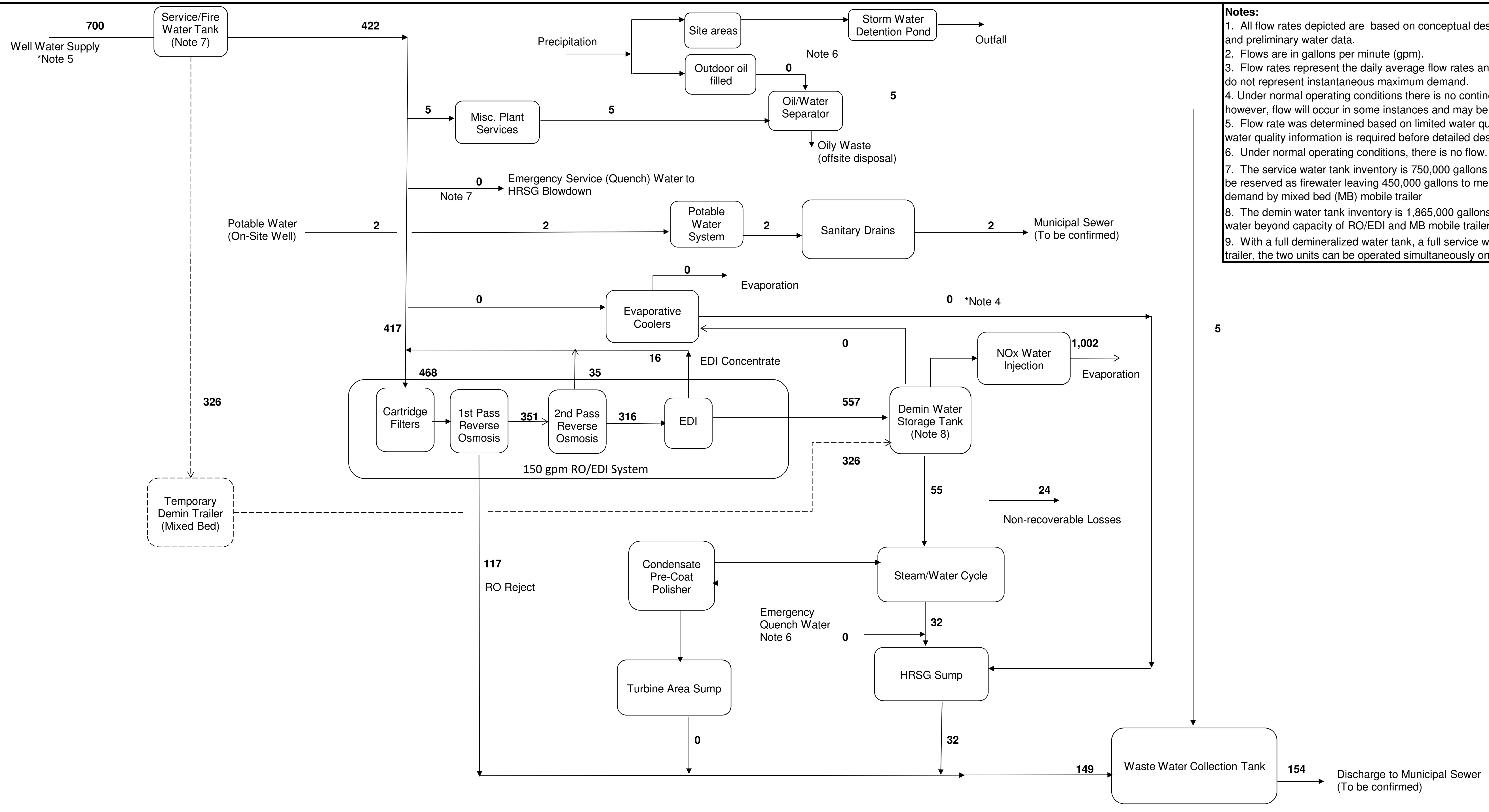


Notes:

1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. Under normal operating conditions there is no continous flow, however, flow will occur in some instances and may be approx. 1 gpm.
5. Flow rate was determined based on limited water quality data available. Additional water quality information is required before detailed design.
6. Under normal operating conditions, there is no flow.
7. The service water tank inventory is 750,000 gallons of which 300,000 gallons must be reserved as firewater leaving 450,000 gallons to meet excess service water demand by mixed bed (MB) mobile trailer
8. The demin water tank inventory is 1,865,000 gallons and provides excess demin water beyond capacity of RO/EDI and MB mobile trailer
9. With a full demineralized water tank, a full service water tank, and using MB mobile trailer, the two units can be operated simultaneously on ULSD for 72 hours.

FOR CONCEPTUAL DESIGN ONLY

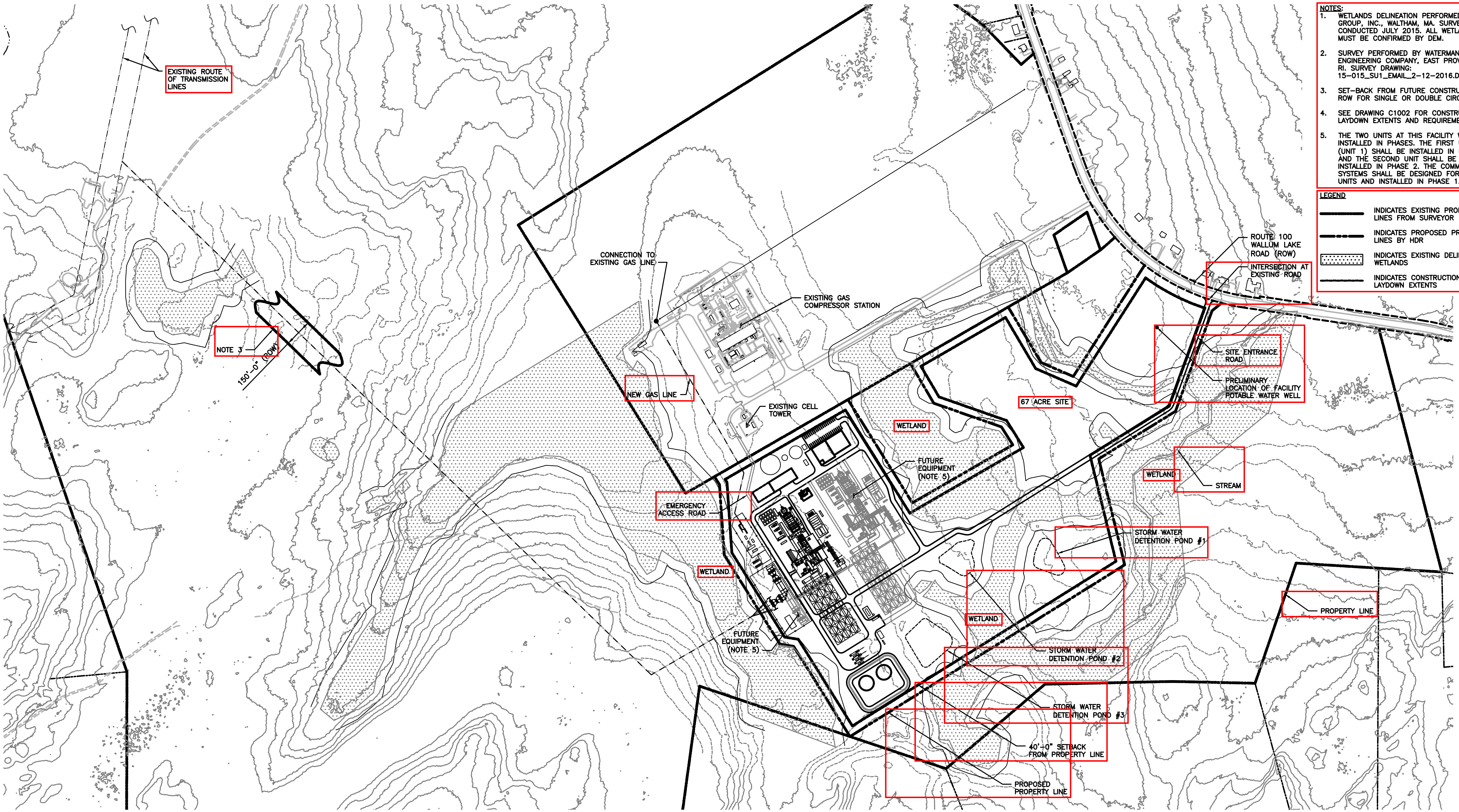
HDR

Conceptual Design Basis	5/16/2016	
Demin Water Makeup Demand	1.75% of Main Steam Flow	
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	20°F / 60%RH	
Cycles of Concentration	NA	

Invenergy

RHODE ISLAND
Two 1 x 1 COMBINED CYCLE
Water Flows - BOTH CTs on FUEL OIL
Two 1 X 1 GE HA.02 - Dry Cooling
Winter Ambient Conditions - Full Load

Project	Drawing
238926	WMB-04
	Rev
	G



NOTES:

1. WETLANDS DELINEATION PERFORMED BY ESS GROUP, INC., WALTHAM, MA. SURVEY CONDUCTED JULY 2015. ALL WETLANDS MUST BE CONFIRMED BY DEM.
2. SURVEY PERFORMED BY WATERMAN ENGINEERING COMPANY, EAST PROVIDENCE, RI. SURVEY DRAWING: 15–015_SU1_EMAIL_2–12–2016.DWG
3. SET–BACK FROM FUTURE CONSTRUCTION. ROW FOR SINGLE OR DOUBLE CIRCUIT.
4. SEE DRAWING C1002 FOR CONSTRUCTION LAYDOWN EXTENTS AND REQUIREMENTS.
5. THE TWO UNITS AT THIS FACILITY WILL BE INSTALLED IN PHASES. THE FIRST UNIT (UNIT 1) SHALL BE INSTALLED IN PHASE 1 AND THE SECOND UNIT SHALL BE INSTALLED IN PHASE 2. THE COMMON BOP SYSTEMS SHALL BE DESIGNED FOR BOTH UNITS AND INSTALLED IN PHASE 1.

LEGEND

▬▬▬	INDICATES EXISTING PROPERTY LINES FROM SURVEYOR
▬ ▬ ▬	INDICATES PROPOSED PROPERTY LINES BY HDR
▨	INDICATES EXISTING DELINEATED WETLANDS
‒‒‒	INDICATES CONSTRUCTION LAYDOWN EXTENTS

NORTH

SITE ARRANGEMENT

SCALE: 1" = 250'-0"

250 0 250 500 750

HDR

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION	DWN	ENGR	CHK	APPV
1	07 MAR 16	BID ISSUE (STAGGERED UNIT INSTALLATION)	EDC	–	–	–
0	02 NOV 15	M0102 BID ISSUE	EDC	–	–	–

PRELIMINARY
NOT FOR
CONSTRUCTION
OR
RECORDING

INVENERGY, LLC
CLEAR RIVER ENERGY CENTER

SINGLE SHAFT
SITE ARRANGEMENT

FILENAME C1000–0GA–238926.dwg

SCALE AS NOTED

SHEET 238926-0GA-C1000

SURVEY OF ULTRA-TRACE METALS IN GAS TURBINE FUELS

Bruce Rising

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Gas turbines are multi-fuel capable power generation systems. Because of their robust design, they can operate on low heating value gases, liquid fuels, natural gases and refinery gases. In a recent industry study, the environmental impact related to gas turbine operation on fuel oil was determined based on the available emissions data for metal emissions from gas turbines. Data collected by EPA reported the noted detectable trace metal emissions during oil operation. However, many of the tests were over fifteen years old, and fuel from the storage tanks at the facility may have been even older. Attempts to determine an accurate environmental assessment were hindered by the quality of the emissions data, and the paucity of fuel sample analytical results for distillate fuels..

Considering the great improvements in the US refining infrastructure, we concluded that any metals in a distillate fuel oil sample would probably be at the ultra-trace level, and would very likely be at the detection limits of the most analytical methods. Further, the concentrations of any hazardous metals (such as lead or mercury) would be extremely low, and the modeled emissions from using such a fuel would yield no measurable health impact. To address this question, we reviewed the existing literature on the subject, and found that no coordinated effort had attempted to identify the concentrations of trace hazardous metals, certainly not using some of the latest measurement methods (in this case ICP-MS).

The next step was to collect samples, and screen them for the presence of eight hazardous metals. Fuel samples (distillate) were collected from around the United States, taken from existing storage facilities, with fuel tanks assigned to a gas turbine power generation unit. Samples were taken to be representative of each Petroleum Administrative Defense Districts (PADD). The survey results revealed no measurable concentrations of Arsenic, Mercury or Lead in any fuel sample taken. No detectable levels of Chromium VI were reported. All samples were screened using Mass-Spec, with detection levels below 1 ppb. These results indicate that the distillate feedstocks available to the power generation industry are essentially free of toxic metals, and pose no health risk to the public when used in a gas turbine. The results also suggest that the petroleum distillate transmission and distribution system does not introduce cross contamination to the fuel supply.

Introduction

Non-combustible materials present in a fuel are typically released into the environment during the combustion process. With low-grade fuels, such as residual fuel oil or coal, metals, including toxic metals can be present in significant concentrations. Such is not the case for distillate fuels. Yet, there has been a widely held perspective that distillate fuels encumbered with potentially toxic metals.

The metals of most concern are those that exhibit a high degree of toxicity, or carcinogenicity, at very low concentrations. Mercury and lead are two key metals where there has been intense interest to reduce or eliminate their release into the environment. Removal of lead from gasoline, and switching to cleaner fuels has had a positive impact in reducing these emissions into the environment. In the twenty years since the removal of lead from gasoline was mandated there has been a steady decrease in lead emissions, and a steady increase in the quality of liquid fuels available for the power generation industry. As the results show here, the quality of distillate fuels is exceptional, and the metal contaminants found in liquid fuel oil are even lower than those mandated in drinking water.

Experimental

Samples from across the US were collected at storage facilities supplying fuel to power generation installations. Thirteen samples were collected and analyzed using ion mass spectrometry to identify the presence of specific metal toxins in the fuels

The toxic metals selected for this study were based on the needs for conducting an environmental health risk analysis related to gas turbine operation. In the risk analysis, emissions from a gas or fuel oil fired gas turbine were determined based on the mass emission rates of each toxic component. Both organic and inorganic emissions were used in the health risk analysis. For liquid fuel (No. 2 fuel oil) operation, the analysis assumed that any metal in the exhaust was due to the presence of metals in the fuel oil. In the initial phase of the study, the dominant metal of concern (based on results of emission tests on gas turbines) was chromium, since emission measurements of chromium yielded the highest emission factors. Yet with chromium, the dominant risk is the Cr-VI oxidation state. However, the existing emissions test data did not attempt to quantify the oxidation state of any metals reportedly detected in the exhaust.

Routine industrial fuel tests, with metal detection levels in the ppm range, report measurable concentrations of arsenic and lead. However, the metals are almost routinely reported at the detection limits of the apparatus, which was not sufficient for our needs. In the risk analysis, the presence of either arsenic or lead at the ppm level would calculate unacceptable risk levels. To address the accuracy of the earlier fuel tests, and to estimate health risks related to emissions from burning liquid fuels, the set of metals selected for a detailed ultra-trace survey was selected. Those metals in selected are shown in the following table.

1. Arsenic	5. Nickel
2. Cadmium	6. Manganese
3. Chromium	7. Selenium
4. Lead	8. Mercury

Metal Analysis from Fuel Samples Selected from Across United States
Samples collected from Gas Turbine Installations around the United States

All concentrations are reported in units of ppb (by weight)

	State or Region	Sample ID	PADD	Arsenic	Cadmium	Total Chromium	Chrome VI	Lead	Manganese	Nickel	Selenium	Mercury
1	**California**	**30352**	**V**	0	0	175	0	3.01	6.9	0	0	0
2	**Colorado**	**30374**	**IV**	0	0	203	0	1.89	6.73	0	0	0
3	**Florida**	**30391**	**III**	0	0	244.6	0	3.48	5.56	0	0	0
4	**Wisconsin**	**30353**	**III**	0	0	226.8	0	2.07	6.03	4.93	0	0
5	**Florida**	**30354**	**III**	0	0	238.2	0	5.29	5.76	12.33	0	0
6	**Minnesota**	**30355**	**II**	0	0	272.1	0	7.2	6.35	184.77	0	0
7	**California-South**	**30405**	**V**	0	0	175.8	0	18.79	10.07	15.05	0	0
8	**NC**	**30423**	**III**	0	0	259.16	0	2.3	6.61	28.95	0	0
9	**Arkansas**	**30424**	**IV**	0	0	202.49	0	46.18	10.95	28.2	0	0
10	**Arkansas**	**30447**	**IV**	0	0	403		61	0	0	0	0
11	**Arizona**	**30494**	**IV**	0	0	306		41	0	0	0	0
12	**California-North**	**30522**	**V**	0	0	165	0	0	0	0	0	0
13	**Maine**	**30425**	**I**	0	0	279.88	0	2.59	7.11	101.78	0	0
	Average			**0**	**0**	**242.4**		**15.0**	**5.5**	**28.9**	**0**	**0**
	SD			**0**	**0**	**65.05**		**20.59**	**3.53**	**54.51**	**0**	**0**
	Max			**0**	**0**	**403**		**61**	**10.95**	**184.77**	**0**	**0**
	Detection Limit, ppb			**0.9**	**0.1**	**0.07**		**0.08**	**0.1**	**0.2**	**5**	**0.2**

Table 1. Summary Of Distillate Oil ICP Results.

Analytical Method. Fuel characterization methods have been used extensively to quantify the presence of various components, including metals, in fuel oil. Historically, most of the test methods have cutoff their analysis at the 1 ppm (1,000 ppb) level, and usually this has been sufficient.

But to accurately determine the impact of burning liquid fuel, and the subsequent release of any metals into the environment, it has been necessary to push for a deeper and more thorough analysis using improved methods methods.

For this study, an Inductively Coupled Plasmas-Mass Spectrometer (Thermo-Elemental X7 ICP/MS) was used. It uses a high temperature plasma between 6000 K and 8000 K, connected to a high sensitivity mass spectrometer. The plasma is formed in an RF chamber, where the sample can be delivered as a solution, vapor, or even solid. The mass spectrometer is a quadrapole mass-spec designed to rapidly measure ions at each mass unit. Detection limits are species dependent, and range from parts-per-trillion (ppt) to parts-per-billion (ppb).

No. 2 Fuel Oil Analysis Results. The results of the survey show that No.2 Fuel Oil to be remarkably clean and of high quality. A detailed summary of the analytical results is shown in Table 1. the most prevalent compound in the fuel samples was chromium, although no Cr-VI was detected. The fuels were essentially free of arsenic, cadmium, selenium, and mercury. The concentration of arsenic permitted in drinking water is higher than the quantities reported in the fuel samples.

Comparison with Other Fuel Samples. As the name implies, residual fuel is the components of the petroleum feedstock that remain after distillation. Because of the nature of the distillation process (atmospheric or vacuum), most of the heavy metals would be expected to be found in the residual fuel oil. This appears to be the general rule that is easily demonstrated.

However, the mere presence of a metal, such as chromium, in the fuel, does not necessarily imply that it is in a toxic form in the turbine exhaust. For chromium, the oxidation state of concern is the +6. A 1998 survey of industrial boilers using heavy oil reported that the metal of critical concern was Nickel. In the case of Nickel, it is the presence of nickel-subsulfide (Ni_2S_3) that is the hazardous component. But it is not the nickel oxide of concern, NiO, but the nickel subsulfide (Ni_2S_3). However, nickel sub-sulfide is in a reduced state, a condition that should be difficult to maintain in intense industrial burner.

With the recent regulatory focus on a wide range of industries, there has been intense focus to determine what compounds represent any real, or potential hazard. A recent survey of residual fuels used in large boilers indicated that nickel was present in ranges from 30-40 ppm, significantly higher than the levels of nickel observed in the current fuel study)(1). Stack test measurements revealed that there was no evidence of reduced nickel in the particulates, indicating that good combustion (and excess oxygen levels) are effective means of fully oxidizing all the compounds in the fuel. We would expect similar results from the nickel present in the No. 2 fuel oil samples noted in this study.

In a 1999 survey of crude oil samples, McGaw reported data on 18 metals trace metals in a wide range of crude oil samples(2). A comparison of the average concentrations found in the McGaw reveals are markedly improved compared to the distillate samples from this study.

Table 2. Comparison Of Crude Samples With Distillate Results

Metal	As	Cr	Pb	Ni	Hg	Cd
Concentration in crude oil samples (McGaw 1999 study), ppb	60	270	32	19690	60	10
Concentrations in distillate fuel oil (this study). ppb	0	242	15	28	0	0

In a study on Iowa ground water quality, researchers used similar techniques as those selected here to identify any role between underground storage of fuels and possible aquifer contamination.[3] The Iowa ground water survey examined transportation fuels, which are even more tightly specified than the fuels used in gas turbines. The authors of that study also failed to identify the presence of any mercury in No. 2 diesel fuels taken from selected regional sources. The highest chromium reported in the study was only 31 ppb, although there was no attempt to identify the presence of any specific oxidation states of the chromium. In essence, this earlier study from a relatively select group of sources further confirms the high quality, and lack of toxic metals, in the US distillate fuels base.

Conclusions

Gas turbine liquid fuel samples were characterized for the presence of eight trace hazardous metals. The study revealed that many of the metals of concerned (including mercury and arsenic) are not present at any level above the detection limits of the ICP-MS used. Chromium is not present in the +6 oxidation state, the oxidation state of most concern. Nickel is present at even lower concentrations, but there is no evidence that nickel could form the toxic sulfide compound during a combustion process that occurs with excess oxygen available. The source of lead is probably due to cross contamination from the small quantities of leaded fuels that are still used today (aviation gasoline is still marketed as a low lead fuel).

References

(1) *"Nickel Speciation of Flyash from Residual Oil-Fired Power Plants"*, Kevin Galbreath, University of North Dakota Energy & Environmental Research Center; presented at Air Quality IV, 22-24 Sep 2003, Arlington, Va.

(2) Magaw, RI, McMillen, SJ, Gala, WR., 1999. Risk evaluation of metals in crude oils: *Proc. 6th Int'l Petrol. Environmental Conf.* Nov. 16-18, Houston, TX, pp. 460-473.

(3) Rich Heathcote, Don Simmons, and Steven Hernholz, *Analysis of Motor-Vehicle Fuels for Metals by Inductively Coupled Plasma-Mass Spectrometry;* Hygenic Laboratory**,** Volume 39, No. 4, pp. 1-4, 2001, The University of Iowa.

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
235 Promenade Street, Providence, RI 02908-5767 TDD 401-222-4462

July 27, 2015

Michael Feinblatt
ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, MA 02451

Dear Mr. Feinblatt:

The Office of Air Resources (OAR) has completed its review of and is hereby approving the Air Dispersion Modeling Protocol for criteria and toxic pollutants, dated April 21, 2015, submitted by ESS on behalf of Invenergy RIEC-Burrillville with the conditions listed below. ESS will conduct a facility-wide modeling analysis of impacts of criteria and toxic pollutants emissions associated with the proposed operation of a combined-cycle electric generating facility in Burrillville, RI. Note that representatives from the US Environmental Protection Agency (EPA) also reviewed the modeling protocol for this project and the EPA's comments are included in this letter.

The following conditions must be followed in accordance with the approval of this protocol:

1. Modeling shall include a scenario whereby the combined cycle turbines are operating in simple cycle mode unless the facility is willing to accept a permit condition prohibiting such operation.
2. Multisource modeling shall be performed, even if preliminary modeling does not show that a SIL is exceeded.
3. Downwash effects shall be selected for all applicable modeling scenarios.
4. The following model versions shall be used:
    - AERMOD version 14134
    - AERSCREEN version 14147
    - AERMAP version 11103
    - AERSURFACE version 13016
    - AERMINUTE version 14337
    - BPIP PRIME version 04274

- MAKEMET version 09183

5. Intermittent source modeling is not required for the proposed project.

6. Although, as stated in the protocol, modeling of emissions from the emergency engine and fire pump is not required, the EPA has requested that the permit application include a discussion of the expected frequency and duration of operation of that equipment.

7. All proposed modeling scenarios shall include Urban and Rural runs for comparison demonstrations for all criteria pollutants modeled.

8. The latest five years of off-site meteorological data from the NWS shall be used for criteria pollutant modeling. Those data are not provided by OAR.

9. OAR's pre-processed five years off-site meteorological data shall be used for air toxics modeling. Those data are provided by OAR.

10. Barbara Morin, Supervising Environmental Scientist in the OAR, noted that, although emissions rates for several substances that are components of polycyclic organic matter (POM, also known as polycyclic aromatic hydrocarbons or PAH) are listed in the June 28, 2015 Health Risk Assessment Protocol submitted by ESS for this project, emissions of those pollutants were not included in the modeling protocol. Note that POM is a listed air toxic in Rhode Island Air Pollution Regulation No. 22. The footnotes to the Minimum Quantity and Acceptable Ambient Level tables in that regulation specify that the POM values in those tables are expressed as benzo(a)pyrene equivalents, calculated as specified in the Rhode Island Air Toxics Guideline. Preliminary calculations using the emissions rates for POM substances specified in the risk assessment protocol and the weighting factors listed in Table F of the Guideline document indicate that POM emissions will exceed the Minimum Quantity; therefore, the air quality modeling should include an evaluation of POM impacts.

Note also that the discussion of AERSCREEN on page 6 of the protocol references 1999 EPA modeling guidelines. AERSCREEN was not available when that guideline was prepared. The most recent AERSCREEN manual was issued in 2011. In addition, the EPA noted that the statement on page 11 of the protocol that background pollutant concentrations at the proposed facility location are likely to be lower than those at DEM's monitoring locations may not be true for short-term concentrations of SO_2.

If you have any questions regarding this letter, you may contact me at (401) 222-2808 ext. 7025.

Sincerely,

Wilfredo Lemus
Senior Air Quality Specialist
Office of Air Resources

From: Morin, Barbara (DEM) <barbara.morin@DEM.RI.GOV>
Sent: Thursday, April 09, 2015 10:48 AM
To: Mike Feinblatt
Cc: McVay, Doug (DEM); Gold, Ruth (DEM)
Subject: RE: Invenergy RI Health Risk Assessment

Mike-

I apologize for not getting back to you sooner. As you are probably aware, the Rhode Island "Guidelines for Assessing Health Risk from Proposed Air Pollution Sources" was developed a number of years ago and has not been used for several years. We plan to propose an update of that document in the near future. The below comments are consistent with our current thinking about the planned procedures, but you may want to wait for the update to be completed before preparing the assessment. Doing so would be unlikely to slow down the permitting process, since the risk assessment cannot be conducted until after the dispersion modeling is completed. When conducting the air dispersion modeling, please include receptors at locations that will be pertinent for the risk assessment, e.g. nearby dairy and produce farms and waterbodies.

Unless you can limit the ULSD NOx potential emissions to less than 50 tons per year (e.g. by reducing the number of days per year that ULSD firing is allowed), this project would be considered a first tier power plant. That said, tools are now available that substantially streamline exposure calculations, so that analysis should be a much less arduous process than in previous assessments. As of now, I am planning to propose use of a risk assessment program like the Risk Assessment Standalone Tool (RAST) developed by the State of California for calculating exposures. The RAST program and related support materials are available for download at http://www.arb.ca.gov/toxics/harp/rast.htm .

The RAST of a similar program would be used for evaluating total exposures to metals and persistent bioaccumulative toxics (PBTs) by all relevant exposure pathways and may be useful for identifying pollutants that affect the same organs, for calculating organ-specific Hazard Indices. Note that short and long-term inhalation exposures for individual pollutants would continue to be evaluated by comparing modeled concentrations to the Rhode Island Regulation No. 22 Acceptable Ambient Levels.

As discussed above, the multiple exposure pathway analysis portion of the assessment should focus on metals and PBTs. EPA's list of PBTs is at http://www2.epa.gov/toxics-release-inventory-tri-program/persistent-bioaccumulative-toxic-pbt-chemicals-covered-tri . Note that the EPA list includes polycyclic aromatic hydrocarbons (PAHs). The only PAH that you identified is naphthalene. Please include any additional PAHs and other PBTs for which emissions information is available in the assessment.

In a quick test run of the RAST program, it appears that the only exposure routes that are likely to contribute significantly to total exposures are inhalation and soil and crop ingestion. However, I would advise running the program for all of the pathways to verify that there are no additional significant exposures.

The risk assessment protocol should include a list of the pollutants and exposure pathways to be evaluated in the assessment along with the program or methodology that will be used to conduct the assessment and the parameters and other options that will be selected in that analysis. As I mentioned previously, we plan to update the guidelines in the near future and it may make sense to wait for that update before preparing the protocol.

If you have any questions, please contact me.

Barbara Morin, Supervising Environmental Scientist
Rhode Island Department of Environmental Management
Office of Air Resources

Rhode Island Department of Environmental Management
Office of Air Resources

GUIDELINES FOR ASSESSING HEALTH RISKS FROM PROPOSED AIR POLLUTION SOURCES

Revised: October 21, 2015

Table of Contents

I. GENERAL INTRODUCTION AND APPLICABILITY

Rhode Island Air Pollution Control Regulation (RIAPCR) No. 9, “Air Pollution Control Permits” requires applicants for permits to construct, install or modify an air pollution source to demonstrate that emissions from that source will not cause ground level off-property ambient impact pollutant concentrations that exceed the Acceptable Ambient Levels (AALs) listed in RIAPCR No. 22, “Air Toxics” and any “Calculated Acceptable Ambient Levels" (CAALs) derived for substances not listed in RIAPCR No. 22. AALs and CAALs are derived by the Rhode Island Department of Environmental Management (RI DEM) using procedures delineated in the “Rhode Island Air Toxics Guidelines.”

AALs and CAALs are sufficiently stringent that, in most cases, air impacts that comply with those limitations are unlikely to be associated with public health effects. However, in some situations, further analysis is required to adequately evaluate the health risks associated with a source’s air emissions. Specifically:

- Multiple Exposure Pathways AALs and CAALs are derived to assess health effects associated with inhalation exposures. Deposition of certain air pollutants may result in exposure by additional pathways, such as soil ingestion and food consumption. This issue is of particular concern for persistent bioaccumulative and toxic pollutants (PBT pollutants). The term “PBT pollutants” is defined by the United States Environmental Protection Agency (US EPA) as “chemicals that are toxic, persist in the environment and bioaccumulate in food chains and, thus, pose risks to human health and ecosystems.”[1]

- Cumulative Effects on Organ Systems The cumulative effect of emissions of two or more air toxics that affect the same organ system may be unacceptable even if the AALS for the individual substances are not exceeded.

- Unusual Impact Locations Evaluation of impacts of emissions of pollutants associated with acute health effects within the facility’s property line may be required if the property is routinely accessed by members of the public. Evaluation of impacts at elevated receptors may also be required in some situations.

To address these issues, RIAPCR No. 9 stipulates that applicants for permits to construct, install or modify an air pollution source (preconstruction permits) must conduct any additional health studies required by the RI DEM, as specified in this document, “Guidelines for Assessing Health Risks from Proposed Air Pollution Sources.” Section II of this edition of the guidelines requires applicants to conduct risk assessments in conjunction with preconstruction permit applications for major stationary sources and major modifications, as defined in RIAPCR No. 9, and sets forth specifications for such assessments.

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1 US EPA Webpage for the Persistent Bioaccumulative and Toxic (PBT) Chemical Program, http://www.epa.gov/pbt/pubs/aboutpbt.htm

II. RISK ASSESSMENT GUIDELINES FOR MAJOR STATIONARY SOURCES AND MAJOR MODIFICATIONS

A. General Information

Preconstruction permit applications for all proposed major stationary sources and major modifications, as defined in RI APCR No. 9, must include a multi-pathway human health risk assessment. This section specifies minimum requirements for such assessments. It is the responsibility of an applicant to supply any additional information which may be required for a comprehensive assessment of the potential health impacts associated with the proposed facility.

The applicant must submit a risk assessment protocol to RI DEM for approval prior to preparation of the assessment. The protocol must include the following:

- A description of the proposed facility, including operations and emissions points;
- A schematic showing the site layout, as proposed;
- A map with an accompanying explanatory narrative showing land use; zoning classifications; the location of drinking water sources, fishing areas, farms and sensitive receptors (e.g. schools, parks and playgrounds, day care centers, nursing homes, hospitals, and residential dwelling units) in the vicinity of the proposed source; and any other geographical information pertinent to the assessment;
- Emissions rate estimates for pollutants that will be emitted from the proposed source by emissions point and the source of those emissions estimates;
- As discussed below, assessors must use the California Environmental Protection Agency’s Risk Assessment Standalone Tool (RAST) to calculate environmental transport, human exposure and health impacts. That tool includes several user-selected options; the protocol must identify the options that will be selected and provide a justification for the selection of those options, particularly when RAST defaults are not used; and
- A detailed discussion of the exposure scenarios that will be evaluated, as discussed below, including the pathways, parameters and other assumptions that will be used to evaluate exposures at non-residential sensitive receptors and workplaces.

The focus of the risk assessment is the impact to the theoretical "most exposed individual" (MEI). For the purpose of this guideline, RI DEM is defining the MEI as a person who lives for thirty years, including childhood, at the location of the facility’s maximally impacted residential receptor and whose diet includes homegrown produce and food and water from impacted sources, if applicable (e.g. local farms that produce milk, meat or produce; drinking water sources; and fishing areas). Note that RI DEM classifies all receptors as residential unless the applicant demonstrates that a receptor is located in an area where residential development is precluded by zoning or other land use limitations.

The applicant may also include an evaluation of a more realistic exposure scenario, and should explain clearly why assumptions included in that scenario may be more appropriate than the assumptions cited above. Impacts at nearby non-residential sensitive receptors and maximally impacted workplaces should also be evaluated.

The Air Resources Board of the California Environmental Protection Agency has developed the Hotspots and Reporting Program (HARP), a free software suite used for the evaluation of risks associated with air pollutant emissions. RI DEM is requiring that risk assessments developed in conjunction with Rhode Island major source or major modification preconstruction permits use the most current version of the Risk Assessment Standalone Tool (RAST) portion of the HARP suite for calculating environmental transport and fate, exposure and health impacts. The RAST tool can be used to calculate risks associated with exposures to pollutants via multiple pathways and the cumulative health impact of exposures to multiple pollutants that affect the same target organ system.[2]

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[2] As of the date of publication of this document, the most current version of RAST (HARP Version 2), is available for download at http://www.arb.ca.gov/toxics/harp/harp.htm The user manual for that program (California Environmental Protection Agency Air Resources Board, “User Manual For the Hotspots Analysis and Reporting Program Health Risk Assessment Standalone Tool Version 2”, March 27, 2015, is available at http://www.arb.ca.gov/toxics/harp/docs2/harp2rastuserguide.pdf . That agency’s “Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments”, which provides the rationale for the assumptions in the RAST tool, is available at http://oehha.ca.gov/air/hot_spots/hotspots2015.html

B. Exposure Assessment

1. Pollutant Selection

Risk assessments must include all pollutants evaluated by the RAST that will be emitted from the proposed facility for which emissions estimates are available, including pollutants that are emitted in quantities lower than the Minimum Quantities listed in Appendix A of RIAPCR No. 9. As discussed above, PBT pollutants are of particular interest in multi-pathway risk assessments. Therefore, the applicant should make every attempt to quantify potential emissions of any PBT pollutant that may be released from the proposed source or modification. PBT pollutants commonly emitted by combustion sources include mercury, benzo(a)pyrene and other polycyclic aromatic hydrocarbons, and dioxins/furans.

2. Dispersion Modeling

RAST requires users to input maximum hourly and annual average ground level concentrations of emitted pollutants, either by direct entry of those concentrations or by importing those values from a CSV file. Rhode Island assessments must use ambient air impact concentrations associated with emissions from the source, as predicted by dispersion modeling analyses conducted as specified in the "Rhode Island Air Dispersion Modeling Guidelines for Stationary Sources."[3] Submission of a modeling protocol, separate from the risk assessment protocol, is required prior to conducting the modeling analysis. Risk assessment input requirements should be considered when designing the modeling analysis, including:

- **Pollutant selection –** As discussed above, the risk assessment does not exclude pollutants for which emissions are below APCR Regulation No. 9 Minimum Quantities thresholds. Therefore, the air quality modeling analysis should include all pollutants evaluated by RAST that will be emitted by the proposed new or modified facility for which air emissions estimates are available.

  Note that RAST allows concentrations of chlorobenzenes, chlorophenols, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), dioxins and dibenzofurans to be entered either as individual speciated substances or as the total concentration of the family of substances. Concentrations of pollutants in those families should be entered as individual substances if speciated emissions data are available. If speciated data are not available for some or all of the emissions, impacts of those emissions should be entered under the family classification.

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[3] At the time of preparation of this document, the most current version of the "Rhode Island Air Dispersion Modeling Guidelines for Stationary Sources," the March 2013 Revision, is available at: http://www.dem.ri.gov/pubs/regs/regs/air/airtoxmd.pdf

- **Receptor locations –** Receptor locations should be sufficient to identify ground level pollutant impacts at the off-site point of maximum impact and at the point of maximum impact for which residential use is not precluded by zoning or other land use restrictions. Receptors should also be located at nearby sensitive receptors (e.g. schools, day care centers, parks, playgrounds and health care facilities). Note that, if residences or other sensitive receptors are located on the source's property, those receptor locations should be modeled. Elevated receptors must also be included where applicable. In addition, since RAST allows the user to input ground level air concentrations at the maximally impacted pasture, drinking water source and fishing area, the modeler should site receptors at those locations, if applicable.

- **Averaging time –** RAST inputs include maximum (one-hour average) and average (annual average) ground-level concentrations for all pollutants, so impacts corresponding to those averaging times must be generated for all pollutants evaluated. Note that the predicted maximum one-hour and maximum annual average concentrations may not occur at the same location.

- **Isopleth maps –** Isopleth maps showing gradients in maximum 1-hour and annual average pollutant concentrations for the five year period modeled should be constructed such that they can be adjusted to include information pertinent to the risk assessment, including zoning classifications and the location of farms, drinking water sources, fishing areas, and sensitive receptors.

3. Exposure Scenarios

The risk assessment will focus on the theoretical MEI resident, but may also evaluate more realistic residential exposure scenarios, For instance, although RI DEM classifies receptors in all areas where residential development is not precluded by zoning or other land use restrictions as residential receptors for the MEI exposure evaluation, the assessor may also want to evaluate exposures in areas where residences are located or planned at the time of the assessment. In addition, exposures at other nearby sensitive receptors (e.g. schools, parks and playgrounds, day care center and health care facilities) and at the maximally impacted workplace should also be evaluated. The following is a discussion of the requirements for evaluating residential exposures and exposures at other pertinent locations.

(1) Residential Exposure

All multi-pathway risk assessments must focus on the MEI, a theoretical person who lives for thirty years, including childhood, at the facility's residential (or potentially residential) point of maximum impact and whose diet includes homegrown produce and food and water from sources maximally impacted by emissions from the source, if applicable (e.g. local farms producing milk, meat, and produce; drinking water reservoirs; and fishing areas).

As discussed above, receptors in all areas that are currently residential or where future residential development is not precluded by zoning or other land use restrictions should be included when selecting maximum one-hour and annual average impact concentrations. Note that the maximum concentrations predicted by the dispersion model for the one-hour and annual averaging times may not occur at the same location.

The modeled maximum one-hour and annual average residential impact concentration are input into the RAST tool as maximum and average concentrations, respectively. Exposures via the following pathways, which are mandatory pathways for Rhode Island residential risk evaluations, are based on those maximum residential concentrations:

- Inhalation;
- Soil ingestion;
- Dermal exposure;
- Ingestion of mother's milk (polycyclic aromatic hydrocarbons (PAHs), creosotes, lead, dioxins, furans and polychlorinated biphenyls (PCBs) only); and
- Ingestion of homegrown produce

In addition, the RAST assessment must assume that the MEI is exposed via the following pathways, as applicable:

- Ingestion of drinking water from the maximally impacted drinking water source;
- Ingestion of fish from the maximally impacted fishing area; and
- Ingestion of produce, beef and dairy, and pigs, chicken and eggs from the maximally impacted farm.

Note that the RAST tool allows users to input the predicted ground level concentrations at the maximally impacted pasture, drinking water source and fishing area.

As discussed above, RAST users are allowed to select some of the parameters used in exposure calculations. In the risk assessment protocol, the applicant should identify the options that will be selected and justify those selections, particularly if parameters that are different from the RAST defaults are selected.

As discussed above, the assessment may also include an evaluation of impacts at current or planned residences or another residential scenario that the applicant considers to be a more realistic representation of the risk associated with the proposed source. Such analyses should identify all assumptions utilized and provide an explanation of why those assumptions are more realistic than those used in the MEI evaluation.

(2) Exposures at Sensitive Receptors and Occupational Locations

An assessment of exposures at nearby non-residential sensitive receptors and at the maximally impacted workplace also must be conducted. Selection of exposure pathways and parameters for such evaluations must be tailored to match the receptor type and site-specific details. In general, such analyses will evaluate fewer exposure pathways than those included in the residential evaluation; however, differences in certain parameters (e.g. an assumed increased breathing rate at work places) may increase exposures at those locations.

C. Risk Characterization and Acceptability Criteria

1. Analysis Type

The RAST tool can be used to evaluate cancer risk, chronic non-cancer risk, acute non-cancer risk and 8-hour/day non-cancer risk for individual residents, populations and workers. RI DEM does not require an evaluation of population risk MEI and other residential assessments must include analyses of cancer risks and chronic, acute and 8-hour non-cancer risks to individual residents. Workplace impacts should be evaluated for 8-hour chronic non-cancer risks to workers. Risk analysis types for non-residential sensitive receptors should be tailored to those receptors. The analysis type that will be applied to each exposure scenario should be identified in the risk assessment protocol.

2. Risk Calculation and Presentation

Applicants must submit a comprehensive risk assessment report to RI DEM that includes a description of the analyses conducted, including an identification and justification of the assumptions used and parameters chosen for each exposure scenario. RAST inputs and outputs for all scenarios evaluated must be attached to the report. RAST output spreadsheets include the following information:

- Cancer risk tables, which include the risk associated with each applicable exposure pathway and the total risk for all pathways for each carcinogenic substance evaluated;

- Chronic non-cancer tables, which include the chronic hazard quotient, calculated as the exposure dose divide by the California chronic health benchmark by substance for each target health effect (12 organ systems plus odor and general toxicity), as well as the dose associated with each exposure route;

- Acute non-cancer tables, which include the acute hazard quotient (exposure dose/California acute health benchmark) for each substance for each target health effect. RAST includes only inhalation exposures in acute dose calculations; and

- 8-hour non-cancer risk tables for residential and worker exposures are also based solely on inhalation exposures; the RAST 8-hour output displays the 8-hour chronic hazard quotient (8-hour exposure dose/California 8-hour health benchmark) for each applicable substance for each target health effect.

The report must include maps and explanatory text that clearly identify the locations of: the MEI residential receptor; any other residential receptor evaluated; the maximally impacted farm, drinking water source and fishing area used in that analysis; non-residential sensitive receptors; and the maximally impacted workplace.

For the MEI and any other residential analysis, the report must include the following information, as extracted from the RAST output:

1. A table showing the cancer risk associated with each carcinogenic substance and the total of those risks;

2. A table and stacked column chart that shows the contribution of each exposure route to the cancer risk calculated for each carcinogen;

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3. A stacked column chart that shows the contribution of each carcinogen and the contribution of each exposure route to the total cancer risk calculated for the project;

4. A table showing the total and pollutant-specific chronic hazard quotients for each target health effect, including general toxicity and odor;

5. A stacked column chart that shows the contribution of each substance to the total chronic hazard quotient for each target health effect, including general toxicity and odor;

6. Tables showing the total and pollutant-specific acute hazard quotients and 8-hour hazard quotients for each target health effect, including general toxicity and odor; and

7. Stacked column charts that show the contribution of each substance to the total acute hazard quotient and total 8-hour hazard quotient for each target health effect, including general toxicity and odor.

Risk summaries for non-residential sensitive receptor and workplace exposure scenarios must include all of the above information that is applicable to that exposure scenario.

3. Acceptability Criteria

The risk posed by a proposed facility will be considered acceptable if the assessment is conducted according to the conditions delineated in this Guideline and in a risk assessment protocol approved by RI DEM and the following criteria are satisfied:

1. The maximum off-site ground level ambient air impacts predicted by an approved air dispersion modeling study for all evaluated pollutants are less than or equal to the corresponding AALs listed in Regulation No. 22 and any CAALs developed by RI DEM for substances not listed in Regulation No. 22, considering appropriate averaging times. Note that Section 22.3.4 of Regulation No. 22 allows RI DEM to modify modeling requirements by:

   a. Allowing the applicant to exclude impacts in an area that is not accessible to the public, provided that the applicant demonstrates that public access to that area is precluded;

   b. Allowing the applicant to use an adjusted annual or 24-hour average AAL to determine the acceptability of impacts in an area, provided that the applicant demonstrates that land use or other factors limit the potential duration of public exposure to the contaminant in that area; or

   c. Requiring the applicant to evaluate one-hour and 24-hour average impacts in areas of the facility's property to which members of the public have unrestricted access.

2. The total cancer risks associated with the impact of facility emissions for the MEI and other residential receptors, non-residential sensitive receptors and the maximally impacted workplace, evaluated according to the specifications of this document for all applicable exposure routes, do not exceed 1/10,000 (10^{-4}).

3. The total chronic hazard quotient, total acute hazard quotient and total 8-hour hazard quotient for each target health effect, including general toxicity and odor, associated with the impact of facility emissions at residential receptors and, as applicable, non-residential sensitive receptors and the maximally impacted workplace, evaluated according to the specifications of this document for all applicable exposure routes, does not exceed one.

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Invenergy ULSD Storage Tank 1
City:	Burrillville
State:	Rhode Island
Company:	Invenergy, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	Invenergy Rhode Island Energy Center, Burrillville, Rhode Island

Tank Dimensions

Shell Height (ft):	30.00
Diameter (ft):	80.00
Liquid Height (ft) :	27.00
Avg. Liquid Height (ft):	27.00
Volume (gallons):	1,000,000.00
Turnovers:	18.42
Net Throughput(gal/yr):	18,423,360.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	80.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Providence, Rhode Island (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Invenergy ULSD Storage Tank 1 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Distillate fuel oil no. 2	All	52.05	47.20	56.90	50.41	0.0049	0.0041	0.0059	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Invenergy ULSD Storage Tank 1 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

Annual Emission Calcaulations

Standing Losses (lb):	61.3147
Vapor Space Volume (cu ft):	42,661.5033
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0339
Vented Vapor Saturation Factor:	0.9978
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	42,661.5033
Tank Diameter (ft):	80.0000
Vapor Space Outage (ft):	8.4872
Tank Shell Height (ft):	30.0000
Average Liquid Height (ft):	27.0000
Roof Outage (ft):	5.4872
Roof Outage (Dome Roof)	
Roof Outage (ft):	5.4872
Dome Radius (ft):	80.0000
Shell Radius (ft):	40.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Daily Avg. Liquid Surface Temp. (deg. R):	511.7234
Daily Average Ambient Temp. (deg. F):	50.3917
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	510.0817
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,228.9982
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0339
Daily Vapor Temperature Range (deg. R):	19.3980
Daily Vapor Pressure Range (psia):	0.0018
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0041
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0059
Daily Avg. Liquid Surface Temp. (deg R):	511.7234
Daily Min. Liquid Surface Temp. (deg R):	506.8739
Daily Max. Liquid Surface Temp. (deg R):	516.5729
Daily Ambient Temp. Range (deg. R):	18.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9978
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0049
Vapor Space Outage (ft):	8.4872
Working Losses (lb):	280.0301
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Annual Net Throughput (gal/yr.):	18,423,360.0000
Annual Turnovers:	18.4200
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	1,000,000.0000
Maximum Liquid Height (ft):	27.0000
Tank Diameter (ft):	80.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	341.3448

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Invenergy ULSD Storage Tank 1 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	280.03	61.31	341.34

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Invenergy ULSD Storage Tank 2
City:	Burrillville
State:	Rhode Island
Company:	Invenergy, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	Invenergy Rhode Island Energy Center, Burrillville, Rhode Island

Tank Dimensions

Shell Height (ft):	30.00
Diameter (ft):	80.00
Liquid Height (ft) :	27.00
Avg. Liquid Height (ft):	27.00
Volume (gallons):	1,000,000.00
Turnovers:	18.42
Net Throughput(gal/yr):	18,423,360.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	80.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Providence, Rhode Island (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Invenergy ULSD Storage Tank 2 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	52.05	47.20	56.90	50.41	0.0049	0.0041	0.0059	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Invenergy ULSD Storage Tank 2 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

Annual Emission Calcaulations

Standing Losses (lb):	61.3147
Vapor Space Volume (cu ft):	42,661.5033
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0339
Vented Vapor Saturation Factor:	0.9978
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	42,661.5033
Tank Diameter (ft):	80.0000
Vapor Space Outage (ft):	8.4872
Tank Shell Height (ft):	30.0000
Average Liquid Height (ft):	27.0000
Roof Outage (ft):	5.4872
Roof Outage (Dome Roof)	
Roof Outage (ft):	5.4872
Dome Radius (ft):	80.0000
Shell Radius (ft):	40.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Daily Avg. Liquid Surface Temp. (deg. R):	511.7234
Daily Average Ambient Temp. (deg. F):	50.3917
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	510.0817
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,228.9982
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0339
Daily Vapor Temperature Range (deg. R):	19.3980
Daily Vapor Pressure Range (psia):	0.0018
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0041
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0059
Daily Avg. Liquid Surface Temp. (deg R):	511.7234
Daily Min. Liquid Surface Temp. (deg R):	506.8739
Daily Max. Liquid Surface Temp. (deg R):	516.5729
Daily Ambient Temp. Range (deg. R):	18.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9978
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0049
Vapor Space Outage (ft):	8.4872
Working Losses (lb):	280.0301
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Annual Net Throughput (gal/yr.):	18,423,360.0000
Annual Turnovers:	18.4200
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	1,000,000.0000
Maximum Liquid Height (ft):	27.0000
Tank Diameter (ft):	80.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	341.3448

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Invenergy ULSD Storage Tank 2 - Vertical Fixed Roof Tank
Burrillville, Rhode Island

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	280.03	61.31	341.34