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April 6, 2021

Mr. Jeffrey Meyer
Manager
Division of Air Enforcement
Bureau of Air Compliance and Enforcement – Northern
7 Ridgedale Avenue
Cedar Knolls, NJ 07927

Subject: Response to NJDEP Comments
Iodine Monitor Evaluation Report submitted by Covanta Essex Company

Mr. Meyer;

In accordance with Condition (d)ii of Phase I of Section B of the Compliance Schedule of the Administrative Consent Order ("ACO") entered into by Covanta Essex Company ("Covanta Essex") and the New Jersey Department of Environmental Protection ("NJDEP or Department"), Covanta Essex submitted a report on November 6, 2020 summarizing an evaluation of available monitoring technologies that could provide continuous, accurate and reliable analysis of vapor phase iodine in an industrial environment in the event that iodine gas was generated from iodinated waste on the tipping floor and pit area. On December 11, 2020, Covanta Essex received an email from the Department which included comments from Mr. Luis Lim of the Bureau of Air Monitoring addressing the November 6, 2020 submittal.

The attached report provides our response to Mr. Lim's comments. Covanta Essex continues to firmly believe that sustainable plume mitigation is achieved through effective waste management strategies that prevent delivery of iodinated waste to the Covanta Essex facility.

Sincerely,

David Blackmore
Facility Manager

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David Blackmore
Facility Manager

4/6/21
Date

Response to NJDEP Comments on Iodine Monitor Evaluation Report
Submitted by Covanta Essex Company
April 6, 2021

1.0 Introduction

The Department provided four specific comments on the November 6, 2020 Iodine Monitor Evaluation Report ("Report") submitted by Covanta Essex, each of which is listed below. Our response to each of the comments is addressed in three parts: 1) the NJDEP comment, 2) a detailed response, and 3) a conclusion.

2.0 Comment # 1

2.1 NJDEP Comment

"The Report indicates that a Covanta Essex survey did not reveal commercially demonstrated applications of iodine monitors in municipal solid waste incinerator environments, and concludes that there are no commercially available iodine monitors that are rugged enough for use in a tipping hall of a municipal solid waste incinerator. As evidence to support this conclusion, they present only two continuous iodine monitors, one of which is specifically designed for non-hazardous environments."

2.2 Response to Comment #1

The initial evaluation performed by Covanta Essex presented in the Iodine Monitor Evaluation Report ("the Report") submitted to the Department on November 6, 2020 identified six (6) gaseous monitor manufacturers. As a general note, iodine monitors only react to iodine gas (I_2) and do not react to solid phase iodinated materials such as dust. Only two (2) of the six (6) manufacturers offered a monitor that could detect iodine in the gaseous phase. The evaluation further focused on commercially demonstrated fixed instruments. "Commercially demonstrated" for this purpose means a monitor that has proven to be capable of continuously monitoring and providing accurate and reliable measurements of iodine gas in environmental conditions typical of those encountered in the tipping hall of the Covanta Essex facility ("Facility"). Attachment 2 of the November 2020 Report included information from the monitor manufacturers that were contacted as part of that evaluation.

Iodinated wastes are not approved for delivery to Covanta Essex and Covanta Essex would not knowingly accept a delivery of waste that contains iodine. The report submitted to the Department on January 7, 2021, as required under Phase I condition (d)i through v of the ACO, detailed efforts implemented by Covanta Essex to prevent delivery of iodinated wastes to the Facility and procedures and training to prevent processing of any iodinated wastes delivered to the Facility and deposited in the tipping floor area.

Iodine can be present in waste as either a liquid or a solid and would most likely be present as a component of a stable compound. Our research demonstrates that solid phase iodine has commercial value because it is purchased as an ingredient for certain manufacturing processes and is not expected to be discarded as waste and be in a waste delivery to the Facility. Liquid or aqueous phase iodine may be contained in pharmaceutical products such as povidone iodine solution used to fight infection. Liquid phase iodine may be present in ampules, small containers, pails, or drums. An iodine monitoring system will only detect iodine in the gaseous or vapor phase (I_2).

Iodine present as a component of a solid pharmaceutical commodity (e.g., potassium iodide pills and levothyroxine tablets) or fungicide ingredient (i.e., 3-Iodo-2-proponyl butylcarbamate used by Troy Chemical Corporation) would be thermally stable and would not liberate iodine gas in the tipping floor area. Iodinated wastes delivered to the Facility would only release iodine vapor when the material is exposed to combustion conditions inside one of the combustors. Solid iodine could theoretically release iodine vapor at ambient temperatures however, as mentioned previously, that commodity has economic value and is unlikely to be managed as a waste. From a practical perspective, vapor phase iodine could only be present on the tipping floor and/or pit area if a significant quantity of smaller containers containing aqueous iodine were compromised (i.e., ampules of povidone iodine solution) or if a larger vessel such as a pail or drum of liquid containing iodine was delivered to the Facility and ruptured or spilled.

The November 2020 evaluation of potential iodine monitors included three steps:

1. Identification of operating conditions in the tipping hall of the Facility and the best location for obtaining a continuous and representative air sample.
2. Identification and evaluation of commercially available monitors with operating experience in a power plant environment or other comparable workplace environment with relatively high dust loadings, diesel exhaust and a wide range of temperatures.
3. Comparison of the environment in the tipping hall of the Facility with I_2 analyzer capabilities to determine the long-term viability of iodine monitors.

That evaluation concluded that continuous and accurate monitoring of iodine as I_2 in the Covanta Essex tipping hall environment has not been commercially demonstrated and is therefore not considered to be an accurate or effective component of Covanta Essex's comprehensive waste management strategy to prevent iodine emissions from the Facility. That conclusion was based on the fact that gaseous phase iodine is unlikely to be present in the tipping hall and because there are not commercially demonstrated monitors that can provide continuous, accurate and reliable results for the conditions in the tipping hall and storage pit areas which were described in detail in our initial evaluation. As detailed in our Report and subsequently confirmed through interviews with equipment suppliers, the best location to continuously sample air is above the charging hopper and below the air vent because all air in the tipping hall is pulled to those vents as part of the continuous combustion process. Information from manufacturers of iodine analyzers has not demonstrated that a fixed I_2 analyzer would provide continuous and accurate

information in an environment characterized by dusty ambient air containing diesel exhaust and moving at a relatively rapid velocity required to keep the building operating under negative pressure. Furthermore, there is a high likelihood of monitored data resulting in false positive readings due to the presence of other gases.

2.3 Conclusion

The November 2020 evaluation submitted by Covanta Essex included information from manufacturers of iodine monitors that identified the following:

- There are no examples of I_2 monitoring equipment being successfully used in a similar environment.
- Combustion and/or other gases can create interference and/or false positive indication of the presence of iodine gas.
- The velocity in the ductwork would not work with a static device using diffusion of air.

An additional evaluation by a third-party expert did not identify the availability of a commercially demonstrated gaseous iodine monitor that would provide accurate and reliable results for the environment in the tipping floor and pit areas.

In summary, two separate reviews of iodine monitors have not identified a commercially available monitor that could provide accurate and reliable information.

3.0 Comment # 2

3.1 NJDEP Comment

"A quick search of continuous iodine monitors over the internet for rugged iodine monitors identified three commercially available iodine monitors that are appropriate for hazardous conditions, two of which were from Analytical Technology, Incorporated, one of the companies in Covanta Essex's survey. I contacted another company with which I was familiar, PureAire, Monitoring Systems, Inc., the same company that manufactures the electrochemical methyl bromide monitors that are used in a fumigation facility in Gloucester County. They manufacture an iodine monitor, Universal Gas Detector, that will work in the dusty and hot/cold environment of the tipping hall of the incinerator according to their technical support staff. A more expansive search of monitors would likely lead to additional continuous iodine monitors for evaluation."

3.2 Response to Comment #2

Tetra Tech was retained by Covanta Essex Company to perform an independent review of iodine monitors and their potential to detect iodine vapor on the tipping floor or in the refuse pit at Covanta Essex. Tetra Tech's subsequent evaluation included an additional review of monitors manufactured by Analytical Technology, Inc. ("ATI") and PureAire Monitoring Systems, Inc.

("PureAire") as suggested by Mr. Lim. The report from Tetra Tech on their findings is included as **Appendix 1** to this document.

3.3 Conclusion

As noted in Tetra Tech's report, both ATI and PureAire were contacted as part of their review and both provided additional information. Covanta Essex offered a virtual tour to both firms on February 9, 2021 however only PureAire accepted. That virtual tour of the Facility led PureAire to conclude that the most effective locations for the monitors would be close to the feed chutes or air ducts. ATI did not provide material information to TetraTech or Covanta Essex during this 2nd review of commercially demonstrated iodine monitors. Therefore, our focus was on PureAire, who did provide material responses to our questions. ATI did confirm that their instrument is not specific to only I_2, and that there are interference gases that could cause an alarm when I_2 was not present.

PureAire offers a static device that operates on diffusion of gas across a membrane. While that may be adequate for a clean room environment, they indicated that a pump and sample system (sample line, pump, and dust filter) would be necessary to draw air to their analyzer, however, they do not provide that sample system, nor does one exist. PureAire also confirmed that their instrument is not specific to only I_2, and that there are interference gases that could cause an alarm when I_2 was not present.

After completion of the review of the monitoring equipment, Tetra Tech concluded that iodine monitors would not be effective in preventing the introduction of iodinated waste into the combustors at the Facility. Their conclusion was based on the following:

1. the monitors only detect gaseous phase substances. As an example, the PureAire monitor would not have detected the solid dust which caused the "purple plume" events;
2. interference from other compounds could lead to false alarms in which the compound which caused the alarm to sound would not be identified; and
3. the monitors are designed for pristine environments like laboratories and medical facilities, not the environment in the tipping hall of a waste-to-energy facility.

Regarding Item # 3 above, the requirement for an entirely new sample system to be developed demonstrates that the PureAire instrument is not commercially demonstrated for the tipping floor environment at Covanta Essex or any municipal waste combustor facility.

Covanta Essex asserts that there are no commercially demonstrated iodine monitors that would effectively work in the tipping hall of the Facility and agrees with TetraTech's conclusion that iodine monitors would not be useful in preventing the feed of iodinated wastes into the combustion units that could contribute to "purple plume" events.

4.0 Comment # 3

4.1 NJDEP comment

"Nitrogen dioxide, which is emitted by idling heavy-duty diesel vehicles that are likely to be present near the tipping hall of an incinerator, is a known interferent for electrochemical iodine monitors. The level of this interference is acceptable."

4.2 Response to Comment #3

There are at least two sources of emissions in the tipping hall of the Facility that must be considered when evaluating the potential of a commercially demonstrated iodine monitor to continuously sample air in the tipping floor and pit area and provide accurate results:

1. Refuse trucks that deposit the waste onto the tipping floor inside the building and emit diesel particulate and combustion gases that can interfere with analyzer results, and;
2. Continuous deposition of waste from the trucks into the waste pit by front-end loaders and movement of MSW in the waste pit by the refuse crane as part of the MSW mixing process will also generate solid and gaseous phase fugitive emissions that can interfere with the sampling mechanism of a monitor.

The ambient air in the tipping hall and pit area is in constant motion due to fans pulling air from those areas up to the vents located above each of the MSW charging hoppers. That draft effectively moves air and associated odors, particulate matter, and other gases to the vents where that air is then used in the combustion process.

Covanta's initial review of fixed iodine monitors and the follow-up evaluation by Tetra Tech indicated that there are gas phase analyzers with the potential to identify iodine as one of many gas phase components. As discussed, these monitors are subject to interference from diesel engine combustion gases and as well as other potential sources. For example, hydrogen peroxide is a household chemical that could be present in the waste stream and trigger a false positive indication that iodine may be present. In either case, the analyzer would sound an alarm potentially indicating the presence of iodine gas when none was present ("false positive"). Refuse trucks and heavy equipment are in operation on the Covanta Essex tipping floor 24 hours per day Monday through Saturday every week of the year. Therefore, the potential interference from diesel emissions on the tipping floor is extremely significant and could be severely disruptive to the essential service of waste disposal.

In his comments, Mr. Lim indicated that he considers the level of interference to be acceptable, however, the comment did not include a technical assessment or justification to support this opinion. Covanta strongly disagrees with this view. Responding to "false positive" alarms caused by diesel emissions from operating trucks and equipment would disrupt operation of the Facility for extended periods while evaluations were conducted to identity what may have caused the alarm. These "false positive" events could adversely impact the ability fo Covanta Essex to

provide an essential service, including unpredictable impacts to trucks enroute to the facility and/or already in the delivery queue.

5.0 Comment # 4

5.1 NJDEP Comment

"There is an OSHA Permissible Exposure Level (PEL) of 0.1 ppm of iodine in air, and an Immediately Dangerous to Life and Health (IDLH) value of 2 ppm. Having a continuous iodine monitor with an alarm would be a useful and sensible tool to ensure workplace safety since there have been reports of "purple smoke" emissions from the incinerator."

5.2 Response to Comment #4

The Department's comment assumes that an instrument in the tipping floor area would provide accurate and useful information to ensure workplace safety and that any alarm would prevent "purple smoke" emissions from the Facility.

Covanta Essex has a robust safety program that includes the regular testing of the indoor air in various locations in the plant for a variety of airborne materials to ensure workplace safety. The facility meets all workplace safety standards in the tipping floor area.

The feasibility of a continuous iodine monitor in the tipping floor area was assessed by both Covanta and Tetra Tech, an independent third party. Continuous iodine monitors were not deemed viable for providing accurate and useful information for preventing "purple smoke" emissions for several reasons including:

- The tipping floor area where most employees are located is not conducive to a static instrument because of the size of the tipping floor.
- Iodine monitors can only measure gas phase I_2. An iodine monitor would not measure iodine present as a component of a solid iodinated compound that exists as dust in the tipping hall. As an example, the chemical used to make fungicide delivered by Troy Chemical Corporation is the most likely source of iodine emissions during the "purple plume" events and it would not have been identified by an iodine monitor.
- Analyzers that can measure the presence of I_2 are subject to interference from other gases. The result could be false positive occurrences where an analyzer issues an alarm due to the presence of another gas. This would be more than an annoyance – false alarms can create a disruptive and unsafe work environment due to employees having to react immediately to an alarm.
- Liquid iodine from a pharmaceutical product could theoretically create gaseous phase iodine if delivered and broken to release liquid however Covanta Essex does not approve delivery of that type of waste. If an unacceptable delivery did occur, any release of gas phase iodine would become part of the draft pulled towards the three vents.

5.3 Conclusion

Covanta has an effective operations plan that includes a health and safety plan for all employees. An iodine monitor would not improve the existing plans.

6.0 Summary and Conclusion

Covanta Essex firmly believes that effective "purple plume" mitigation must be based on waste management strategies that prevent delivery of iodinated waste to the Facility. Covanta's efforts to implement such strategies have been successful in preventing stack opacity exceedances attributable to iodine emissions over the past year.

Research into the current state-of-the art of iodine monitoring by Covanta Essex and Tetra Tech, an independent third party, support the original conclusion that iodine is unlikely to be present in the gaseous phase in the tipping hall of the Facility and that there are no commercially demonstrated monitors that can provide continuous, accurate and reliable results for measuring the concentration of gaseous iodine in the environmental conditions which exist in the tipping hall and storage pit areas. Finally, the potential gaseous interferents commonly present in the tipping hall could falsely indicate the presence of gaseous iodine and would lead to unacceptable disruptions to the essential service we provide, without any environmental benefit.

Appendix 1

TETRA TECH

TECHNICAL MEMO

ISSUED FOR USE

To:	Patricia Ann Earls (Covanta Essex Co.)	**Date:**	March 30, 2021
c:		**Memo No.:**	01
From:	Peter Klaassen (Tetra Tech Canada Inc.)	**File:**	704-SWM.ONMB03111-01
Subject:	Evaluation of Iodine Detectors for Use in Essex WtE Facility		

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was requested by Covanta Essex Co. (Covanta) to review the potential of using wall mounted iodine detectors in the facility to warn staff when iodine was potentially present in waste received at the Essex facility located at 183 Raymond Blvd, Newark, NJ 07105.

This review is in response to correspondence received from NJDEP on November 20, 2020 from Luis Lim of the Bureau of Air Monitoring to Jeffrey Meyer of the Air Compliance & Enforcement. Specifically, the reference of the review was from item 2 in the Memorandum which stated:

A quick search of continuous iodine monitors over the internet for rugged iodine monitors identified three commercially available iodine monitors that are appropriate for hazardous conditions, two of which were from Analytical Technology, Inc., one of the companies in Covanta Essex's survey. I contacted another company with which I was familiar, PureAire, Monitoring Systems, Inc., the same company that manufactures the electrochemical methyl bromide monitors that are used in a fumigation facility in Gloucester County. They manufacture an iodine monitor, Universal Gas Detector, that will work in the dusty and hot/cold environment of the tipping hall of the incinerator according to their technical support staff. A more expansive search of monitors would likely lead to additional continuous iodine monitors for evaluation.

And item 3:

Nitrogen dioxide, which is emitted by idling heavy-duty diesel vehicles that are likely to be present near the tipping hall of an incinerator, is a known interferent for electrochemical iodine monitors. The level of this interference is acceptable.

Tetra Tech has reached out to two of the aforementioned companies, namely Analytical Technology Inc. (ATI) and PureAire Monitoring Systems Inc. (PureAire) to assess their technologies and their respective applicability within the Covanta Essex facility. The following is the result of the investigation.

Tetra Tech Canada Inc.
Suite 203 – 111 Farquhar Street
Guelph, ON N1H 3N4 CANADA
Tel 226.343.4381 | 226.203.5209

2.0 INVESTIGATION

2.1 Location Evaluation

Tetra Tech has reviewed the potential application of iodine detectors within the facility and determined that there were three potential locations for the detectors, namely on the tipping floor, the waste pit and near the feed chutes and associated air ducts feeding the combustion units. Of these three, it has been determined that the tipping area is too spread out with activities occurring over too wide an area. (Waste is discharged from the trucks in many areas depending on traffic and the amount of loads on the floor.) Similarly, the pit is large (wide, long, and tall) and it would be difficult to place a detector where it could provide any sensible coverage. The only area that would suffice would be close to the feed chutes or air duct where all of the combustion air is drawn. The duct is located approximately 20 feet above the floor in the feed chute area and is significantly dusty.

2.2 Information from Vendors

As noted above, the two manufacturers were contacted to ascertain the viability of using their respective instruments for the detection of iodine. In both cases the manufacturers indicated that they had measured interference from other compounds that would simulate the signals generated by the sensors. It should be noted that the list of interference compounds was only from the measured list, not other potential compounds that could be present at the Essex facility.

From ATI, the measured responses were denoted as equivalent impact of the respective compounds. (i.e., in the case of chlorine, the equivalent amount of chlorine would have the same impact as the equivalent amount of iodine.)

Interference Response

Gas	Equivalent Impact
Bromine	1.0
Fluorine	1.0
Chlorine Dioxide	1.0
Chlorine	1.0
Ozone	1.5
Nitrogen Dioxide	0.2
Hydrogen Sulfide	-0.1
Hydrogen Cyanide	-0.05
Methyl Mercaptan	-0.04
Sulfur Dioxide	-0.01

ATI did not provide any other information to Tetra Tech.

From PureAire, the results were measured in concentration versus indication with fewer apparent interreferences.

Gas	Concentration	Indication
I_2	3 ppm	3 ppm
Cl_2	3 ppm	3 ppm
F_2	3 ppm	1 ppm
Br_2	3 ppm	3 ppm
HCl	20 ppm	0 ppm
HF	9 ppm	0 ppm
$SiCl_4$	100 ppm	0 ppm
NH_3	75 ppm	0 ppm
O_3	2 ppm	0 ppm
CO	1 %	0 ppm
BCl_3	100 ppm	0 ppm
NO_2	70 ppm	0 ppm
IPA	Vapor	0 ppm
HNO_3	Vapor	2 ppm
H_2O_2	Vapor	>>3 ppm
H_2	4%	0 ppm
CO_2	100%	0 ppm

Note: ppm – parts per million

In both cases the manufacturer indicated that the sensors would only detect the respective compounds in vapour phase.

PureAire was given a virtual tour of the facility and they corroborated the suggestion that the most effective locations of the sensors would be close to the feed chutes or air ducts.

PureAire also indicated that dust buildup on the sensors would inhibit the efficacy of the subsequent signal. They recommended to draw air from a selected location via a combination of tubes, air pump and air filter to reduce the impact of dust buildup on the sensor head. At this time given the amount of dust present in the area it was difficult to assess the amount of time needed to clean the filter and time needed for filter replacements to render the instrument viable. The tubes, filter and pump needed for the system would have to be supplied by Covanta.

It should be noted that PureAire was very helpful in trying to provide both information and try to solve the issues surrounding the use of their instrument.

3.0 CONCLUSION

Tetra Tech has reviewed the results of the information from the manufacturers and has determined the following:

- Interference of both known and unknown compounds may lead to a high rate of false readings from the instrument, thus rendering any alarms from the instrument to be in question and therefore complicate effective response actions by the facility. The alarms from the instrument would not indicate which compound was detected.
- The instruments are designed for pristine environments (i.e., such as labs and medical facilities) and not the rugged dusty and multi compound environment within the Essex facility.

- The instruments detect the respective compounds in vapour phase, not solid phase as was determined by Essex staff to be the most likely source of the purple plumes.

Based on this, Tetra Tech does not believe that Iodine detectors would be helpful to prevent the feed of iodine compounds into the combustors located at the Essex facility that could contribute to a purple plume event.

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5.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

Prepared by:
Peter Klaassen, P.Eng.
Vice President – Ontario/Manitoba Division
Solid Waste Management Practice
Direct Line: 226.203.5209
Peter.Klaassen@tetratech.com

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Enclosure: Limitations on the Use of This Document

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

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