN SOLID OR SEMISOLID WASTE

EPA 7471A/B

ALS-KELSO

SOP ID:	MET-7471	Rev. Number:	16	Effective Date:	1/31/2013

Approved By: _____ Date: 12/31/12
Department Supervisor – Jeff Coronado

Approved By: _____ Date: 12/31/12
QA Manager – Suzanne LeMay

Approved By: _____ Date: 12/31/12
Laboratory Director – Jeff Grindstaff

Issue Date:	_____	Doc Control ID#:	_____	Issued To:	_____

Standard Operating Procedure

for

MERCURY IN SOLID OR SEMISOLID WASTE

1. SCOPE AND APPLICATION

1.1. This Standard Operating Procedure (SOP) describes the procedure used to determine the concentrations of Mercury in soils, sediments, freeze dried tissues, bottom deposits, and sludge-type materials using Method EPA 7471A or 7471B. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix. Method 7471 is a cold-vapor atomic absorption procedure.

1.2. The Method Reporting Limit (MRL) is 0.02 mg/kg. Equivalent nomenclature for MRL includes Estimated Quantitation Limit (EQL). Therefore, MRL=EQL. The reported MRL may be adjusted if required for specific project requirements; however, the capability of achieving other reported MRLs must be demonstrated. A Method Detection Limit (MDL) of 0.002 mg/kg has been achieved using this procedure.

2. METHOD SUMMARY

2.1. A representative aliquot of sample is prepared as described in this procedure. The mercury is reduced to its elemental state and aerated from solution and measured with an atomic absorption spectrometer. The mercury vapor passes through a cell positioned in the light path of the AA where absorbance is measured as a function of mercury concentration.

3. DEFINITIONS

3.1. **Batch** - A batch of samples is a group of environmental samples that are prepared and/or analyzed together as a unit with the same process and personnel using the same lot(s) of reagents. It is the basic unit for analytical quality control.

3.1.1. Preparation Batch - A preparation batch is composed of one to twenty field samples, all of the same matrix, and with a maximum time between the start of processing of the first and last samples in the batch to be 24 hours.

3.1.2. Analysis Batch - Samples are analyzed in a set referred to as an analysis sequence. The sequence begins with instrument calibration (initial or continuing verification) followed by sample extracts interspersed with calibration standards (CCBs, CCVs, etc.) The sequence ends when the set of samples has been injected or when qualitative and/or quantitative QC criteria indicate an out-of-control situation.

3.2. **Sample**

3.2.1. Field Sample - An environmental sample collected and delivered to the laboratory for analysis; a.k.a., client's sample.

3.2.2. Laboratory Sample - A representative portion, aliquot, or subsample of a field sample upon which laboratory analyses are made and results generated.

3.3. **Quality System Matrix** - The *matrix* of an environmental sample is distinguished by its physical and/or chemical state and by the program for which the results are intended. The following sections describe the matrix distinctions. These matrices shall be used for purpose of batch and quality control requirements.

3.3.1. Aqueous - Any groundwater sample, surface water sample, effluent sample, and TCLP or other extract. Specifically excluded are samples of the drinking water matrix and the saline/estuarine water matrix.

3.3.2. Drinking water - Any aqueous sample that has been designated a potable or potential potable water source.

3.3.3. Saline/Estuarine water - Any aqueous sample from an ocean or estuary or other salt-water source.

3.3.4. Non-aqueous Liquid - Any organic liquid with <15% settleable solids.

3.3.5. Animal tissue - Any tissue sample of an animal, invertebrate, marine organism, or other origin; such as fish tissue/organs, shellfish, worms, or animal material.

3.3.6. Solids - Any solid sample such as soil, sediment, sludge, and other materials with >15% settleable solids.

3.3.7. Chemical waste - Any sample of a product or by-product of an industrial process that results in a matrix not described in one of the matrices in Sections 3.3.1 through 3.3.6. These can be such matrices as non-aqueous liquids, solvents, oil, etc.

3.3.8. Miscellaneous matrices – Samples of any composition not listed in 3.3.1 – 3.3.7. These can be such matrices as plant material, paper/paperboard, wood, auto fluff, mechanical parts, filters, wipes, etc. Such samples shall be batched/grouped according to their specific matrix.

3.4. Matrix Spike/Duplicate Matrix Spike (MS/DMS) Analysis - In the matrix spike analysis, predetermined quantities of target analytes are added to a sample matrix prior to sample preparation and analysis. The purpose of the matrix spike is to evaluate the effects of the sample matrix on the method used for the analysis. Duplicate samples are spiked, and analyzed as a MS/DMS pair. Percent recoveries are calculated for each of the analytes detected. The relative percent difference (RPD) between the duplicate spikes (or samples) is calculated and used to assess analytical precision. The concentration of the spike should be at the mid point of the calibration range or at levels specified by a project analysis plan.

3.5. Laboratory Duplicates (DUP) – Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. The relative percent difference (RPD) between the sample and its duplicate is calculated and used to assess analytical precision.

3.6. Surrogate - Surrogates are organic compounds which are similar to analytes of interest in chemical composition, extraction and chromatography, but which are not normally found in

environmental samples. The purpose of the surrogates is to evaluate the preparation and analysis of samples. These compounds are spiked into all blanks, standards, samples and spiked samples prior to extraction and analysis. Percent recoveries are calculated for each surrogate.

3.7. Method Blank (MB) - The method blank is an artificial sample composed of analyte-free water or solid matrix and is designed to monitor the introduction of artifacts into the analytical process. The method blank is carried through the entire analytical procedure.

3.8. Laboratory Control Samples (LCS) – The LCS is an aliquot of analyte free water or analyte free solid to which known amounts target analytes are added. The LCS is prepared and analyzed in exactly the same manner as the samples. The percent recovery is compared to established limits and assists in determining whether the batch is in control.

3.9. Independent Verification Standard (ICV) - A mid-level standard injected into the instrument after the calibration curve and prepared from a different source than the initial calibration standards. This is used to verify the validity of the initial calibration standards

3.10. Continuing Calibration Verification Standard (CCV) - A mid-level standard analyzed at specified intervals. Used to verify that the initial calibration curve is still valid for quantitative purposes.

3.11. Instrument Blank (CCB) - The instrument blank (also called continuing calibration blank) is a volume of clean solvent analyzed on each column and instrument used for sample analysis. The purpose of the instrument blank is to determine the levels of contamination associated with the instrumental analysis itself, particularly with regard to the carry-over of analytes from standards or highly contaminated samples into subsequent sample analyses.

3.12. Duplicates and Duplicate Matrix Spikes are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed.

3.13. Standard Reference Material (SRM) – A material with specific certification criteria and is issued with a certificate or certificate of analysis that reports the results of its characterizations and provides information regarding the appropriate use(s) of the material. An SRM is prepared and used for three main purposes: (1) to help develop accurate methods of analysis; (2) to calibrate measurement systems used to facilitate exchange of goods, institute quality control, determine performance characteristics, or measure a property at the state-of-the-art limit; and (3) to ensure the long-term adequacy and integrity of measurement quality assurance programs.

4. INTERFERENCES

4.1. Potassium permanganate is added to eliminate possible interference from sulfide. Samples high in chlorides require additional permanganate because, during the oxidation step, chlorides are converted to free chlorine, which absorbs radiation at 253 nm.

5. SAFETY

5.1. All appropriate safety precautions for handling solvents, reagents and samples must be taken when performing this procedure. This includes the use of personnel protective equipment, such as, safety glasses, lab coat and the correct gloves.

5.2. Chemicals, reagents and standards must be handled as described in the ALS safety policies, approved methods and in MSDSs where available. Refer to the ALS Environmental, Health and Safety Manual and the appropriate MSDS prior to beginning this method.

5.3. Hydrochloric and/or Nitric Acid are used in this method. These acids are extremely corrosive and care must be taken while handling them. A face shield should be used while pouring acids. And safety glasses should be worn while working with the solutions. Lab coat and gloves should always be worn while working with these solutions.

6. SAMPLE COLLECTION, CONTAINERS, PRESERVATION, AND STORAGE

6.1. Glass, plastic, and polytetraflouroethylene (PTFE) containers are suitable in most cases.

6.2. Non-aqueous samples are stored at 4 ± 2 °C from receipt until analysis, unless otherwise dictated by project specifications.

6.3. Samples must be analyzed within 28 days of sampling.

7. APPARATUS AND EQUIPMENT

7.1. CETAC M-6000A Mercury Analyzer. See Attachments for instrument parameters.

7.2. CPI-Modified Block (Mod Block)

7.3. Pipettors, Eppendorf and Finnpipette fixed and adjustable volume

7.4. Polypropylene graduated cylinders, 25 mL

7.5. 125 ml Digestion Vessel tubes.

7.6. Laboratory balance, top-loader capable of readings .001g (3-place). Mettler, Ohaus, or equivalent.

8. STANDARDS AND REAGENTS

8.1. Reagent grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lowering the accuracy of the determination. The preparation for all laboratory prepared reagents and solutions must be documented in a laboratory logbook. Refer to the SOP *Reagent/Standards Login and Tracking (ADM-RTL)* for the complete procedure and documentation requirements.

8.2. Mercury stock solution (1,000 mg/L). Commercially prepared certified solution stored at room temperature. The expiration date determined by manufacturer.

8.3. Mercury working standard (100µg/L). Prepared from the intermediate stock solution listed above. Store at room temperature and prepare a new standard daily.

8.4. Laboratory Control Sample - ERA Priority Pollutant/CLP Inorganic Soil reference material. Store at room temperature in the original container and use the vendor expiration date.

8.5. Matrix spike solution (1 mg/L) - Prepare by making a 1:1000 dilution of the mercury stock solution. Store at room temperature and prepare a new standard monthly.

Note: See section 11.2.2-3 for details on preparation of calibration and ICV standards. See section 12 for QC sample preparation.

8.6. Reagent water - ASTM Type II water (laboratory deionized water).

8.7. Acids - Purity of acids must be established by the laboratory as being high enough to eliminate the introduction of contamination above the Method Reporting Limit.

8.7.1. Nitric Acid (HNO_3) 69-70% - JT Baker-Baker Instra-Analyzed® or equivalent.

8.7.2. Sulfuric Acid concentrated (H_2SO_4) - EMD-OmniTrace® or equivalent.

8.7.3. Hydrochloric Acid concentrated (HCL) - VWR - BHD-Aristar® or equivalent.

8.8. Potassium permanganate solution, 5% w/v. To prepare, add 50 g of solid reagent to 1000 mL of D.I. water and place on magnetic stir plate for approximately 30 minutes until dissolved.

8.9. Sodium chloride/hydroxylamine hydrochloride solution, 12% w/v each. To prepare, add 120g sodium chloride and 120 g of hydroxylamine hydrochloride to 1000 mL of D.I. water and place on magnetic stir plate for approximately 15 minutes until dissolved.

8.10. Stannous chloride, 10% w/v in HCl (7% v/v). To prepare, add 100g stannous chloride crystals and 70 mL of concentrated hydrochloric acid in 1000 mL of D.I. water. Seal lid on mixing bottle and shake until the stannous chloride is dissolved.

8.11. Aqua Regia - Prepare immediately before use by carefully adding 3 parts of concentrated HCL to one part of HNO_3.

9. PREVENTIVE MAINTENANCE

9.1. All maintenance activities are recorded in a maintenance logbook kept for each instrument. Pertinent information (serial numbers, instrument I.D., etc.) must be in the logbook. This includes the routine maintenance described in section 9. The entry in the log must include: date of event, who performed the work, and a reference to return to analytical control.

9.2. ALS staff performs all routine maintenance and troubleshooting. Preventative maintenance activities listed below should be performed when needed as determined by instrument performance (i.e. stability, sensitivity, etc.) or by visual inspection. Repairs of an extraordinary nature may or may not require factory service, depending on the nature of the task.

9.3. Keep the instrument free of dust, deposits, and chemical spills.

9.4. Replace the peristaltic and autosampler rinse tubing.

9.5. Remove and clean the Gas-Liquid Separator.

9.6. Remove, dismantle, and clean the optical cells (sample cell and reference cell) including the sapphire windows.

9.7. Replace the Hg lamp bulb when the lamp current reaches 13 mA.

10. RESPONSIBILITIES

10.1. It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP. This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

10.2. It is the responsibility of the department supervisor/manager to document analyst training and method proficiency, as described in the *ADM-TRAIN.*

11. PROCEDURE

11.1. Sample Preparation

11.1.1. Mix the sample thoroughly to achieve homogeneity. For soil, sediment, solids, weigh approximately 0.5g of well-homogenized sample and place in the bottom of a 125 ml digestion tube and record the weight to the nearest 0.01g. Add 5.0 mL of reagent water and 5.0 mL of aqua regia, then heat in the Mod Block for 2 minutes at 95°C.

11.1.2. Cool then add 10 mL of reagent water and 15 mL of potassium permanganate solution. If the purple color does not persist for 15 minutes add additional potassium permanganate until it does so. Any additional potassium permanganate solution must also be added to the blanks and standards in equal proportion.

Note: Spiking solution is added prior to acidification.

11.1.3. Mix thoroughly and place in the heating block for 30 minutes at 95°C. The temperature of the block is monitored with a thermometer that is calibrated monthly.

11.1.4. Cool and add 6 mL of sodium chloride-hydroxylamine hydrochloride to reduce the excess permanganate. Perform this addition under a hood as Cl_2 could be evolved.

11.1.5. Add 27 mL of reagent water and the sample is ready for analysis. (The vapor generator does the step of adding the stannous chloride solution automatically.)

11.2. Calibration

11.2.1. To prepare calibration standards a 10 ppm intermediate stock solution is first prepared by aliquoting 1.0 mL of commercially prepared 1000 ppm stock standard into an acid rinsed 100 mL Class A volumetric flask and diluting to volume with 1% HNO3. This solution must be prepared monthly. Next, a 100 ppb working solution is prepared by aliquoting 1.0 mL of the 10 ppm intermediate stock solution into an acid rinsed 100 mL Class A volumetric flask and diluting to volume with 1% HNO3. This solution must be prepared daily.

Note: All standard aliquots are measured using calibrated fixed or adjustable volume autopipettors or calibrated disposable 5.0 or 10.0 mL pipettes.

11.2.2. Transfer 0, 0.1, 0.25, 0.5, 2.5 and 5.0 mL aliquots of the working solution to a series of labeled 125 ml digestion tubes. Add the appropriate amount of reagent water to bring each bottle to a volume of 5mL. Add 5.0 mL of aqua regia and heat in the heating block for 2 minutes at 95°C. The final concentrations of the prepared standards are 0, 0.2, 0.5, 1.0, 5.0, 10.0 ppb.

11.2.3. The Initial Calibration Verification (ICV) is prepared by first making a 1000 ppb intermediate solution. 0.10 mL of commercially prepared 1000 ppm stock standard, from a different manufacturer and lot than the calibration standard, is aliquoted into an acid rinsed 100 mL Class A volumetric flask and diluting to volume with 1% HNO_3. This solution must be prepared monthly. Prepare the ICV standard by aliquoting 0.25 mL to a labeled 125 ml digestion tube. Add the 4.75 mL of reagent water and 5.0 ml of Aqua Regia.

11.2.4. Cool and then add 10 mL of reagent water and 15 mL of potassium permanganate solution and return the bottles to the water bath for 30 minutes.

11.2.5. Cool and add 6.0 mL of sodium chloride-hydroxylamine hydrochloride solution. Add 27 mL of reagent water and the standards are ready for analysis.

11.2.6. CETAC Calibration and Sample Analysis

11.2.6.1. Turn on the CETAC instrument, including the Hg lamp, and autosampler. After this is done turn open the operating software (Mercury Analyzer 1.5.1.1).

11.2.6.2. The rinse station for the autosampler turns on automatically, but the peristaltic pump must be started manually. Make sure all sample uptake and drain tubes are placed correctly on the pump and are secured with the appropriate tension. Place the reagent uptake tube in the stannous chloride and start the pump.

11.2.6.3. From the software's main screen select the "Worksheet" button and then the "Template" button. Select the "Kelso Mercury Program".

11.2.6.4. Go to the "Labels" tab and enter the QC and field samples to be analyzed in the appropriate order.

11.2.6.5. Transfer the solutions to be analyzed to labeled 12mL polyethylene test tubes and place them in the appropriate spaces on the autosampler trays.

11.2.6.6. Transfer the calibration blank and standards (0.2, 0.5, 1.0, 5.0, and 10 ppb) from their digestion tubes to the standard tubes located behind the autosampler trays. The calibration blank is placed in the left most tube and the other standards are placed in ascending order to the right.

11.2.6.7. Return to the software and go to the "Analysis" tab. At this point the analysis is ready to begin. Click on the start button. In the dialog box that appears be sure the following are checked:

- Calibrate before first sample.
- New output file before first sample.
- Zero before first sample.

Click start and the analysis will begin.

11.2.7. After the calibration standards have run the software will use linear regression to create a calibration curve based on the concentration and measured absorbance of each standard. The form of regression line is $y = mx + b$. If the correlation coefficient of the curve is greater than 0.995 the analysis will continue, if not the analysis will be terminated and corrective action will be needed by the analyst.

11.3. As the analysis sequence proceeds, next analyze the following QC standards.

- ICV (5.0 ppb standard prepared from a second source)
- ICB
- CCV (5.0 ppb calibration standard)
- CCB
- CRA (0.2 ppb calibration standard)

If either the ICV or CCV are different from their true values by more than 10% the software will terminate the analysis. If either the ICB or CCB is greater than the MRL the software will terminate the analysis. Method 7471A does not contain criteria for the CRA, however, the result must be a positive measured concentration. For 7471B analyses the criteria are 50-150% of the true value. Also, specific project requirements may apply.

Note: For projects falling under DoD QSM requirements, the QSM criteria for CCV standards is ±20% and for ICB and CCB standards no analytes detected > LOD. (The ICV limit is as listed above.)

11.4. Sample Analysis

11.4.1. The samples are analyzed with the CETAC analyzer in the same manner as the calibration standards. The analyzer does the step of adding the stannous chloride solution automatically. Check the baseline between samples to verify that the spectrometer reading has stabilized at the normal baseline level.

11.4.2. The analytical sequence should be set up to include all samples, QC samples, blanks, and calibration verification standards at necessary intervals. Refer to the SOP for Sample Batches.

11.4.3. Sample digestion batches are analyzed with a set of CCV and CCB standards which are run at the beginning and end of the analytical run and at a minimum every 10 samples during the run. The same criteria listed above are applied to the CCVs and CCBs and if one is found to be outside these limits the analysis is terminated.

12. QA/QC REQUIREMENTS

12.1. Initial Precision and Recovery Validation

12.1.1. Acceptable accuracy and precision of the procedure must be demonstrated before analysis of samples begins, or whenever significant changes to the procedures have been made.

12.1.2. Accuracy and precision is demonstrated by preparing and analyzing four LCS aliquots. The average percent recovery of for each analyte must be within LCS limits and the %RSD within precision limits.

12.1.3. initial demonstration of capability must be performed by each analyst performing sample analysis and documented in the laboratory records.

12.2. Method Detection Limits

12.2.1. A method detection limit (MDL) study must be undertaken before analysis of samples can begin. To establish detection limits that are precise and accurate, the analyst must perform the following procedure. Spike a minimum of seven blank replicates with a MDL spiking solution near the MRL and analyze. Refer to the ALS *SOP Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation* (ADM-MDL).

12.2.2. Calculate the average concentration found (x) in the sample concentration, and the standard deviation of the concentrations for each analyte. Calculate the MDL for each analyte using the correct T value for the number of replicates. The MDL study should be done annually. The MDL study and MDL verification check should be analyzed annually or whenever there are major changes in the instrument or procedure is implemented.

12.3. For method 7471B, an LLQC sample (a CRA that is carried through the digestion) must be analyzed to verify accuracy at the MRL. The recovery must be 50-150%.

12.4. For method 7471B, Instrument Detection Limit (IDL) studies are performed quarterly. These will be calculated and made available to the analysts.

12.5. Ongoing QC Samples required are described in the ALS-Kelso Quality Assurance Manual, in the *SOP for Sample Batches* (ADM-Batch). For this analysis, these include:

12.5.1. Prepare one method blank (MB) per digestion batch, or per 20 samples, whichever is more frequent. The MB is to be prepared as done with samples. The Method Blank should be < MRL. If the Method Blank is >MRL redigest the associated samples if sample levels are <20x the MB level.

Note: For projects falling under DoD QSM requirements, the QSM criteria for method blanks is no analytes detected > ½ MRL.

12.5.2. Prepare one Laboratory Control Sample (LCS) per digestion batch, or per 20 samples. Weigh 0.25g of the current lot of "Environmental Resource Associates Priority Pollutant/CLP Inorganic Soil" prepared reference material in to a 125 mL Digestion vessel tube and prepare as per the procedure.

12.5.3. Calculate the LCS recovery as follows:

$$\%R = X/TV \times 100$$

Where X = Concentration of the analyte recovered
TV = True value of amount spiked

Apply LCS recovery criteria from the DQO Table, unless project-specific or in-house limits are established. For method 7471B, the LCS recovery limits are 80-120%. If statistical in-house limits are used, they must fall within the 80-120% range.

Note: For DoD QSM projects, the QSM LCS criterion is 80-120%. If the LCS fails the acceptance criteria, re-digest the batch of samples.

12.5.4. Prepare one sample duplicate and one matrix spike sample per each digestion batch, or per twenty samples, whichever is more frequent. For the matrix spike, add 0.25mL of the matrix spike solution to the designated spike sample, resulting in a spike concentration of 0.5 mg/kg. At times, specific samples will be assigned as duplicates or spikes depending on client requirements.

Note: Duplicate samples are routinely analyzed; however some projects may require a MSD. All DoD projects require a MSD. The MSD sample is prepare as described above.

12.5.5. The RPD criterion for duplicates is 20% RPD. If not, flag the data or redigest samples. Apply matrix spike recovery criterion listed in the DQO Table, unless project-specific limits are required. For method 7471B, the recovery limits are 80-120%. If statistical in-house limits are used, they must fall within the 80-120% range. For DoD QSM work, MS recoveries are assessed using the QSM LCS control limits. If the MS (and/or MSD where applicable) recovery is outside acceptance limits proceed with the additional interference tests described in section 12.5.4. Based on results of these tests, the physical nature of the sample (e.g. homogeneity), and any specific project requirements, a determination can then be made as to appropriate corrective action (e.g. redigestion, reporting with a qualifier, alternative methodologies, etc.). If the analyte concentration is >4x the spike level the spike control limit is no longer applicable and no action is required.

Note: For DoD QSM projects, the duplicate RPD limit is 20% and MS recoveries are assessed using the QSM LCS control limits 80-120%.

12.5.5.1.Calculate percent recovery (%R) as:

$$\%R = \frac{X - X1}{TV} \times 100$$

Where X = Concentration of the analyte recovered
X1 = Concentration of unspiked analyte
TV = True value of amount spiked

12.5.5.2.Calculate Relative Percent Difference (RPD) as:

$$\%RPD = \frac{|R1 - R2|}{(R1 + R2)/2} \times 100$$

Where R1= Higher Result
R2= Lower Result

12.5.6. Interference Tests: Prepare one post spike for every batch of samples and if samples are sufficiently high (10x the MRL/LOQ) a serial dilution. The serial dilution must agree within 10% of the original sample result. Post spike recovery acceptance limits for method 7471A and 7471B are 80-120% for project falling under SW846 Update IV. When both the post spike and dilution tests fail all of the samples in the associated preparation batch must be quantified via Method of Standard Additions (MSA).

13. CALCULATIONS, DATA REDUCTION, AND REPORTING

13.1. It is the analyst's responsibility to review analytical data to ensure that all quality control requirements have been met for each analytical run. Results for QC analyses are calculated and recorded as specified in section 12.

13.2. Record all sample weight, volumes and dilutions on an A.A. benchsheet (see Attachments).

13.3. Solution concentrations are calculated by the Mercury Analyzer software based on the linear regression calibration curve created when the calibration standards are analyzed. The absorbance measured for each sample is applied to the linear regression curve and the final solution concentration is determined and displayed as the instrument result.

13.4. Calculate sample results using the data system printouts and digestion information. The digestion and dilution information is entered into the data system. The data system then uses the calculations below to generate a sample result. Solid samples are reported in mg/Kg:

$$mg/Kg(Sample) = C^* \times PostDigestionDilutionFactor \times \frac{DigestionVol.(ml)}{Samplewt.(g)} \times \frac{1mg}{1000ug} \times \frac{1L}{1000ml} \times \frac{1000g}{1Kg}$$

C*= Concentration of analyte as measured at the instrument in ug/L (in digestate).

NOTE: If results are to be reported on a dry weight basis as required by certain projects, the Sample Wt (g) component of the equation should be the dry-weight derived from a

determination of %moisture of a separate aliquot of the sample using the SOP for Total Solids.

13.5. Record all concentrations determined at the instrument and calculate the final results in mg/Kg. Record the final results on the A.A. Benchsheet.

13.6. The data packet for the sequence is submitted for review by supervisor or designee. The results are transferred to the appropriate report form located in the ALS network directory R:\ICP\WIP. Once the results are transferred, the report is reviewed.

13.7. A daily run log of all samples analyzed is maintained. All data should be printed and stored after operator has checked for evenness of burns. A copy of this document will go with each package of Tier III or higher data run that day.

13.8. Refer to the SOP for *Laboratory Data Review Process* (ADM-DREV) for general instructions for data review.

14. CONTINGENCIES FOR HANDLING OUT- OF- CONTROL OR UNACCEPTABLE DATA

14.1. Refer to the SOP for *Corrective Action (ADM-CA)* for procedures for corrective action. Personnel at all levels and positions in the laboratory are to be alert to identifying problems and nonconformities when errors, deficiencies, or out-of-control situations are detected.

14.2. Handling out-of-control or unacceptable data

14.2.1. On-the-spot corrective actions that are routinely made by analysts and result in acceptable analyses should be documented as normal operating procedures, and no specific documentation need be made other than notations in laboratory maintenance logbooks, runlogs, for example.

14.2.2. Some examples when documentation of a nonconformity is required using a Nonconformity and Corrective Action Report (NCAR):

- Quality control results outside acceptance limits for accuracy and precision
- Method blanks or continuing calibration blanks (CCBs) with target analytes above acceptable levels
- Sample holding time missed due to laboratory error or operations
- Deviations from SOPs or project requirements
- Laboratory analysis errors impacting sample or QC results
- Miscellaneous laboratory errors (spilled sample, incorrect spiking, etc)
- Sample preservation or handling discrepancies due to laboratory or operations error

15. METHOD PERFORMANCE

15.1. This method was validated through single laboratory studies of accuracy and precision. Refer to the reference method for additional available method performance data.

15.2. The method detection limit (MDL), limit of detection (LOD), and limit of quantitation (LOQ) are established using the procedure described in the SOP for *Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantification (ADM-MDL).* Method

Reporting Limits are established for this method based on MDL studies and as specified in the ALS Quality Assurance Manual.

16. POLLUTION PREVENTION AND WASTE MANAGEMENT

16.1. It is the laboratory's practice to minimize the amount of solvents, acids, and reagents used to perform this method wherever feasibly possible. Standards are prepared in volumes consistent with methodology and only the amount needed for routine laboratory use is kept on site. The threat to the environment from solvents and/or reagents used in this method can be minimized when recycled or disposed of properly.

16.2. The laboratory will comply with all Federal, State, and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restrictions as specified in the ALS Environmental Health and Safety Manual.

16.3. This method uses acid. Waste acid is hazardous to the sewer system and to the environment. All acid waste must be neutralized to a pH of 2.5-12 prior to disposal down the drain. The neutralization step is considered hazardous waste treatment and must be documented on the treatment by generator record. See the ALS EH&S Manual for details.

17. TRAINING

17.1. Training outline

17.1.1. Review literature (see references section). Read and understand the SOP. Also review the applicable MSDS for all reagents and standards used. Following these reviews, observe the procedure as performed by an experienced analyst at least three times.

17.1.2. The next training step is to assist in the procedure under the guidance of an experienced analyst. During this period, the analyst is expected to transition from a role of assisting, to performing the procedure with minimal oversight from an experienced analyst.

17.1.3. Perform initial precision and recovery (IPR) study as described above for water samples. Summaries of the IPR are reviewed and signed by the supervisor. Copies may be forwarded to the employee's training file. For applicable tests, IPR studies should be performed in order to be equivalent to NELAC's Initial Demonstration of Capability.

17.2. Training is documented following the *ALS, KELSO TRAINING PROCEDURE* SOP.

NOTE: When the analyst training is documented by the supervisor on internal training documentation forms, the supervisor is acknowledging that the analyst has read and understands this SOP and that adequate training has been given to the analyst to competently perform the analysis independently.

18. METHOD MODIFICATIONS

18.1. There are no known differences between the reference method and this procedure

19. REFERENCES

19.1. USEPA, Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition, Final Update II, Method 7471A, September 1994.

19.2. USEPA, Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition, Update IV, Method 7471B, Revision 2, February 2007.

19.3. DoD Quality Systems Manual for Environmental Laboratories Version 4.1 4/22/2009.

20. CHANGES SINCE THE LAST REVISION

20.1. Updated Definitions section.
20.2. Reformatted SOP to ALS style.
20.3. Added Attachments 1 and 2: Instrument parameters and benchsheet.
20.4. Added Table 1: Summary of Corrective actions.

ATTACHMENT 1
Instrument Parameters

Analysis Parameters

Instrument M-6100 Mercury Analyzer

Conditions

Gas flow (mL/min)	Sample Uptake (s)	Rinse (s)	Read delay (s)	Replicates (#)	Replicate time (s)	Pump speed (%)	Wavelength (nm)
40	30.00	60.00	60.00	4	2.00		253.65

Instrumental Zero

Zero before first sample: No

Zero periodically: Yes
Before each calibration.

Baseline Correction

#1 Start time (s)	#1 End time (s)	#2 Start time (s)	#2 End time (s)
5.00	10.00		

Standby Mode

Enabled: Yes
Standby Options: gas off, lamp off

Autodilution

Enabled: No
Condition:
Tube # range:
If no autodilution tubes remaining

Calibration

Settings

Algorithm	Through blank	Weighted fit	Cal. Type	Recalibration rate	Reslope rate	Reslope standard
Linear	Yes	No	Normal	0	0	N/A

Limits

Calibration slope		Reslope		Coeff. of
Lower (%)	Upper (%)	Lower (%)	Upper (%)	Determination
75	125	75	125	0.99500

Error action: Stop analysis

QC

GLP Override: Yes

QC Tests

ATTACHMENT 2
Benchsheets

COLUMBIA ANALYTICAL SERVICES, INC.
ANALYTICAL WORKSHEET

PRINTOUT WITH:_____

Method: (Circle One) 7470A 7471B 245.1	Service Request # :
Analysis For: Hg	

DATA

Pos.	SAMPLE NUMBER	Initial Sample (g) or (mL)	Initial Dilution (mL)	Dilution Factor	Measured (µg/L)	Sample Actual (mg/kg)	Sample Actual (µg/L)
1	Cal. Blk.	0.00	50	~	0.00		0.00
2	Std 0.2	*0.1	50	~	0.20		0.20
3	Std 0.5	*0.25	50	~	0.50		0.50
4	Std 1.0	*0.5	50	~	1.00		1.00
5	Std 5.0	*2.5	50	~	5.00		5.00
6	Std 10.0	*5.0	50	~	10.00		10.00
7		~	~	~			
8		~	~	~			
9		~	~	~			
10		~	~	~			
11		~	~	~			
12				~			
13				~			
14				~			
15				~			
16				~			
17				~			
18				~			
19				~			
20				~			
21				~			
22		~	~	~			
23		~	~	~			
24				~			
25				~			

Comments: Reporting Levels:
Soil/Tissue Spike Level:
Post Spike Level: 1.0 ppb

Cal. Inter. Std* (100ppb)_____
2nd Source Inter Std** (1ppm)_____

Method	Spike Level	MRL	LCS Limit	MS Limit	RPD
7470A Water	1.0 µg/L	0.2 µg/L	83-117%	80-120%	20%
245.1 Water	1.0 µg/L	0.2 µg/L	85-115%	70-130%	20%
7470A TCLP	5.0 µg/L	1.0 µg/L	85-115%	75-125%	20%
7471A Soil LCSS	3.73 mg/kg	0.02 mg/kg	72-128%	80-120%	30%
7471A Tissue Tort	0.27 mg/kg	0.02 mg/kg	63-130%	80-120%	30%

Analyst:	Date:	Page Number: 1

[Controlled - HgWaterRunForm 7-11-11] HG1.XLS

TABLE 1

Summary of Corrective Actions				
Method Reference	**Control**	**Specification and Frequency**	**Acceptance Criteria**	**Corrective Action**
EPA 7471A/B	ICAL	Prior to sample analysis	R2 ≥ 0.995	Correct problem then repeat ICAL
EPA 7471A/B	ICV	After ICAL	± 10%	Correct problem and verify second source standard; rerun second source verification. If fails, correct problem and repeat initial calibration.
EPA 7471A/B	CCV	Prior to sample analysis	± 10%	Correct problem then repeat CCV or repeat ICAL
EPA 7471A/B	Method Blank	Include with each analysis batch (up to 20 samples)	<MRL	If target exceeds MRL, reanalyze to determine if instrument was cause. If still noncompliant then: Re-extract or reanalyze samples containing contaminate, unless samples contain > 20x amount in blank.
EPA 7471A/B	Laboratory Control Sample	Include with each analysis batch (up to 20 samples)	See DQO	If exceeds limits, re-extract and re-analyze
EPA 7471A/B	Matrix Spike	Include with each analysis batch (up to 20 samples)	See DQO	Evaluate data to determine if the there is a matrix effect or analytical error
EPA 7471A/B	Sample Duplicates	Include with each analysis batch (up to 20 samples)	≤ 20 % RPD	Re-homogenize and re-analyze if result is > 5 X the MRL

ATTACHMENT C

FIELD SHEETS

BB&E
CONSULTING ENGINEERS & PROFESSIONALS

SOIL BORING LOG

Borehole ID:
Sheet ___ of __

			Location	
Project Name	Project Number	LTCCODE (IRPIMS)	Site ID	LPRCODE (IRPIMS)
Drilling Company	Driller	Ground Elevation	Total Drilled Depth	
Drilling Equipment / Drilling Method / Borehole Diameter		Date/Time Drilling Started	Date/Time Total Depth Reached	
Type of Sampling Device		Water Level (bgs) First / Final		
Sample Hammer Type / Driving Wt. / Drop		Hydrogeologist	Checked by/Date	
Location Description (include sketch in field logbook)				

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, minerology, bedding, plasticity, density, consistency, etc., as applicable)	PID	Sample	Water Content	Remarks

ATTACHMENT D

SYSTEMATIC PLANNING PROCESS WORKSHEET

SYSTEMATIC PLANNING PROCESS WORKSHEET

SITE NAME: Collis Manufacturing Facility, Clinton, Clinton County, Iowa

1. STATE THE PROBLEM

a. Planning Team Members
   i. Mr. Kevin Snowden – EPA Project Manager
   ii. Ms. Diane E. Harris – EPA RQAM
   iii. Mr. Brian Calhoun –Corporate Safety and Environmental Director, SSW Holding Company, Inc.
   iv. Mr. Jim Colmer – BB&E Project Manager
   v. Mr. Jason Cabra – Field Team Leader

b. Concise Description of Problem
In June 2010, during a routine Resource Conservation and Recovery Act (RCRA) inspection, an area near the filter building was identified that stored totes of process acids and caustics. The United States Environmental Protection Agency (USEPA) was inquiring in determining whether any releases occurred from the totes. The inquiry was to determine if any exceedances of industrial soils Regional Screening Levels (RSLs) for RCRA 8 metals occurred.

c. Available Resources and Deadlines
Funds for the focused soil investigation have been authorized by the facility owner, SSW Holdings Company. A final focused soil investigation Sampling Final Report will be submitted to the EPA Region VII project manager. The final report will include: figures with sample locations, analytical data, table with analyte detections, any deviations from the work plan or quality assurance project plan (QAPP), and discussion of additional actions, if required, or closure.

2. IDENTIFY THE DECISION

a. Primary Study Question
Did the contents of the stored totes impact the adjacent soil greater than the EPA RSL industrial criteria?

b. Alternative Actions from the Resolution of the Primary Study Question?
   (1) Remediate the contamination, if detected above EPA RSL industrial soil levels, and prevent any other totes containing hazardous substances from being stored in the investigated areas.
   (2) Take no action.

c. Decision Statement
Determine whether the contents of the stored totes impacted the adjacent soil greater than EPA RSL industrial criteria.

3. IDENTIFY THE INPUTS TO THE DECISION

a. Identify the Information Needed to Resolve Decision Statement
Measurements of the concentrations of metals in the shallow soil are required.

b. Determine Sources for Needed Information
The concentration of RCRA 8 metals detected in the shallow soil samples must be compared with the EPA RSL industrial soil criteria.

The shallow soil samples analytical results will be compared to USEPA Industrial Soil Regional Screening Levels.

d. Confirm Appropriate Measurement Techniques Exist to Provide the Data
Assessment will be conducted to provide analytical results from the shallow soil samples. The RCRA 8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) will be analyzed by the USEPA Method 6020A, and Mercury will also be analyzed by USEPA Method 7471B by a national Environmental Laboratory Accreditation Program (NELAC) fixed-base laboratory.

4. DEFINE THE BOUNDARY OF THE STUDY

a. Specify Characteristics that Define the Population of Interest
RCRA 8 Metals and Mercury will be analyzed from the shallow soil samples collected from the investigated area.

b. Define Spatial Boundary of the Decision Statement
Decisions will apply to the soil in the area where the totes were stored on the site.

c. Define Temporal Boundary of the Decision Statement
It is assumed the sampling data will represent the current concentrations of metal and mercury at the former storage location. The data will be collected in 2013.

d. Define Scale of Decision Making
The scale of decision making will be the former storage area of the totes and possible impacted areas.

e. Identify Practical Constraints on Data Collection
The most practical consideration that could interfere with the sampling is the limited access to soils underneath the pavement areas. Depending on the thickness of the pavement, this may prevent shallow soil sampling from occurring at the former tote storage area.

5. DEVELOP A DECISION RULE

a. Specify Statistical Parameter Characterizing the Population of Interest
The planning team is interested in the concentration of possible analytes in the shallow soil in the area of the former tote storage.

b. Specify the Action Level of the Study (Industrial Soil RSLs)

RCRA 8 Metals:

(1) Arsenic – 1.900 mg/kg
(2) Barium – 190,000 mg/kg
(3) Cadmium – 800 mg/kg
(4) Chromium – 5.6 mg/kg
(5) Lead – 800 mg/kg
(6) Mercury –43 mg/kg
(7) Selenium – 5,100 mg/kg
(8) Silver – 5,100 mg/kg

c. Develop a Decision Rule
If any analytes are exceeding the EPA RSLs, then remediation of the identified contamination will be required. If all analytes are below the EPA RSLs, then no further action is required.

6. SPECIFY LIMITS ON DECISION ERRORS

It is important to look at the risks or possibilities of errors with the analytical data results. Possible errors are discussed in laboratory analytical standard operating procedures (SOPs). SOPs are available on request from the laboratories.

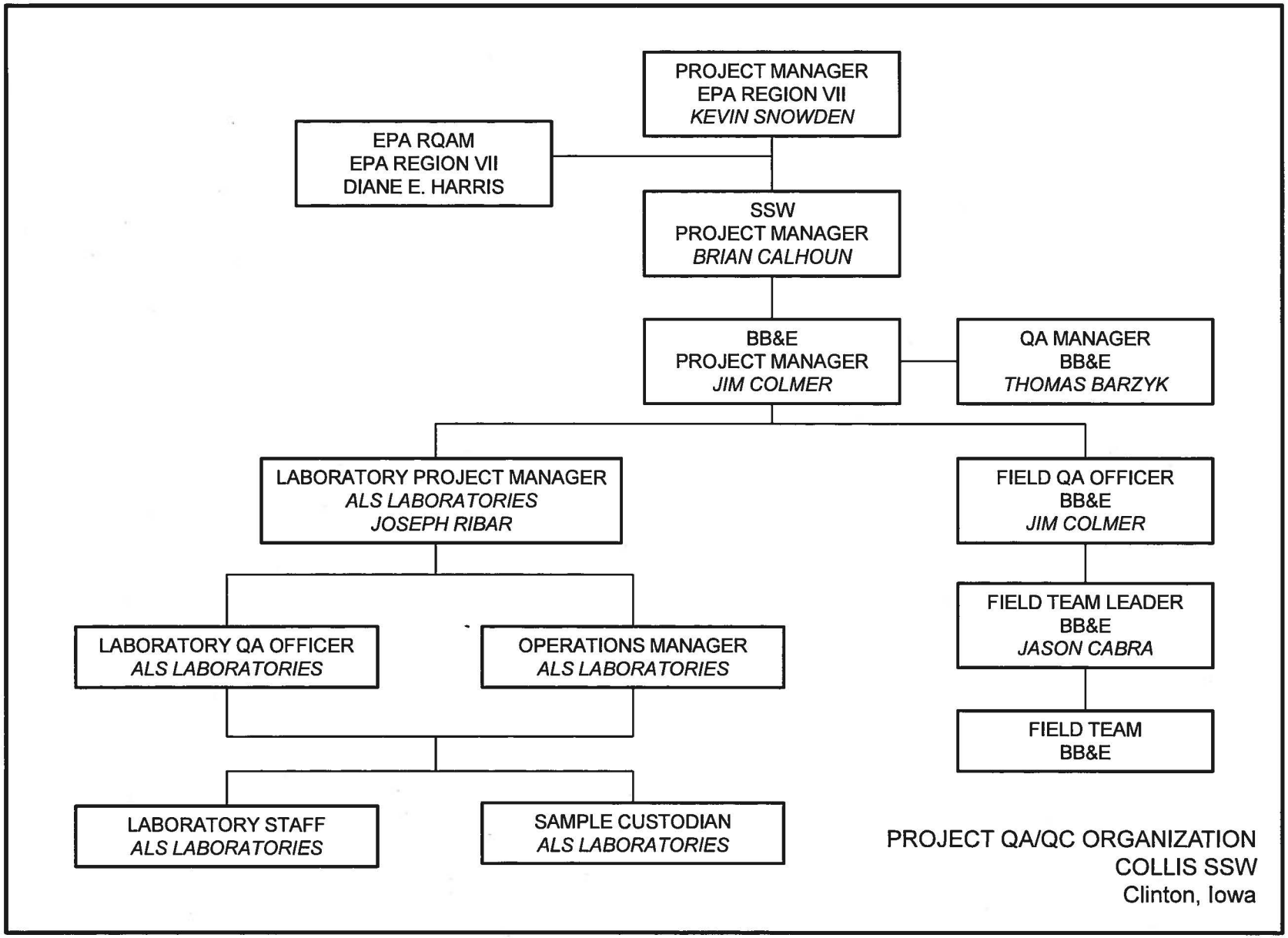
7. OPTIMIZE THE DESIGN

The sample locations will be chosen by the field team at the site after the concrete and adjacent areas are visually observed. Biased sampling locations will be selected. The locations along the perimeter of the pavement, the locations below the pavement, and background locations, if required, will be selected based on-site conditions and visual observations. In addition to perimeter sampling, cracks or joints discovered that appear to have compromised the integrity of the slab to the underlying soils will be marked and subsequently cored to provide access to the soils beneath.

Remaining sections of the Systematic Planning Process Worksheet were not included. These sections will not be addressed in this document and were omitted.

ATTACHMENT E

PROCESS ORGANIZATION CHART


PROJECT MANAGER
EPA REGION VII
KEVIN SNOWDEN
EPA RQAM
EPA REGION VII
DIANE E. HARRIS
SSW
PROJECT MANAGER
BRIAN CALHOUN
BB&E
PROJECT MANAGER
JIM COLMER
QA MANAGER
BB&E
THOMAS BARZYK
LABORATORY PROJECT MANAGER
ALS LABORATORIES
JOSEPH RIBAR
FIELD QA OFFICER
BB&E
JIM COLMER
LABORATORY QA OFFICER
ALS LABORATORIES
OPERATIONS MANAGER
ALS LABORATORIES
FIELD TEAM LEADER
BB&E
JASON CABRA
FIELD TEAM
BB&E
LABORATORY STAFF
ALS LABORATORIES
SAMPLE CUSTODIAN
ALS LABORATORIES
PROJECT QA/QC ORGANIZATION
COLLIS SSW
Clinton, Iowa

ATTACHMENT F

USEPA RSLS INDUSTRIAL SOIL NOVEMBER 2012

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		1.4E+09		ALAR	1596-84-5	1.6E+02	2.4E+02	3.3E+06	9.6E+01	1.5E+05	2.3E+05		9.2E+04
8.7E-03	I			4.0E-03	I					1	0.1		1.4E+09		Acephate	30560-19-1	3.3E+02	5.0E+02		2.0E+02	4.1E+03[s]	6.2E+03		2.5E+03
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	1.4E+09	9.4E+03	Acetaldehyde	75-07-0			5.2E+01	5.2E+01			3.7E+02	3.7E+02
				2.0E-02	I					1	0.1		1.4E+09		Acetochlor	34256-82-1					2.0E+04	3.1E+04		1.2E+04
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	1.4E+09	1.5E+04	Acetone	67-64-1					9.2E+05		2.0E+06	6.3E+05
						2.0E-03	X	V		1		1.1E+05	1.4E+09	2.6E+04	Acetone Cyanohydrin	75-86-5							2.2E+02	2.2E+02
						6.0E-02	I	V		1		1.3E+05	1.4E+09	1.4E+04	Acetonitrile	75-05-8							3.7E+03	3.7E+03
				1.0E-01	I			V		1		2.5E+03	1.4E+09	6.4E+04	Acetophenone	98-86-2					1.0E+05			1.0E+05
3.8E+00	C	1.3E-03	C							1	0.1		1.4E+09		Acetylaminofluorene, 2-	53-96-3	7.5E-01	1.1E+00	1.3E+04	4.5E-01				
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	1.4E+09	7.4E+03	Acrolein	107-02-8					5.1E+02		6.5E-01	6.5E-01
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		1.4E+09		Acrylamide	79-06-1	5.7E+00	8.7E+00	1.7E+05	3.4E+00	2.0E+03	3.1E+03	3.6E+07	1.2E+03
				5.0E-01	I	1.0E-03	I			1	0.1		1.4E+09		Acrylic Acid	79-10-7					5.1E+05	7.7E+05	6.0E+06	2.9E+05
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	1.4E+09	8.3E+03	Acrylonitrile	107-13-1	5.3E+00		1.5E+00	1.2E+00	4.1E+04		7.2E+01	7.2E+01
						6.0E-03	P			1	0.1		1.4E+09		Adiponitrile	111-69-3							3.6E+07	3.6E+07
5.6E-02	C			1.0E-02	I					1	0.1		1.4E+09		Alachlor	15972-60-8	5.1E+01	7.7E+01		3.1E+01	1.0E+04	1.5E+04		6.2E+03
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb	116-06-3					1.0E+03	1.5E+03		6.2E+02
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb Sulfone	1646-88-4					1.0E+03	1.5E+03		6.2E+02
										1	0.1		1.4E+09		Aldicarb sulfoxide	1646-87-3								
1.7E+01	I	4.9E-03	I	3.0E-05	I					1	0.1		1.4E+09		Aldrin	309-00-2	1.7E-01	2.6E-01	3.4E+03	1.0E-01	3.1E+01	4.6E+01		1.8E+01
				2.5E-01	I					1	0.1		1.4E+09		Ally	74223-64-6					2.6E+05	3.9E+05		1.5E+05
				5.0E-03	I	1.0E-04	X			1	0.1		1.4E+09		Allyl Alcohol	107-18-6					5.1E+03	7.7E+03	6.0E+05	3.1E+03
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	1.4E+09	1.7E+03	Allyl Chloride	107-05-1	1.4E+02		3.5E+00	3.4E+00			7.5E+00	7.5E+00
				1.0E+00	P	5.0E-03	P			1			1.4E+09		Aluminum	7429-90-5					1.0E+06		3.0E+07	9.9E+05
				4.0E-04	I					1			1.4E+09		Aluminum Phosphide	20859-73-8					4.1E+02			4.1E+02
				3.0E-04	I					1	0.1		1.4E+09		Amdro	67485-29-4					3.1E+02	4.6E+02		1.8E+02
				9.0E-03	I					1	0.1		1.4E+09		Ametryn	834-12-8					9.2E+03	1.4E+04		5.5E+03
2.1E+01	C	6.0E-03	C							1	0.1		1.4E+09		Aminobiphenyl, 4-	92-67-1	1.4E-01	2.1E-01	2.8E+03	8.2E-02				
				8.0E-02	P					1	0.1		1.4E+09		Aminophenol, m-	591-27-5					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	P					1	0.1		1.4E+09		Aminophenol, p-	123-30-8					2.0E+04	3.1E+04		1.2E+04
				2.5E-03	I					1	0.1		1.4E+09		Amitraz	33089-61-1					2.6E+03	3.9E+03		1.5E+03
						1.0E-01	I			1					Ammonia	7664-41-7								
				2.0E-01	I					1			1.4E+09		Ammonium Sulfamate	7773-06-0					2.0E+05			2.0E+05
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		1.4E+09		Aniline	62-53-3	5.0E+02	7.6E+02	1.0E+07	3.0E+02	7.2E+03	1.1E+04	6.0E+06	4.3E+03
4.0E-02	P			2.0E-03	X					1	0.1		1.4E+09		Anthraquinone, 9,10-	84-65-1	7.2E+01	1.1E+02		4.3E+01	2.0E+03	3.1E+03		1.2E+03
				4.0E-04	I					0.15			1.4E+09		Antimony (metallic)	7440-36-0					4.1E+02			4.1E+02
				5.0E-04	H					0.15			1.4E+09		Antimony Pentoxide	1314-60-9					5.1E+02			5.1E+02
				9.0E-04	H					0.15			1.4E+09		Antimony Potassium Tartrate	11071-15-1					9.2E+02			9.2E+02
				4.0E-04	H					0.15			1.4E+09		Antimony Tetroxide	1332-81-6					4.1E+02			4.1E+02
						2.0E-04	I			0.15			1.4E+09		Antimony Trioxide	1309-64-4							1.2E+06	1.2E+06
				1.3E-02	I					1	0.1		1.4E+09		Apollo	74115-24-5					1.3E+04	2.0E+04		8.0E+03
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		1.4E+09		Aramite	140-57-8	1.1E+02	1.7E+02	2.3E+06	6.9E+01	5.1E+04	7.7E+04		3.1E+04
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		1.4E+09		Arsenic, Inorganic	7440-38-2	1.9E+00	9.6E+00	3.9E+03	1.6E+00	3.1E+02	1.5E+03	8.9E+04	2.6E+02
				3.5E-06	C	5.0E-05	I			1			1.4E+09		Arsine	7784-42-1					3.6E+00		3.0E+05	3.6E+00
				9.0E-03	I					1	0.1		1.4E+09		Assure	76578-14-8					9.2E+03	1.4E+04		5.5E+03
				5.0E-02	I					1	0.1		1.4E+09		Asulam	3337-71-1					5.1E+04	7.7E+04		3.1E+04
2.3E-01	C			3.5E-02	I					1	0.1		1.4E+09		Atrazine	1912-24-9	1.2E+01	1.9E+01		7.5E+00	3.6E+04	5.4E+04		2.2E+04
8.8E-01	C	2.5E-04	C							1	0.1		1.4E+09		Auramine	492-80-8	3.3E+00	4.9E+00	6.7E+04	2.0E+00				
				4.0E-04	I					1	0.1		1.4E+09		Avermectin B1	65195-55-3					4.1E+02	6.2E+02		2.5E+02
1.1E-01	I	3.1E-05	I					V		1			1.4E+09	5.6E+05	Azobenzene	103-33-3	2.6E+01		2.2E+02	2.3E+01				
				2.0E-01	I	5.0E-04	H			0.07			1.4E+09		Barium	7440-39-3					2.0E+05		3.0E+06	1.9E+05
				4.0E-03	I					1	0.1		1.4E+09		Baygon	114-26-1					4.1E+03	6.2E+03		2.5E+03
				3.0E-02	I					1	0.1		1.4E+09		Bayleton	43121-43-3					3.1E+04	4.6E+04		1.8E+04
				2.5E-02	I					1	0.1		1.4E+09		Baythroid	68359-37-5					2.6E+04	3.9E+04		1.5E+04
				3.0E-01	I					1	0.1		1.4E+09		Benefin	1861-40-1					3.1E+05	4.6E+05		1.8E+05
				5.0E-02	I					1	0.1		1.4E+09		Benomyl	17804-35-2					5.1E+04	7.7E+04		3.1E+04
				3.0E-02	I					1	0.1		1.4E+09		Bentazon	25057-89-0					3.1E+04	4.6E+04		1.8E+04
				1.0E-01	I			V		1		1.2E+03	1.4E+09	2.4E+04	Benzaldehyde	100-52-7					1.0E+05			1.0E+05
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	1.4E+09	3.8E+03	Benzene	71-43-2	5.2E+01		6.0E+00	5.4E+00	4.1E+03		5.0E+02	4.5E+02
				2.0E-04	X					1	0.1		1.4E+09		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1					2.0E+02	3.1E+02		1.2E+02
				1.0E-03	P			V		1		1.3E+03	1.4E+09	2.1E+04	Benzenethiol	108-98-5					1.0E+03			1.0E+03
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		1.4E+09		Benzidine	92-87-5	1.2E-02	1.9E-02	2.5E+02	7.5E-03	3.1E+03	4.6E+03		1.8E+03
				4.0E+00	I					1	0.1		1.4E+09		Benzoic Acid	65-85-0					4.1E+06	6.2E+06		2.5E+06
1.3E+01	I							V		1		3.2E+02	1.4E+09	7.3E+04	Benzotrichloride	98-07-7	2.2E-01			2.2E-01				
				1.0E-01	P					1	0.1		1.4E+09		Benzyl Alcohol	100-51-6					1.0E+05	1.5E+05		6.2E+04
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	1.4E+09	2.7E+04	Benzyl Chloride	100-44-7	1.7E+01		6.9E+00	4.9E+00	2.0E+03		1.2E+02	1.1E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD$_o$ (mg/kg-day)	key	RfC$_i$ (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C$_{sat}$ (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			1.4E+09		Beryllium and compounds	7440-41-7			6.9E+03	6.9E+03	2.0E+03		1.2E+05	2.0E+03
				1.0E-04	I					1	0.1		1.4E+09		Bidrin	141-66-2					1.0E+02	1.5E+02		6.2E+01
				9.0E-03	P					1	0.1		1.4E+09		Bifenox	42576-02-3					9.2E+03	1.4E+04		5.5E+03
				1.5E-02	I					1	0.1		1.4E+09		Biphenthrin	82657-04-3					1.5E+04	2.3E+04		9.2E+03
8.0E-03	X			5.0E-02	I	4.0E-04	X	V		1			1.4E+09	1.2E+05	Biphenyl, 1,1'-	92-52-4	3.6E+02			3.6E+02	5.1E+04		2.1E+02	2.1E+02
7.0E-02	H	1.0E-05	H	4.0E-02	I			V		1		1.0E+03	1.4E+09	3.8E+04	Bis(2-chloro-1-methylethyl) ether	108-60-1	4.1E+01		4.6E+01	2.2E+01	4.1E+04			4.1E+04
				3.0E-03	P					1	0.1		1.4E+09		Bis(2-chloroethoxy)methane	111-91-1					3.1E+03	4.6E+03		1.8E+03
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	1.4E+09	4.6E+04	Bis(2-chloroethyl)ether	111-44-4	2.6E+00		1.7E+00	1.0E+00				
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		1.4E+09		Bis(2-ethylhexyl)phthalate	117-81-7	2.0E+02	3.1E+02	6.9E+06	1.2E+02	2.0E+04	3.1E+04		1.2E+04
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	1.4E+09	2.0E+03	Bis(chloromethyl)ether	542-88-1	1.3E-02		4.0E-04	3.9E-04				
				5.0E-02	I					1	0.1		1.4E+09		Bisphenol A	80-05-7					5.1E+04	7.7E+04		3.1E+04
				2.0E-01	I	2.0E-02	H			1			1.4E+09		Boron And Borates Only	7440-42-8					2.0E+05		1.2E+08	2.0E+05
				2.0E+00	P	2.0E-02	P		M	1			1.4E+09		Boron Trichloride	10294-34-5					2.0E+06		1.2E+08	2.0E+06
				4.0E-02	C	1.3E-02	C			1			1.4E+09		Boron Trifluoride	7637-07-2					4.1E+04		7.7E+07	4.1E+04
7.0E-01	I			4.0E-03	I					1			1.4E+09		Bromate	15541-45-4	4.1E+00			4.1E+00	4.1E+03			4.1E+03
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	1.4E+09	6.4E+03	Bromo-2-chloroethane, 1-	107-04-0	1.4E+00		1.3E-01	1.2E-01				
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	1.4E+09	9.0E+03	Bromobenzene	108-86-1					8.2E+03		2.4E+03	1.8E+03
						4.0E-02	X	V		1		4.0E+03	1.4E+09	3.9E+03	Bromochloromethane	74-97-5							6.8E+02	6.8E+02
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	1.4E+09	4.3E+03	Bromodichloromethane	75-27-4	4.6E+01		1.4E+00	1.4E+00	2.0E+04			2.0E+04
7.9E-03	I	1.1E-06	I	2.0E-02	I					1	0.1		1.4E+09		Bromoform	75-25-2	3.6E+02	5.5E+02	1.5E+07	2.2E+02	2.0E+04	3.1E+04		1.2E+04
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	1.4E+09	1.5E+03	Bromomethane	74-83-9					1.4E+03		3.3E+01	3.2E+01
				5.0E-03	H					1	0.1		1.4E+09		Bromophos	2104-96-3					5.1E+03	7.7E+03		3.1E+03
				2.0E-02	I					1	0.1		1.4E+09		Bromoxynil	1689-84-5					2.0E+04	3.1E+04		1.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Bromoxynil Octanoate	1689-99-2					2.0E+04	3.1E+04		1.2E+04
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	1.4E+09	9.3E+02	Butadiene, 1,3-	106-99-0	8.4E-01		3.8E-01	2.6E-01			8.2E+00	8.2E+00
				1.0E-01	I					1	0.1		1.4E+09		Butanol, N-	71-36-3					1.0E+05	1.5E+05		6.2E+04
1.9E-03	P			2.0E-01	I					1	0.1		1.4E+09		Butyl Benzyl Phthlate	85-68-7	1.5E+03	2.3E+03		9.1E+02	2.0E+05	3.1E+05		1.2E+05
				2.0E+00	P	3.0E+01	P			1	0.1		1.4E+09		Butyl alcohol, sec-	78-92-2					2.0E+06	3.1E+06	1.8E+11	1.2E+06
				5.0E-02	I					1	0.1		1.4E+09		Butylate	2008-41-5					5.1E+04	7.7E+04		3.1E+04
2.0E-04	C	5.7E-08	C							1	0.1		1.4E+09		Butylated hydroxyanisole	25013-16-5	1.4E+04	2.2E+04	2.9E+08	8.6E+03				
				5.0E-02	P			V		1		1.1E+02	1.4E+09	8.8E+03	Butylbenzene, n-	104-51-8					5.1E+04			5.1E+04
				1.0E+00	I					1	0.1		1.4E+09		Butylphthalyl Butylglycolate	85-70-1					1.0E+06	1.5E+06		6.2E+05
				2.0E-02	A					1	0.1		1.4E+09		Cacodylic Acid	75-60-5					2.0E+04	3.1E+04		1.2E+04
		1.8E-03	I	1.0E-03	I	2.0E-05	C			0.025	0.001		1.4E+09		Cadmium (Diet)	7440-43-9			9.3E+03	9.3E+03	1.0E+03	3.9E+03	1.2E+05	8.0E+02
		1.8E-03	I	5.0E-04	I	2.0E-05	C			0.05	0.001				Cadmium (Water)	7440-43-9								
				5.0E-01	I					1	0.1		1.4E+09		Caprolactam	105-60-2					5.1E+05	7.7E+05		3.1E+05
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		1.4E+09		Captafol	2425-06-1	1.9E+01	2.9E+01	3.9E+05	1.1E+01	2.0E+03	3.1E+03		1.2E+03
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		1.4E+09		Captan	133-06-2	1.2E+03	1.9E+03	2.5E+07	7.5E+02	1.3E+05	2.0E+05		8.0E+04
				1.0E-01	I					1	0.1		1.4E+09		Carbaryl	63-25-2					1.0E+05	1.5E+05		6.2E+04
				5.0E-03	I					1	0.1		1.4E+09		Carbofuran	1563-66-2					5.1E+03	7.7E+03		3.1E+03
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	1.4E+09	1.3E+03	Carbon Disulfide	75-15-0					1.0E+05		3.9E+03	3.7E+03
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	1.4E+09	1.6E+03	Carbon Tetrachloride	56-23-5	4.1E+01		3.3E+00	3.0E+00	4.1E+03		7.0E+02	6.0E+02
				1.0E-02	I					1	0.1		1.4E+09		Carbosulfan	55285-14-8					1.0E+04	1.5E+04		6.2E+03
				1.0E-01	I					1	0.1		1.4E+09		Carboxin	5234-68-4					1.0E+05	1.5E+05		6.2E+04
						9.0E-04	I			1			1.4E+09		Ceric oxide	1306-38-3							5.4E+06	5.4E+06
				1.0E-01	I					1	0.1		1.4E+09		Chloral Hydrate	302-17-0					1.0E+05	1.5E+05		6.2E+04
				1.5E-02	I					1	0.1		1.4E+09		Chloramben	133-90-4					1.5E+04	2.3E+04		9.2E+03
4.0E-01	H									1	0.1		1.4E+09		Chloranil	118-75-2	7.1E+00	1.1E+01		4.3E+00				
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I			1	0.04		1.4E+09		Chlordane	12789-03-6	8.2E+00	3.1E+01	1.7E+05	6.5E+00	5.1E+02	1.9E+03	4.2E+06	4.0E+02
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		1.4E+09		Chlordecone (Kepone)	143-50-0	2.9E-01	4.3E-01	3.6E+03	1.7E-01	3.1E+02	4.6E+02		1.8E+02
				7.0E-04	A					1	0.1		1.4E+09		Chlorfenvinphos	470-90-6					7.2E+02	1.1E+03		4.3E+02
				2.0E-02	I					1	0.1		1.4E+09		Chlorimuron, Ethyl-	90982-32-4					2.0E+04	3.1E+04		1.2E+04
				1.0E-01	I	1.5E-04	A			1			1.4E+09		Chlorine	7782-50-5					1.0E+05		8.6E+05	9.1E+04
				3.0E-02	I	2.0E-04	I			1			1.4E+09		Chlorine Dioxide	10049-04-4					3.1E+04		1.2E+06	3.0E+04
				3.0E-02	I					1			1.4E+09		Chlorite (Sodium Salt)	7758-19-2					3.1E+04			3.1E+04
						5.0E+01	I	V		1		1.2E+03	1.4E+09	1.1E+03	Chloro-1,1-difluoroethane, 1-	75-68-3							2.4E+05	2.4E+05
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.5E+02	1.4E+09	1.2E+03	Chloro-1,3-butadiene, 2-	126-99-8			4.7E-02	4.7E-02	2.0E+04		1.0E+02	1.0E+02
4.6E-01	H									1	0.1		1.4E+09		Chloro-2-methylaniline HCl, 4-	3165-93-3	6.2E+00	9.4E+00		3.7E+00				
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		1.4E+09		Chloro-2-methylaniline, 4-	95-69-2	2.9E+01	4.3E+01	2.2E+05	1.7E+01	3.1E+03	4.6E+03		1.8E+03
2.7E-01	X							V		1	0.1	2.8E+04	1.4E+09	2.0E+04	Chloroacetaldehyde, 2-	107-20-0	1.1E+01	1.6E+01		6.4E+00				
				2.0E-03	H					1	0.1		1.4E+09		Chloroacetic Acid	79-11-8					2.0E+03	3.1E+03		1.2E+03
						3.0E-05	I			1	0.1		1.4E+09		Chloroacetophenone, 2-	532-27-4							1.8E+05	1.8E+05
2.0E-01	P			4.0E-03	I					1	0.1		1.4E+09		Chloroaniline, p-	106-47-8	1.4E+01	2.2E+01		8.6E+00	4.1E+03	6.2E+03		2.5E+03
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	1.4E+09	6.9E+03	Chlorobenzene	108-90-7					2.0E+04		1.5E+03	1.4E+03
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		1.4E+09		Chlorobenzilate	510-15-6	2.6E+01	3.9E+01	5.4E+05	1.6E+01	2.0E+04	3.1E+04		1.2E+04

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				3.0E-02	X					1	0.1		1.4E+09		Chlorobenzoic Acid, p-	74-11-3					3.1E+04	4.6E+04		1.8E+04
				3.0E-03	P	3.0E-01	P	V		1		1.2E+02	1.4E+09	7.3E+03	Chlorobenzotrifluoride, 4-	98-56-6					3.1E+03		9.6E+03	2.3E+03
				4.0E-02	P			V		1		7.3E+02	1.4E+09	1.9E+03	Chlorobutane, 1-	109-69-3					4.1E+04			4.1E+04
						5.0E+01	I	V		1		1.7E+03	1.4E+09	1.0E+03	Chlorodifluoromethane	75-45-6							2.2E+05	2.2E+05
				2.0E-02	P				M	1	0.1		1.4E+09		Chloroethanol, 2-	107-07-3					2.0E+04	3.1E+04		1.2E+04
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	1.4E+09	2.8E+03	Chloroform	67-66-3	9.2E+01		1.5E+00	1.5E+00	1.0E+04		1.2E+03	1.1E+03
						9.0E-02	I	V		1		1.3E+03	1.4E+09	1.3E+03	Chloromethane	74-87-3							5.0E+02	5.0E+02
2.4E+00	C	6.9E-04	C					V		1		2.6E+04	1.4E+09	5.7E+03	Chloromethyl Methyl Ether	107-30-2	1.2E+00		1.0E-01	9.4E-02				
				8.0E-02	I			V		1			1.4E+09	8.6E+04	Chloronaphthalene, Beta-	91-58-7					8.2E+04			8.2E+04
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		1.4E+09		Chloronitrobenzene, o-	88-73-3	9.5E+00	1.4E+01		5.7E+00	3.1E+03	4.6E+03	6.0E+04	1.8E+03
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		1.4E+09		Chloronitrobenzene, p-	100-00-5	4.5E+02	6.9E+02		2.7E+02	1.0E+03	1.5E+03	3.6E+06	6.2E+02
				5.0E-03	I			V		1		2.2E+04	1.4E+09	1.3E+05	Chlorophenol, 2-	95-57-8					5.1E+03			5.1E+03
						4.0E-04	C	V		1		6.2E+02	1.4E+09	5.0E+03	Chloropicrin	76-06-2							8.8E+00	8.8E+00
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		1.4E+09		Chlorothalonil	1897-45-6	9.2E+02	1.4E+03	1.9E+07	5.6E+02	1.5E+04	2.3E+04		9.2E+03
				2.0E-02	I			V		1		9.1E+02	1.4E+09	8.7E+03	Chlorotoluene, o-	95-49-8					2.0E+04			2.0E+04
				2.0E-02	X			V		1		2.5E+02	1.4E+09	7.9E+03	Chlorotoluene, p-	106-43-4					2.0E+04			2.0E+04
2.4E+02	C	6.9E-02	C							1	0.1		1.4E+09		Chlorozotocin	54749-90-5	1.2E-02	1.8E-02	2.4E+02	7.2E-03				
				2.0E-01	I					1	0.1		1.4E+09		Chlorpropham	101-21-3					2.0E+05	3.1E+05		1.2E+05
				1.0E-03	A					1	0.1		1.4E+09		Chlorpyrifos	2921-88-2					1.0E+03	1.5E+03		6.2E+02
				1.0E-02	H					1	0.1		1.4E+09		Chlorpyrifos Methyl	5598-13-0					1.0E+04	1.5E+04		6.2E+03
				5.0E-02	I					1	0.1		1.4E+09		Chlorsulfuron	64902-72-3					5.1E+04	7.7E+04		3.1E+04
				8.0E-04	H					1	0.1		1.4E+09		Chlorthiophos	60238-56-4					8.2E+02	1.2E+03		4.9E+02
				1.5E+00	I					0.013			1.4E+09		Chromium(III), Insoluble Salts	16065-83-1					1.5E+06			1.5E+06
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			1.4E+09		Chromium(VI)	18540-29-9	5.7E+00		2.0E+02	5.6E+00	3.1E+03		6.0E+05	3.1E+03
										0.013			1.4E+09		Chromium, Total	7440-47-3								
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			1.4E+09		Cobalt	7440-48-4			1.9E+03	1.9E+03	3.1E+02		3.6E+04	3.0E+02
		6.2E-04	I						M	1	0.1				Coke Oven Emissions	8007-45-2								
				4.0E-02	H					1			1.4E+09		Copper	7440-50-8					4.1E+04			4.1E+04
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, m-	108-39-4					5.1E+04	7.7E+04	3.6E+09	3.1E+04
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, o-	95-48-7					5.1E+04	7.7E+04	3.6E+09	3.1E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresol, p-	106-44-5					1.0E+05	1.5E+05	3.6E+09	6.2E+04
				1.0E-01	A					1	0.1		1.4E+09		Cresol, p-chloro-m-	59-50-7					1.0E+05	1.5E+05		6.2E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresols	1319-77-3					1.0E+05	1.5E+05	3.6E+09	6.2E+04
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	1.4E+09	2.0E+04	Crotonaldehyde, trans-	123-73-9	1.5E+00			1.5E+00	1.0E+03			1.0E+03
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	1.4E+09	6.7E+03	Cumene	98-82-8					1.0E+05		1.2E+04	1.1E+04
2.2E-01	C	6.3E-05	C							1	0.1		1.4E+09		Cupferron	135-20-6	1.3E+01	2.0E+01	2.6E+05	7.8E+00				
8.4E-01	H			2.0E-03	H					1	0.1		1.4E+09		Cyanazine	21725-46-2	3.4E+00	5.2E+00		2.1E+00	2.0E+03	3.1E+03		1.2E+03
															Cyanides									
				1.0E-03	I					1			1.4E+09		"Calcium Cyanide	592-01-8					1.0E+03			1.0E+03
				5.0E-03	I					1			1.4E+09		"Copper Cyanide	544-92-3					5.1E+03			5.1E+03
				6.0E-04	I	8.0E-04	S	V		1		1.0E+07	1.4E+09	5.0E+04	"Cyanide (CN-)	57-12-5					6.1E+02		1.8E+02	1.4E+02
				1.0E-03	I			V		1			1.4E+09		"Cyanogen	460-19-5					1.0E+03			1.0E+03
				9.0E-02	I			V		1			1.4E+09		"Cyanogen Bromide	506-68-3					9.2E+04			9.2E+04
				5.0E-02	I			V		1			1.4E+09		"Cyanogen Chloride	506-77-4					5.1E+04			5.1E+04
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	1.4E+09	5.6E+04	"Hydrogen Cyanide	74-90-8					6.1E+02		2.0E+02	1.5E+02
				2.0E-03	I					1			1.4E+09		"Potassium Cyanide	151-50-8					2.0E+03			2.0E+03
				5.0E-03	I					0.04			1.4E+09		"Potassium Silver Cyanide	506-61-6					5.1E+03			5.1E+03
				1.0E-01	I					0.04			1.4E+09		"Silver Cyanide	506-64-9					1.0E+05			1.0E+05
				1.0E-03	I					1			1.4E+09		"Sodium Cyanide	143-33-9					1.0E+03			1.0E+03
				2.0E-04	X					1			1.4E+09		"Thiocyanate	463-56-9					2.0E+02			2.0E+02
				5.0E-02	I					1			1.4E+09		"Zinc Cyanide	557-21-1					5.1E+04			5.1E+04
						6.0E+00	I	V		1		1.2E+02	1.4E+09	1.1E+03	Cyclohexane	110-82-7							2.9E+04	2.9E+04
2.3E-02	H									1	0.1		1.4E+09		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	1.2E+02	1.9E+02		7.5E+01				
				5.0E+00	I	7.0E-01	P			1	0.1		1.4E+09		Cyclohexanone	108-94-1					5.1E+06	7.7E+06	4.2E+09	3.1E+06
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	1.4E+09	1.4E+03	Cyclohexene	110-83-8					5.1E+03		6.3E+03	2.8E+03
				2.0E-01	I					1	0.1		1.4E+09		Cyclohexylamine	108-91-8					2.0E+05	3.1E+05		1.2E+05
				5.0E-03	I					1	0.1		1.4E+09		Cyhalothrin/karate	68085-85-8					5.1E+03	7.7E+03		3.1E+03
				1.0E-02	I					1	0.1		1.4E+09		Cypermethrin	52315-07-8					1.0E+04	1.5E+04		6.2E+03
				7.5E-03	I					1	0.1		1.4E+09		Cyromazine	66215-27-8					7.7E+03	1.2E+04		4.6E+03
2.4E-01	I	6.9E-05	C							1	0.1		1.4E+09		DDD	72-54-8	1.2E+01	1.8E+01	2.4E+05	7.2E+00				
3.4E-01	I	9.7E-05	C							1	0.1		1.4E+09		DDE, p,p'-	72-55-9	8.4E+00	1.3E+01	1.7E+05	5.1E+00				
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		1.4E+09		DDT	50-29-3	8.4E+00	4.3E+01	1.7E+05	7.0E+00	5.1E+02	2.6E+03		4.3E+02
				1.0E-02	I					1	0.1		1.4E+09		Dacthal	1861-32-1					1.0E+04	1.5E+04		6.2E+03
				3.0E-02	I					1	0.1		1.4E+09		Dalapon	75-99-0					3.1E+04	4.6E+04		1.8E+04
7.0E-04	I			7.0E-03	I					1	0.1		1.4E+09		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.1E+03	6.2E+03		2.5E+03	7.2E+03	1.1E+04		4.3E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information																Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	voc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				4.0E-05	I					1	0.1		1.4E+09		Demeton	8065-48-3					4.1E+01	6.2E+01		2.5E+01
1.2E-03	I			6.0E-01	I					1	0.1		1.4E+09		Di(2-ethylhexyl)adipate	103-23-1	2.4E+03	3.6E+03		1.4E+03	6.1E+05	9.3E+05		3.7E+05
6.1E-02	H									1	0.1		1.4E+09		Diallate	2303-16-4	4.7E+01	7.1E+01		2.8E+01				
				7.0E-04	A					1	0.1		1.4E+09		Diazinon	333-41-5					7.2E+02	1.1E+03		4.3E+02
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	1.4E+09	3.4E+04	Dibromo-3-chloropropane, 1,2-	96-12-8	3.6E+00		7.0E-02	6.9E-02	2.0E+02		3.0E+01	2.6E+01
				1.0E-02	I					1	0.1		1.4E+09		Dibromobenzene, 1,4-	106-37-6					1.0E+04	1.5E+04		6.2E+03
8.4E-02	I	2.7E-05	C	2.0E-02	I			V		1	0.1	8.0E+02	1.4E+09	8.6E+03	Dibromochloromethane	124-48-1	3.4E+01	5.2E+01	3.9E+00	3.3E+00	2.0E+04	3.1E+04		1.2E+04
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	1.4E+09	9.3E+03	Dibromoethane, 1,2-	106-93-4	1.4E+00		1.9E-01	1.7E-01	9.2E+03		3.7E+02	3.5E+02
				1.0E-02	H	4.0E-03	X	V		1		2.8E+03	1.4E+09	6.1E+03	Dibromomethane (Methylene Bromide)	74-95-3					1.0E+04		1.1E+02	1.1E+02
				1.0E-01	I					1	0.1		1.4E+09		Dibutyl Phthalate	84-74-2					1.0E+05	1.5E+05		6.2E+04
				3.0E-04	P					1	0.1		1.4E+09		Dibutyltin Compounds	NA					3.1E+02	4.6E+02		1.8E+02
				3.0E-02	I					1	0.1		1.4E+09		Dicamba	1918-00-9					3.1E+04	4.6E+04		1.8E+04
		4.2E-03	P					V		1		5.2E+02	1.4E+09	1.2E+04	Dichloro-2-butene, 1,4-	764-41-0			3.5E-02	3.5E-02				
		4.2E-03	P					V		1	0.1	5.2E+02	1.4E+09	1.2E+04	Dichloro-2-butene, cis-1,4-	1476-11-5			3.5E-02	3.5E-02				
		4.2E-03	P					V		1	0.1	7.6E+02	1.4E+09	1.2E+04	Dichloro-2-butene, trans-1,4-	110-57-6			3.5E-02	3.5E-02				
5.0E-02	I			4.0E-03	I					1	0.1		1.4E+09		Dichloroacetic Acid	79-43-6	5.7E+01	8.7E+01		3.4E+01	4.1E+03	6.2E+03		2.5E+03
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	1.4E+09	1.3E+04	Dichlorobenzene, 1,2-	95-50-1					9.2E+04		1.1E+04	9.8E+03
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			1.4E+09	1.1E+04	Dichlorobenzene, 1,4-	106-46-7	5.3E+02		1.3E+01	1.2E+01	7.2E+04		3.9E+04	2.5E+04
4.5E-01	I	3.4E-04	C							1	0.1		1.4E+09		Dichlorobenzidine, 3,3'-	91-94-1	6.4E+00	9.6E+00	4.9E+04	3.8E+00				
				9.0E-03	X					1	0.1		1.4E+09		Dichlorobenzophenone, 4,4'-	90-98-2					9.2E+03	1.4E+04		5.5E+03
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	1.4E+09	9.1E+02	Dichlorodifluoromethane	75-71-8					2.0E+05		4.0E+02	4.0E+02
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	1.4E+09	2.2E+03	Dichloroethane, 1,1-	75-34-3	5.0E+02		1.7E+01	1.7E+01	2.0E+05			2.0E+05
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	1.4E+09	4.9E+03	Dichloroethane, 1,2-	107-06-2	3.1E+01		2.3E+00	2.2E+00	6.1E+03		1.5E+02	1.5E+02
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	1.4E+09	1.2E+03	Dichloroethylene, 1,1-	75-35-4					5.1E+04		1.1E+03	1.1E+03
				9.0E-03	H			V		1		1.3E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0					9.2E+03			9.2E+03
				2.0E-03	I			V		1		2.4E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2-cis-	156-59-2					2.0E+03			2.0E+03
				2.0E-02	I	6.0E-02	P	V		1		1.7E+03	1.4E+09	2.7E+03	Dichloroethylene, 1,2-trans-	156-60-5					2.0E+04		7.1E+02	6.9E+02
				3.0E-03	I					1	0.1		1.4E+09		Dichlorophenol, 2,4-	120-83-2					3.1E+03	4.6E+03		1.8E+03
				1.0E-02	I					1	0.05		1.4E+09		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					1.0E+04	3.1E+04		7.7E+03
				8.0E-03	I					1	0.1		1.4E+09		Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6					8.2E+03	1.2E+04		4.9E+03
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	1.4E+09	4.1E+03	Dichloropropane, 1,2-	78-87-5	7.9E+01		5.0E+00	4.7E+00	9.2E+04		7.1E+01	7.1E+01
				2.0E-02	P			V		1		1.5E+03	1.4E+09	7.3E+03	Dichloropropane, 1,3-	142-28-9					2.0E+04			2.0E+04
				3.0E-03	I					1	0.1		1.4E+09		Dichloropropanol, 2,3-	616-23-9					3.1E+03	4.6E+03		1.8E+03
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	1.4E+09	3.8E+03	Dichloropropene, 1,3-	542-75-6	2.9E+01		1.2E+01	8.3E+00	3.1E+04		3.4E+02	3.3E+02
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		1.4E+09		Dichlorvos	62-73-7	9.9E+00	1.5E+01	2.0E+05	5.9E+00	5.1E+02	7.7E+02	3.0E+06	3.1E+02
				8.0E-03	P	7.0E-03	P	V		1			1.4E+09	4.4E+03	Dicyclopentadiene	77-73-6					8.2E+03		1.4E+02	1.3E+02
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		1.4E+09		Dieldrin	60-57-1	1.8E-01	2.7E-01	3.6E+03	1.1E-01	5.1E+01	7.7E+01		3.1E+01
		3.0E-04	C			5.0E-03	I			1	0.1				Diesel Engine Exhaust	NA								
				2.0E-03	P	2.0E-04	P			1	0.1		1.4E+09		Diethanolamine	111-42-2					2.0E+03	3.1E+03	1.2E+06	1.2E+03
				8.0E-01	I					1	0.1		1.4E+09		Diethyl Phthalate	84-66-2					8.2E+05	1.2E+06		4.9E+05
				3.0E-02	P	1.0E-04	P			1	0.1		1.4E+09		Diethylene Glycol Monobutyl Ether	112-34-5					3.1E+04	4.6E+04	6.0E+05	1.8E+04
				6.0E-02	P	3.0E-04	P			1	0.1		1.4E+09		Diethylene Glycol Monoethyl Ether	111-90-0					6.1E+04	9.3E+04	1.8E+06	3.6E+04
				1.0E-03	P					1	0.1		1.4E+09		Diethylformamide	617-84-5					1.0E+03	1.5E+03		6.2E+02
3.5E+02	C	1.0E-01	C							1	0.1		1.4E+09		Diethylstilbestrol	56-53-1	8.2E-03	1.2E-02	1.7E+02	4.9E-03				
				8.0E-02	I					1	0.1		1.4E+09		Difenzoquat	43222-48-6					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	I					1	0.1		1.4E+09		Diflubenzuron	35367-38-5					2.0E+04	3.1E+04		1.2E+04
						4.0E+01	I	V		1		1.4E+03	1.4E+09	1.2E+03	Difluoroethane, 1,1-	75-37-6							2.2E+05	2.2E+05
4.4E-02	C	1.3E-05	C					V		1	0.1		1.4E+09	1.3E+03	Dihydrosafrole	94-58-6	6.5E+01	9.9E+01	1.3E+00	1.2E+00				
						7.0E-01	P	V		1		2.3E+03	1.4E+09	3.3E+03	Diisopropyl Ether	108-20-3							1.0E+04	1.0E+04
				8.0E-02	I			V		1		5.3E+02	1.4E+09	3.1E+04	Diisopropyl Methylphosphonate	1445-75-6					8.2E+04			8.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Dimethipin	55290-64-7					2.0E+04	3.1E+04		1.2E+04
				2.0E-04	I					1	0.1		1.4E+09		Dimethoate	60-51-5					2.0E+02	3.1E+02		1.2E+02
1.4E-02	H									1	0.1		1.4E+09		Dimethoxybenzidine, 3,3'-	119-90-4	2.0E+02	3.1E+02		1.2E+02				
1.7E-03	P			6.0E-02	P					1	0.1		1.4E+09		Dimethyl methylphosphonate	756-79-6	1.7E+03	2.6E+03		1.0E+03	6.1E+04	9.3E+04		3.7E+04
4.6E+00	C	1.3E-03	C							1	0.1		1.4E+09		Dimethylamino azobenzene [p-]	60-11-7	6.2E-01	9.4E-01	1.3E+04	3.7E-01				
5.8E-01	H									1	0.1		1.4E+09		Dimethylaniline HCl, 2,4-	21436-96-4	4.9E+00	7.5E+00		3.0E+00				
2.0E-01	P			2.0E-03	X					1	0.1		1.4E+09		Dimethylaniline, 2,4-	95-68-1	1.4E+01	2.2E+01		8.6E+00	2.0E+03	3.1E+03		1.2E+03
				2.0E-03	I			V		1		8.3E+02	1.4E+09	3.4E+04	Dimethylaniline, N,N-	121-69-7					2.0E+03			2.0E+03
1.1E+01	P									1	0.1		1.4E+09		Dimethylbenzidine, 3,3'-	119-93-7	2.6E-01	3.9E-01		1.6E-01				
				1.0E-01	P	3.0E-02	I			1	0.1		1.4E+09		Dimethylformamide	68-12-2					1.0E+05	1.5E+05	1.8E+08	6.2E+04
				1.0E-04	X	2.0E-06	X			1	0.1		1.4E+09		Dimethylhydrazine, 1,1-	57-14-7					1.0E+02	1.5E+02	1.2E+04	6.1E+01
5.5E+02	C	1.6E-01	C							1	0.1		1.4E+09		Dimethylhydrazine, 1,2-	540-73-8	5.2E-03	7.9E-03	1.0E+02	3.1E-03				
				2.0E-02	I					1	0.1		1.4E+09		Dimethylphenol, 2,4-	105-67-9					2.0E+04	3.1E+04		1.2E+04
				6.0E-04	I					1	0.1		1.4E+09		Dimethylphenol, 2,6-	576-26-1					6.1E+02	9.3E+02		3.7E+02
				1.0E-03	I					1	0.1		1.4E+09		Dimethylphenol, 3,4-	95-65-8					1.0E+03	1.5E+03		6.2E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information																Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				1.0E-01	I			V		1			1.4E+09	2.3E+04	Dimethylterephthalate	120-61-6					1.0E+05			1.0E+05
4.5E-02	C	1.3E-05	C					V		1	0.1	1.1E+03	1.4E+09	1.1E+03	Dimethylvinylchloride	513-37-1	6.4E+01	9.6E+01	1.0E+00	1.0E+00				
				8.0E-05	X					1	0.1		1.4E+09		Dinitro-o-cresol, 4,6-	534-52-1					8.2E+01	1.2E+02		4.9E+01
				2.0E-03	I					1	0.1		1.4E+09		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					2.0E+03	3.1E+03		1.2E+03
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,2-	528-29-0					1.0E+02	1.5E+02		6.2E+01
				1.0E-04	I					1	0.1		1.4E+09		Dinitrobenzene, 1,3-	99-65-0					1.0E+02	1.5E+02		6.2E+01
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,4-	100-25-4					1.0E+02	1.5E+02		6.2E+01
				2.0E-03	I					1	0.1		1.4E+09		Dinitrophenol, 2,4-	51-28-5					2.0E+03	3.1E+03		1.2E+03
6.8E-01	I									1	0.1		1.4E+09		Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	4.2E+00	6.4E+00		2.5E+00				
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		1.4E+09		Dinitrotoluene, 2,4-	121-14-2	9.2E+00	1.4E+01	1.9E+05	5.5E+00	2.0E+03	3.0E+03		1.2E+03
				1.0E-03	P					1	0.099		1.4E+09		Dinitrotoluene, 2,6-	606-20-2					1.0E+03	1.6E+03		6.2E+02
				2.0E-03	S					1	0.006		1.4E+09		Dinitrotoluene, 2-Amino-4,6-	35572-78-2					2.0E+03	5.2E+04		2.0E+03
				2.0E-03	S					1	0.009		1.4E+09		Dinitrotoluene, 4-Amino-2,6-	19406-51-0					2.0E+03	3.4E+04		1.9E+03
				1.0E-03	I					1	0.1		1.4E+09		Dinoseb	88-85-7					1.0E+03	1.5E+03		6.2E+02
1.0E-01	I	7.7E-06	C	3.0E-02	I	3.0E+00	C			1	0.1		1.4E+09		Dioxane, 1,4-	123-91-1	2.9E+01	4.3E+01	2.2E+06	1.7E+01	3.1E+04	4.6E+04	1.8E+10	1.8E+04
															Dioxins									
6.2E+03	I	1.3E+00	I							1	0.03		1.4E+09		"Hexachlorodibenzo-p-dioxin, Mixture	NA	4.6E-04	2.3E-03	1.3E+01	3.9E-04				
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C			1	0.03		1.4E+09		"TCDD, 2,3,7,8-	1746-01-6	2.2E-05	1.1E-04	4.4E-01	1.8E-05	7.2E-04	3.6E-03	2.4E+02	6.0E-04
				3.0E-02	I					1	0.1		1.4E+09		Diphenamid	957-51-7					3.1E+04	4.6E+04		1.8E+04
				8.0E-04	X					1	0.1		1.4E+09		Diphenyl Sulfone	127-63-9					8.2E+02	1.2E+03		4.9E+02
				2.5E-02	I					1	0.1		1.4E+09		Diphenylamine	122-39-4					2.6E+04	3.9E+04		1.5E+04
8.0E-01	I	2.2E-04	I							1	0.1		1.4E+09		Diphenylhydrazine, 1,2-	122-66-7	3.6E+00	5.4E+00	7.6E+04	2.2E+00				
				2.2E-03	I					1	0.1		1.4E+09		Diquat	85-00-7					2.2E+03	3.4E+03		1.4E+03
7.4E+00	C	2.1E-03	C							1	0.1		1.4E+09		Direct Black 38	1937-37-7	3.9E-01	5.9E-01	7.9E+03	2.3E-01				
7.4E+00	C	2.1E-03	C							1	0.1		1.4E+09		Direct Blue 6	2602-46-2	3.9E-01	5.9E-01	7.9E+03	2.3E-01				
6.7E+00	C	1.9E-03	C							1	0.1		1.4E+09		Direct Brown 95	16071-86-6	4.3E-01	6.5E-01	8.8E+03	2.6E-01				
				4.0E-05	I					1	0.1		1.4E+09		Disulfoton	298-04-4					4.1E+01	6.2E+01		2.5E+01
				1.0E-02	I			V		1	0.1		1.4E+09	4.6E+04	Dithiane, 1,4-	505-29-3					1.0E+04	1.5E+04		6.2E+03
				2.0E-03	I					1	0.1		1.4E+09		Diuron	330-54-1					2.0E+03	3.1E+03		1.2E+03
				4.0E-03	I					1	0.1		1.4E+09		Dodine	2439-10-3					4.1E+03	6.2E+03		2.5E+03
				2.5E-02	I			V		1			1.4E+09	1.3E+05	EPTC	759-94-4					2.6E+04			2.6E+04
				6.0E-03	I					1	0.1		1.4E+09		Endosulfan	115-29-7					6.1E+03	9.3E+03		3.7E+03
				2.0E-02	I					1	0.1		1.4E+09		Endothall	145-73-3					2.0E+04	3.1E+04		1.2E+04
				3.0E-04	I					1	0.1		1.4E+09		Endrin	72-20-8					3.1E+02	4.6E+02		1.8E+02
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	1.4E+09	2.0E+04	Epichlorohydrin	106-89-8	2.9E+02		2.1E+02	1.2E+02	6.1E+03		8.9E+01	8.8E+01
						2.0E-02	I	V		1		1.5E+04	1.4E+09	8.2E+03	Epoxybutane, 1,2-	106-88-7							7.2E+02	7.2E+02
				5.0E-03	I					1	0.1		1.4E+09		Ethephon	16672-87-0					5.1E+03	7.7E+03		3.1E+03
				5.0E-04	I					1	0.1		1.4E+09		Ethion	563-12-2					5.1E+02	7.7E+02		3.1E+02
				1.0E-01	P	6.0E-02	P			1	0.1		1.4E+09		Ethoxyethanol Acetate, 2-	111-15-9					1.0E+05	1.5E+05	3.6E+08	6.2E+04
				4.0E-01	H	2.0E-01	I			1	0.1		1.4E+09		Ethoxyethanol, 2-	110-80-5					4.1E+05	6.2E+05	1.2E+09	2.5E+05
				9.0E-01	I			V		1		1.1E+04	1.4E+09	9.3E+03	Ethyl Acetate	141-78-6					9.2E+05			9.2E+05
4.8E-02	H							V		1		2.5E+03	1.4E+09	6.8E+03	Ethyl Acrylate	140-88-5	6.0E+01			6.0E+01				
						1.0E+01	I	V		1		2.1E+03	1.4E+09	1.4E+03	Ethyl Chloride	75-00-3							6.1E+04	6.1E+04
				2.0E-01	I			V		1		1.0E+04	1.4E+09	3.4E+03	Ethyl Ether	60-29-7					2.0E+05			2.0E+05
				9.0E-02	H	3.0E-01	P	V		1		1.1E+03	1.4E+09	6.2E+03	Ethyl Methacrylate	97-63-2					9.2E+04		8.2E+03	7.5E+03
				1.0E-05	I					1	0.1		1.4E+09		Ethyl-p-nitrophenyl Phosphonate	2104-64-5					1.0E+01	1.5E+01		6.2E+00
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	1.4E+09	6.1E+03	Ethylbenzene	100-41-4	2.6E+02		3.0E+01	2.7E+01	1.0E+05		2.7E+04	2.1E+04
				7.0E-02	P					1	0.1		1.4E+09		Ethylene Cyanohydrin	109-78-4					7.2E+04	1.1E+05		4.3E+04
				9.0E-02	P					1	0.1		1.4E+09		Ethylene Diamine	107-15-3					9.2E+04	1.4E+05		5.5E+04
				2.0E+00	I	4.0E-01	C			1	0.1		1.4E+09		Ethylene Glycol	107-21-1					2.0E+06	3.1E+06	2.4E+09	1.2E+06
				1.0E-01	I	1.6E+00	I			1	0.1		1.4E+09		Ethylene Glycol Monobutyl Ether	111-76-2					1.0E+05	1.5E+05	9.5E+09	6.2E+04
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	1.4E+09	6.6E+03	Ethylene Oxide	75-21-8	9.2E+00		9.1E-01	8.3E-01			8.6E+02	8.6E+02
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		1.4E+09		Ethylene Thiourea	96-45-7	6.4E+01	9.6E+01	1.3E+06	3.8E+01	8.2E+01	1.2E+02		4.9E+01
6.5E+01	C	1.9E-02	C					V		1	0.1	1.5E+05	1.4E+09	2.6E+04	Ethyleneimine	151-56-4	4.4E-02	6.7E-02	1.7E-02	1.0E-02				
				3.0E+00	I					1	0.1		1.4E+09		Ethylphthalyl Ethyl Glycolate	84-72-0					3.1E+06	4.6E+06		1.8E+06
				8.0E-03	I					1	0.1		1.4E+09		Express	101200-48-0					8.2E+03	1.2E+04		4.9E+03
				2.5E-04	I					1	0.1		1.4E+09		Fenamiphos	22224-92-6					2.6E+02	3.9E+02		1.5E+02
				2.5E-02	I					1	0.1		1.4E+09		Fenpropathrin	39515-41-8					2.6E+04	3.9E+04		1.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Fluometuron	2164-17-2					1.3E+04	2.0E+04		8.0E+03
				4.0E-02	C	1.3E-02	C			1			1.4E+09		Fluoride	16984-48-8					4.1E+04		7.7E+07	4.1E+04
				6.0E-02	I	1.3E-02	C			1			1.4E+09		Fluorine (Soluble Fluoride)	7782-41-4					6.1E+04		7.7E+07	6.1E+04
				8.0E-02	I					1	0.1		1.4E+09		Fluridone	59756-60-4					8.2E+04	1.2E+05		4.9E+04
				2.0E-02	I					1	0.1		1.4E+09		Flurprimidol	56425-91-3					2.0E+04	3.1E+04		1.2E+04
				6.0E-02	I					1	0.1		1.4E+09		Flutolanil	66332-96-5					6.1E+04	9.3E+04		3.7E+04
				1.0E-02	I					1	0.1		1.4E+09		Fluvalinate	69409-94-5					1.0E+04	1.5E+04		6.2E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO $(mg/kg\text{-}day)^{-1}$	key	IUR $(ug/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
3.5E-03	I			1.0E-01	I					1	0.1		1.4E+09		Folpet	133-07-3	8.2E+02	1.2E+03		4.9E+02	1.0E+05	1.5E+05		6.2E+04
1.9E-01	I									1	0.1		1.4E+09		Fomesafen	72178-02-0	1.5E+01	2.3E+01		9.1E+00				
				2.0E-03	I					1	0.1		1.4E+09		Fonofos	944-22-9					2.0E+03	3.1E+03		1.2E+03
		1.3E-05	I	2.0E-01	I	9.8E-03	A			1	0.1		1.4E+09		Formaldehyde	50-00-0			1.3E+06	1.3E+06	2.0E+05	3.1E+05	5.8E+07	1.2E+05
				9.0E-01	P	3.0E-04	X			1	0.1		1.4E+09		Formic Acid	64-18-6					9.2E+05	1.4E+06	1.8E+06	4.2E+05
				3.0E+00	I					1	0.1		1.4E+09		Fosetyl-AL	39148-24-8					3.1E+06	4.6E+06		1.8E+06
															Furans									
				1.0E-03	X			V		1			1.4E+09	2.1E+05	~Dibenzofuran	132-64-9					1.0E+03			1.0E+03
				1.0E-03	I			V		1		6.2E+03	1.4E+09	2.8E+03	~Furan	110-00-9					1.0E+03			1.0E+03
				9.0E-01	I	2.0E+00	I	V		1	0.1	1.7E+05	1.4E+09	1.3E+04	~Tetrahydrofuran	109-99-9					9.2E+05	1.4E+06	1.2E+05	9.5E+04
3.8E+00	H									1	0.1		1.4E+09		Furazolidone	67-45-8	7.5E-01	1.1E+00		4.5E-01				
				3.0E-03	I	5.0E-02	H			1	0.1		1.4E+09		Furfural	98-01-1					3.1E+03	4.6E+03	3.0E+08	1.8E+03
1.5E+00	C	4.3E-04	C							1	0.1		1.4E+09		Furium	531-82-8	1.9E+00	2.9E+00	3.9E+04	1.1E+00				
3.0E-02	I	8.6E-06	C							1	0.1		1.4E+09		Furmecyclox	60568-05-0	9.5E+01	1.4E+02	1.9E+06	5.7E+01				
				4.0E-04	I					1	0.1		1.4E+09		Glufosinate, Ammonium	77182-82-2					4.1E+02	6.2E+02		2.5E+02
						8.0E-05	C			1	0.1		1.4E+09		Glutaraldehyde	111-30-8							4.8E+05	4.8E+05
				4.0E-04	I	1.0E-03	H			1	0.1		1.4E+09		Glycidyl	765-34-4					4.1E+02	6.2E+02	6.0E+06	2.5E+02
				1.0E-01	I					1	0.1		1.4E+09		Glyphosate	1071-83-6					1.0E+05	1.5E+05		6.2E+04
				3.0E-03	I					1	0.1		1.4E+09		Goal	42874-03-3					3.1E+03	4.6E+03		1.8E+03
				3.0E-03	A	1.0E-02	A			1	0.1		1.4E+09		Guthion	86-50-0					3.1E+03	4.6E+03	6.0E+07	1.8E+03
				5.0E-05	I					1	0.1		1.4E+09		Haloxyfop, Methyl	69806-40-2					5.1E+01	7.7E+01		3.1E+01
				1.3E-02	I					1	0.1		1.4E+09		Harmony	79277-27-3					1.3E+04	2.0E+04		8.0E+03
4.5E+00	I	1.3E-03	I	5.0E-04	I					1	0.1		1.4E+09		Heptachlor	76-44-8	6.4E-01	9.6E-01	1.3E+04	3.8E-01	5.1E+02	7.7E+02		3.1E+02
9.1E+00	I	2.6E-03	I	1.3E-05	I					1	0.1		1.4E+09		Heptachlor Epoxide	1024-57-3	3.1E-01	4.8E-01	6.4E+03	1.9E-01	1.3E+01	2.0E+01		8.0E+00
				2.0E-03	I					1	0.1		1.4E+09		Hexabromobenzene	87-82-1					2.0E+03	3.1E+03		1.2E+03
				2.0E-04	I					1	0.1		1.4E+09		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2					2.0E+02	3.1E+02		1.2E+02
1.6E+00	I	4.6E-04	I	8.0E-04	I					1	0.1		1.4E+09		Hexachlorobenzene	118-74-1	1.8E+00	2.7E+00	3.6E+04	1.1E+00	8.2E+02	1.2E+03		4.9E+02
7.8E-02	I	2.2E-05	I	1.0E-03	P					1	0.1		1.4E+09		Hexachlorobutadiene	87-68-3	3.7E+01	5.6E+01	7.6E+05	2.2E+01	1.0E+03	1.5E+03		6.2E+02
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		1.4E+09		Hexachlorocyclohexane, Alpha-	319-84-6	4.5E-01	6.9E-01	9.3E+03	2.7E-01	8.2E+03	1.2E+04		4.9E+03
1.8E+00	I	5.3E-04	I							1	0.1		1.4E+09		Hexachlorocyclohexane, Beta-	319-85-7	1.6E+00	2.4E+00	3.1E+04	9.6E-01				
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		1.4E+09		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	2.6E+00	9.9E+00	5.4E+04	2.1E+00	3.1E+02	1.2E+03		2.4E+02
1.8E+00	I	5.1E-04	I							1	0.1		1.4E+09		Hexachlorocyclohexane, Technical	608-73-1	1.6E+00	2.4E+00	3.3E+04	9.6E-01				
				6.0E-03	I	2.0E-04	I			1	0.1		1.4E+09		Hexachlorocyclopentadiene	77-47-4					6.1E+03	9.3E+03	1.2E+06	3.7E+03
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I			1	0.1		1.4E+09		Hexachloroethane	67-72-1	7.2E+01	1.1E+02	1.5E+06	4.3E+01	7.2E+02	1.1E+03	1.8E+08	4.3E+02
				3.0E-04	I					1	0.1		1.4E+09		Hexachlorophene	70-30-4					3.1E+02	4.6E+02		1.8E+02
1.1E-01	I			3.0E-03	I					1	0.015		1.4E+09		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	2.6E+01	2.6E+02		2.4E+01	3.1E+03	3.1E+04		2.8E+03
						1.0E-05	I	V		1		5.2E+03	1.4E+09	3.2E+05	Hexamethylene Diisocyanate, 1,6-	822-06-0							1.4E+01	1.4E+01
				4.0E-04	P					1	0.1		1.4E+09		Hexamethylphosphoramide	680-31-9					4.1E+02	6.2E+02		2.5E+02
				6.0E-02	H	7.0E-01	I	V		1		1.4E+02	1.4E+09	8.9E+02	Hexane, N-	110-54-3					6.1E+04		2.7E+03	2.6E+03
				2.0E+00	P					1	0.1		1.4E+09		Hexanedioic Acid	124-04-9					2.0E+06	3.1E+06		1.2E+06
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	1.4E+09	1.4E+04	Hexanone, 2-	591-78-6					5.1E+03		1.9E+03	1.4E+03
				3.3E-02	I					1	0.1		1.4E+09		Hexazinone	51235-04-2					3.4E+04	5.1E+04		2.0E+04
3.0E+00	I	4.9E-03	I			3.0E-05	P			1			1.4E+09		Hydrazine	302-01-2	9.5E-01		3.4E+03	9.5E-01			1.8E+05	1.8E+05
3.0E+00	I	4.9E-03	I							1			1.4E+09		Hydrazine Sulfate	10034-93-2	9.5E-01		3.4E+03	9.5E-01				
						2.0E-02	I			1			1.4E+09		Hydrogen Chloride	7647-01-0							1.2E+08	1.2E+08
				4.0E-02	C	1.4E-02	C			1			1.4E+09		Hydrogen Fluoride	7664-39-3					4.1E+04		8.3E+07	4.1E+04
						2.0E-03	I			1			1.4E+09		Hydrogen Sulfide	7783-06-4							1.2E+07	1.2E+07
6.0E-02	P			4.0E-02	P					1	0.1		1.4E+09		Hydroquinone	123-31-9	4.8E+01	7.2E+01		2.9E+01	4.1E+04	6.2E+04		2.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Imazalil	35554-44-0					1.3E+04	2.0E+04		8.0E+03
				2.5E-01	I					1	0.1		1.4E+09		Imazaquin	81335-37-7					2.6E+05	3.9E+05		1.5E+05
				1.0E-02	A					1			1.4E+09		Iodine	7553-56-2					1.0E+04			1.0E+04
				4.0E-02	I					1	0.1		1.4E+09		Iprodione	36734-19-7					4.1E+04	6.2E+04		2.5E+04
				7.0E-01	P					1			1.4E+09		Iron	7439-89-6					7.2E+05			7.2E+05
				3.0E-01	I					1	0.1		1.4E+09		Isobutyl Alcohol	78-83-1					3.1E+05	4.6E+05		1.8E+05
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		1.4E+09		Isophorone	78-59-1	3.0E+03	4.6E+03		1.8E+03	2.0E+05	3.1E+05	1.2E+10	1.2E+05
				1.5E-02	I					1	0.1		1.4E+09		Isopropalin	33820-53-0					1.5E+04	2.3E+04		9.2E+03
						7.0E+00	C			1	0.1		1.4E+09		Isopropanol	67-63-0							4.2E+10	4.2E+10
				1.0E-01	I					1	0.1		1.4E+09		Isopropyl Methyl Phosphonic Acid	1832-54-8					1.0E+05	1.5E+05		6.2E+04
				5.0E-02	I					1	0.1		1.4E+09		Isoxaben	82558-50-7					5.1E+04	7.7E+04		3.1E+04
						3.0E-01	A	V		1			1.4E+09		JP-7	NA							1.8E+09	1.8E+09
				7.5E-02	I					1	0.1		1.4E+09		Kerb	23950-58-5					7.7E+04	1.2E+05		4.6E+04
				2.0E-03	I					1	0.1		1.4E+09		Lactofen	77501-63-4					2.0E+03	3.1E+03		1.2E+03
															Lead Compounds									
2.8E-01	C	8.0E-05	C							1	0.1		1.4E+09		~Lead acetate	301-04-2	1.0E+01	1.5E+01	2.1E+05	6.2E+00				
										1			1.4E+09		~Lead and Compounds	7439-92-1								8.0E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
3.8E-02	C	1.1E-05	C							1	0.1		1.4E+09		~Lead subacetate	1335-32-6	7.5E+01	1.1E+02	1.5E+06	4.5E+01				
				1.0E-07	I					1	0.1		1.4E+09		~Tetraethyl Lead	78-00-2					1.0E-01	1.5E-01		6.2E-02
				2.0E-03	I					1	0.1		1.4E+09		Linuron	330-55-2					2.0E+03	3.1E+03		1.2E+03
				2.0E-03	P					1			1.4E+09		Lithium	7439-93-2					2.0E+03			2.0E+03
				2.0E-01	I					1	0.1		1.4E+09		Londax	83055-99-6					2.0E+05	3.1E+05		1.2E+05
				5.0E-04	I					1	0.1		1.4E+09		MCPA	94-74-6					5.1E+02	7.7E+02		3.1E+02
				1.0E-02	I					1	0.1		1.4E+09		MCPB	94-81-5					1.0E+04	1.5E+04		6.2E+03
				1.0E-03	I					1	0.1		1.4E+09		MCPP	93-65-2					1.0E+03	1.5E+03		6.2E+02
				2.0E-02	I					1	0.1		1.4E+09		Malathion	121-75-5					2.0E+04	3.1E+04		1.2E+04
				1.0E-01	I	7.0E-04	C			1	0.1		1.4E+09		Maleic Anhydride	108-31-6					1.0E+05	1.5E+05	4.2E+06	6.1E+04
				5.0E-01	I					1	0.1		1.4E+09		Maleic Hydrazide	123-33-1					5.1E+05	7.7E+05		3.1E+05
				1.0E-04	P					1	0.1		1.4E+09		Malononitrile	109-77-3					1.0E+02	1.5E+02		6.2E+01
				3.0E-02	H					1	0.1		1.4E+09		Mancozeb	8018-01-7					3.1E+04	4.6E+04		1.8E+04
				5.0E-03	I					1	0.1		1.4E+09		Maneb	12427-38-2					5.1E+03	7.7E+03		3.1E+03
				1.4E-01	I	5.0E-05	I			1					Manganese (Diet)	7439-96-5								
				2.4E-02	S	5.0E-05	I			0.04			1.4E+09		Manganese (Non-diet)	7439-96-5					2.5E+04		3.0E+05	2.3E+04
				9.0E-05	H					1	0.1		1.4E+09		Mephosfolan	950-10-7					9.2E+01	1.4E+02		5.5E+01
				3.0E-02	I					1	0.1		1.4E+09		Mepiquat Chloride	24307-26-4					3.1E+04	4.6E+04		1.8E+04
															Mercury Compounds									
				3.0E-04	I	3.0E-04	S			0.07			1.4E+09		~Mercuric Chloride (and other Mercury salts)	7487-94-7					3.1E+02		1.8E+06	3.1E+02
						3.0E-04	I	V		1		3.1E+00	1.4E+09	3.2E+04	~Mercury (elemental)	7439-97-6							4.3E+01	4.3E+01
				1.0E-04	I					1			1.4E+09		~Methyl Mercury	22967-92-6					1.0E+02			1.0E+02
				8.0E-05	I					1	0.1		1.4E+09		~Phenylmercuric Acetate	62-38-4					8.2E+01	1.2E+02		4.9E+01
				3.0E-05	I					1	0.1		1.4E+09		Merphos	150-50-5					3.1E+01	4.6E+01		1.8E+01
				3.0E-05	I					1	0.1		1.4E+09		Merphos Oxide	78-48-8					3.1E+01	4.6E+01		1.8E+01
				6.0E-02	I					1	0.1		1.4E+09		Metalaxyl	57837-19-1					6.1E+04	9.3E+04		3.7E+04
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	1.4E+09	7.3E+03	Methacrylonitrile	126-98-7					1.0E+02		9.6E+02	9.2E+01
				5.0E-05	I					1	0.1		1.4E+09		Methamidophos	10265-92-6					5.1E+01	7.7E+01		3.1E+01
				5.0E-01	I	4.0E+00	C			1	0.1		1.4E+09		Methanol	67-56-1					5.1E+05	7.7E+05	2.4E+10	3.1E+05
				1.0E-03	I					1	0.1		1.4E+09		Methidathion	950-37-8					1.0E+03	1.5E+03		6.2E+02
				2.5E-02	I					1	0.1		1.4E+09		Methomyl	16752-77-5					2.6E+04	3.9E+04		1.5E+04
4.9E-02	C	1.4E-05	C							1	0.1		1.4E+09		Methoxy-5-nitroaniline, 2-	99-59-2	5.8E+01	8.8E+01	1.2E+06	3.5E+01				
				5.0E-03	I					1	0.1		1.4E+09		Methoxychlor	72-43-5					5.1E+03	7.7E+03		3.1E+03
				8.0E-03	P	1.0E-03	P			1	0.1		1.4E+09		Methoxyethanol Acetate, 2-	110-49-6					8.2E+03	1.2E+04	6.0E+06	4.9E+03
				5.0E-03	P	2.0E-02	I			1	0.1		1.4E+09		Methoxyethanol, 2-	109-86-4					5.1E+03	7.7E+03	1.2E+08	3.1E+03
				1.0E+00	X			V		1		2.9E+04	1.4E+09	8.7E+03	Methyl Acetate	79-20-9					1.0E+06			1.0E+06
				3.0E-02	H	2.0E-02	P	V		1		6.8E+03	1.4E+09	7.5E+03	Methyl Acrylate	96-33-3					3.1E+04		6.6E+02	6.4E+02
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	1.4E+09	1.3E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3					6.1E+05		2.9E+05	2.0E+05
		1.0E-03	X	1.0E-03	P	2.0E-05	X			1	0.1		1.4E+09		Methyl Hydrazine	60-34-4			1.7E+04	1.7E+04	1.0E+03	1.5E+03	1.2E+05	6.1E+02
				8.0E-02	H	3.0E+00	I	V		1		3.4E+03	1.4E+09	1.1E+04	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1					8.2E+04		1.5E+05	5.3E+04
						1.0E-03	C	V		1	0.1	1.7E+04	1.4E+09	4.8E+03	Methyl Isocyanate	624-83-9							2.1E+01	2.1E+01
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	1.4E+09	6.8E+03	Methyl Methacrylate	80-62-6					1.4E+06		2.1E+04	2.1E+04
				2.5E-04	I					1	0.1		1.4E+09		Methyl Parathion	298-00-0					2.6E+02	3.9E+02		1.5E+02
				6.0E-02	X					1	0.1		1.4E+09		Methyl Phosphonic Acid	993-13-5					6.1E+04	9.3E+04		3.7E+04
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	1.4E+09	1.2E+04	Methyl Styrene (Mixed Isomers)	25013-15-4					6.1E+03		2.0E+03	1.5E+03
9.9E-02	C	2.8E-05	C							1	0.1		1.4E+09		Methyl methanesulfonate	66-27-3	2.9E+01	4.4E+01	6.0E+05	1.7E+01				
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	1.4E+09	5.3E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.6E+03		2.5E+02	2.2E+02			6.9E+04	6.9E+04
				2.0E-04	X					1	0.1		1.4E+09		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2					2.0E+02	3.1E+02		1.2E+02
9.0E-03	P			2.0E-02	X					1	0.1		1.4E+09		Methyl-5-Nitroaniline, 2-	99-55-8	3.2E+02	4.8E+02		1.9E+02	2.0E+04	3.1E+04		1.2E+04
8.3E+00	C	2.4E-03	C							1	0.1		1.4E+09		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	3.4E-01	5.2E-01	6.9E+03	2.1E-01				
1.3E-01	C	3.7E-05	C							1	0.1		1.4E+09		Methylaniline Hydrochloride, 2-	636-21-5	2.2E+01	3.3E+01	4.5E+05	1.3E+01				
				1.0E-02	A					1	0.1		1.4E+09		Methylarsonic acid	124-58-3					1.0E+04	1.5E+04		6.2E+03
				2.0E-04	X					1	0.1		1.4E+09		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7					2.0E+02	3.1E+02		1.2E+02
				2.0E-04	X					1	0.1		1.4E+09		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9					2.0E+02	3.1E+02		1.2E+02
2.2E+01	C	6.3E-03	C						M	1	0.1		1.4E+09		Methylcholanthrene, 3-	56-49-5	1.3E-01	2.0E-01	2.6E+03	7.8E-02				
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	1.4E+09	2.4E+03	Methylene Chloride	75-09-2	1.4E+03		2.9E+03	9.6E+02	6.1E+03		6.2E+03	3.1E+03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		1.4E+09		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.9E+01	4.3E+01	3.9E+04	1.7E+01	2.0E+03	3.1E+03		1.2E+03
4.6E-02	I	1.3E-05	C							1	0.1		1.4E+09		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	6.2E+01	9.4E+01	1.3E+06	3.7E+01				
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		1.4E+09		Methylenebisbenzenamine, 4,4'-	101-77-9	1.8E+00	2.7E+00	3.6E+04	1.1E+00			1.2E+08	1.2E+08
						6.0E-04	I			1	0.1		1.4E+09		Methylenediphenyl Diisocyanate	101-68-8							3.6E+06	3.6E+06
				7.0E-02	H			V		1		5.0E+02	1.4E+09	1.4E+04	Methylstyrene, Alpha-	98-83-9					7.2E+04			7.2E+04
				1.5E-01	I					1	0.1		1.4E+09		Metolachlor	51218-45-2					1.5E+05	2.3E+05		9.2E+04
				2.5E-02	I					1	0.1		1.4E+09		Metribuzin	21087-64-9					2.6E+04	3.9E+04		1.5E+04
				3.0E+00	P			V		1	0.1	3.4E-01	1.4E+09	1.1E+03	Mineral oils	8012-95-1					3.1E+06	4.6E+06		1.8E+06
1.8E+01	C	5.1E-03	C	2.0E-04	I					1	0.1		1.4E+09		Mirex	2385-85-5	1.6E-01	2.4E-01	3.3E+03	9.6E-02	2.0E+02	3.1E+02		1.2E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO $(mg/kg\text{-}day)^{-1}$	key	IUR $(ug/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				2.0E-03	I					1	0.1		1.4E+09		Molinate	2212-67-1					2.0E+03	3.1E+03		1.2E+03
				5.0E-03	I					1			1.4E+09		Molybdenum	7439-98-7					5.1E+03			5.1E+03
				1.0E-01	I					1			1.4E+09		Monochloramine	10599-90-3					1.0E+05			1.0E+05
				2.0E-03	P					1	0.1		1.4E+09		Monomethylaniline	100-61-8					2.0E+03	3.1E+03		1.2E+03
				3.0E-04	X					1	0.1		1.4E+09		N,N'-Diphenyl-1,4-benzenediamine	74-31-7					3.1E+02	4.6E+02		1.8E+02
				2.0E-03	I					1	0.1		1.4E+09		Naled	300-76-5					2.0E+03	3.1E+03		1.2E+03
				3.0E-02	X	1.0E-01	P	V		1			1.4E+09		Naphtha, High Flash Aromatic (HFAN)	64724-95-6					3.1E+04		6.0E+08	3.1E+04
1.8E+00	C	0.0E+00	C							1	0.1		1.4E+09		Naphthylamine, 2-	91-59-8	1.6E+00	2.4E+00		9.6E-01				
				1.0E-01	I					1	0.1		1.4E+09		Napropamide	15299-99-7					1.0E+05	1.5E+05		6.2E+04
				5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Carbonyl	13463-39-3					5.1E+04		3.0E+05	4.4E+04
				5.0E-02	C	1.0E-04	C			1			1.4E+09		Nickel Oxide	1313-99-1					5.1E+04		6.0E+05	4.7E+04
		2.4E-04	I	5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Refinery Dust	NA			6.9E+04	6.9E+04	5.1E+04		3.0E+05	4.4E+04
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			1.4E+09		Nickel Soluble Salts	7440-02-0			6.4E+04	6.4E+04	2.0E+04		5.4E+05	2.0E+04
1.7E+00	C	4.8E-04	I	5.0E-02	C	5.0E-05	C			0.04			1.4E+09		Nickel Subsulfide	12035-72-2	1.7E+00		3.5E+04	1.7E+00	5.1E+04		3.0E+05	4.4E+04
				1.6E+00	I					1			1.4E+09		Nitrate	14797-55-8					1.6E+06			1.6E+06
										1			1.4E+09		Nitrate + Nitrite (as N)	NA								
				1.0E-01	I					1			1.4E+09		Nitrite	14797-65-0					1.0E+05			1.0E+05
				1.0E-02	X	5.0E-05	X			1	0.1		1.4E+09		Nitroaniline, 2-	88-74-4					1.0E+04	1.5E+04	3.0E+05	6.0E+03
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		1.4E+09		Nitroaniline, 4-	100-01-6	1.4E+02	2.2E+02		8.6E+01	4.1E+03	6.2E+03	3.6E+07	2.5E+03
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	1.4E+09	7.9E+04	Nitrobenzene	98-95-3			2.4E+01	2.4E+01	2.0E+03		3.1E+03	1.2E+03
				3.0E+03	P					1	0.1		1.4E+09		Nitrocellulose	9004-70-0					3.1E+09	4.6E+09		1.8E+09
				7.0E-02	H					1	0.1		1.4E+09		Nitrofurantoin	67-20-9					7.2E+04	1.1E+05		4.3E+04
1.3E+00	C	3.7E-04	C							1	0.1		1.4E+09		Nitrofurazone	59-87-0	2.2E+00	3.3E+00	4.5E+04	1.3E+00				
1.7E-02	P			1.0E-04	P					1	0.1		1.4E+09		Nitroglycerin	55-63-0	1.7E+02	2.6E+02		1.0E+02	1.0E+02	1.5E+02		6.2E+01
				1.0E-01	I					1	0.1		1.4E+09		Nitroguanidine	556-88-7					1.0E+05	1.5E+05		6.2E+04
		9.0E-06	P			2.0E-02	P	V		1		1.8E+04	1.4E+09	1.8E+04	Nitromethane	75-52-5			2.5E+01	2.5E+01			1.6E+03	1.6E+03
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	1.4E+09	1.4E+04	Nitropropane, 2-	79-46-9			6.4E-02	6.4E-02			1.2E+03	1.2E+03
2.7E+01	C	7.7E-03	C						M	1	0.1		1.4E+09		Nitroso-N-ethylurea, N-	759-73-9	1.1E-01	1.6E-01	2.2E+03	6.4E-02				
1.2E+02	C	3.4E-02	C						M	1	0.1		1.4E+09		Nitroso-N-methylurea, N-	684-93-5	2.4E-02	3.6E-02	4.9E+02	1.4E-02				
5.4E+00	I	1.6E-03	I					V		1			1.4E+09	2.1E+05	Nitroso-di-N-butylamine, N-	924-16-3	5.3E-01		1.6E+00	4.0E-01				
7.0E+00	I	2.0E-03	C							1	0.1		1.4E+09		Nitroso-di-N-propylamine, N-	621-64-7	4.1E-01	6.2E-01	8.3E+03	2.5E-01				
2.8E+00	I	8.0E-04	C							1	0.1		1.4E+09		Nitrosodiethanolamine, N-	1116-54-7	1.0E+00	1.5E+00	2.1E+04	6.2E-01				
1.5E+02	I	4.3E-02	I						M	1	0.1		1.4E+09		Nitrosodiethylamine, N-	55-18-5	1.9E-02	2.9E-02	3.9E+02	1.1E-02				
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X		M	1	0.1		1.4E+09		Nitrosodimethylamine, N-	62-75-9	5.6E-02	8.5E-02	1.2E+03	3.4E-02	8.2E+00	1.2E+01	2.4E+05	4.9E+00
4.9E-03	I	2.6E-06	C							1	0.1		1.4E+09		Nitrosodiphenylamine, N-	86-30-6	5.8E+02	8.8E+02	6.4E+06	3.5E+02				
2.2E+01	I	6.3E-03	C							1	0.1		1.4E+09		Nitrosomethylethylamine, N-	10595-95-6	1.3E-01	2.0E-01	2.6E+03	7.8E-02				
6.7E+00	C	1.9E-03	C							1	0.1		1.4E+09		Nitrosomorpholine [N-]	59-89-2	4.3E-01	6.5E-01	8.8E+03	2.6E-01				
9.4E+00	C	2.7E-03	C							1	0.1		1.4E+09		Nitrosopiperidine [N-]	100-75-4	3.0E-01	4.6E-01	6.2E+03	1.8E-01				
2.1E+00	I	6.1E-04	I							1	0.1		1.4E+09		Nitrosopyrrolidine, N-	930-55-2	1.4E+00	2.1E+00	2.7E+04	8.2E-01				
				1.0E-04	X					1	0.1		1.4E+09		Nitrotoluene, m-	99-08-1					1.0E+02	1.5E+02		6.2E+01
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	1.4E+09	1.5E+05	Nitrotoluene, o-	88-72-2	1.3E+01			1.3E+01	9.2E+02			9.2E+02
1.6E-02	P			4.0E-03	P					1	0.1		1.4E+09		Nitrotoluene, p-	99-99-0	1.8E+02	2.7E+02		1.1E+02	4.1E+03	6.2E+03		2.5E+03
				3.0E-04	X	2.0E-01	P	V		1		6.9E+00	1.4E+09	1.1E+03	Nonane, n-	111-84-2					3.1E+02		9.8E+02	2.3E+02
				4.0E-02	I					1	0.1		1.4E+09		Norflurazon	27314-13-2					4.1E+04	6.2E+04		2.5E+04
				7.0E-04	I					1	0.1		1.4E+09		Nustar	85509-19-9					7.2E+02	1.1E+03		4.3E+02
				3.0E-03	I					1	0.1		1.4E+09		Octabromodiphenyl Ether	32536-52-0					3.1E+03	4.6E+03		1.8E+03
				5.0E-02	I					1	0.006		1.4E+09		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0					5.1E+04	1.3E+06		4.9E+04
				2.0E-03	H					1	0.1		1.4E+09		Octamethylpyrophosphoramide	152-16-9					2.0E+03	3.1E+03		1.2E+03
				1.2E-02	P					1	0.1		1.4E+09		Octyl Phthalate, di-N-	117-84-0					1.2E+04	1.9E+04		7.4E+03
				5.0E-02	I					1	0.1		1.4E+09		Oryzalin	19044-88-3					5.1E+04	7.7E+04		3.1E+04
				5.0E-03	I					1	0.1		1.4E+09		Oxadiazon	19666-30-9					5.1E+03	7.7E+03		3.1E+03
				2.5E-02	I					1	0.1		1.4E+09		Oxamyl	23135-22-0					2.6E+04	3.9E+04		1.5E+04
				1.3E-02	I					1	0.1		1.4E+09		Paclobutrazol	76738-62-0					1.3E+04	2.0E+04		8.0E+03
				4.5E-03	I					1	0.1		1.4E+09		Paraquat Dichloride	1910-42-5					4.6E+03	7.0E+03		2.8E+03
				6.0E-03	H					1	0.1		1.4E+09		Parathion	56-38-2					6.1E+03	9.3E+03		3.7E+03
				5.0E-02	H					1	0.1		1.4E+09		Pebulate	1114-71-2					5.1E+04	7.7E+04		3.1E+04
				4.0E-02	I					1	0.1		1.4E+09		Pendimethalin	40487-42-1					4.1E+04	6.2E+04		2.5E+04
				2.0E-03	I					1	0.1		1.4E+09		Pentabromodiphenyl Ether	32534-81-9					2.0E+03	3.1E+03		1.2E+03
				1.0E-04	I					1	0.1		1.4E+09		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					1.0E+02	1.5E+02		6.2E+01
				8.0E-04	I					1	0.1		1.4E+09		Pentachlorobenzene	608-93-5					8.2E+02	1.2E+03		4.9E+02
9.0E-02	P									1	0.1		1.4E+09		Pentachloroethane	76-01-7	3.2E+01	4.8E+01		1.9E+01				
2.6E-01	H			3.0E-03	I					1	0.1		1.4E+09		Pentachloronitrobenzene	82-68-8	1.1E+01	1.7E+01		6.6E+00	3.1E+03	4.6E+03		1.8E+03
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		1.4E+09		Pentachlorophenol	87-86-5	7.2E+00	4.3E+00	3.3E+06	2.7E+00	5.1E+03	3.1E+03		1.9E+03
4.0E-03	X			2.0E-03	P					1	0.1		1.4E+09		Pentaerythritol tetranitrate (PETN)	78-11-5	7.2E+02	1.1E+03		4.3E+02	2.0E+03	3.1E+03		1.2E+03
						1.0E+00	P	V		1		3.9E+02	1.4E+09	8.4E+02	Pentane, n-	109-66-0							3.7E+03	3.7E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR ($\mu g/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
															Perchlorates									
				7.0E-04	I					1			1.4E+09		~Ammonium Perchlorate	7790-98-9					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Lithium Perchlorate	7791-03-9					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Perchlorate and Perchlorate Salts	14797-73-0					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Potassium Perchlorate	7778-74-7					7.2E+02			7.2E+02
				7.0E-04	I					1			1.4E+09		~Sodium Perchlorate	7601-89-0					7.2E+02			7.2E+02
				5.0E-02	I					1	0.1		1.4E+09		Permethrin	52645-53-1					5.1E+04	7.7E+04		3.1E+04
2.2E-03	C	6.3E-07	C							1	0.1		1.4E+09		Phenacetin	62-44-2	1.3E+03	2.0E+03	2.6E+07	7.8E+02				
				2.5E-01	I					1	0.1		1.4E+09		Phenmedipham	13684-63-4					2.6E+05	3.9E+05		1.5E+05
				3.0E-01	I	2.0E-01	C			1	0.1		1.4E+09		Phenol	108-95-2					3.1E+05	4.6E+05	1.2E+09	1.8E+05
				5.0E-04	X					1	0.1		1.4E+09		Phenothiazine	92-84-2					5.1E+02	7.7E+02		3.1E+02
				6.0E-03	I					1	0.1		1.4E+09		Phenylenediamine, m-	108-45-2					6.1E+03	9.3E+03		3.7E+03
4.7E-02	H									1	0.1		1.4E+09		Phenylenediamine, o-	95-54-5	6.1E+01	9.2E+01		3.7E+01				
				1.9E-01	H					1	0.1		1.4E+09		Phenylenediamine, p-	106-50-3					1.9E+05	2.9E+05		1.2E+05
1.9E-03	H									1	0.1		1.4E+09		Phenylphenol, 2-	90-43-7	1.5E+03	2.2E+03		8.9E+02				
				2.0E-04	H					1	0.1		1.4E+09		Phorate	298-02-2					2.0E+02	3.1E+02		1.2E+02
						3.0E-04	I	V		1		1.6E+03	1.4E+09	1.1E+03	Phosgene	75-44-5							1.4E+00	1.4E+00
				2.0E-02	I					1	0.1		1.4E+09		Phosmet	732-11-6					2.0E+04	3.1E+04		1.2E+04
															Phosphates, Inorganic									
				4.9E+01	P					1			1.4E+09		~Aluminum metaphosphate	13776-88-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Ammonium polyphosphate	68333-79-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Calcium pyrophosphate	7790-76-3					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Diammonium phosphate	7783-28-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dicalcium phosphate	7757-93-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dimagnesium phosphate	7782-75-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Dipotassium phosphate	7758-11-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Disodium phosphate	7558-79-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monoaluminum phosphate	13530-50-2					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monoammonium phosphate	7722-76-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monocalcium phosphate	7758-23-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monomagnesium phosphate	7757-86-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monopotassium phosphate	7778-77-0					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Monosodium phosphate	7558-80-7					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Polyphosphoric acid	8017-16-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Potassium tripolyphosphate	13845-36-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium acid pyrophosphate	7758-16-9					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (acidic)	7785-88-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (anhydrous)	10279-59-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium hexametaphosphate	10124-56-8					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium polyphosphate	68915-31-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium trimetaphosphate	7785-84-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Sodium tripolyphosphate	7758-29-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tetrapotassium phosphate	7320-34-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tetrasodium pyrophosphate	7722-88-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tricalcium phosphate	7758-87-4					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trimagnesium phosphate	7757-87-1					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Tripotassium phosphate	7778-53-2					5.0E+07			5.0E+07
				4.9E+01	P					1			1.4E+09		~Trisodium phosphate	7601-54-9					5.0E+07			5.0E+07
				3.0E-04	I	3.0E-04	I			1			1.4E+09		Phosphine	7803-51-2					3.1E+02		1.8E+06	3.1E+02
				4.9E+01	P	1.0E-02	I			1			1.4E+09		Phosphoric Acid	7664-38-2					5.0E+07		6.0E+07	2.7E+07
				2.0E-05	I					1			1.4E+09		Phosphorus, White	7723-14-0					2.0E+01			2.0E+01
				1.0E+00	H					1	0.1		1.4E+09		Phthalic Acid, P-	100-21-0					1.0E+06	1.5E+06		6.2E+05
				2.0E+00	I	2.0E-02	C			1	0.1		1.4E+09		Phthalic Anhydride	85-44-9					2.0E+06	3.1E+06	1.2E+08	1.2E+06
				7.0E-02	I					1	0.1		1.4E+09		Picloram	1918-02-1					7.2E+04	1.1E+05		4.3E+04
				1.0E-04	X					1	0.1		1.4E+09		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					1.0E+02	1.5E+02		6.2E+01
				1.0E-02	I					1	0.1		1.4E+09		Pirimiphos, Methyl	29232-93-7					1.0E+04	1.5E+04		6.2E+03
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		1.4E+09		Polybrominated Biphenyls	59536-65-1	9.5E-02	1.4E-01	1.9E+03	5.7E-02	7.2E+00	1.1E+01		4.3E+00
															Polychlorinated Biphenyls (PCBs)									
7.0E-02	S	2.0E-05	S	7.0E-05	I					1	0.14		1.4E+09		~Aroclor 1016	12674-11-2	4.1E+01	4.4E+01	8.3E+05	2.1E+01	7.2E+01	7.7E+01		3.7E+01
2.0E+00	S	5.7E-04	S					V		1	0.14	7.6E+02	1.4E+09	9.2E+04	~Aroclor 1221	11104-28-2	1.4E+00	1.5E+00	2.0E+00	5.4E-01				
2.0E+00	S	5.7E-04	S					V		1	0.14	7.3E+01	1.4E+09	9.2E+04	~Aroclor 1232	11141-16-5	1.4E+00	1.5E+00	2.0E+00	5.4E-01				
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1242	53469-21-9	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1248	12672-29-6	1.4E+00	1.5E+00	2.9E+04	7.4E-01				

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR ($\mu g/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	voc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
2.0E+00	S	5.7E-04	S	2.0E-05	I					1	0.14		1.4E+09		~Aroclor 1254	11097-69-1	1.4E+00	1.5E+00	2.9E+04	7.4E-01	2.0E+01	2.2E+01		1.1E+01
2.0E+00	S	5.7E-04	S							1	0.14		1.4E+09		~Aroclor 1260	11096-82-5	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+03	E	1.1E+00	E	3.3E-08	E	1.3E-06	E			1	0.14		1.4E+09		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	7.3E-04	7.9E-04	1.5E+01	3.8E-04	3.4E-02	3.7E-02	7.9E+03	1.8E-02
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
3.9E+00	E	1.1E-03	E	3.3E-05	E	1.3E-03	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	7.3E-01	7.9E-01	1.5E+04	3.8E-01	3.4E+01	3.7E+01	7.9E+06	1.8E+01
1.3E+04	E	3.8E+00	E	1.0E-08	E	4.0E-07	E			1	0.14		1.4E+09		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	2.2E-04	2.4E-04	4.4E+00	1.1E-04	1.0E-02	1.1E-02	2.4E+03	5.3E-03
2.0E+00	I	5.7E-04	I							1	0.14		1.4E+09		~Polychlorinated Biphenyls (high risk)	1336-36-3	1.4E+00	1.5E+00	2.9E+04	7.4E-01				
4.0E-01	I	1.0E-04	I							1	0.14				~Polychlorinated Biphenyls (low risk)	1336-36-3								
7.0E-02	I	2.0E-05	I							1	0.14				~Polychlorinated Biphenyls (lowest risk)	1336-36-3								
1.3E+01	E	3.8E-03	E	1.0E-05	E	4.0E-04	E			1	0.14		1.4E+09		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	2.2E-01	2.4E-01	4.4E+03	1.1E-01	1.0E+01	1.1E+01	2.4E+06	5.3E+00
3.9E+01	E	1.1E-02	E	3.3E-06	E	1.3E-04	E			1	0.14		1.4E+09		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	7.3E-02	7.9E-02	1.5E+03	3.8E-02	3.4E+00	3.7E+00	7.9E+05	1.8E+00
						6.0E-04	I			1	0.1		1.4E+09		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							3.6E+06	3.6E+06
															Polynuclear Aromatic Hydrocarbons (PAHs)									
				6.0E-02	I			V		1	0.13		1.4E+09	1.5E+05	~Acenaphthene	83-32-9					6.1E+04	7.1E+04		3.3E+04
				3.0E-01	I			V		1	0.13		1.4E+09	5.6E+05	~Anthracene	120-12-7					3.1E+05	3.6E+05		1.7E+05
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benz[a]anthracene	56-55-3	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
1.2E+00	C	1.1E-04	C							1	0.13		1.4E+09		~Benzo(j)fluoranthene	205-82-3	2.4E+00	2.8E+00	1.5E+05	1.3E+00				
7.3E+00	I	1.1E-03	C						M	1	0.13		1.4E+09		~Benzo[a]pyrene	50-32-8	3.9E-01	4.6E-01	1.5E+04	2.1E-01				
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benzo[b]fluoranthene	205-99-2	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
7.3E-02	E	1.1E-04	C						M	1	0.13		1.4E+09		~Benzo[k]fluoranthene	207-08-9	3.9E+01	4.6E+01	1.5E+05	2.1E+01				
7.3E-03	E	1.1E-05	C						M	1	0.13		1.4E+09		~Chrysene	218-01-9	3.9E+02	4.6E+02	1.5E+06	2.1E+02				
7.3E+00	E	1.2E-03	C						M	1	0.13		1.4E+09		~Dibenz[a,h]anthracene	53-70-3	3.9E-01	4.6E-01	1.4E+04	2.1E-01				
1.2E+01	C	1.1E-03	C							1	0.13		1.4E+09		~Dibenzo(a,e)pyrene	192-65-4	2.4E-01	2.8E-01	1.5E+04	1.3E-01				
2.5E+02	C	7.1E-02	C						M	1	0.13		1.4E+09		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	1.1E-02	1.3E-02	2.3E+02	6.2E-03				
				4.0E-02	I					1	0.13		1.4E+09		~Fluoranthene	206-44-0					4.1E+04	4.8E+04		2.2E+04
				4.0E-02	I			V		1	0.13		1.4E+09	3.0E+05	~Fluorene	86-73-7					4.1E+04	4.8E+04		2.2E+04
7.3E-01	E	1.1E-04	C						M	1	0.13		1.4E+09		~Indeno[1,2,3-cd]pyrene	193-39-5	3.9E+00	4.6E+00	1.5E+05	2.1E+00				
2.9E-02	P			7.0E-02	A			V		1	0.13		1.4E+09	6.3E+04	~Methylnaphthalene, 1-	90-12-0	9.9E+01	1.2E+02		5.3E+01	7.2E+04	8.3E+04		3.9E+04
				4.0E-03	I			V		1	0.13		1.4E+09	6.2E+04	~Methylnaphthalene, 2-	91-57-6					4.1E+03	4.8E+03		2.2E+03
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		1.4E+09	5.0E+04	~Naphthalene	91-20-3			1.8E+01	1.8E+01	2.0E+04	2.4E+04	6.6E+02	6.2E+02
1.2E+00	C	1.1E-04	C							1	0.13		1.4E+09		~Nitropyrene, 4-	57835-92-4	2.4E+00	2.8E+00	1.5E+05	1.3E+00				
				3.0E-02	I			V		1	0.13		1.4E+09	2.6E+06	~Pyrene	129-00-0					3.1E+04	3.6E+04		1.7E+04
1.5E-01	I			9.0E-03	I					1	0.1		1.4E+09		Prochloraz	67747-09-5	1.9E+01	2.9E+01		1.1E+01	9.2E+03	1.4E+04		5.5E+03
				6.0E-03	H					1	0.1		1.4E+09		Profluralin	26399-36-0					6.1E+03	9.3E+03		3.7E+03
				1.5E-02	I					1	0.1		1.4E+09		Prometon	1610-18-0					1.5E+04	2.3E+04		9.2E+03
				4.0E-03	I					1	0.1		1.4E+09		Prometryn	7287-19-6					4.1E+03	6.2E+03		2.5E+03
				1.3E-02	I					1	0.1		1.4E+09		Propachlor	1918-16-7					1.3E+04	2.0E+04		8.0E+03
				5.0E-03	I					1	0.1		1.4E+09		Propanil	709-98-8					5.1E+03	7.7E+03		3.1E+03
				2.0E-02	I					1	0.1		1.4E+09		Propargite	2312-35-8					2.0E+04	3.1E+04		1.2E+04
				2.0E-03	I					1	0.1		1.4E+09		Propargyl Alcohol	107-19-7					2.0E+03	3.1E+03		1.2E+03
				2.0E-02	I					1	0.1		1.4E+09		Propazine	139-40-2					2.0E+04	3.1E+04		1.2E+04
				2.0E-02	I					1	0.1		1.4E+09		Propham	122-42-9					2.0E+04	3.1E+04		1.2E+04
				1.3E-02	I					1	0.1		1.4E+09		Propiconazole	60207-90-1					1.3E+04	2.0E+04		8.0E+03
						8.0E-03	I	V		1		3.3E+04	1.4E+09	9.6E+03	Propionaldehyde	123-38-6							3.4E+02	3.4E+02
				1.0E-01	X	1.0E+00	X	V		1	0.1	2.6E+02	1.4E+09	7.5E+03	Propyl benzene	103-65-1					1.0E+05	1.5E+05	3.3E+04	2.1E+04
						3.0E+00	C	V		1	0.1	3.5E+02	1.4E+09	7.6E+02	Propylene	115-07-1							1.0E+04	1.0E+04
				2.0E+01	P					1	0.1		1.4E+09		Propylene Glycol	57-55-6					2.0E+07	3.1E+07		1.2E+07
						2.7E-04	A			1	0.1		1.4E+09		Propylene Glycol Dinitrate	6423-43-4							1.6E+06	1.6E+06
				7.0E-01	H					1	0.1		1.4E+09		Propylene Glycol Monoethyl Ether	1569-02-4					7.2E+05	1.1E+06		4.3E+05
				7.0E-01	H	2.0E+00	I			1	0.1		1.4E+09		Propylene Glycol Monomethyl Ether	107-98-2					7.2E+05	1.1E+06	1.2E+10	4.3E+05
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	1.4E+09	1.1E+04	Propylene Oxide	75-56-9	1.2E+01		3.7E+01	9.0E+00			1.5E+03	1.5E+03
				2.5E-01	I					1	0.1		1.4E+09		Pursuit	81335-77-5					2.6E+05	3.9E+05		1.5E+05
				2.5E-02	I					1	0.1		1.4E+09		Pydrin	51630-58-1					2.6E+04	3.9E+04		1.5E+04
				1.0E-03	I			V		1		5.3E+05	1.4E+09	6.0E+04	Pyridine	110-86-1					1.0E+03			1.0E+03
				5.0E-04	I					1	0.1		1.4E+09		Quinalphos	13593-03-8					5.1E+02	7.7E+02		3.1E+02
3.0E+00	I									1	0.1		1.4E+09		Quinoline	91-22-5	9.5E-01	1.4E+00		5.7E-01				
						3.0E-02	A			1			1.4E+09		Refractory Ceramic Fibers	NA							1.8E+08	1.8E+08
				3.0E-02	I					1	0.1		1.4E+09		Resmethrin	10453-86-8					3.1E+04	4.6E+04		1.8E+04
				5.0E-02	H					1	0.1		1.4E+09		Ronnel	299-84-3					5.1E+04	7.7E+04		3.1E+04

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	cancer	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				4.0E-03	I					1	0.1		1.4E+09		Rotenone	83-79-4					4.1E+03	6.2E+03		2.5E+03
2.2E-01	C	6.3E-05	C						M	1	0.1		1.4E+09		Safrole	94-59-7	1.3E+01	2.0E+01	2.6E+05	7.8E+00				
				2.5E-02	I					1	0.1		1.4E+09		Savey	78587-05-0					2.6E+04	3.9E+04		1.5E+04
				5.0E-03	I					1			1.4E+09		Selenious Acid	7783-00-8					5.1E+03			5.1E+03
				5.0E-03	I	2.0E-02	C			1			1.4E+09		Selenium	7782-49-2					5.1E+03		1.2E+08	5.1E+03
				5.0E-03	C	2.0E-02	C			1			1.4E+09		Selenium Sulfide	7446-34-6					5.1E+03		1.2E+08	5.1E+03
				9.0E-02	I					1	0.1		1.4E+09		Sethoxydim	74051-80-2					9.2E+04	1.4E+05		5.5E+04
						3.0E-03	C			1			1.4E+09		Silica (crystalline, respirable)	7631-86-9							1.8E+07	1.8E+07
				5.0E-03	I					0.04			1.4E+09		Silver	7440-22-4					5.1E+03			5.1E+03
1.2E-01	H			5.0E-03	I					1	0.1		1.4E+09		Simazine	122-34-9	2.4E+01	3.6E+01		1.4E+01	5.1E+03	7.7E+03		3.1E+03
				1.3E-02	I					1	0.1		1.4E+09		Sodium Acifluorfen	62476-59-9					1.3E+04	2.0E+04		8.0E+03
				4.0E-03	I					1			1.4E+09		Sodium Azide	26628-22-8					4.1E+03			4.1E+03
2.7E-01	H			3.0E-02	I					1	0.1		1.4E+09		Sodium Diethyldithiocarbamate	148-18-5	1.1E+01	1.6E+01		6.4E+00	3.1E+04	4.6E+04		1.8E+04
				5.0E-02	A	1.3E-02	C			1			1.4E+09		Sodium Fluoride	7681-49-4					5.1E+04		7.7E+07	5.1E+04
				2.0E-05	I					1	0.1		1.4E+09		Sodium Fluoroacetate	62-74-8					2.0E+01	3.1E+01		1.2E+01
				1.0E-03	H					1			1.4E+09		Sodium Metavanadate	13718-26-8					1.0E+03			1.0E+03
2.4E-02	H			3.0E-02	I					1	0.1		1.4E+09		Stirofos (Tetrachlorovinphos)	961-11-5	1.2E+02	1.8E+02		7.2E+01	3.1E+04	4.6E+04		1.8E+04
				6.0E-01	I					1			1.4E+09		Strontium, Stable	7440-24-6					6.1E+05			6.1E+05
				3.0E-04	I					1	0.1		1.4E+09		Strychnine	57-24-9					3.1E+02	4.6E+02		1.8E+02
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	1.4E+09	1.0E+04	Styrene	100-42-5					2.0E+05		4.4E+04	3.6E+04
				1.0E-03	P	2.0E-03	P			1	0.1		1.4E+09		Sulfolane	126-33-0					1.0E+03	1.5E+03	1.2E+07	6.2E+02
				8.0E-04	P					1	0.1		1.4E+09		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					8.2E+02	1.2E+03		4.9E+02
						1.0E-03	C			1			1.4E+09		Sulfuric Acid	7664-93-9							6.0E+06	6.0E+06
				2.5E-02	I					1	0.1		1.4E+09		Systhane	88671-89-0					2.6E+04	3.9E+04		1.5E+04
				3.0E-02	H					1	0.1		1.4E+09		TCMTB	21564-17-0					3.1E+04	4.6E+04		1.8E+04
				7.0E-02	I					1	0.1		1.4E+09		Tebuthiuron	34014-18-1					7.2E+04	1.1E+05		4.3E+04
				2.0E-02	H					1	0.1		1.4E+09		Temephos	3383-96-8					2.0E+04	3.1E+04		1.2E+04
				1.3E-02	I					1	0.1		1.4E+09		Terbacil	5902-51-2					1.3E+04	2.0E+04		8.0E+03
				2.5E-05	H					1	0.1		1.4E+09		Terbufos	13071-79-9					2.6E+01	3.9E+01		1.5E+01
				1.0E-03	I					1	0.1		1.4E+09		Terbutryn	886-50-0					1.0E+03	1.5E+03		6.2E+02
				1.0E-04	I					1	0.1		1.4E+09		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					1.0E+02	1.5E+02		6.2E+01
				3.0E-04	I					1	0.1		1.4E+09		Tetrachlorobenzene, 1,2,4,5-	95-94-3					3.1E+02	4.6E+02		1.8E+02
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	1.4E+09	6.1E+03	Tetrachloroethane, 1,1,1,2-	630-20-6	1.1E+02		1.0E+01	9.3E+00	3.1E+04			3.1E+04
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	1.4E+09	1.6E+04	Tetrachloroethane, 1,1,2,2-	79-34-5	1.4E+01		3.4E+00	2.8E+00	2.0E+04			2.0E+04
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	1.4E+09	2.5E+03	Tetrachloroethylene	127-18-4	1.4E+03		1.2E+02	1.1E+02	6.1E+03		4.4E+02	4.1E+02
				3.0E-02	I					1	0.1		1.4E+09		Tetrachlorophenol, 2,3,4,6-	58-90-2					3.1E+04	4.6E+04		1.8E+04
2.0E+01	H									1	0.1		1.4E+09		Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	1.4E-01	2.2E-01		8.6E-02				
				5.0E-04	I					1	0.1		1.4E+09		Tetraethyl Dithiopyrophosphate	3689-24-5					5.1E+02	7.7E+02		3.1E+02
						8.0E+01	I	V		1		1.1E+03	1.4E+09	1.3E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2							4.6E+05	4.6E+05
				4.0E-03	P					1	0.1		1.4E+09		Tetryl (Trinitrophenylmethylnitramine)	479-45-8					4.1E+03	6.2E+03		2.5E+03
				7.0E-06	X					1			1.4E+09		Thallium (I) Nitrate	10102-45-1					7.2E+00			7.2E+00
				1.0E-05	X					1			1.4E+09		Thallium (Soluble Salts)	7440-28-0					1.0E+01			1.0E+01
				6.0E-06	X					1			1.4E+09		Thallium Acetate	563-68-8					6.1E+00			6.1E+00
				2.0E-05	X					1			1.4E+09		Thallium Carbonate	6533-73-9					2.0E+01			2.0E+01
				6.0E-06	X					1			1.4E+09		Thallium Chloride	7791-12-0					6.1E+00			6.1E+00
				2.0E-05	X					1			1.4E+09		Thallium Sulfate	7446-18-6					2.0E+01			2.0E+01
				1.0E-02	I					1	0.1		1.4E+09		Thiobencarb	28249-77-6					1.0E+04	1.5E+04		6.2E+03
				7.0E-02	X					1	0.008		1.4E+09		Thiodiglycol	111-48-8					7.2E+04	1.4E+06		6.8E+04
				3.0E-04	H					1	0.1		1.4E+09		Thiofanox	39196-18-4					3.1E+02	4.6E+02		1.8E+02
				8.0E-02	I					1	0.1		1.4E+09		Thiophanate, Methyl	23564-05-8					8.2E+04	1.2E+05		4.9E+04
				5.0E-03	I					1	0.1		1.4E+09		Thiram	137-26-8					5.1E+03	7.7E+03		3.1E+03
				6.0E-01	H					1			1.4E+09		Tin	7440-31-5					6.1E+05			6.1E+05
						1.0E-04	A			1			1.4E+09		Titanium Tetrachloride	7550-45-0							6.0E+05	6.0E+05
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	1.4E+09	4.6E+03	Toluene	108-88-3					8.2E+04		1.0E+05	4.5E+04
				6.0E-01	H					1	0.1		1.4E+09		Toluene-2,5-diamine	95-70-5					6.1E+05	9.3E+05		3.7E+05
3.0E-02	P			4.0E-03	X					1	0.1		1.4E+09		Toluidine, p-	106-49-0	9.5E+01	1.4E+02		5.7E+01	4.1E+03	6.2E+03		2.5E+03
1.1E+00	I	3.2E-04	I							1	0.1		1.4E+09		Toxaphene	8001-35-2	2.6E+00	3.9E+00	5.2E+04	1.6E+00				
				7.5E-03	I					1	0.1		1.4E+09		Tralomethrin	66841-25-6					7.7E+03	1.2E+04		4.6E+03
				3.0E-04	A					1	0.1		1.4E+09		Tri-n-butyltin	688-73-3					3.1E+02	4.6E+02		1.8E+02
				8.0E+01	X				M	1	0.1		1.4E+09		Triacetin	102-76-1					8.2E+07	1.2E+08		4.9E+07
				1.3E-02	I					1	0.1		1.4E+09		Triallate	2303-17-5					1.3E+04	2.0E+04		8.0E+03
				1.0E-02	I					1	0.1		1.4E+09		Triasulfuron	82097-50-5					1.0E+04	1.5E+04		6.2E+03
				5.0E-03	I					1	0.1		1.4E+09		Tribromobenzene, 1,2,4-	615-54-3					5.1E+03	7.7E+03		3.1E+03
9.0E-03	P			1.0E-02	P					1	0.1		1.4E+09		Tributyl Phosphate	126-73-8	3.2E+02	4.8E+02		1.9E+02	1.0E+04	1.5E+04		6.2E+03
				3.0E-04	P					1	0.1		1.4E+09		Tributyltin Compounds	NA					3.1E+02	4.6E+02		1.8E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; O = EPA Office of Water; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO $(mg/kg\text{-}day)^{-1}$	key	IUR $(ug/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volc	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL HQ=1 (mg/kg)	Dermal SL HQ=1 (mg/kg)	Inhalation SL HQ=1 (mg/kg)	Noncarcinogenic SL HI=1 (mg/kg)
				3.0E-04	I					1	0.1		1.4E+09		Tributyltin Oxide	56-35-9					3.1E+02	4.6E+02		1.8E+02
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	1.4E+09	1.4E+03	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					3.1E+07		1.8E+05	1.8E+05
7.0E-02	I			2.0E-02	I					1	0.1		1.4E+09		Trichloroacetic Acid	76-03-9	4.1E+01	6.2E+01		2.5E+01	2.0E+04	3.1E+04		1.2E+04
2.9E-02	H									1	0.1		1.4E+09		Trichloroaniline HCl, 2,4,6-	33663-50-2	9.9E+01	1.5E+02		5.9E+01				
7.0E-03	X			3.0E-05	X					1	0.1		1.4E+09		Trichloroaniline, 2,4,6-	634-93-5	4.1E+02	6.2E+02		2.5E+02	3.1E+01	4.6E+01		1.8E+01
				8.0E-04	X			V		1	0.1		1.4E+09	3.5E+04	Trichlorobenzene, 1,2,3-	87-61-6					8.2E+02	1.2E+03		4.9E+02
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	1.4E+09	3.2E+04	Trichlorobenzene, 1,2,4-	120-82-1	9.9E+01			9.9E+01	1.0E+04		2.8E+02	2.7E+02
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	1.4E+09	1.8E+03	Trichloroethane, 1,1,1-	71-55-6					2.0E+06		3.9E+04	3.8E+04
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	1.4E+09	7.8E+03	Trichloroethane, 1,1,2-	79-00-5	5.0E+01		6.0E+00	5.3E+00	4.1E+03		6.8E+00	6.8E+00
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	1.4E+09	2.4E+03	Trichloroethylene	79-01-6	6.2E+01		7.1E+00	6.4E+00	5.1E+02		2.1E+01	2.0E+01
				3.0E-01	I	7.0E-01	H	V		1		1.2E+03	1.4E+09	1.1E+03	Trichlorofluoromethane	75-69-4					3.1E+05		3.4E+03	3.4E+03
				1.0E-01	I					1	0.1		1.4E+09		Trichlorophenol, 2,4,5-	95-95-4					1.0E+05	1.5E+05		6.2E+04
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		1.4E+09		Trichlorophenol, 2,4,6-	88-06-2	2.6E+02	3.9E+02	5.4E+06	1.6E+02	1.0E+03	1.5E+03		6.2E+02
				1.0E-02	I					1	0.1		1.4E+09		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					1.0E+04	1.5E+04		6.2E+03
				8.0E-03	I					1	0.1		1.4E+09		Trichlorophenoxypropionic acid, -2,4,5	93-72-1					8.2E+03	1.2E+04		4.9E+03
				5.0E-03	I			V		1		1.3E+03	1.4E+09	1.6E+04	Trichloropropane, 1,1,2-	598-77-6					5.1E+03			5.1E+03
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	1.4E+09	1.7E+04	Trichloropropane, 1,2,3-	96-18-4	9.5E-02			9.5E-02	4.1E+03		2.2E+01	2.2E+01
				3.0E-03	X	3.0E-04	P	V		1		4.5E+02	1.4E+09	2.5E+03	Trichloropropene, 1,2,3-	96-19-5					3.1E+03		3.3E+00	3.3E+00
				3.0E-03	I					1	0.1		1.4E+09		Tridiphane	58138-08-2					3.1E+03	4.6E+03		1.8E+03
						7.0E-03	I	V		1		2.8E+04	1.4E+09	1.7E+04	Triethylamine	121-44-8							5.2E+02	5.2E+02
7.7E-03	I			7.5E-03	I					1	0.1		1.4E+09		Trifluralin	1582-09-8	3.7E+02	5.6E+02		2.2E+02	7.7E+03	1.2E+04		4.6E+03
2.0E-02	P			1.0E-02	P					1	0.1		1.4E+09		Trimethyl Phosphate	512-56-1	1.4E+02	2.2E+02		8.6E+01	1.0E+04	1.5E+04		6.2E+03
						5.0E-03	P	V		1		2.9E+02	1.4E+09	1.0E+04	Trimethylbenzene, 1,2,3-	526-73-8							2.2E+02	2.2E+02
						7.0E-03	P	V		1		2.2E+02	1.4E+09	8.5E+03	Trimethylbenzene, 1,2,4-	95-63-6							2.6E+02	2.6E+02
				1.0E-02	X			V		1		1.8E+02	1.4E+09	7.1E+03	Trimethylbenzene, 1,3,5-	108-67-8					1.0E+04			1.0E+04
				3.0E-02	I					1	0.019		1.4E+09		Trinitrobenzene, 1,3,5-	99-35-4					3.1E+04	2.4E+05		2.7E+04
3.0E-02	I			5.0E-04	I					1	0.032		1.4E+09		Trinitrotoluene, 2,4,6-	118-96-7	9.5E+01	4.5E+02		7.9E+01	5.1E+02	2.4E+03		4.2E+02
				2.0E-02	P					1	0.1		1.4E+09		Triphenylphosphine Oxide	791-28-6					2.0E+04	3.1E+04		1.2E+04
				1.0E-02	X				M	1	0.1		1.4E+09		Tris(1-chloro-2-propyl)phosphate	13674-84-5					1.0E+04	1.5E+04		6.2E+03
2.0E-02	P			7.0E-03	P					1	0.1		1.4E+09		Tris(2-chloroethyl)phosphate	115-96-8	1.4E+02	2.2E+02		8.6E+01	7.2E+03	1.1E+04		4.3E+03
3.2E-03	P			1.0E-01	P					1	0.1		1.4E+09		Tris(2-ethylhexyl)phosphate	78-42-2	8.9E+02	1.4E+03		5.4E+02	1.0E+05	1.5E+05		6.2E+04
				3.0E-03	I					1			1.4E+09		Uranium (Soluble Salts)	NA					3.1E+03			3.1E+03
1.0E+00	C	2.9E-04	C						M	1	0.1		1.4E+09		Urethane	51-79-6	2.9E+00	4.3E+00	5.7E+04	1.7E+00				
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			1.4E+09		Vanadium Pentoxide	1314-62-1			2.0E+03	2.0E+03	9.2E+03		4.2E+04	7.5E+03
				5.0E-03	S					1			1.4E+09		Vanadium and Compounds	NA					5.2E+03			5.2E+03
				1.0E-03	I					1	0.1		1.4E+09		Vernolate	1929-77-7					1.0E+03	1.5E+03		6.2E+02
				2.5E-02	I					1	0.1		1.4E+09		Vinclozolin	50471-44-8					2.6E+04	3.9E+04		1.5E+04
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	1.4E+09	4.7E+03	Vinyl Acetate	108-05-4					1.0E+06		4.1E+03	4.1E+03
		3.2E-05	H			3.0E-03	I	V		1		3.4E+03	1.4E+09	1.5E+03	Vinyl Bromide	593-60-2			5.6E-01	5.6E-01			1.9E+01	1.9E+01
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	1.4E+09	1.0E+03	Vinyl Chloride	75-01-4	4.0E+00		2.9E+00	1.7E+00	3.1E+03		4.5E+02	3.9E+02
				3.0E-04	I					1	0.1		1.4E+09		Warfarin	81-81-2					3.1E+02	4.6E+02		1.8E+02
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	6.0E+03	Xylene, P-	106-42-3					2.0E+05		2.6E+03	2.6E+03
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	5.9E+03	Xylene, m-	108-38-3					2.0E+05		2.6E+03	2.5E+03
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	1.4E+09	7.0E+03	Xylene, o-	95-47-6					2.0E+05		3.0E+03	3.0E+03
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	1.4E+09	6.3E+03	Xylenes	1330-20-7					2.0E+05		2.7E+03	2.7E+03
				3.0E-04	I					1			1.4E+09		Zinc Phosphide	1314-84-7					3.1E+02			3.1E+02
				3.0E-01	I					1			1.4E+09		Zinc and Compounds	7440-66-6					3.1E+05			3.1E+05
				5.0E-02	I					1	0.1		1.4E+09		Zineb	12122-67-7					5.1E+04	7.7E+04		3.1E+04
				8.0E-05	P					1			1.4E+09		Zirconium	7440-67-7					8.2E+01			8.2E+01