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Stephen J. Humes
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May 13, 2016

VIA ELECTRONIC MAIL AND
OVERNIGHT MAIL

Melanie A. Bachman
Acting Executive Director
State of Connecticut
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Re: **PETITION NO. 1218** - PSEG Power Connecticut LLC petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the construction, maintenance, and operation of a new 485 megawatt (MW) dual fuel combined-cycle electric generating facility at the existing Bridgeport Harbor Station located at 1 Atlantic Street, Bridgeport, Connecticut

Dear Ms. Bachman:

Enclosed please one original and fifteen (15) copies of PSEG Power Connecticut LLC's responses to the Connecticut Siting Council's requests for late file exhibits made at the public hearing held on May 5, 2013.

Sincerely yours,

HOLLAND & KNIGHT LLP

Stephen J. Humes

Enclosures
cc: Service List

PSEG Power Connecticut LLC
Petition No. 1218

Late Filed Exhibit 01
Dated: 05/13/2016
LF-01

Witness: Witness Panel

Request from: Connecticut Siting Council

LF-01. Provide an Exhaust Plume Analysis with any inputs / assumptions and any outputs / computer printouts and associated conclusions regarding aviation safety in the vicinity of stack plumes.

Response: Attached as Exhibit LF-01-A is a memorandum from Jeffrey Pantazes, Senior Technical Director at AKRF, Inc. to Michael Stagliola, Project Director at PSEG related to the Connecticut Airport Authority's memorandum to the Connecticut Siting Council, dated April 28, 2016.

AKRF

Environmental, Planning, and Engineering Consultants

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Suite 214
Mt. Laurel, NJ 08054
tel: 856 797-9930
fax: 856 797-9932
www.akrf.com

Memorandum

To:	Michael Stagliola – Project Director
From:	Jeffrey Pantazes – Senior Technical Director
Date:	May 10, 2016
Re:	PSEG Power Connecticut LLC Siting Council Memo from the Connecticut Airport Authority
cc:	Kathryn Gerlach, Robert Silvestri

On April 28, 2016, the Connecticut Siting Council (CSC) received a memo from the Connecticut Airport Authority (CAA) submitting two comments on the PSEG Power Connecticut LLC (PSEG) application for a Declaratory Ruling, Petition No. 1218 before the CSC. The CAA memo is included as Attachment A.

This memo transmits the responses and analyses to PSEG for submittal to the CSC.

The CAA memo requested that (a) PSEG file a Federal Aviation Administration (FAA) "Notice of Proposed Construction or Alteration" for the project; and (b) that PSEG complete an Exhaust Plume Analysis per the FAA guidance memorandum issued on September 24, 2015.

With regard to the first question, PSEG filed a response to CSC interrogatory 24 (dated April 28, 2016) with the CSC that includes the FAA response to the above requested FAA submittal and a discussion of the stack lighting requirements. Specifically, the FAA provided a "Determination of No Hazard to Air Navigation" dated April 20, 2015 for the proposed stack for the combined cycle unit. For convenience, the FAA Determination is included as Attachment B.

The second question posed by the CAA addressed the potential for exhaust plumes to pose a hazard to aircraft and requested that an Exhaust Plume Analysis be conducted. This analysis has been completed and the model outputs are included as Attachment C. The model output provides probabilities that an aircraft (four discrete types were modeled) would be subject to "severe turbulence" or an "upset," if inadvertently flown directly into the proposed stack exhaust plume. Both are defined terms as further described in Attachment C. Additionally, the same analysis was performed for the existing coal plant at the Bridgeport Harbor Station site which yielded similar results for all four aircraft types.

It is noted that the FAA, in issuing the September 24, 2015 memorandum (Attachment D), referenced a change made to the Aeronautical Information Manual (AIM) on July 24, 2014. This change updated terminology and provided more detail regarding the associated hazards of exhaust plumes. Additionally, in order to retain a current license, all aircraft pilots are required to complete a Biennial Flight Review (BFR). This two year refresher training includes both classroom and flight time, and is intended to assure that all pilots remain aware of regulatory and other information included in the AIM. Therefore, all pilots who hold current licenses are expected to be aware of the potential risks of flying in the vicinity of exhaust plumes by the second anniversary of the AIM update, or by the end of July 2016. This is well before the plant will be constructed and approximately 2 years prior to the initial startup testing and initial use of the proposed stack for the new plant.

Additionally, there are other guidelines included in the AIM related to minimum elevations over congested areas (such as Bridgeport) and flight operations in the vicinity of power plants and other similar infrastructure. Regulations have been in place for over ten (10) years for pilots operating under visual flight rules (VFR) to see and remain clear of all power plants.

As a result of the Exhaust Plume Analysis, and the inclusion of the guidance in the AIM, the concerns of the CAA have been addressed by the FAA. Taken cumulatively the FAA has provided:

- Guidance and direction regarding exhaust plumes (the September 24, 2015 memo);
- Analysis tools to consistently address the characteristics of specific exhaust plumes (the MITRE Corporation Exhaust-Plume-Analyzer Model);
- Pilot training inputs via the AIM (as noted in the footnote on page two of Exhibit D); and
- The ongoing BFR requirements to address the questions raised by the CAA.

To summarize, the FAA criteria and pilot expectations regarding air safety have been clearly established.

Jeffrey Pantazes

Attachments

A. Connecticut Airport Authority letter dated April 28, 2016

B. FAA Determination of No Hazard to Navigation dated April 20, 2015

C. Exhaust Plume Analysis prepared by AKRF dated May 11, 2016

D. FAA Memorandum – Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations dated September 24, 2015

NJ16061-71312.0002

Attachment A

Connecticut Airport Authority letter
Dated April 28, 2016

CAA
CONNECTICUT AIRPORT AUTHORITY

April 28, 2016

Ms. Melanie Bachman
Acting Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Subject: **Petition No. 1218**
485 Megawatt Dual Fuel Combined-cycle Electric Generating Facility
1 Atlantic Street
Bridgeport, Connecticut

Dear Ms. Bachman:

The Connecticut Airport Authority (CAA) has reviewed the above referenced Petition and has the following comments.

- Igor I. Sikorsky Memorial Airport is a public airport located in Fairfield County, and is owned by the City of Bridgeport. The Airport is situated three miles southeast of downtown Bridgeport, within the Town of Stratford. The Dual Fuel Combined-cycle Electric Generating Facility is located west of Igor I. Sikorsky Memorial Airport. The proposed HRSG Stack is located approximately 12,300' from the end, and offset 1,450 to the left from the extended centerline of airport runway 11-29. The applicant should verify that the proposed construction will not create a hazard to air navigation. The applicant should file a Federal Form 7460-1 "Notice of Proposed Construction or Alteration" for required determinations.

- In the FAA memorandum on "Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations" dated September 24, 2015, the FAA concluded that thermal exhaust plumes in the vicinity of airports may pose a unique hazard to aircraft in critical phases of flight (particularly takeoff, landing and within the pattern) and therefore are incompatible with airport operations. A link to this memorandum is available at: https://www.faa.gov/airports/environmental/land_use/media/Technical-Guidance-Assessment-Tool-Thermal-Exhaust-Plume-Impact.pdf

334 Ella Grasso Turnpike · Suite 160 · Windsor Locks, CT 06096

- The CAA recommends that the applicant complete an Exhaust Plume Analysis and provide the results to the Siting Council to ensure that the potential effects of thermal exhaust plumes on airport operations can be adequately evaluated.

If you have any questions in regard to this matter, please feel free to contact me at 860-254-5516.

Sincerely,

Robert J. Bruno

Robert J. Bruno
Director of Planning,
Engineering & Environmental Services

Attachment B

FAA Determination of No Hazard to Navigation Dated April 20, 2015

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
2601 Meacham Boulevard
Fort Worth, TX 76193

Aeronautical Study No.
2014-ANE-2323-OE

Issued Date: 04/20/2015

Thomas Copus
PSEG Power Connecticut LLC
1 Atlantic Street
Bridgeport, CT 06604

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Stack Bridgeport Unit 5 Stack
Location:	Bridgeport, CT
Latitude:	41-10-00.16N NAD 83
Longitude:	73-10-48.42W
Heights:	17 feet site elevation (SE)
	300 feet above ground level (AGL)
	317 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the structure would not be a hazard to air navigation provided the following condition(s) is(are) met:

As a condition to this Determination, the structure is marked/lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8(M-Dual),&12.

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part 1)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

See attachment for additional condition(s) or information.

Any height exceeding 300 feet above ground level (317 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

This determination expires on 10/20/2016 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.

(b) extended, revised, or terminated by the issuing office.

(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is subject to review if an interested party files a petition that is received by the FAA on or before May 20, 2015. In the event a petition for review is filed, it must contain a full statement of the basis upon which it is made and be submitted to the Manager, Airspace Regulations & ATC Procedures Group, Federal Aviation Administration, 800 Independence Ave, SW, Room 423, Washington, DC 20591.

This determination becomes final on May 30, 2015 unless a petition is timely filed. In which case, this determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review. For any questions regarding your petition, please contact Airspace Regulations & ATC Procedures Group via telephone -- 202-267-8783 - or facsimile 202-267-9328.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation.

An account of the study findings, aeronautical objections received by the FAA during the study (if any), and the basis for the FAA's decision in this matter can be found on the following page(s).

If we can be of further assistance, please contact Darin Clipper, at (404) 305-6531. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2014-ANE-2323-OE.

Signature Control No: 235894583-249506848 (DNH)

Mike Helvey
Manager, Obstruction Evaluation Group

Attachment(s)
Additional Information
Case Description
Map(s)

Additional information for ASN 2014-ANE-2323-OE

The proposed Bridgeport Unit 5 Exhaust Stack, not exceeding a height of 300 feet (ft.) above ground level (AGL), 317 ft. above means sea level (AMSL), would be located approximately 2.45 nautical miles (NM) west of Igor I Sikorsky Memorial Airport's (BDR) airport reference point (ARP), Bridgeport, CT. The proposed exhaust stack has been identified as an obstruction under the standards of Title 14, Code of Federal Regulations (CFR), Part 77, as applied to BDR as follows:

Section 77.17 (a) (2): A height that is 200 feet AGL, or above the established airport elevation, whichever is higher, within 3 nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length, and that height increases in the proportion of 100 feet for each additional nautical mile from the airport up to a maximum of 499 feet. The proposed stack would exceed by up to 100 ft.

Section 77.17 (a) (5): The surface of a takeoff and landing area of an airport or any imaginary surface established under 77.19, 77.21, or 77.23. However, no part of the takeoff or landing area itself will be considered an obstruction.

Section 77.19 (b): Conical surface. A surface, extending outward and upward, from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet. The proposed stack exceeds by up to 47 ft.

The proposal was circularized on March 3, 2015, to all known aviation interests and to non-aeronautical interests that may be affected by the proposal. No letters of objection were received as a result of circularization.

Aeronautical study disclosed that the proposed stack would have no effects on any proposed arrival, departure, or en route instrument flight rule (IFR) operations or procedures.

Since the proposed stack lies beyond the lateral limits of the VFR conical surface, and in the Runway 06/24 climb/descent area for Category C and D aircraft (aircraft with approach speeds of 121 knots but less than 166 knots), the maximum allowable height is 350 ft. above airport elevation or the height of 14 CFR Part 77.17(a) (2), whichever is greater not to exceed 499 ft. above the ground. The height that is 350 ft. above airport elevation is 359 ft. AMSL. The height that would not exceed 14 CFR Part 77.17(a) (2) is 217 ft. AMSL.

The proposed stack also lies beyond the lateral limits of the VFR conical surface and not in the climb/descent area for Runway 11/29. The maximum allowable height for this runway is 499 ft. above the airport elevation not to exceed 499 ft. AGL in which this proposed stack does not exceed criteria.

Study for possible visual flight rules (VFR) effect disclosed that the proposed stack would have no effects on any existing or proposed arrival or departure VFR operations or procedures. It would not conflict with airspace required to conduct normal VFR traffic pattern operations at BDR or any other known public-use or military airports. At 300 ft. AGL, the proposed stack would not have a substantial adverse effect on VFR en route flight operations because it is located within traffic pattern airspace.

Even though the proposed stack exceeds 77.19 (b), the proposed stack does not exceed the height of the VFR transition, approach, horizontal, or conical surfaces as applied to visual approach runways at BDR, the foundation of VFR traffic pattern analysis.

The proposed stack would need appropriate obstruction marking and lighting to make it more conspicuous to airmen should circumnavigation be necessary.

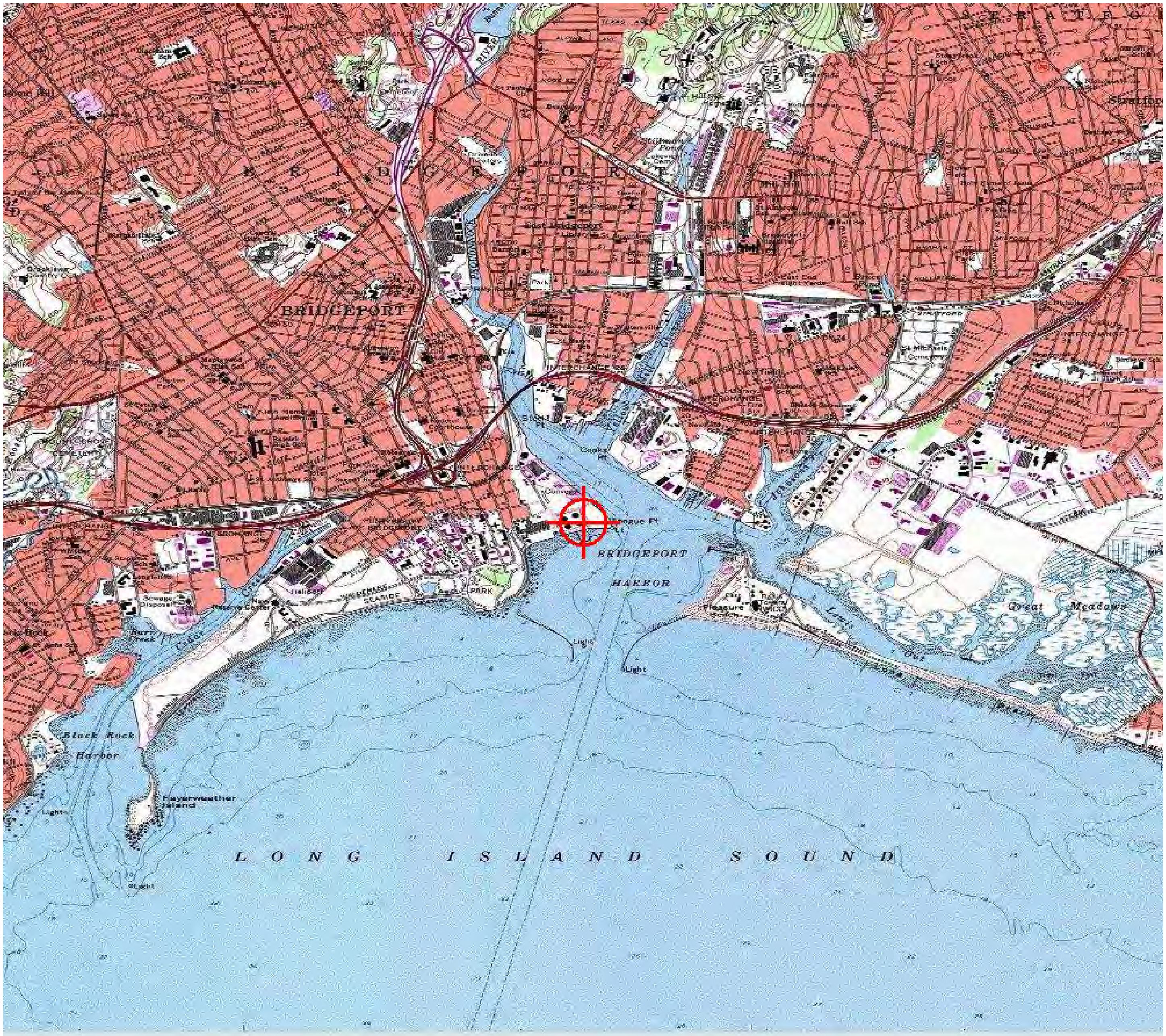
The cumulative impact of the proposed stack, when combined with other proposed and existing structures, is not considered to be significant. Study did not disclose any adverse effects on existing or proposed public-use or military airports or navigational facilities, nor does the proposal affect the capacity of any known existing or planned public-use or military airport.

Therefore, it is determined that the proposed stack would not have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on any air navigation facility and would not be a hazard to air navigation as long as all conditions written within this determination are met.

Case Description for ASN 2014-ANE-2323-OE

PSEG Power Connecticut LLC is proposing to construct a combined cycle electric generating facility (Bridgeport Unit 5) at the site of its existing Bridgeport Harbor Station. The project?s proposed exhaust stack is proposed at 300 feet above the proposed site design grade of 16 feet AMSL.

TOPO Map for ASN 2014-ANE-2323-OE



Sectional Map for ASN 2014-ANE-2323-OE

Attachment C

Exhaust Plume Analysis prepared by AKRF
Dated May 11, 2016

Bridgeport Harbor Station Combined Cycle Unit No. 5

Exhaust Plume Analysis Using FAA/MITRE Corporation Exhaust Plume Analyzer

Summary of Study Methodology and Results

PSEG Power Connecticut, LLC
Bridgeport Harbor Station
Bridgeport, CT

Prepared by AKRF, Inc. for
PSEG Power Connecticut, LLC

AKRF, Inc.
307 Fellowship Road
Suite 214
Mt. Laurel, NJ 08054

May 11, 2016

Exhaust Plume Analysis Using FAA/MITRE Corp. Exhaust Plume Analyzer
Summary of Study Methodology and Results

The FAA / MITRE Corp. Exhaust Plume Analyzer[1] ("Analyzer") was used to estimate the vertical and radial extent of conditions above the PSEG Bridgeport Harbor Station proposed Unit No. 5 stack that could produce either severe turbulence or an aircraft upset condition as a result of stack emissions of a buoyant plume. The Analyzer is a computer simulation model which calculates the turbulent intensity and potential effects of the vertically discharged plume in the airspace near the stack exit under actual meteorological conditions. Computations are performed for each individual hour of meteorological data. The model results are a function of meteorology, stack height and diameter, stack flow and temperature and aircraft type. The Analyzer includes aircraft parameters for four different types of aircraft, "Light Sport", "Light General Aviation", "Business Jet" and "Narrow-Body Jet". All four available types of aircraft were run. The model predicts the probability of occurrence of plume conditions which each of the various aircraft types would experience as either severe turbulence or which would produce an aircraft upset condition, as a function of horizontal and vertical distance from the stack.

The Analyzer software utilizes multi-layer meteorological data from a gridded prognostic model. In execution, the software selects the meteorological input for the location of the stack from a 12 terabyte (TB) meteorological database stored on a remote server managed by MITRE Corporation. A three-year period of analysis is recommended by the model developer to assure that all meteorological conditions are reasonably accounted for in a statistical sense. For the present analysis, a three year period of meteorological data beginning January 1, 2011 and ending December 31, 2013 is used. The stack coordinates used for the extraction of data from the gridded meteorology are latitude: 41.166594526 and longitude: -73.181238377.

The criterion used in the Analyzer for severe turbulence is a vertical acceleration of 1g or greater. The criterion used to determine whether an aircraft upset would occur is the vertical gust required to reach a 45° wing tilt for an aircraft already executing a turn with a 25 ° wing tilt with the gust caused by the stack plume hitting the wing tip.

The stack analyzed is the Heat Recovery Steam Generator ("HRSG") stack associated with the proposed Unit No. 5 combined cycle plant to be located at the southern end of the Bridgeport Harbor Station site. The Igor I. Sikorsky Memorial Airport (airport designator "BDR") is located slightly south of due east from the proposed stack. The proposed stack will be located to the left of the westward extension of the Runway 29 centerline and in excess of approximately 2.4 miles (2.1 nautical miles) from the departure end of that runway. Figure 1 shows the relative locations of the stack and the airport. Exhibit 1 is the FAA air navigation guidance that indicates that the existing stack for Bridgeport Harbor Station Unit 3 (approximately 497 feet above ground level) is 275 feet left of the centerline of runway 29 at BDR. The proposed stack will be approximately 1500 additional feet to the left of the runway centerline.

The stack information required by the Analyzer is stack height above sea level, stack inside diameter, exit velocity and exit gas temperature. Since the stack exit gas velocity and temperature for the proposed Unit No. 5 differ by fuel type and ambient weather condition, four cases were run. Two cases were run for the summer condition (100° F turbine air inlet temperature) – one for natural gas fuel and

[1] Exhaust Plume Analyzer is licensed to AKRF, Inc. by MITRE Corporation. The Analyzer is a copyrighted work of the MITRE Corporation with a limited distribution and was produced for the U.S. Government under Contract Number DTFAQA-10-C-00080. Version 1.0.1.1 was used in this analysis. See Exhibit 2.

the other for Ultra Low Sulfur Distillate ("ULSD"). Note that the use of ULSD during the summer is unlikely, but possible. Two cases were also run for the winter condition (0° F turbine air inlet temperature); again one firing natural gas and the other ULSD. The supplemental firing system (duct burner) was assumed to be in operation for all cases. Table 1 summarizes the input to the Analyzer for the four runs.

Table 1

Parameter	Units	Summer Natural Gas GE Case 2.1	Summer ULSD GE Case 2.1	Winter Natural Gas GE Case 8.1B	Winter ULSD GE Case 8.1
Turbine Load	percent	100	100	100	100
Inlet Temp.	degrees F	100	100	0	0
Duct Burners	status	On	On	On	On
Stack Height	feet above msl	317	317	317	317
Stack ID	feet	21	21	21	21
Stack Exit Gas Velocity	ft/sec	76.82	81.86	79.89	84.07
Stack Exit Gas Temp.	degrees F	194	207	180	184

The Analyzer software produces results in image form only[2]. The output from the analyzer for a given set of stack parameters consists of seven plots. For each aircraft type except "Light Sport", two plots are produced: one depicts the probability of encountering a plume condition which would produce a vertical acceleration equivalent to that associated with severe turbulence. The other depicts the probability of encountering a plume condition which could produce an upset. Only the severe turbulence plot is produced for the "Light Sport" aircraft type. The probabilities are calculated based on the results of a model simulation run on each of 25,108 valid hours of meteorological data.

Each plot is a vertical cross-section through the stack location showing color-coded, filled contours depicting various levels of probability as a function of the radial distance from the stack (horizontal) and the vertical distance above the stack. Distance scales are provided on the ordinate and axis. Note that the vertical and horizontal scales are auto-generated by the software and differ from each other. The vertical scale displayed for the ULSD summer case differs from the vertical scale for other cases. A set of lines consisting of a vertical and horizontal line have been superimposed on each plot to facilitate reading the maximum extent of the 1 in 10,000 probability distances for each case. That information has also been added to a text box placed in the lower right hand corner of each plot. The horizontal and

---

[2] The Analyzer also produces a short text file "Completion Messages.TXT" containing brief computer statistics and file path for the analysis. For instance, the contents of the "Completion Messages" file for the ULSD, 0 F case is as follows:

25100 / 26304 possible hours of weather data processed in 21503 seconds.
Saved downloaded weather data to "C:\Exhaust Plume Analyzer\exhaust plume weather data – lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv".
Processed 25108 hours (i.e., instances in time) of weather data successfully.
1196 / 26304 hours of weather data were missing.
Processing completed in 5h58m26s.
Plots generated. Simulation run complete.

vertical distances from the stack top that are displayed in the text box have been rounded to the nearest whole scale division.

Figures 2 through 8 show available severe turbulence and upset probabilities for each type of aircraft for the Unit No. 5 summer case firing natural gas. As mentioned earlier, the Analyzer does not produce an "upset condition" probability for the light sport category.

Figures 9 through 15 provide similar information for the summer case if Unit No. 5 were to fire ULSD in summer conditions.

Finally, Figures 16 through 22 provide information for the natural gas winter case and 23 through 29 provide results for the ULSD winter case.

For comparison purposes, the Analyzer has also been run for the Bridgeport Harbor Station Unit No. 3 stack. The location of the Unit 3 stack is shown in Figure 1. The physical height of this stack is 498 feet above the local terrain elevation. The stack is shown as 511 feet above sea level on FAA charts and 511 feet was used as the stack height in the Analyzer. The stack inside diameter is 14 feet, the efflux temperature is 260 °F and the exit velocity is 127.22 ft/sec. The stack conditions are representative of full load on this unit. The previously discussed set of seven plots for the four aircraft types was generated for this stack. These plots are provided in Figures 30 through 36. Again, the plots are marked with the vertical and horizontal lines depicting the spatial extent of the one in 10,000 probability and the summary text box is provided in the lower left corner of the plot. With minor variations, the plots for the current operating unit area similar to those provided for the proposed new combined cycle plant. These conditions exist today when the existing unit is in service.

For reference purposes, all plots produced by the Analyzer are provided again in the Appendix just as output from the Analyzer, without the text box or markings. They are located within the Appendix in the same order they appear as Figures in the body of the report.

Figure 1
Relationship of Proposed Bridgeport Harbor Station
Unit No. 5 Combined Cycle HRSG Stack Location
to Igor I. Sikorsky Memorial Airport

Figures 2 through 8

GE Case 2.1 – Natural Gas – Summer

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure 2

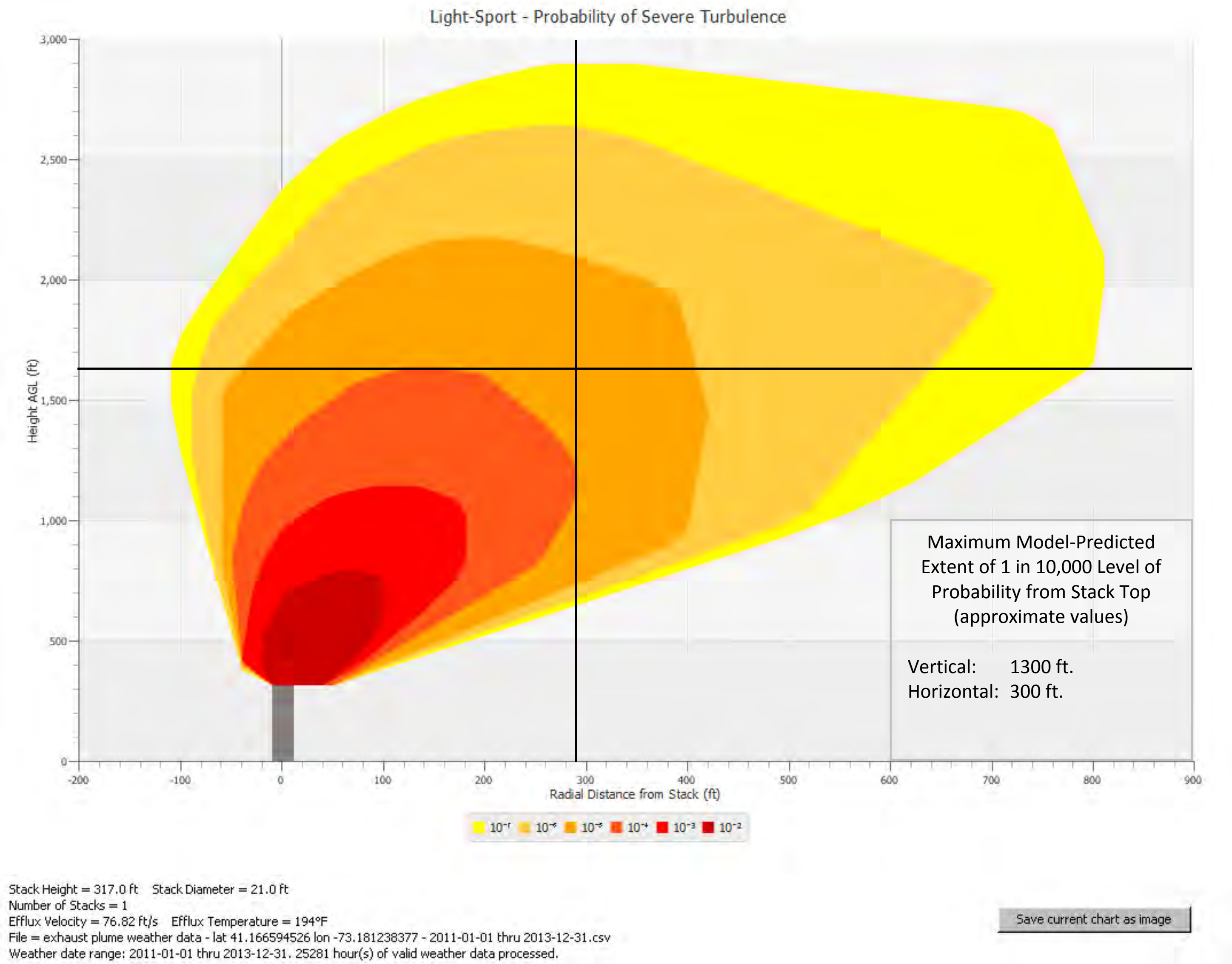

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 1300 ft.
Horizontal: 300 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 3

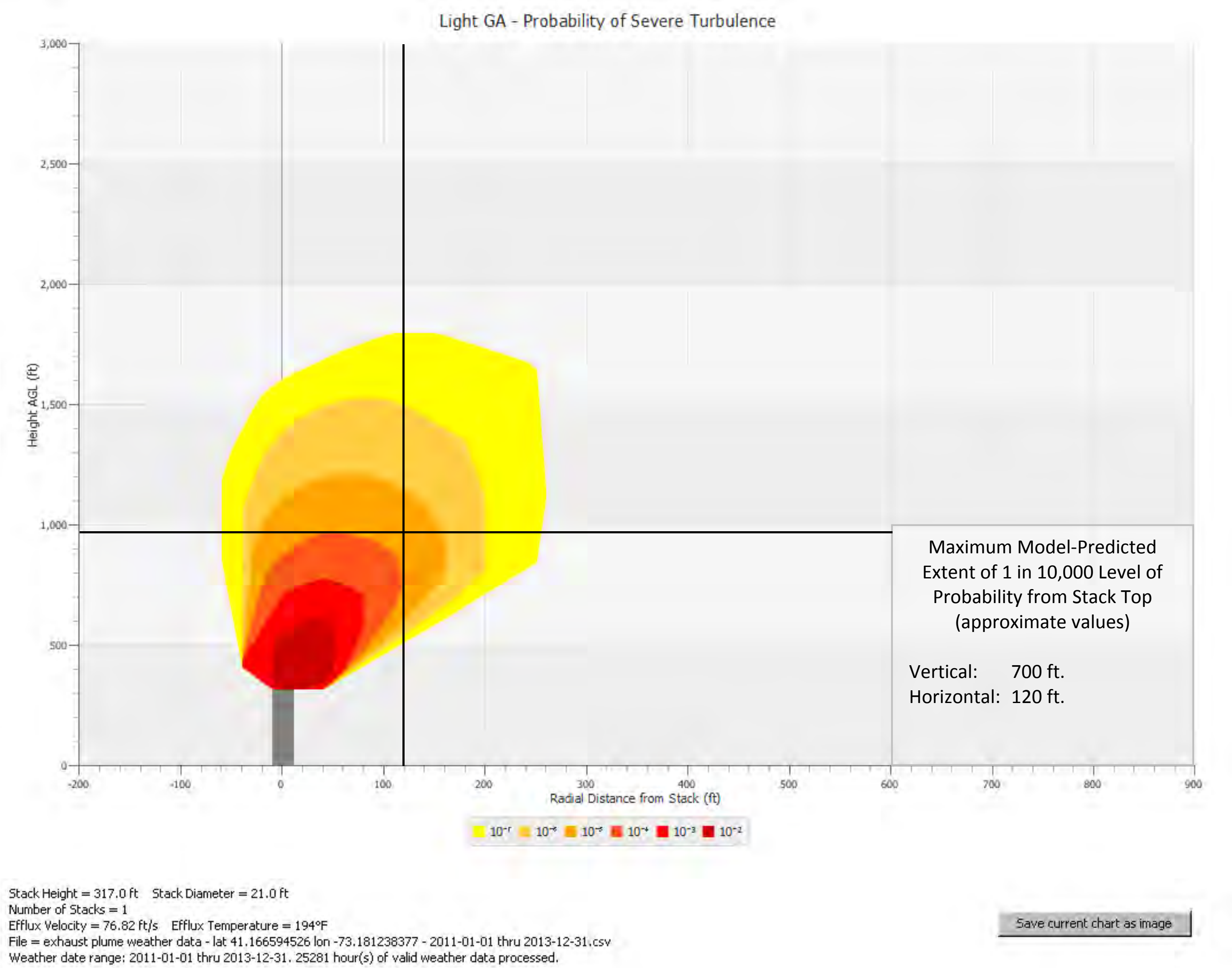

Light GA - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 700 ft.
Horizontal: 120 ft.
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 4

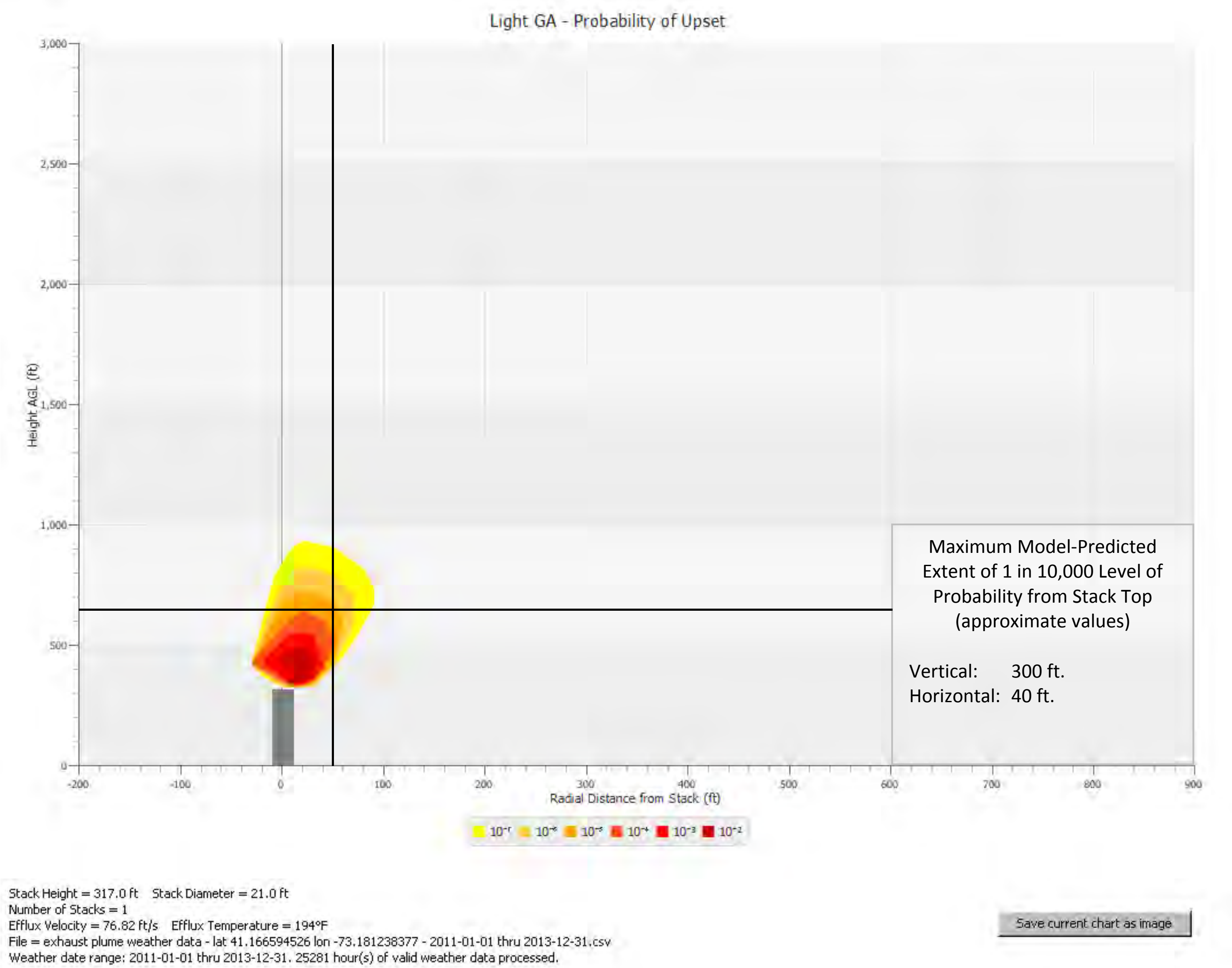
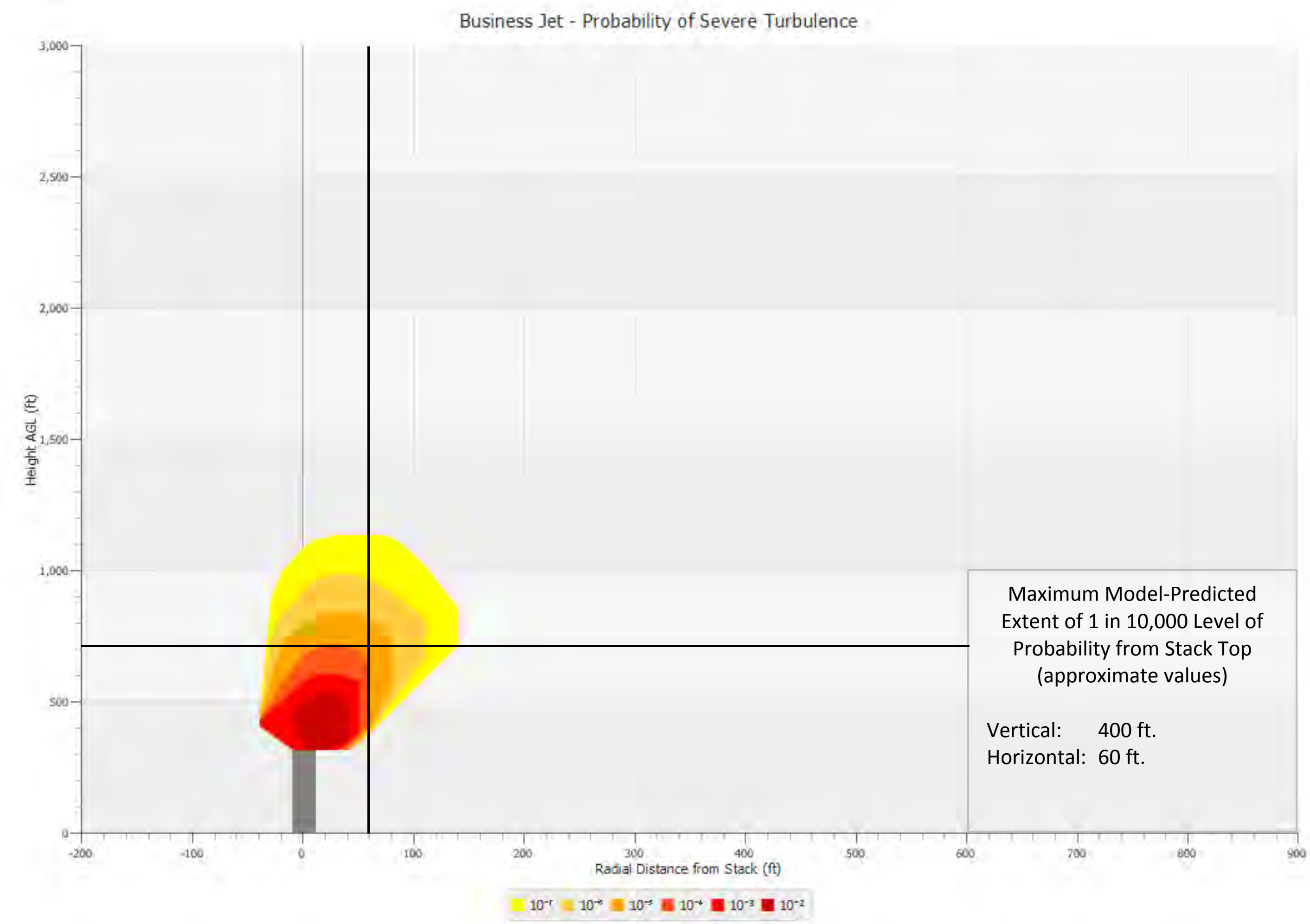

Light GA - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 300 ft.
Horizontal: 40 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 5



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s   Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 6

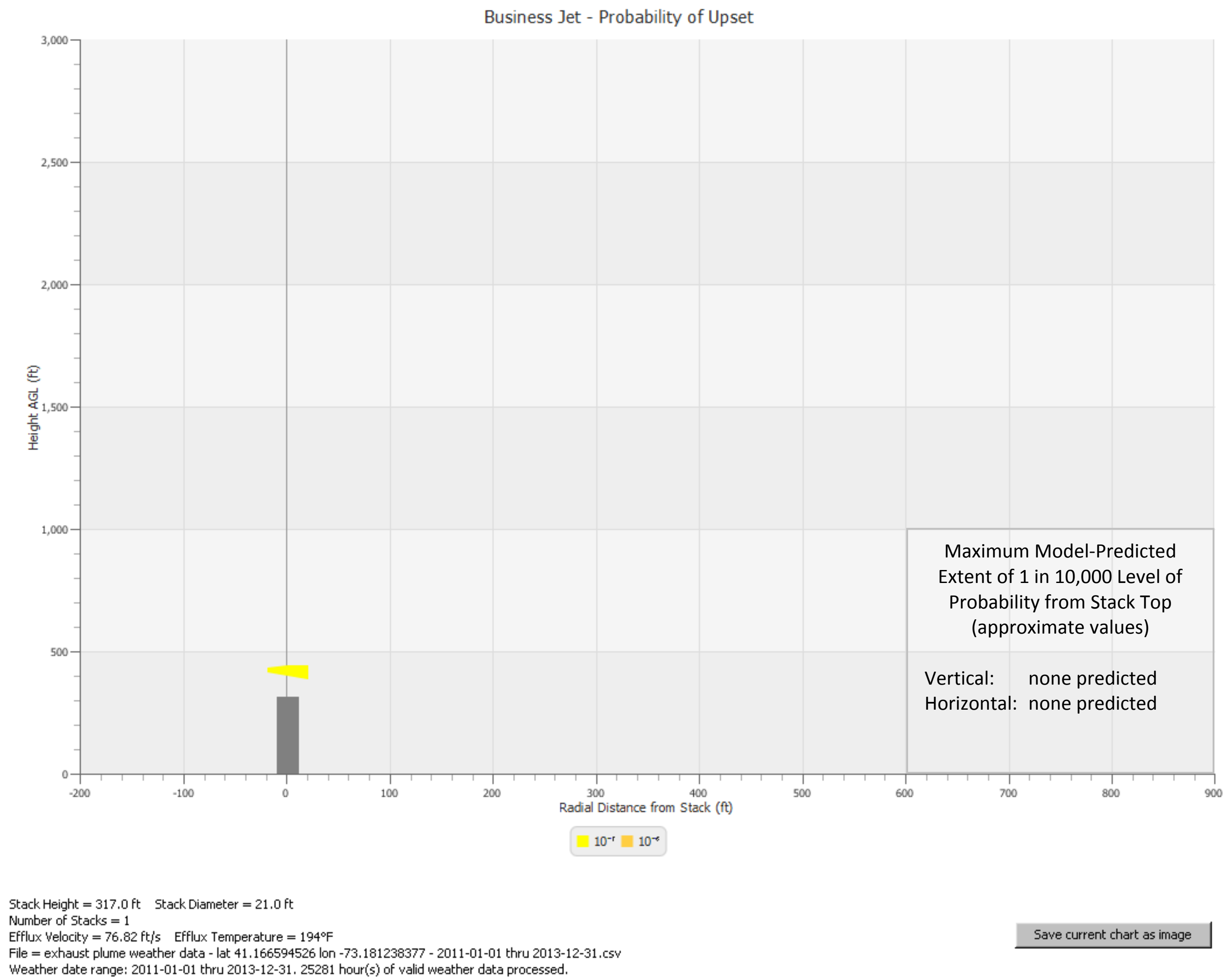

Business Jet - Probability of Upset
Height AGL (ft)
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: none predicted
Horizontal: none predicted
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 7

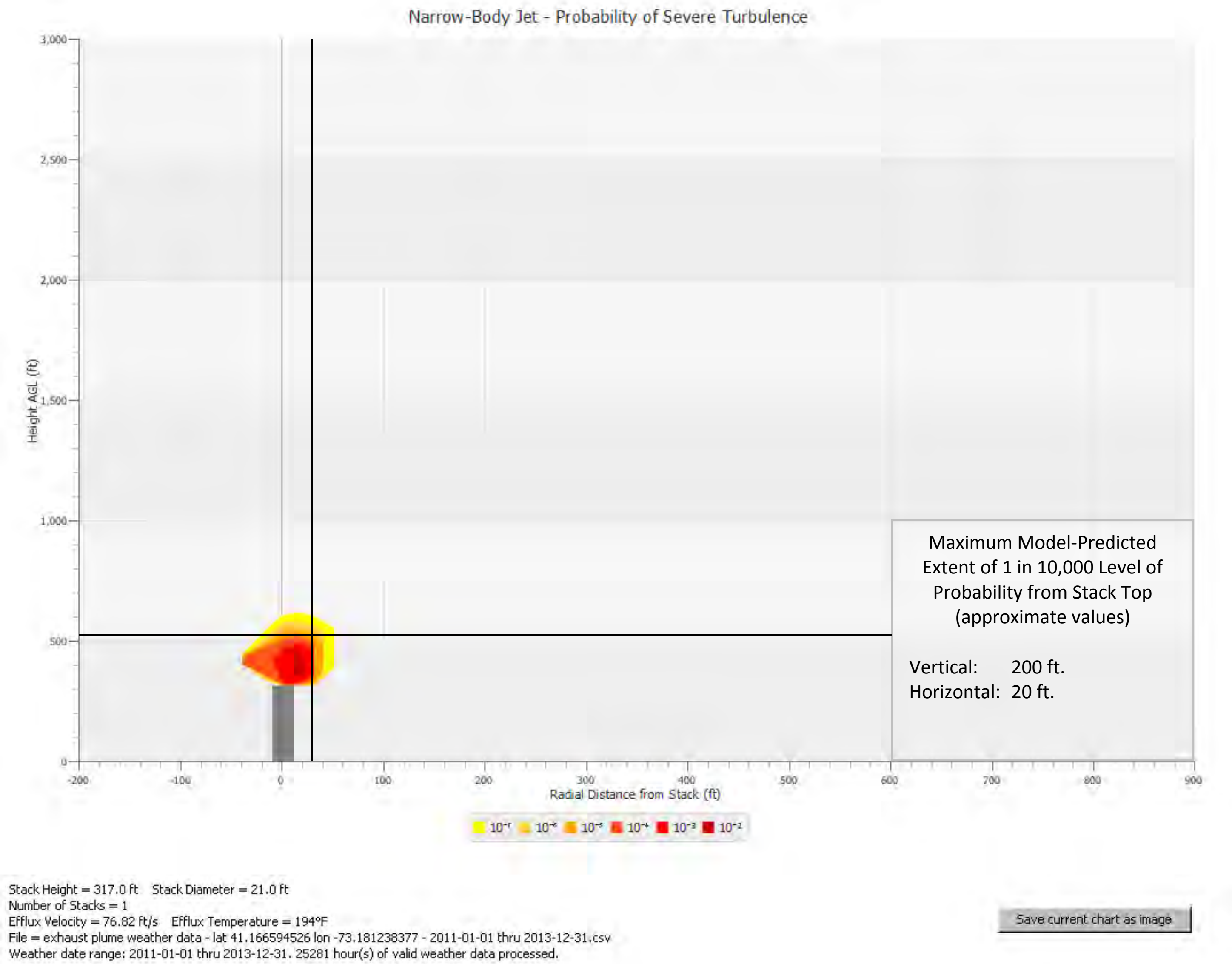
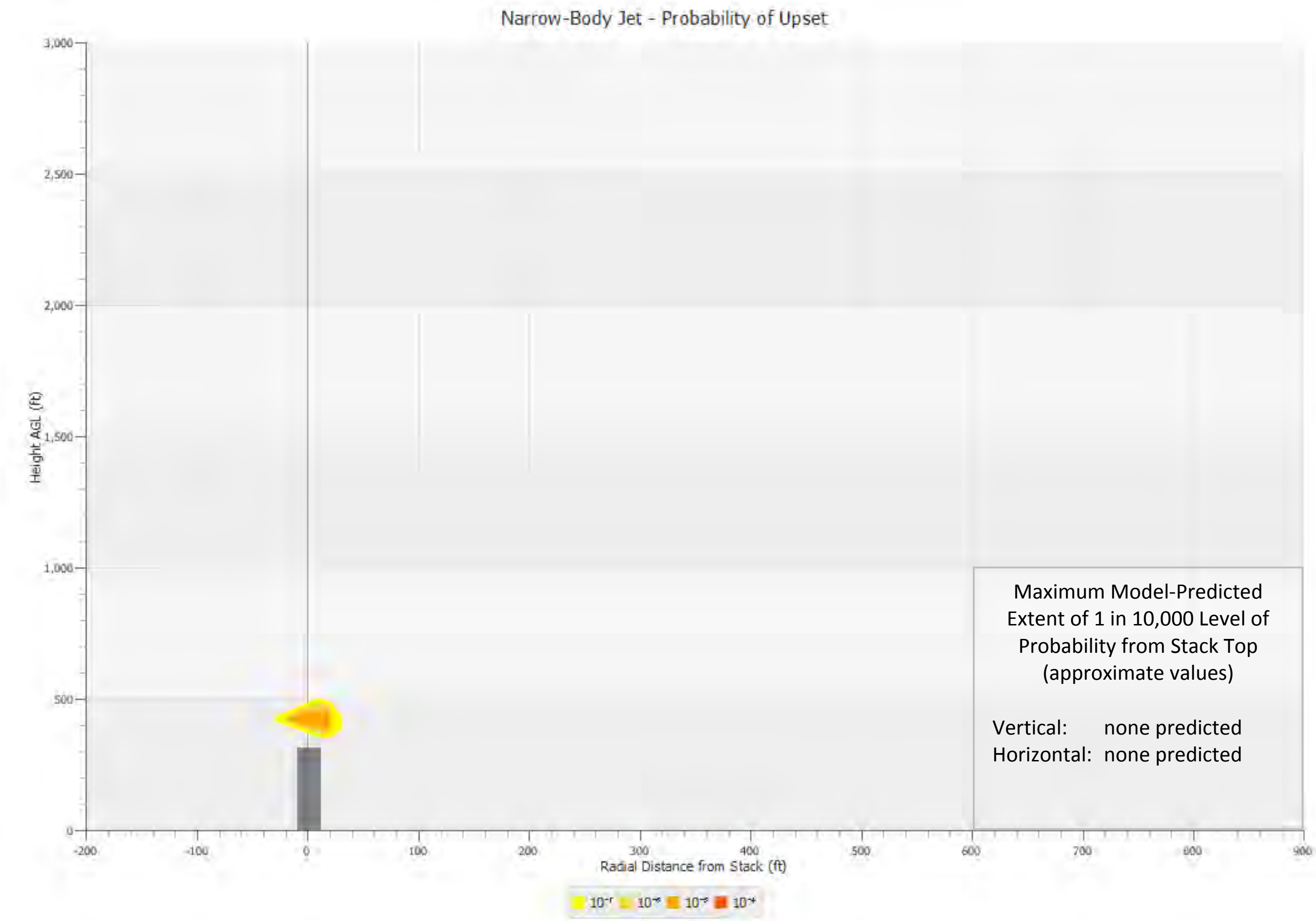

Narrow-Body Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 200 ft.
Horizontal: 20 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 8



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

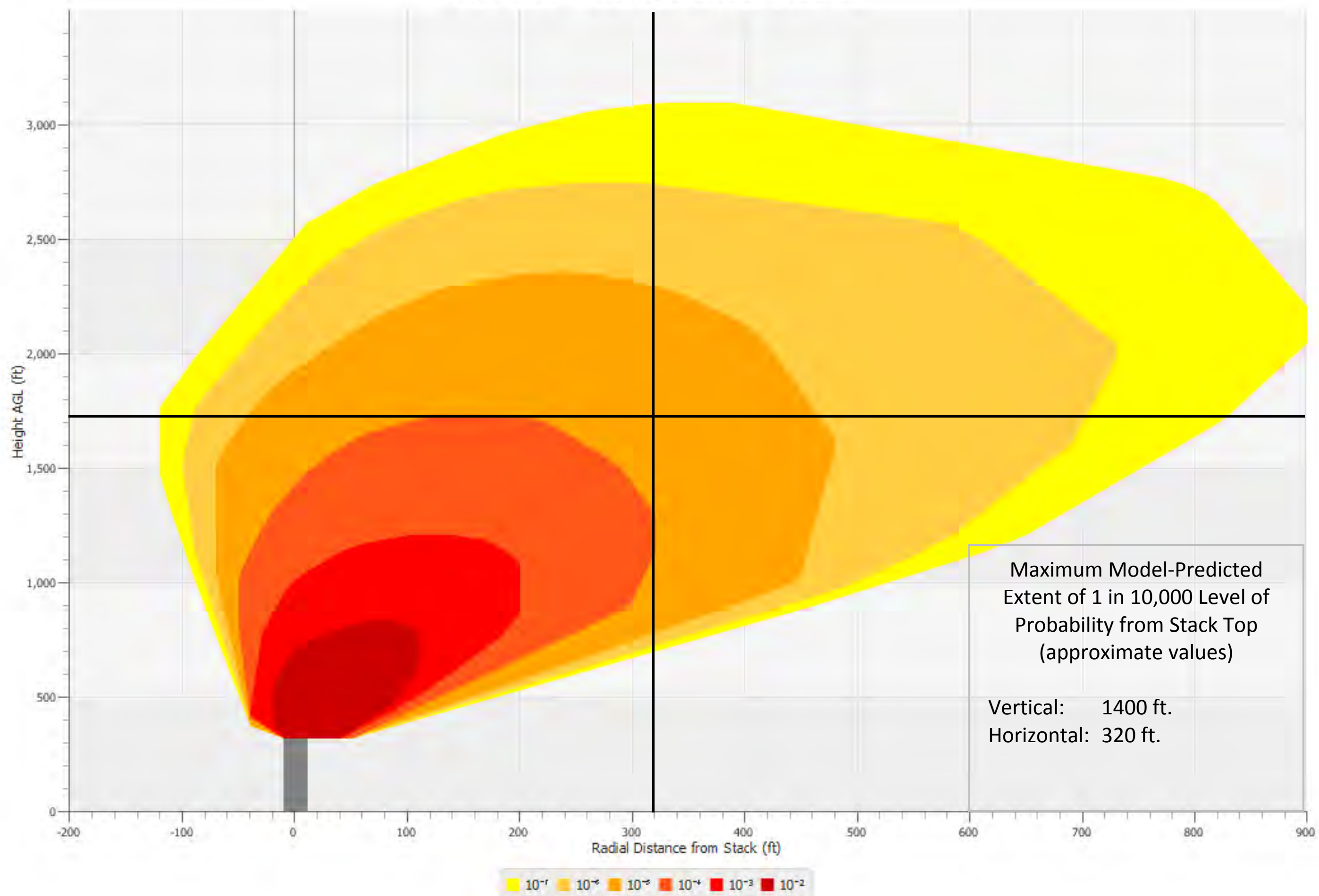
Figures 9 through 15

GE Case 2.1 – ULSD – Summer

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure 9

Light-Sport - Probability of Severe Turbulence



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 10

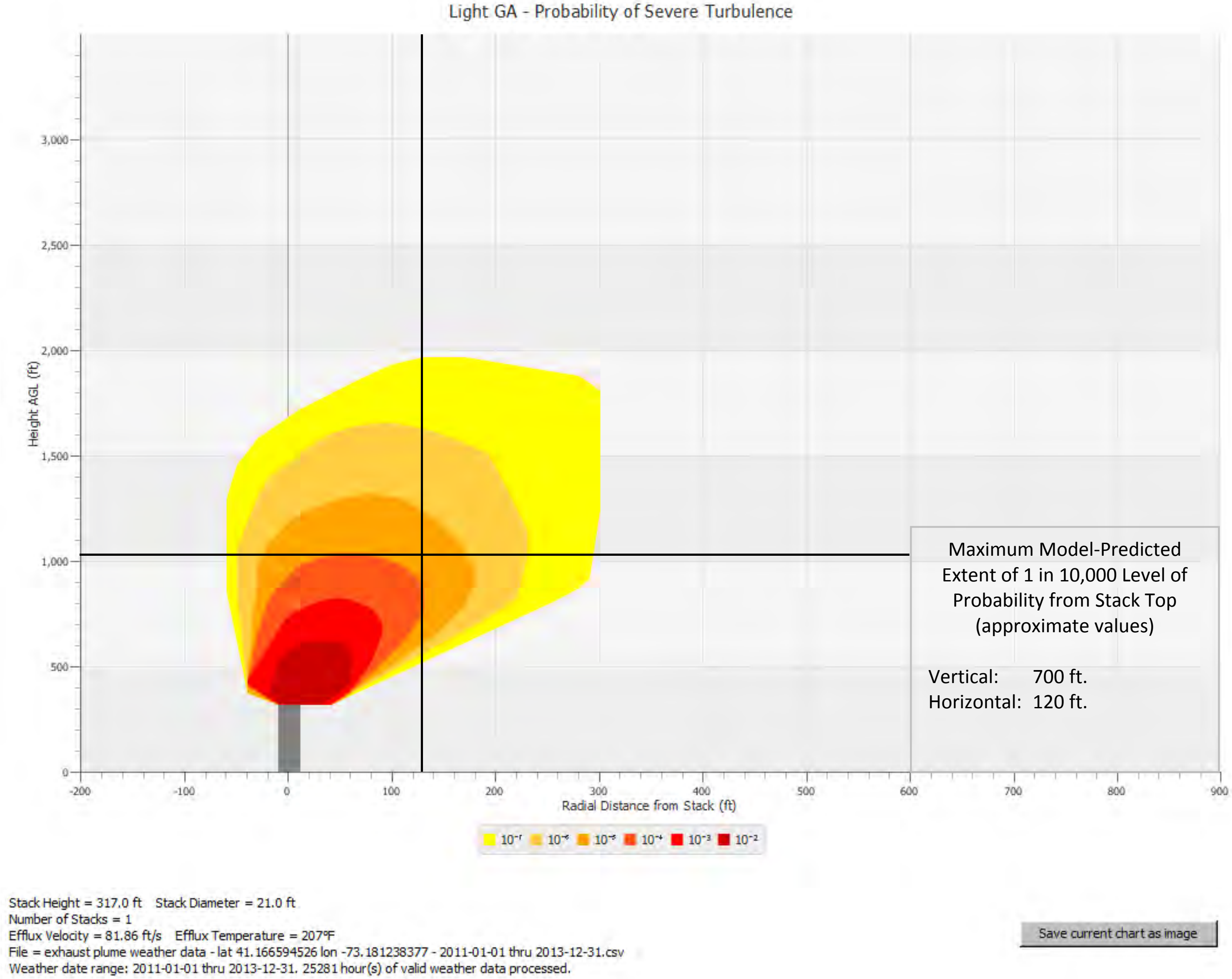

Light GA - Probability of Severe Turbulence
Height AGL (ft)
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 700 ft.
Horizontal: 120 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 11

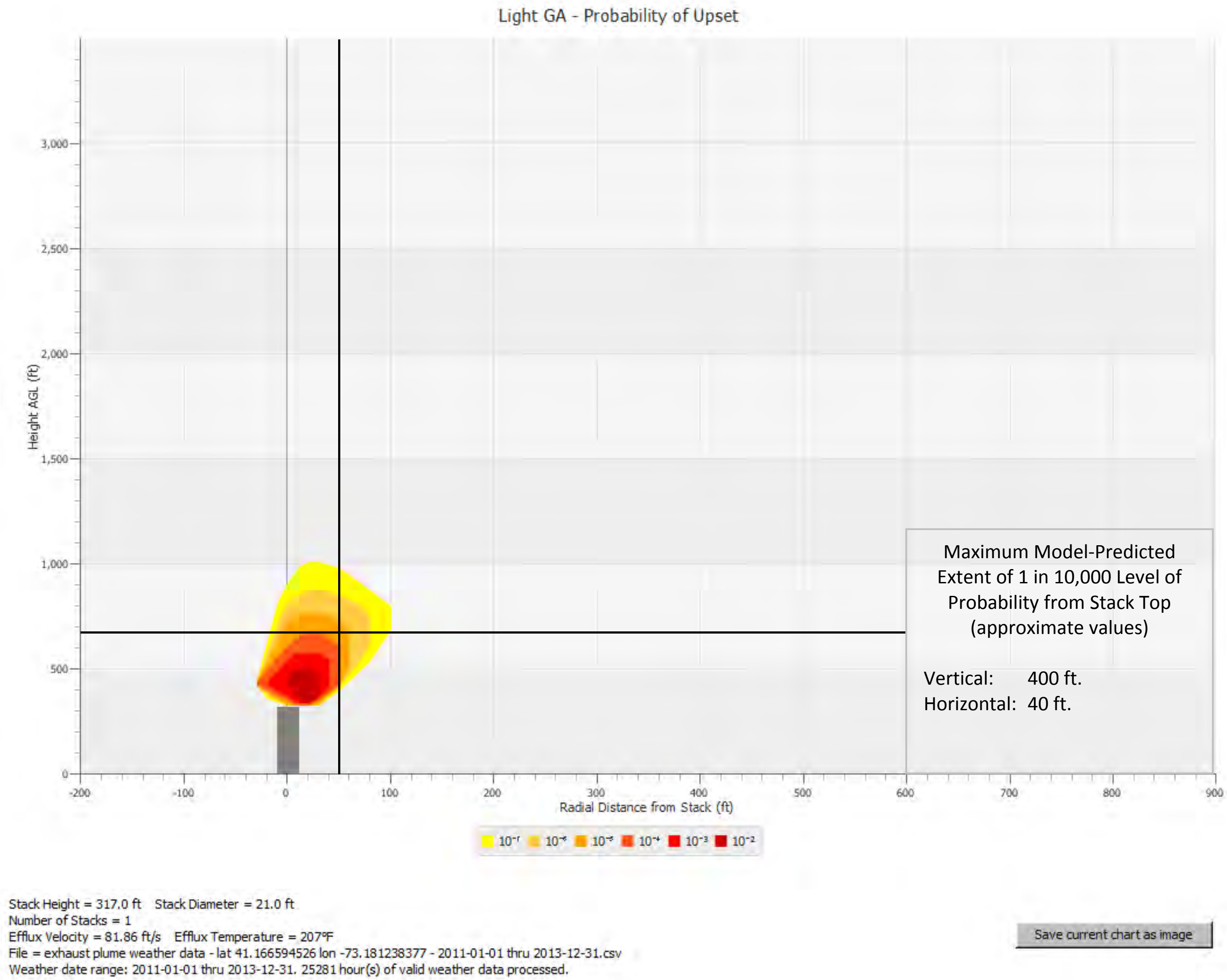

Light GA - Probability of Upset
Height AGL (ft)
Radial Distance from Stack (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 400 ft.
Horizontal: 40 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 12

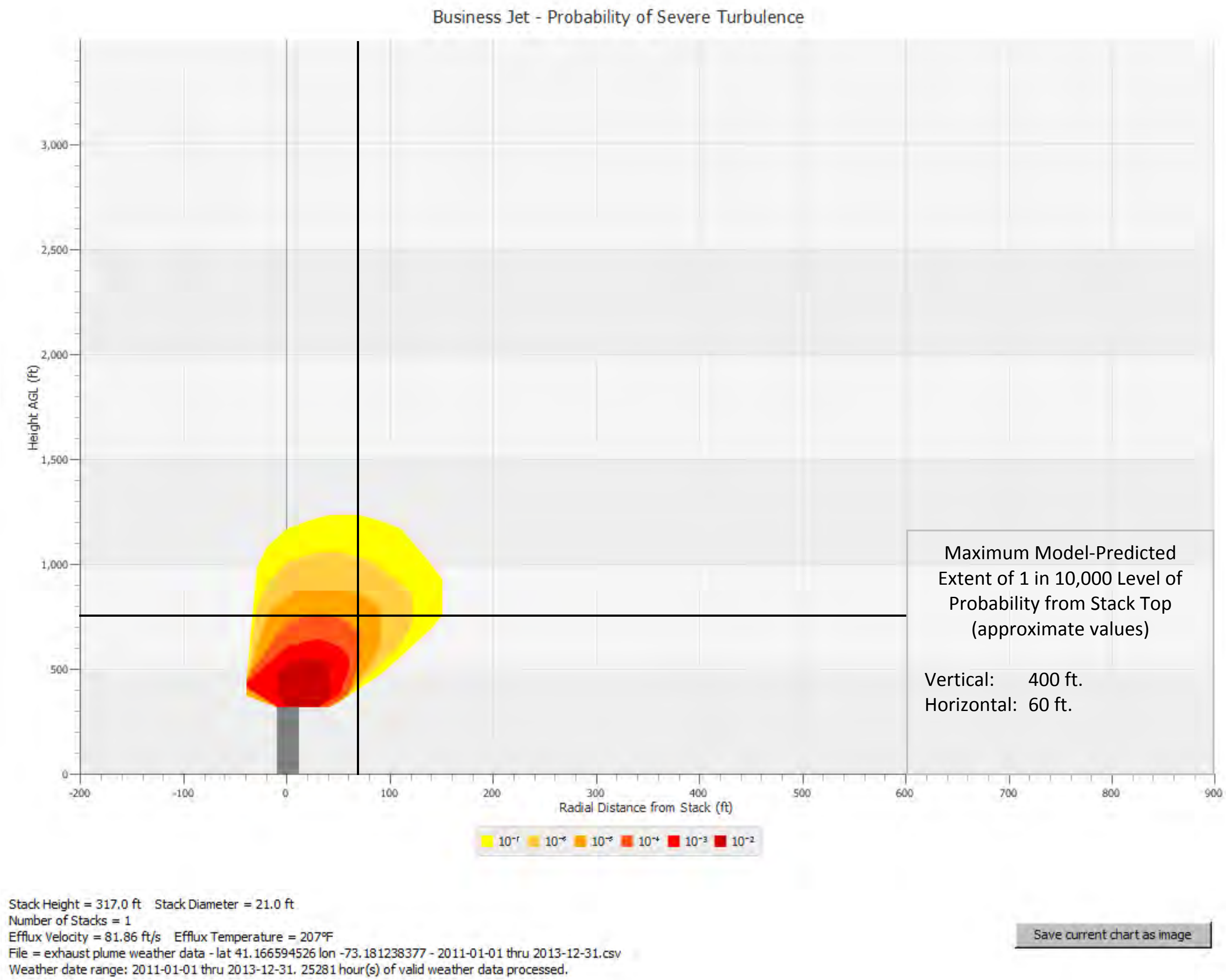
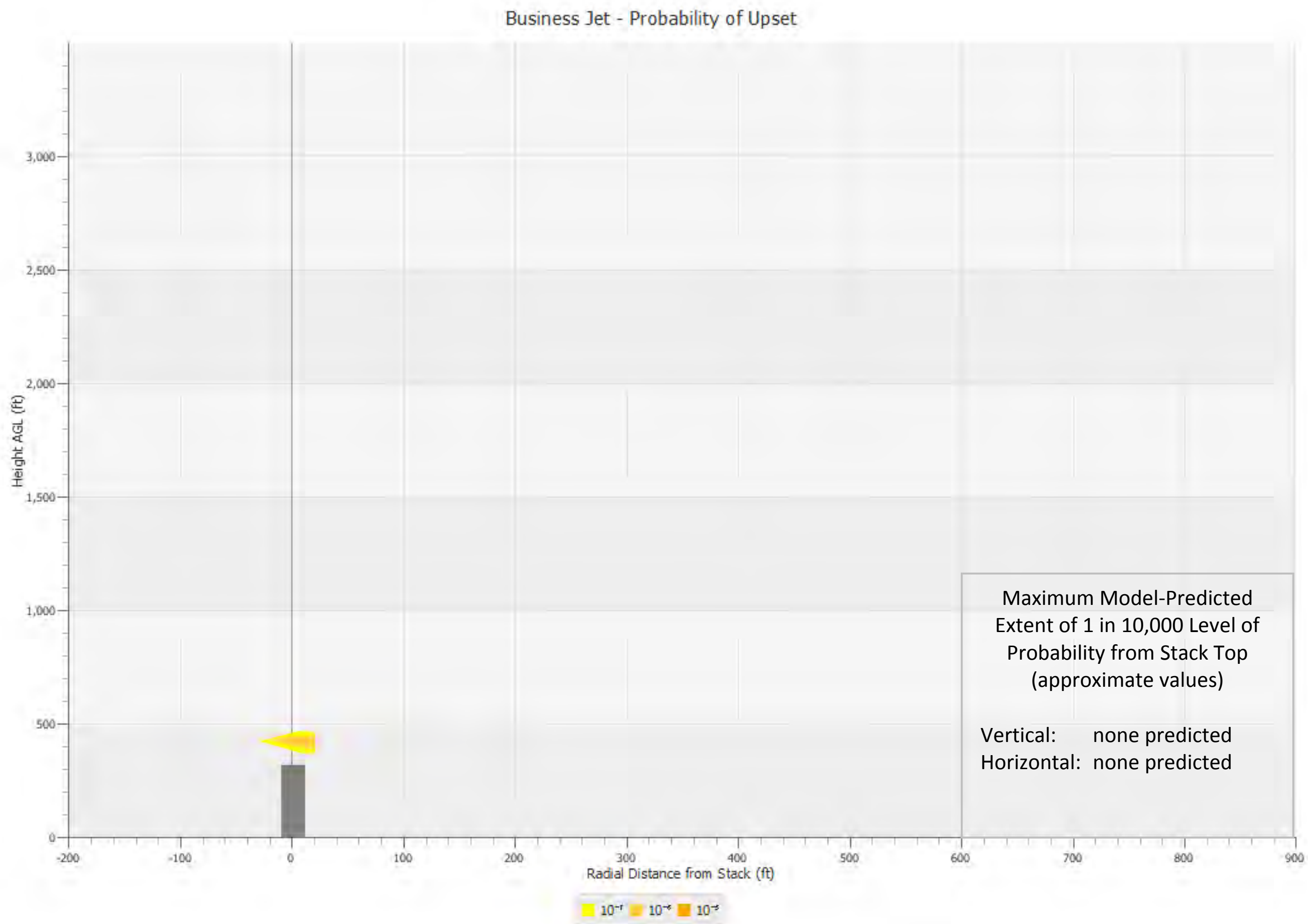

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 400 ft.
Horizontal: 60 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 13



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 14

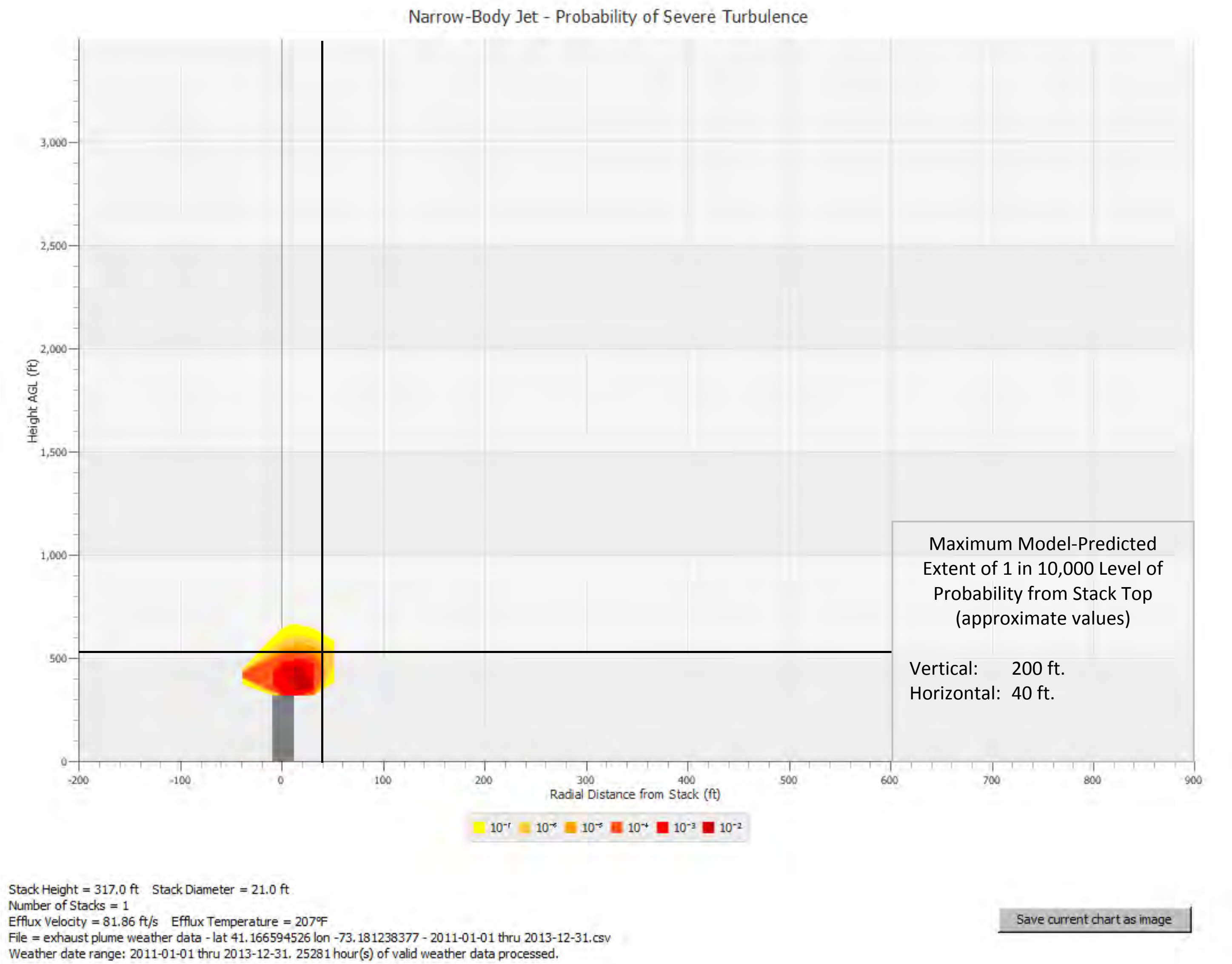
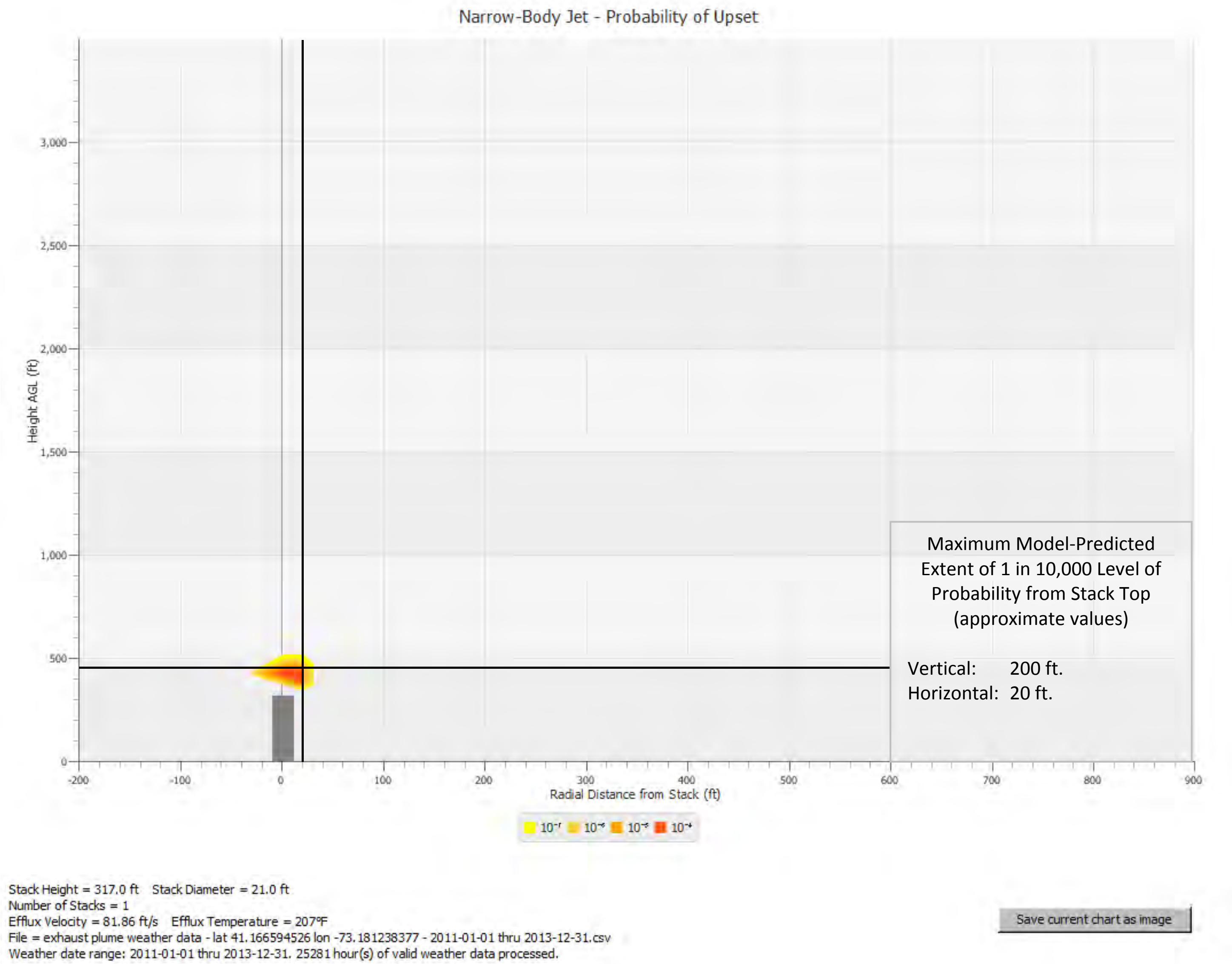

Narrow-Body Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 200 ft.
Horizontal: 40 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 15


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-6}
10^{-5}
10^{-4}
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 200 ft.
Horizontal: 20 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figures 16 through 22

GE Case 8.1B – Natural Gas – Winter

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure 16

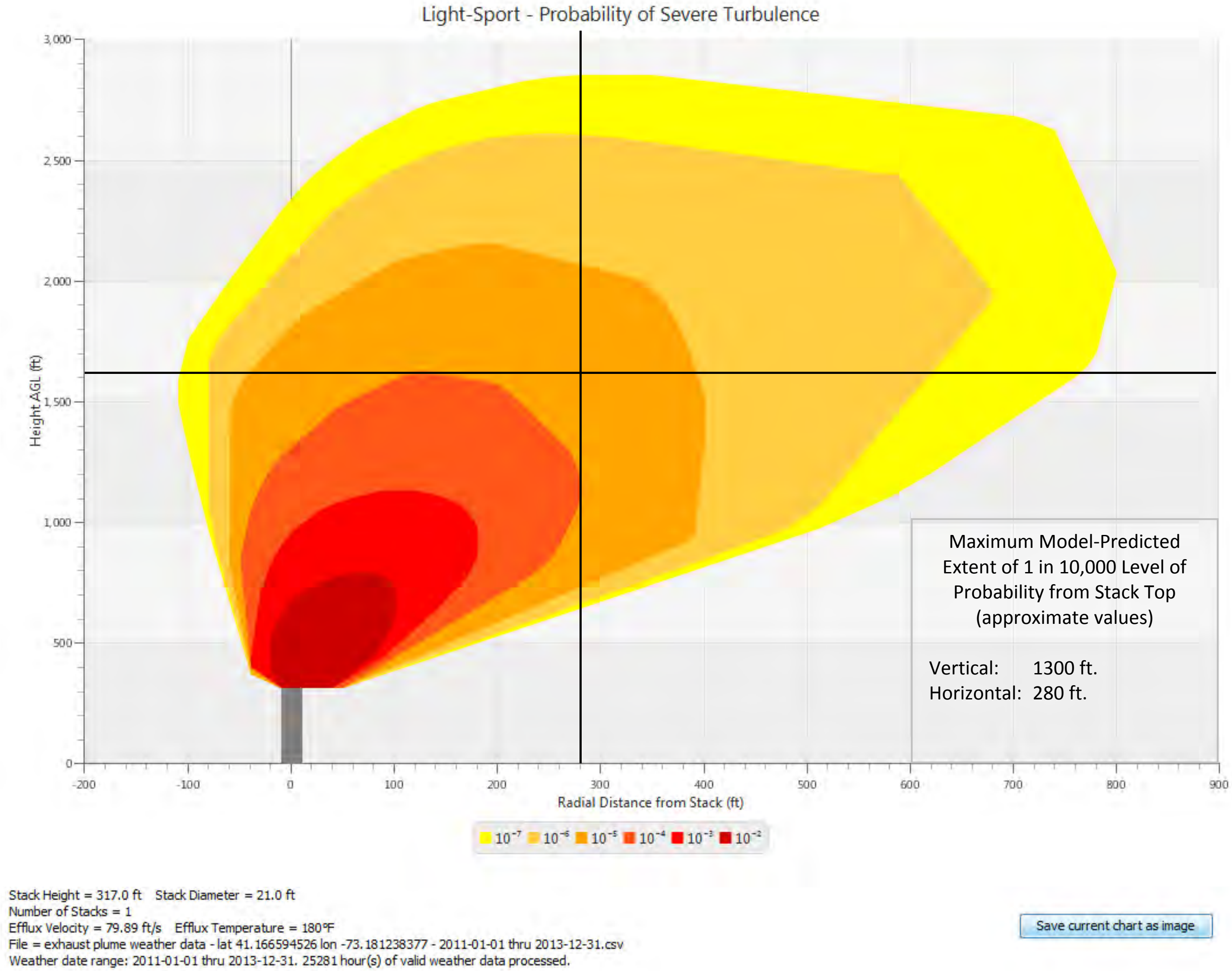
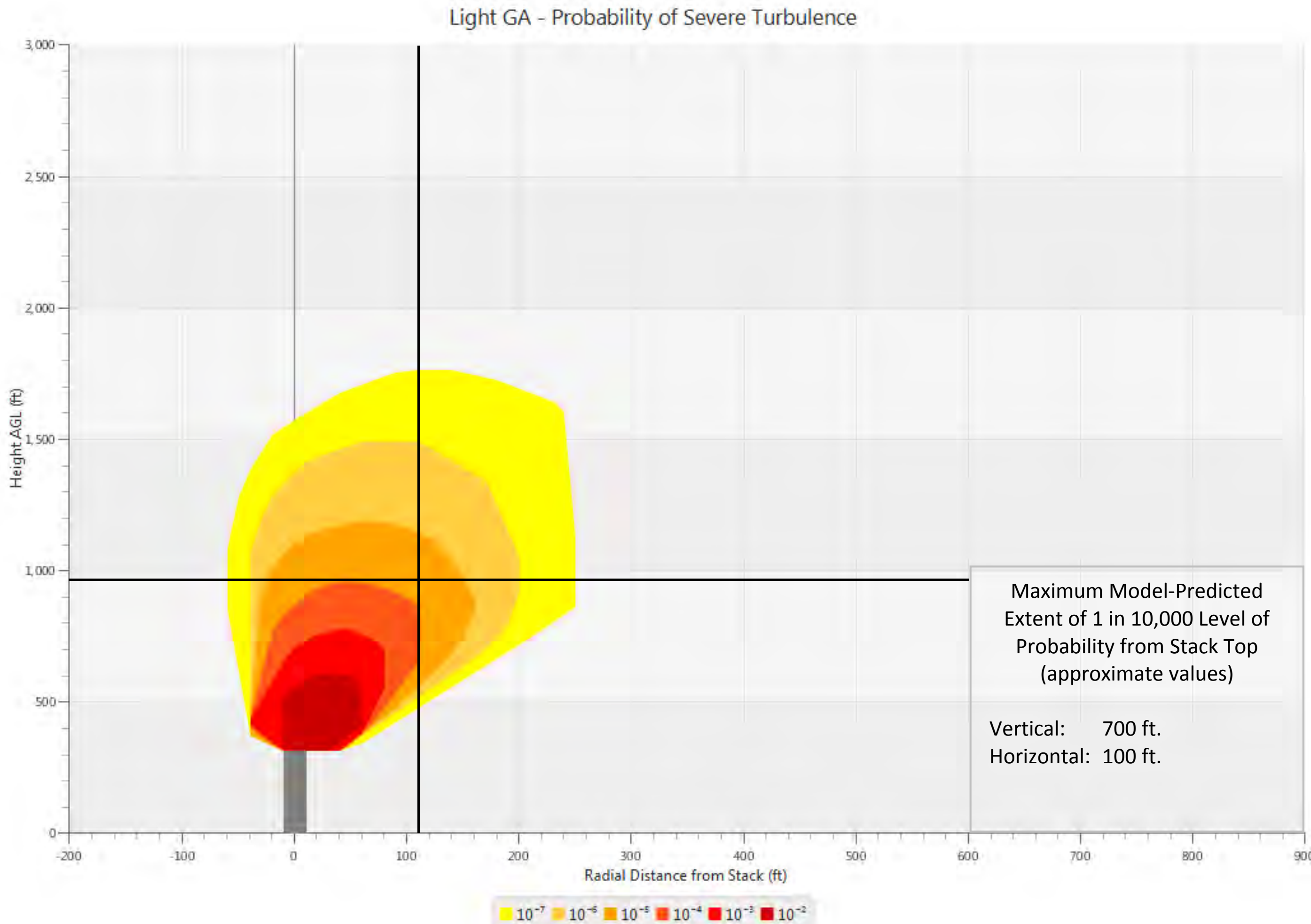

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 1300 ft.
Horizontal: 280 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 17



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 18

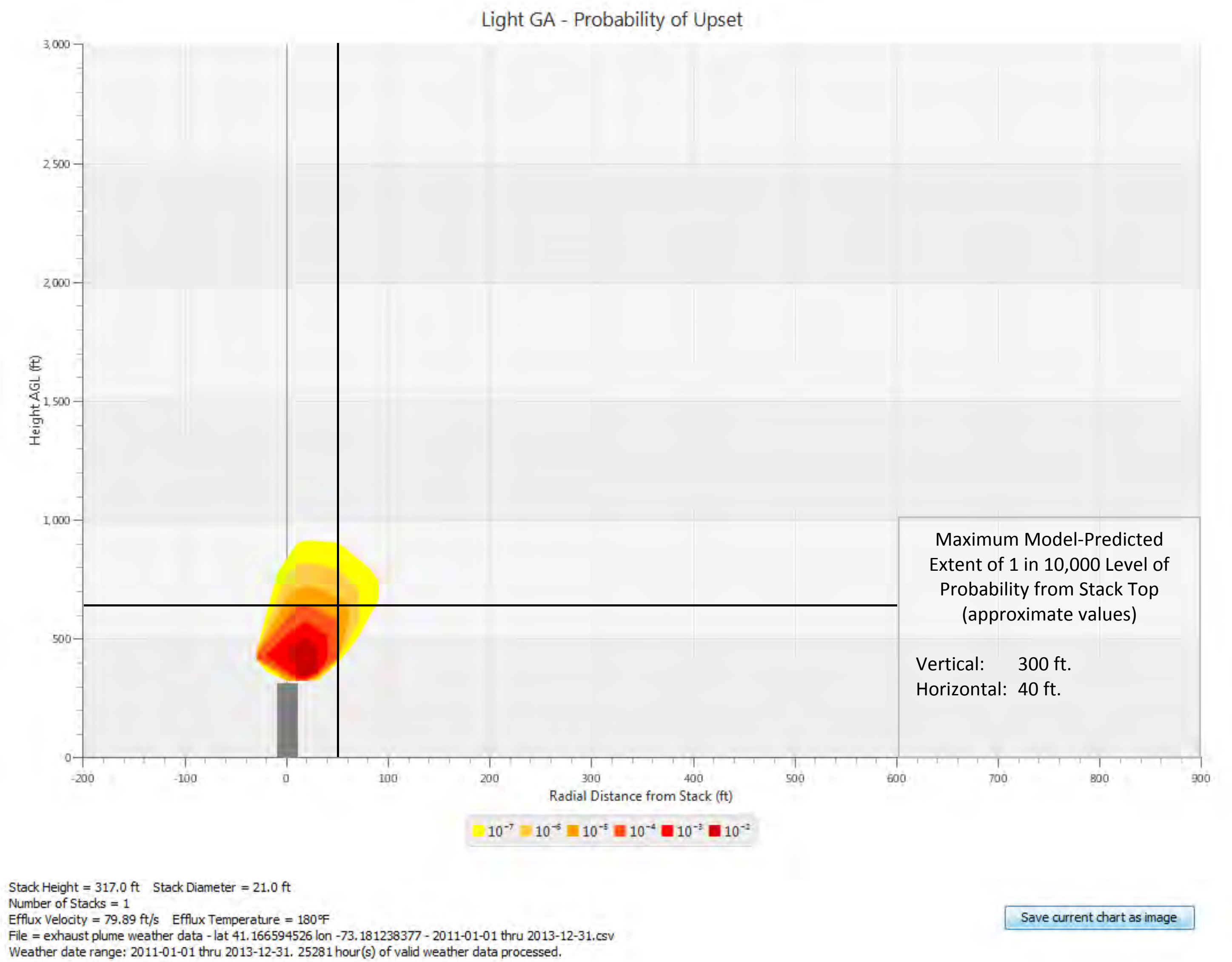

Light GA - Probability of Upset
Height AGL (ft)
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 300 ft.
Horizontal: 40 ft.
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 19

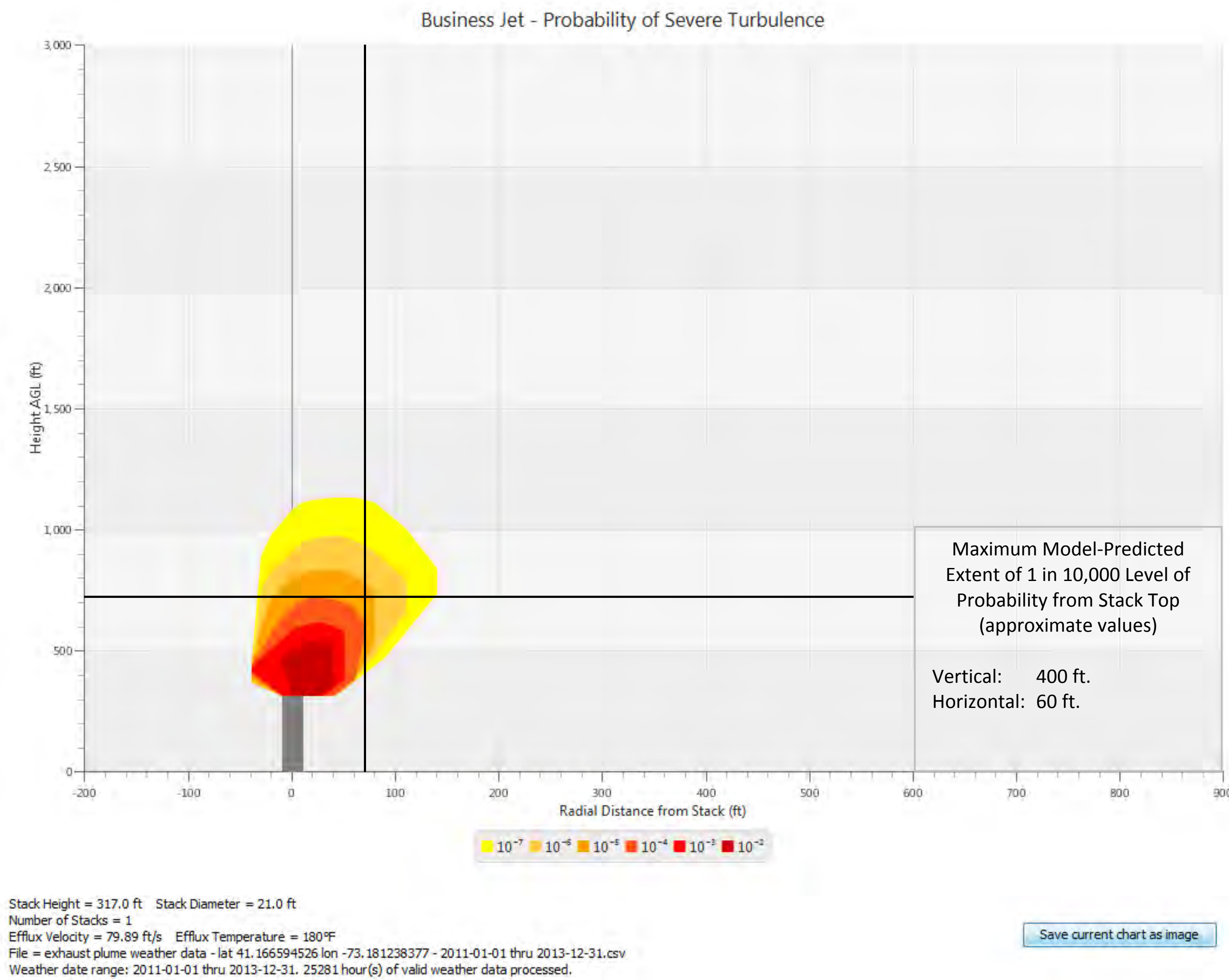

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 400 ft.
Horizontal: 60 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 20

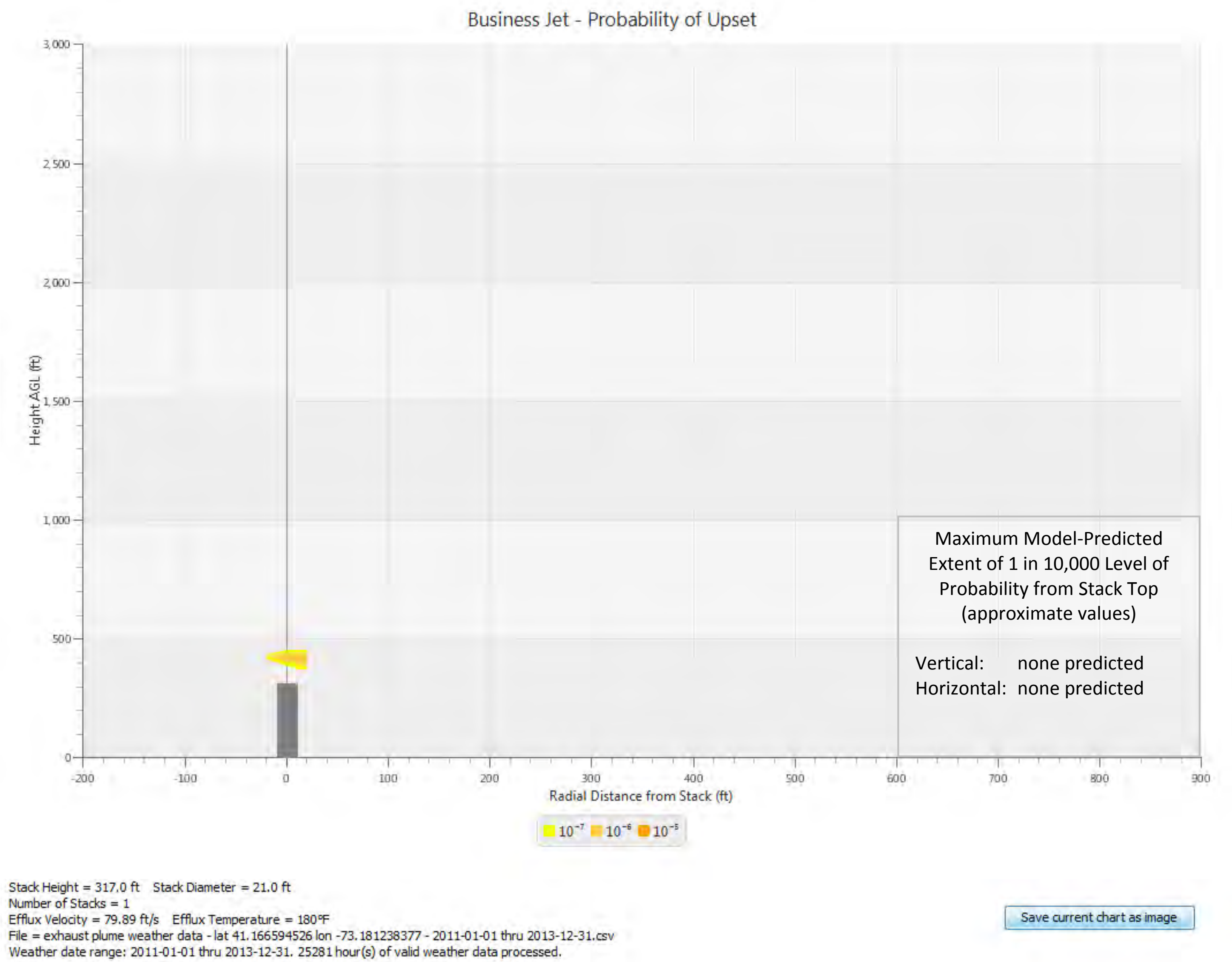

Business Jet - Probability of Upset
3,000
2,500
2,000
1,500
1,000
500
0
Height AGL (ft)
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: none predicted
Horizontal: none predicted
10^{-7} 10^{-6} 10^{-5}
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 21

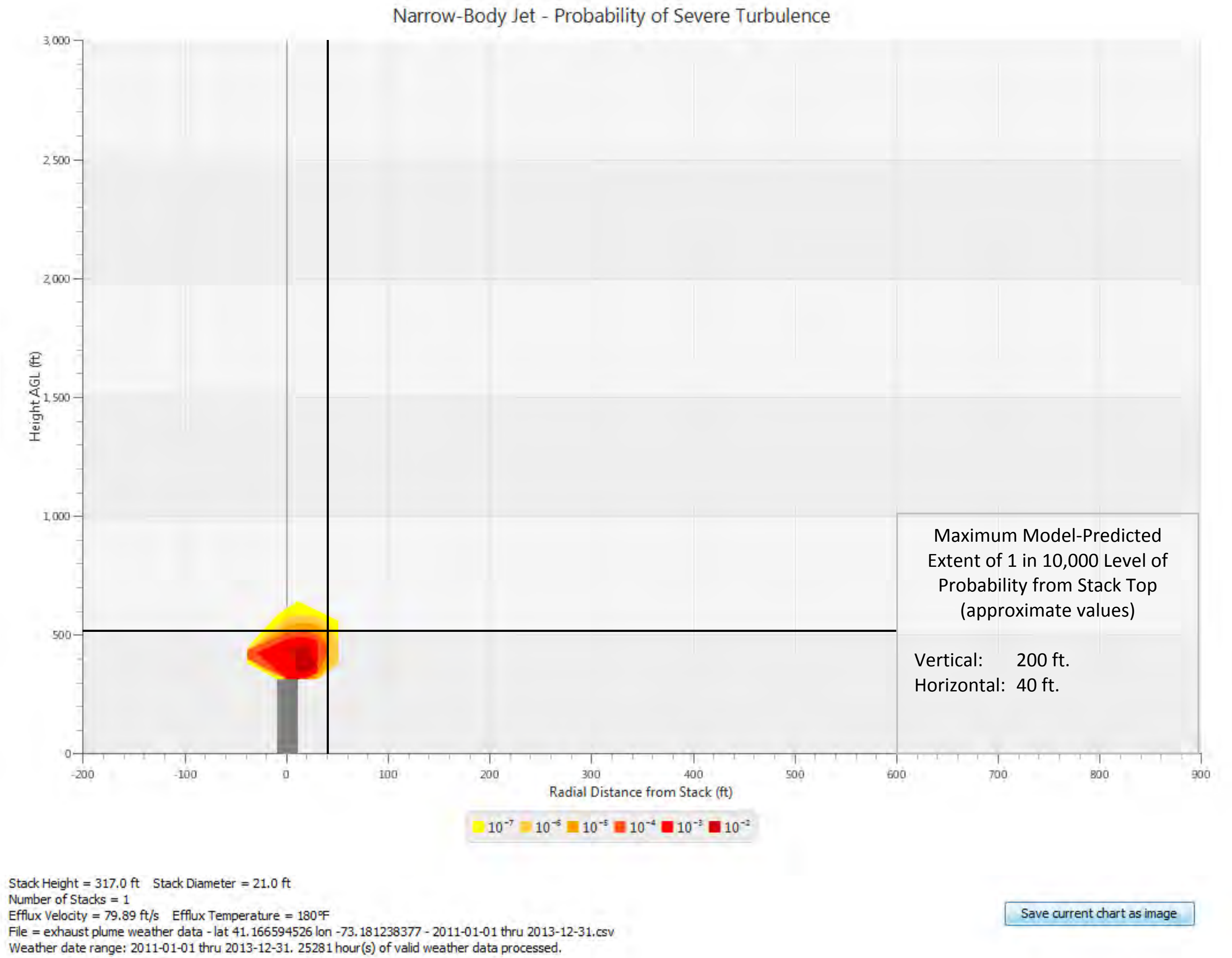
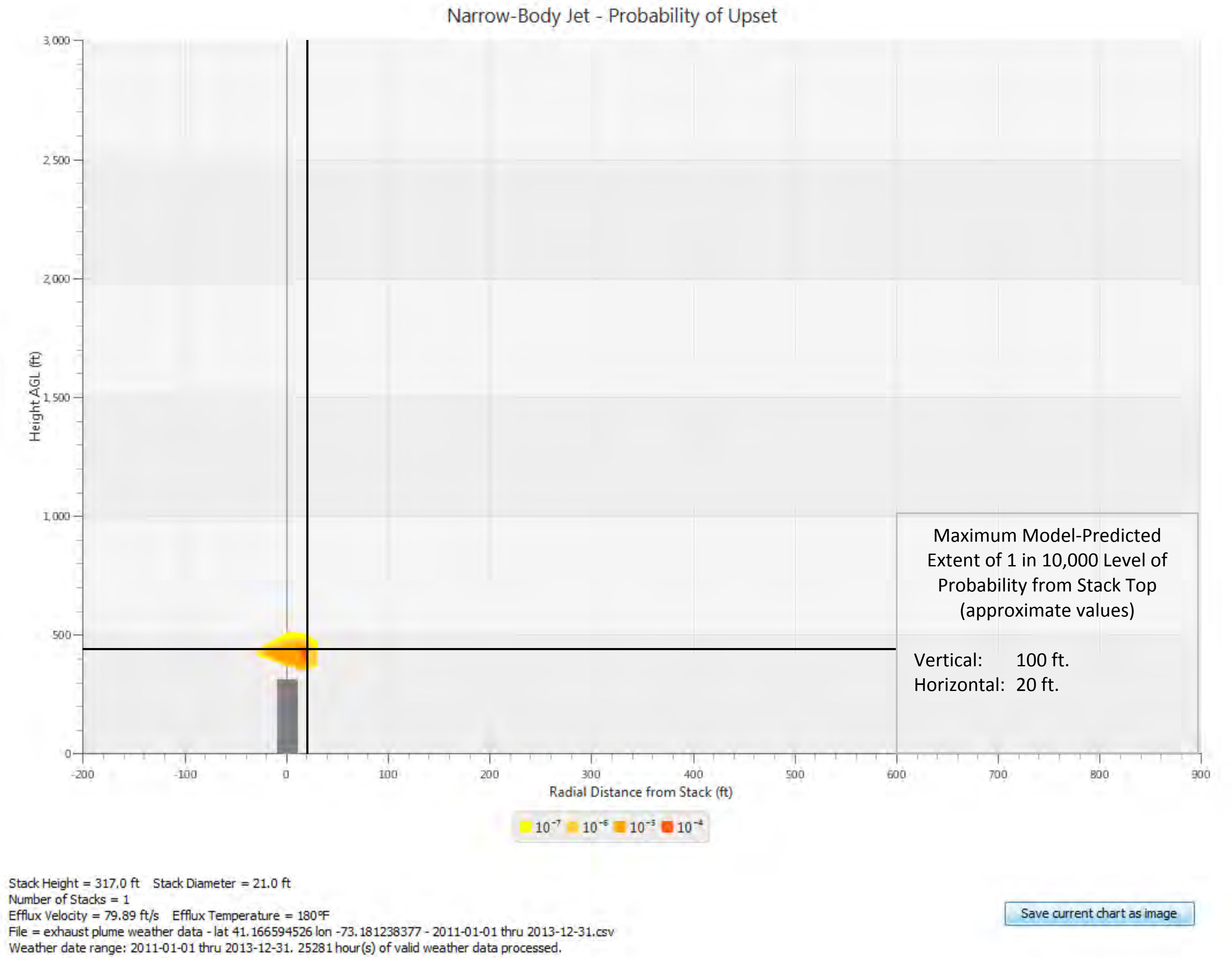

Narrow-Body Jet - Probability of Severe Turbulence
Height AGL (ft)
Radial Distance from Stack (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 200 ft.
Horizontal: 40 ft.
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 22


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4}
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 100 ft.
Horizontal: 20 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figures 23 through 29

GE Case 8.1 – ULSD – Winter

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure 23

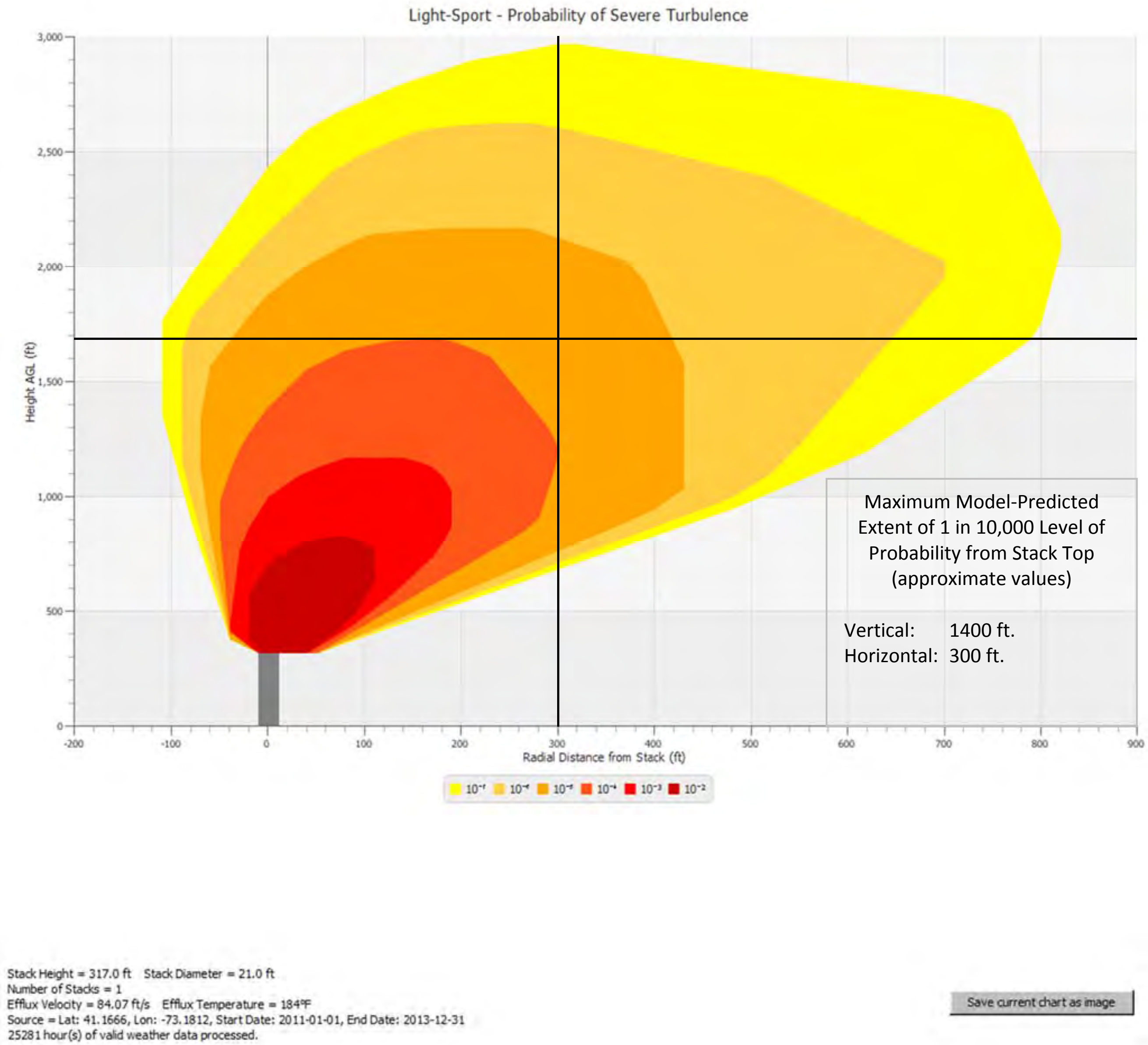

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻³
10⁻²
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 1400 ft.
Horizontal: 300 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184ºF
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 24

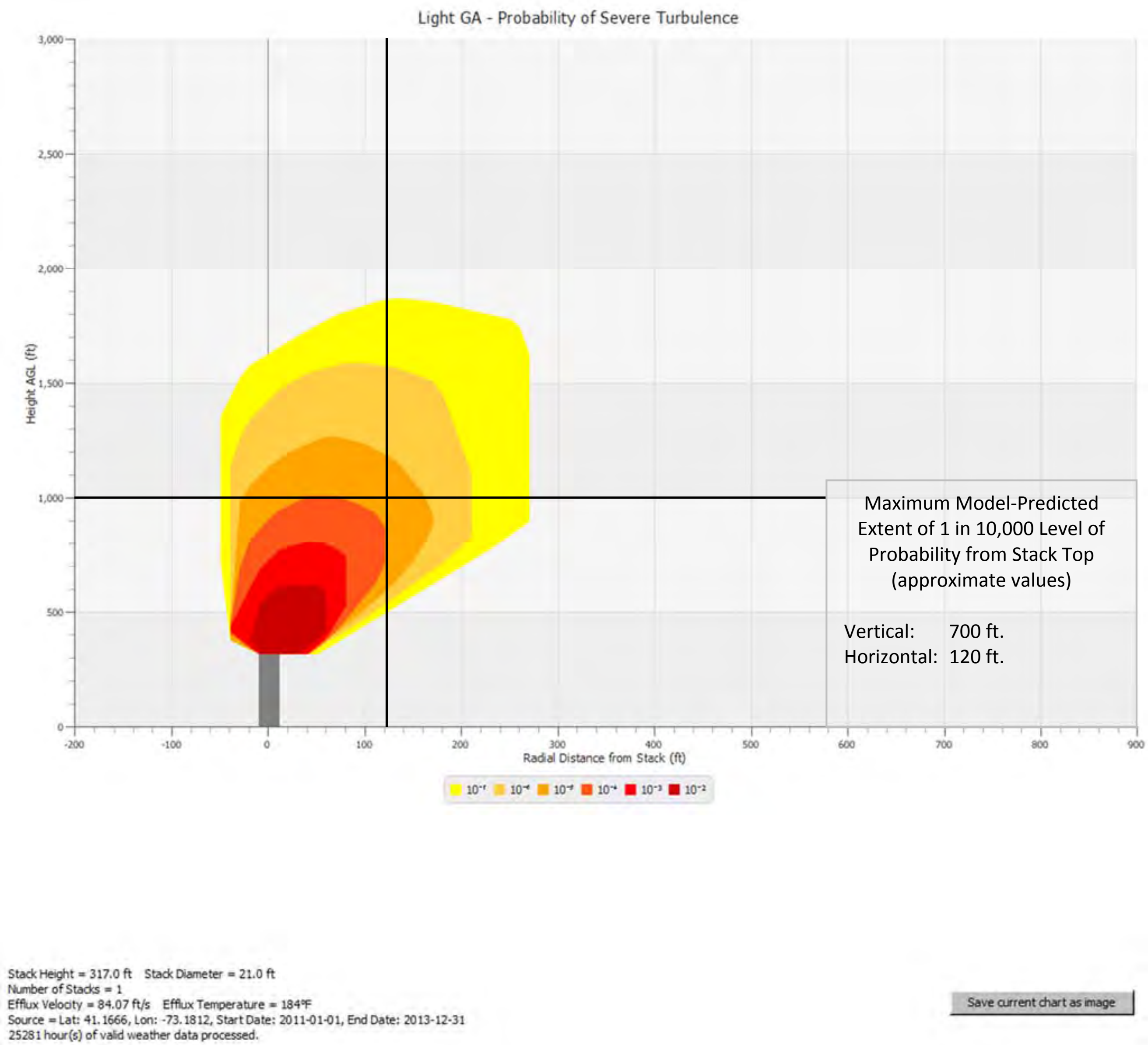

Light GA - Probability of Severe Turbulence
Height AGL (ft)
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 700 ft.
Horizontal: 120 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 25

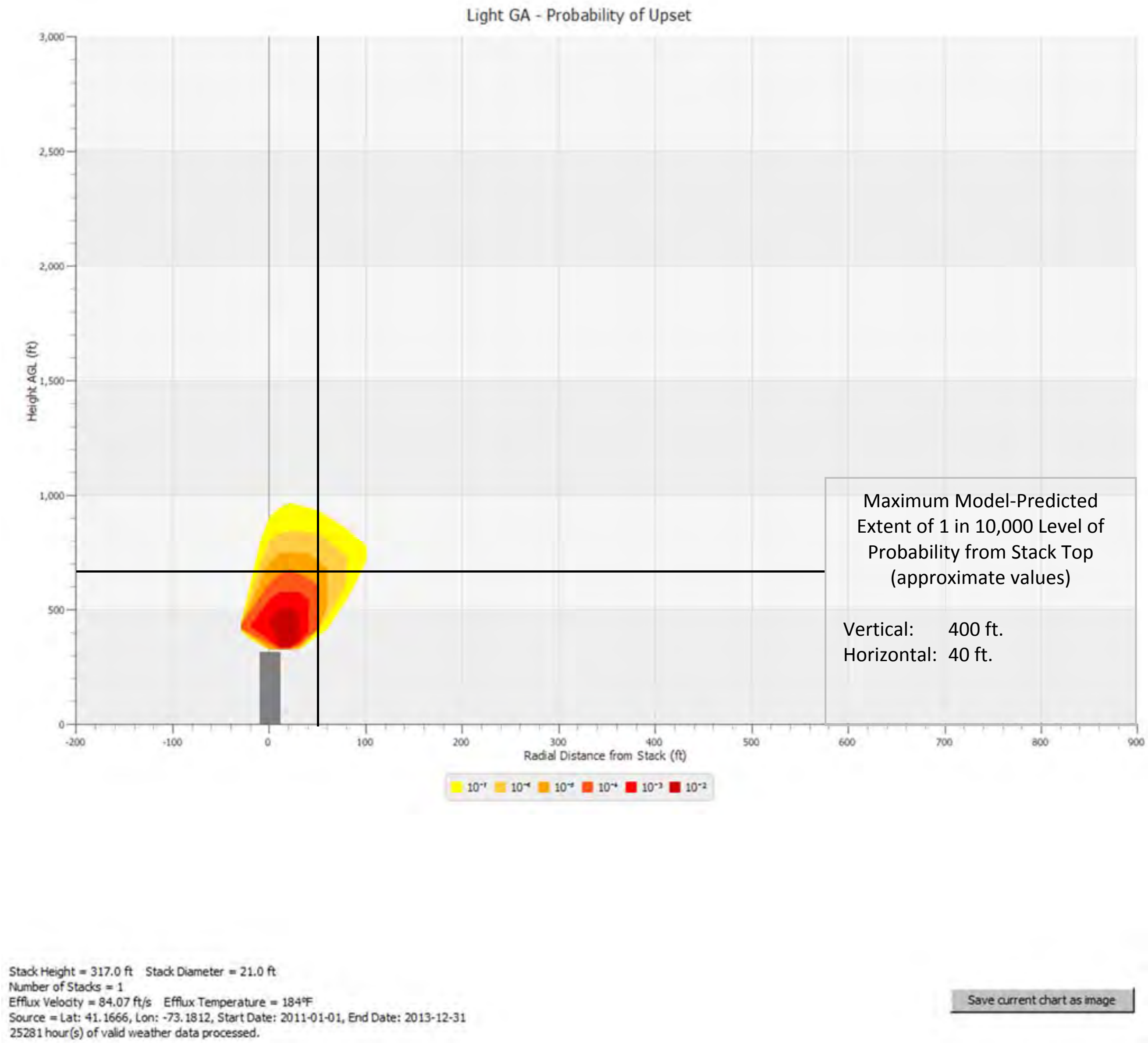

Light GA - Probability of Upset
Height AGL (ft)
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 400 ft.
Horizontal: 40 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184ºF
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 26

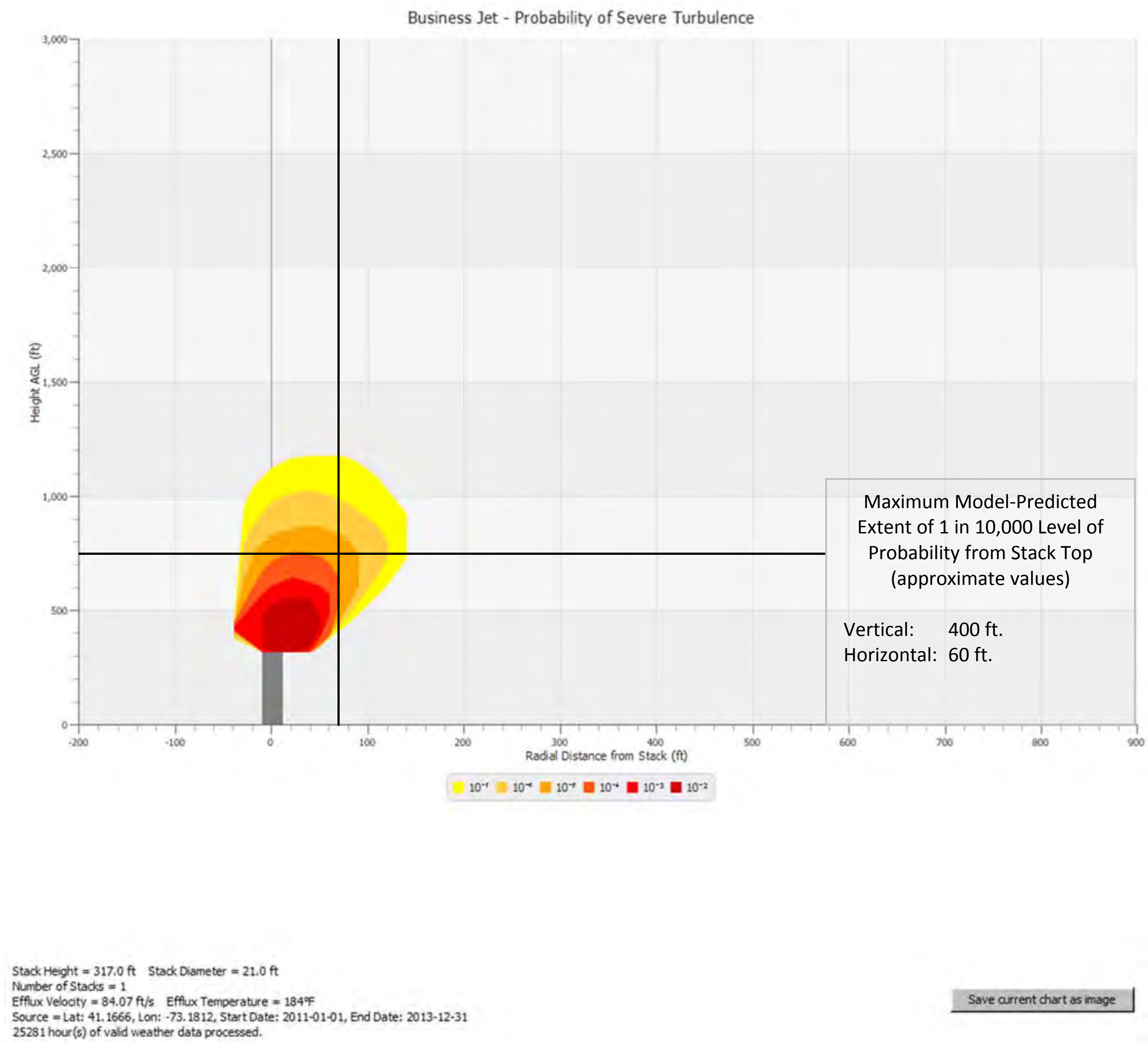

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-3}
10^{-2}
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 400 ft.
Horizontal: 60 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 27

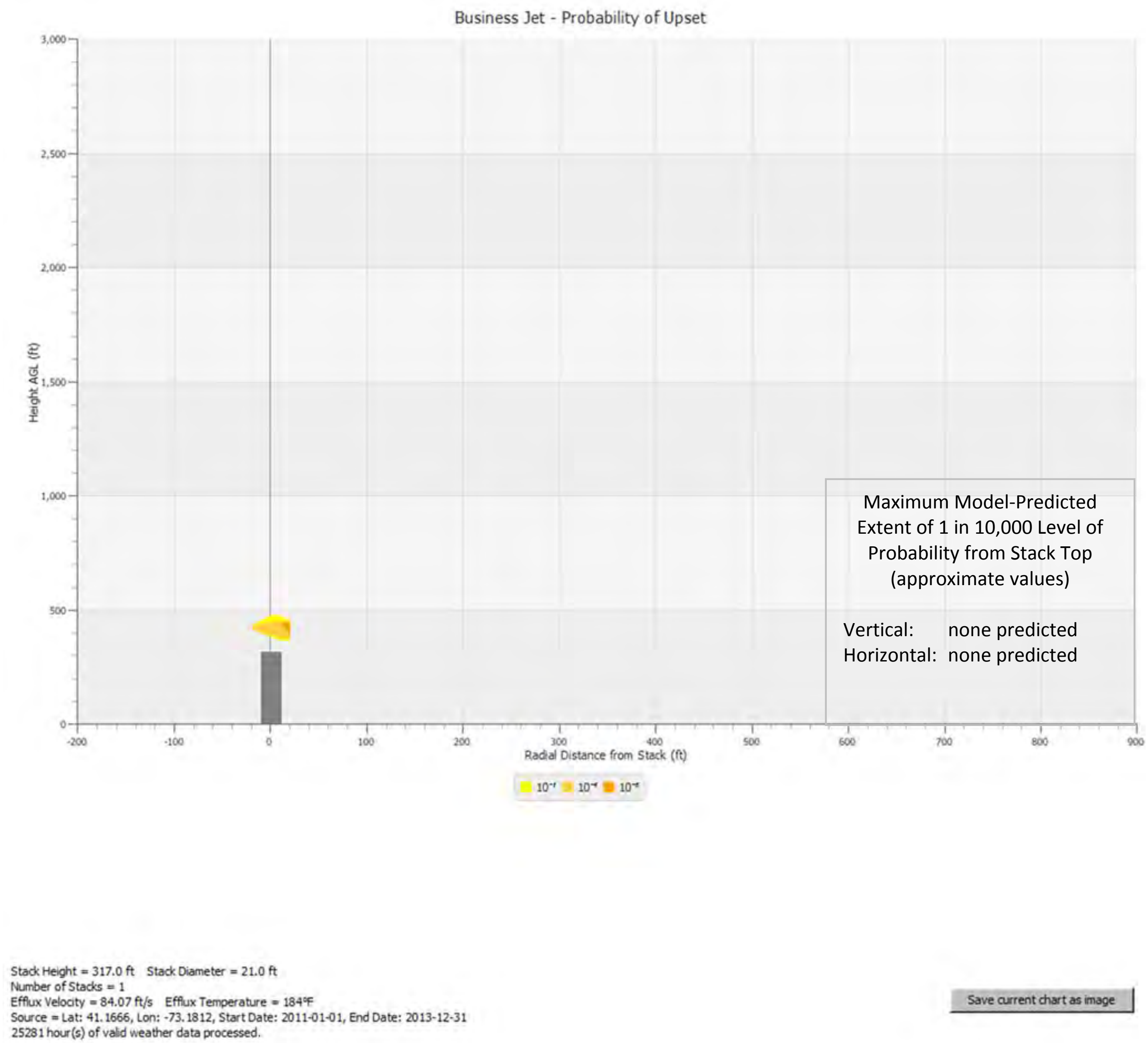
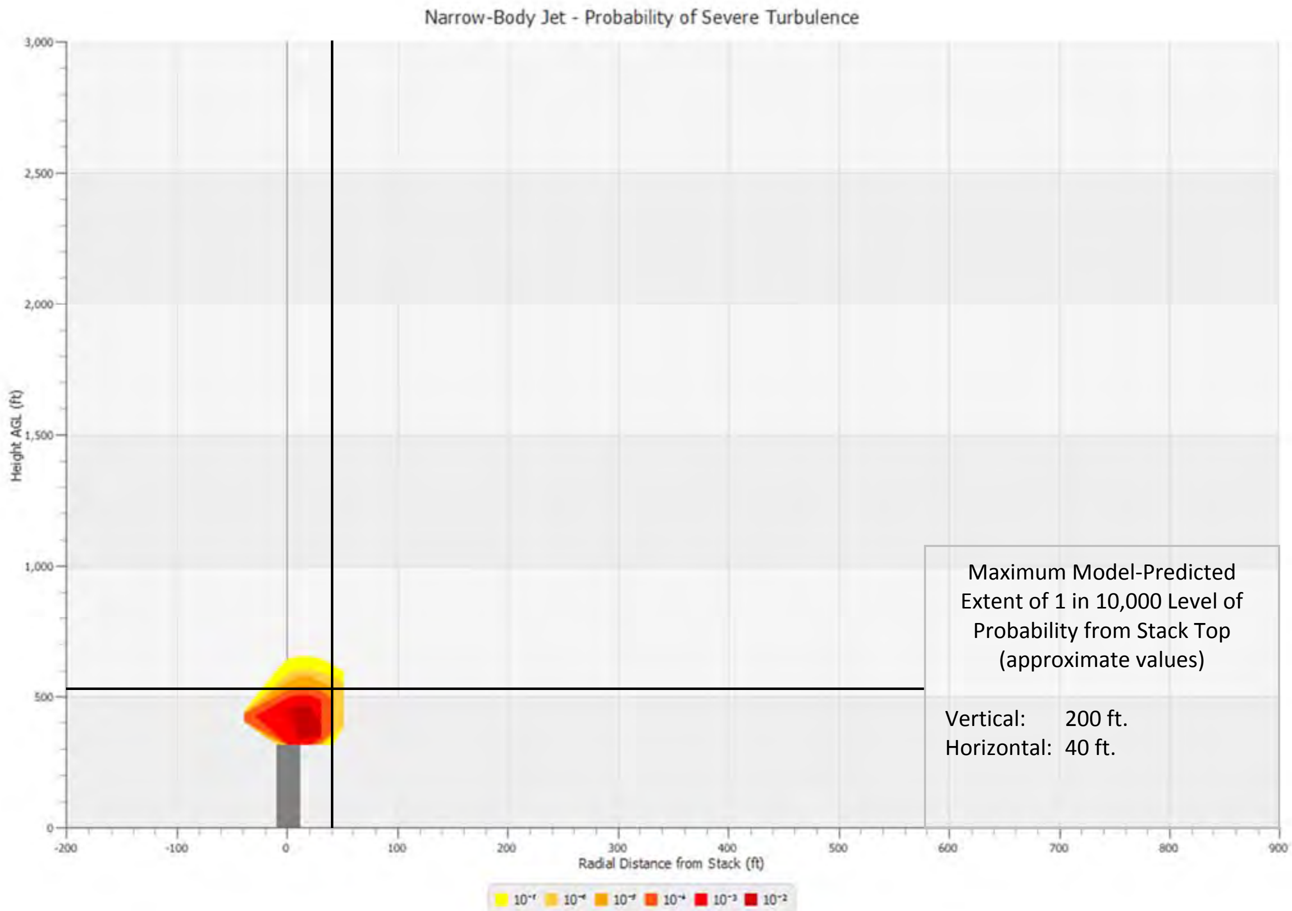

Business Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: none predicted
Horizontal: none predicted
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

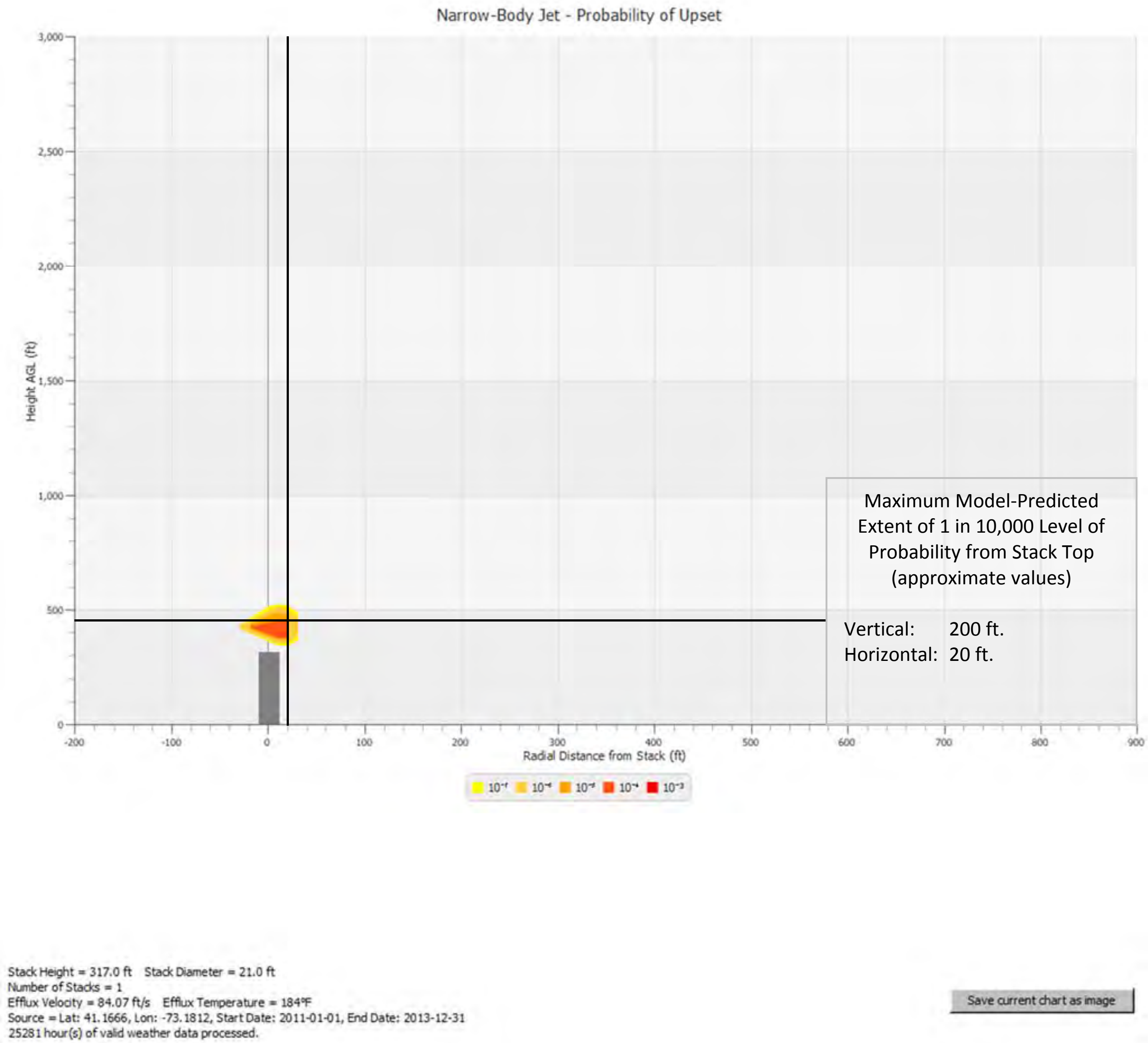
Figure 28



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 29


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Maximum Model-Predicted Extent of 1 in 10,000 Level of Probability from Stack Top (approximate values)
Vertical: 200 ft.
Horizontal: 20 ft.
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figures 30 through 36

Bridgeport Harbor Existing Unit No. 3 Under Full Load Conditions

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure 30

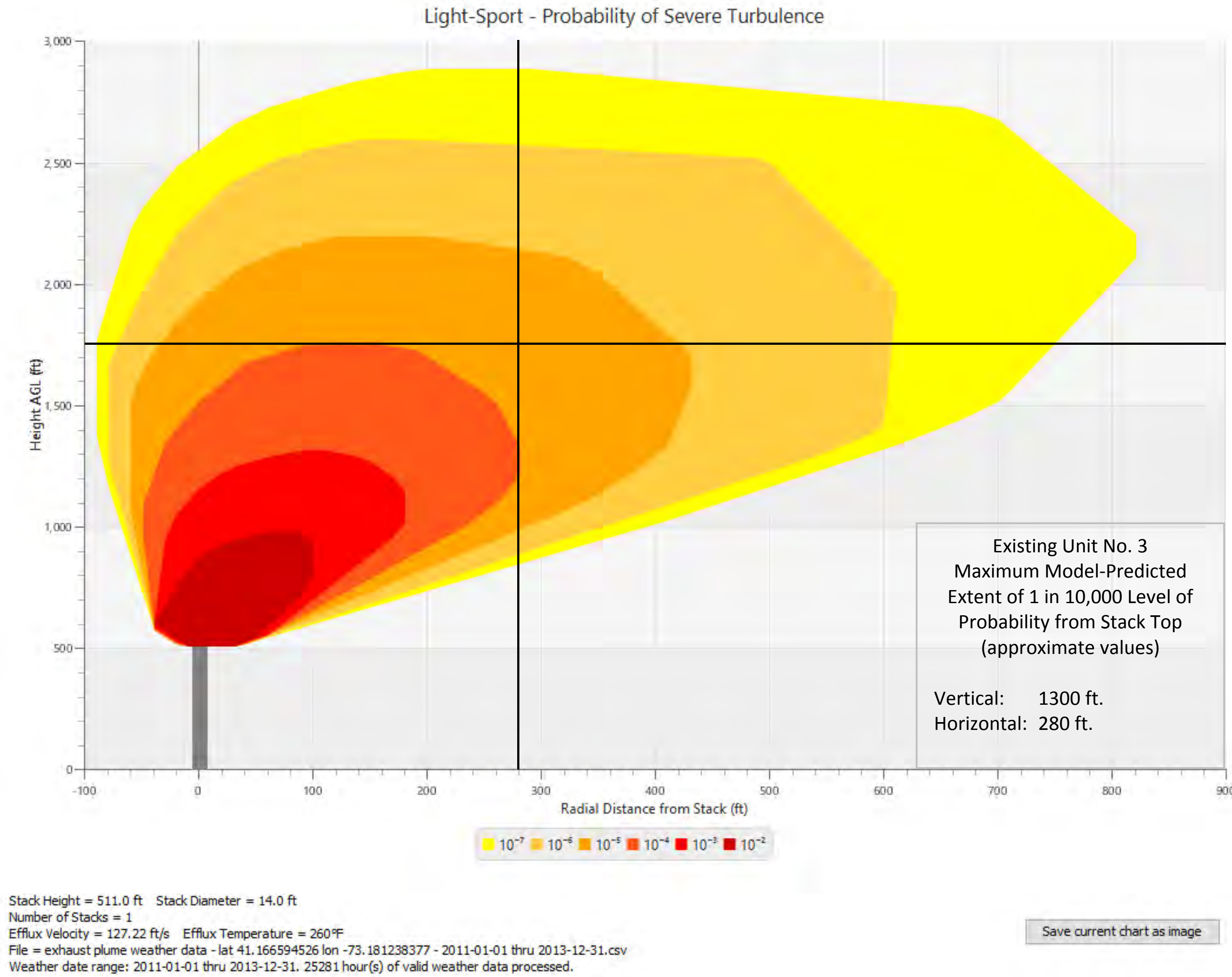

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 1300 ft.
Horizontal: 280 ft.
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 31

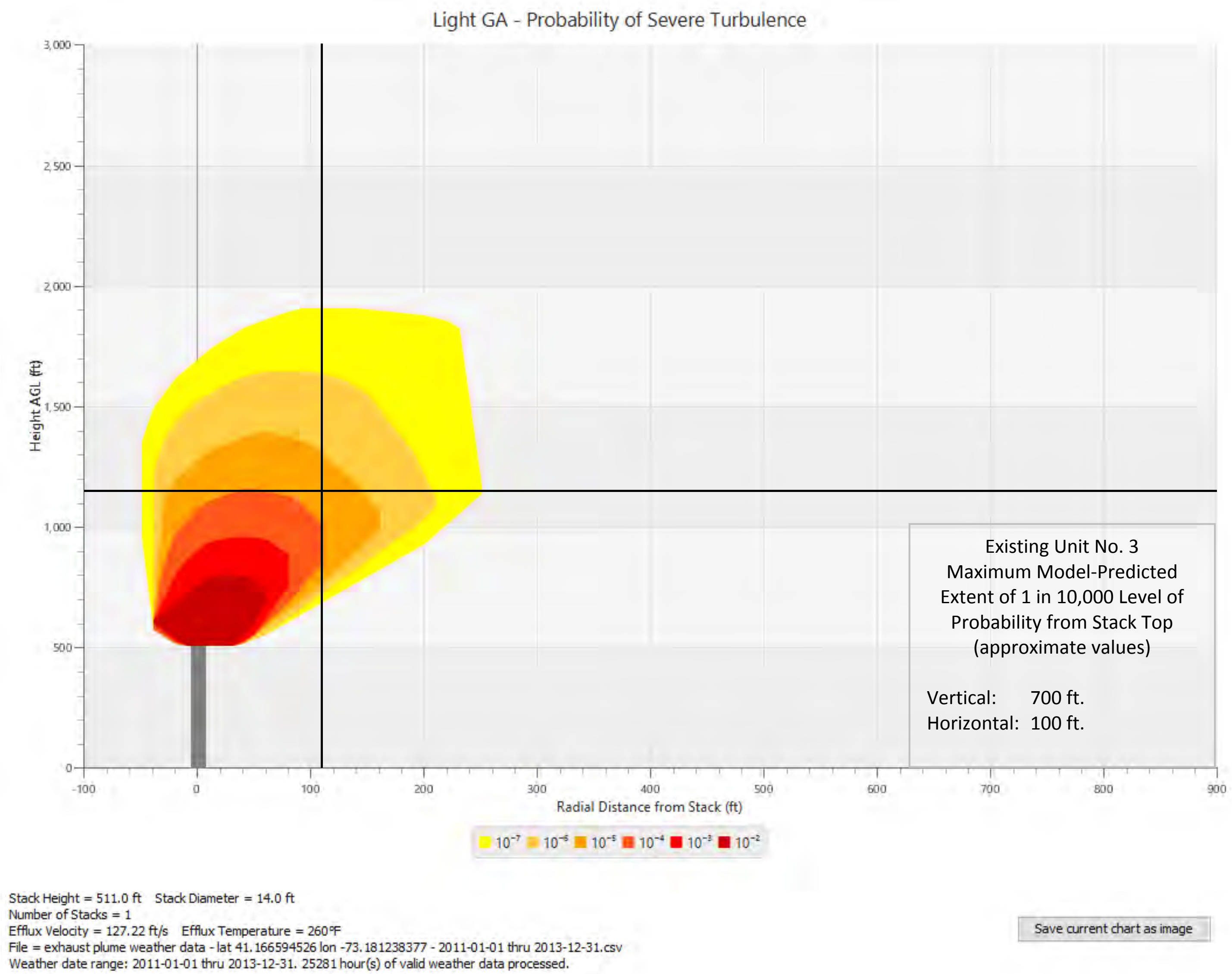

Light GA - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 700 ft.
Horizontal: 100 ft.
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 32

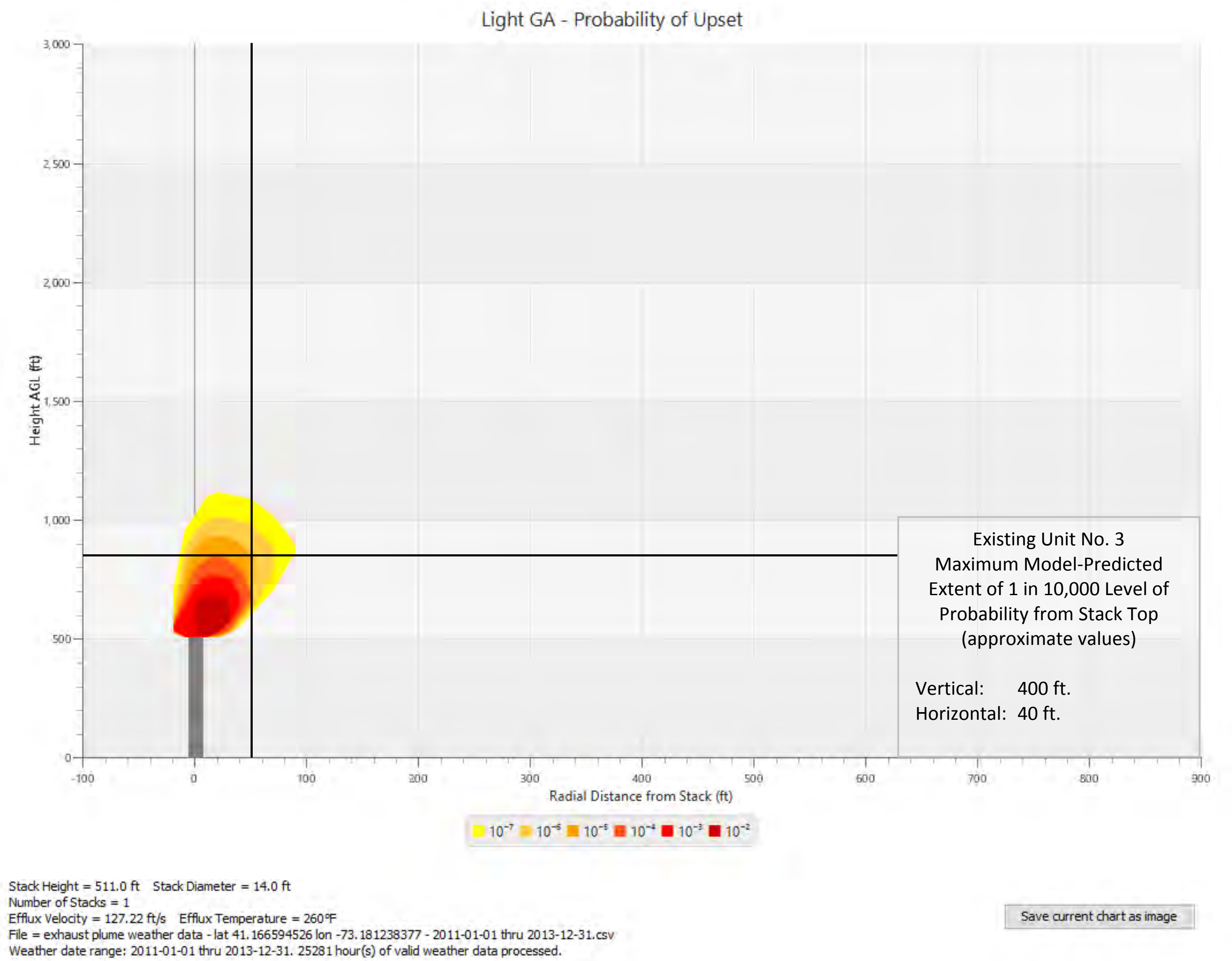

Light GA - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 400 ft.
Horizontal: 40 ft.
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 33

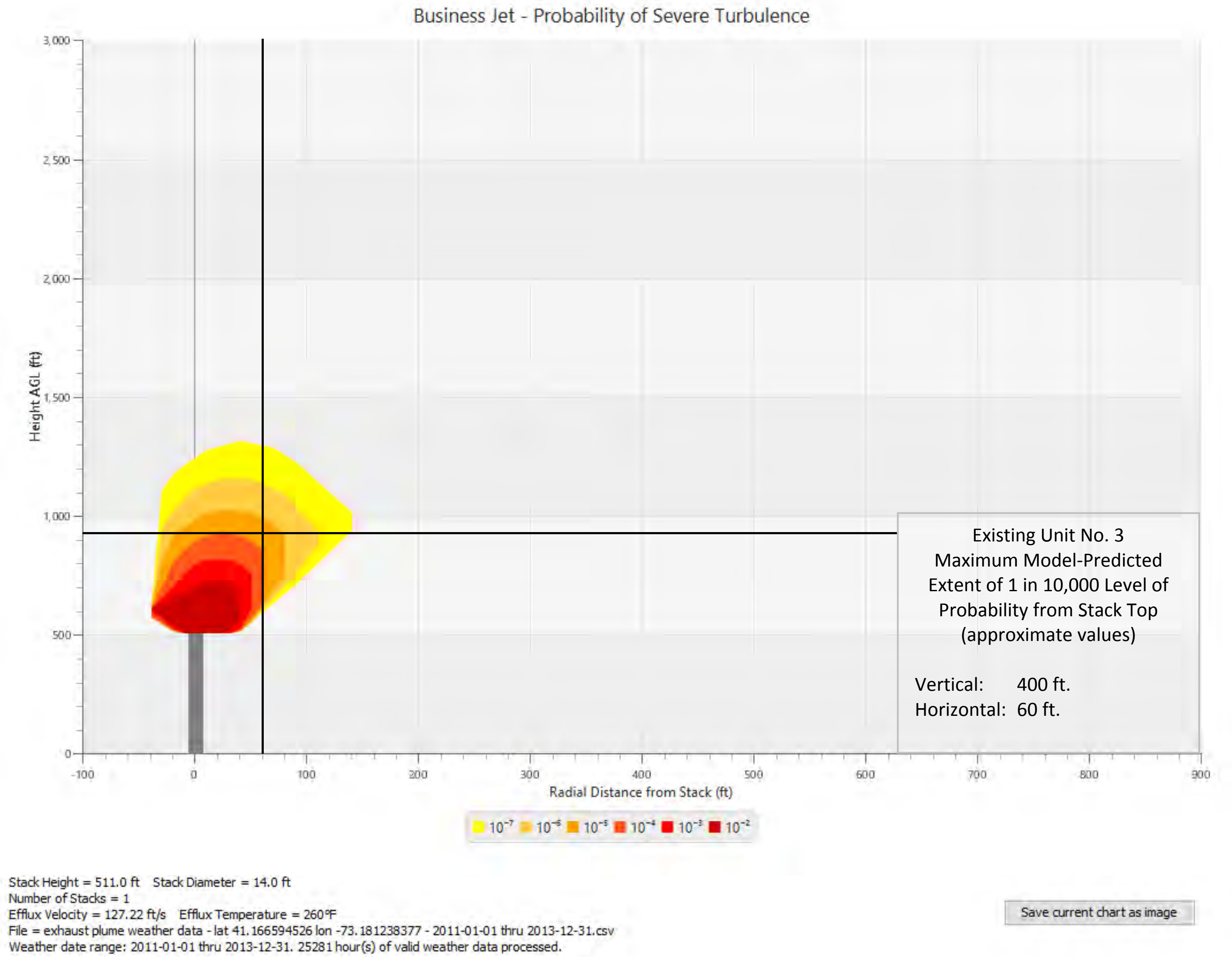
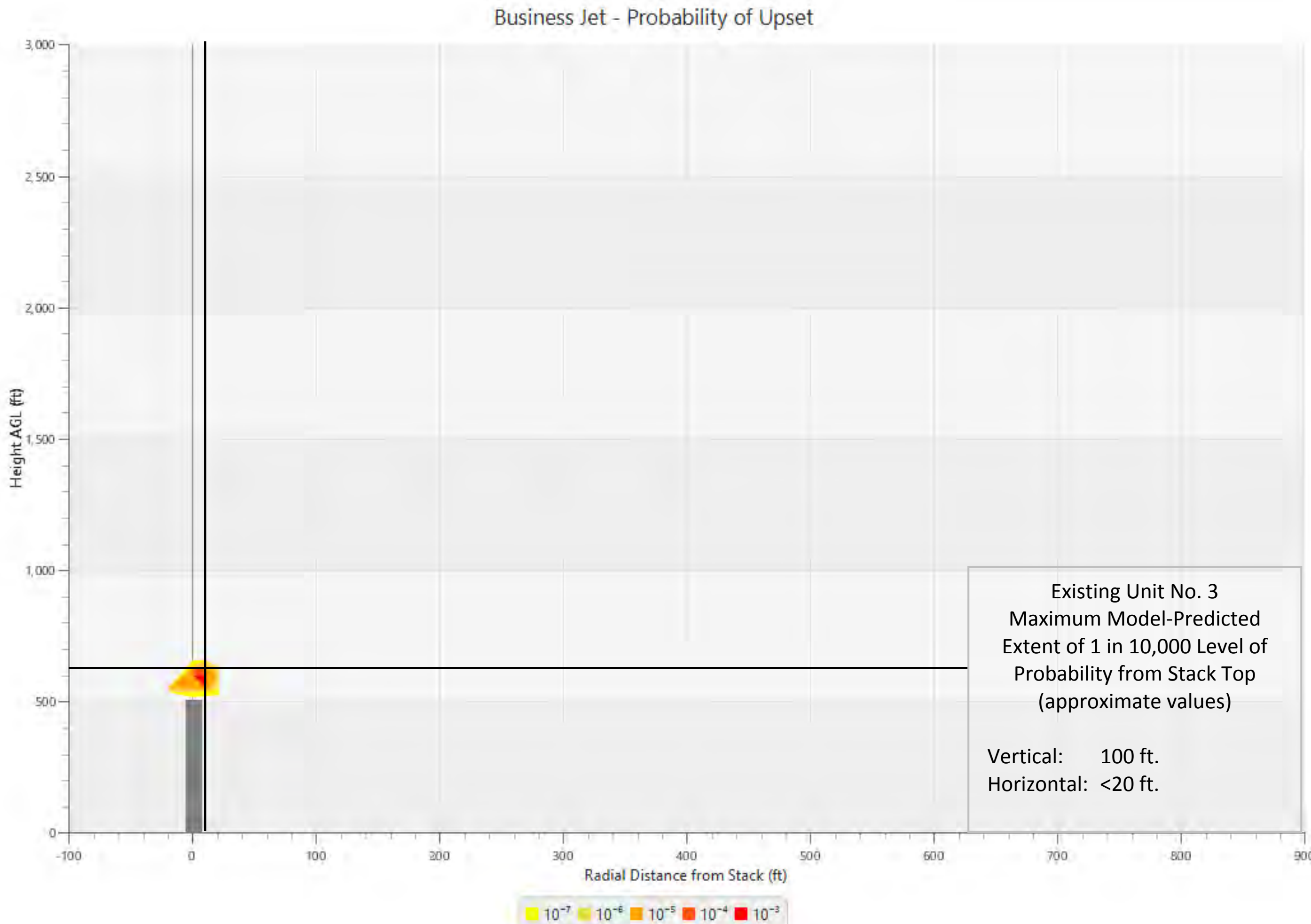

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 400 ft.
Horizontal: 60 ft.
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 34



Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure 35

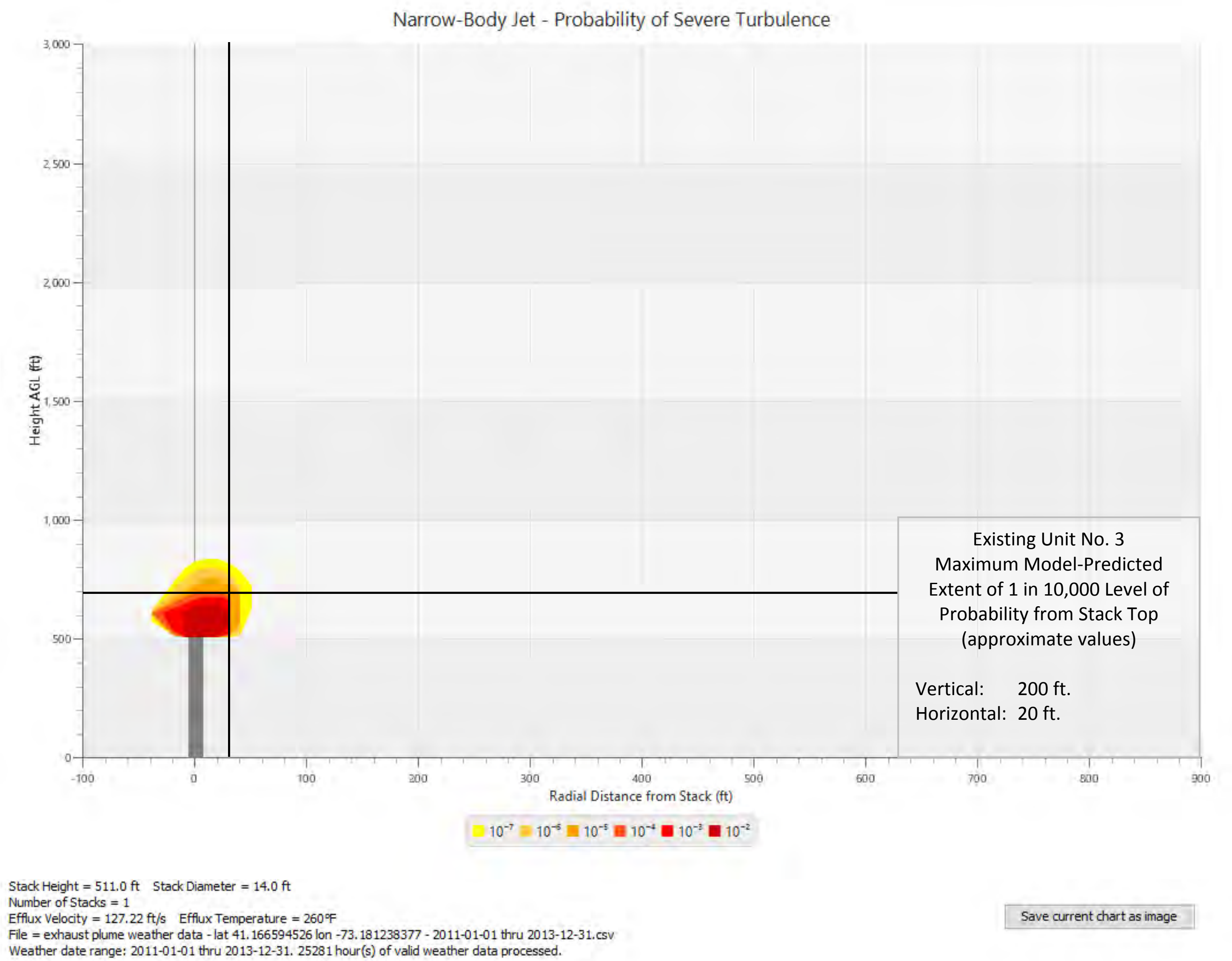
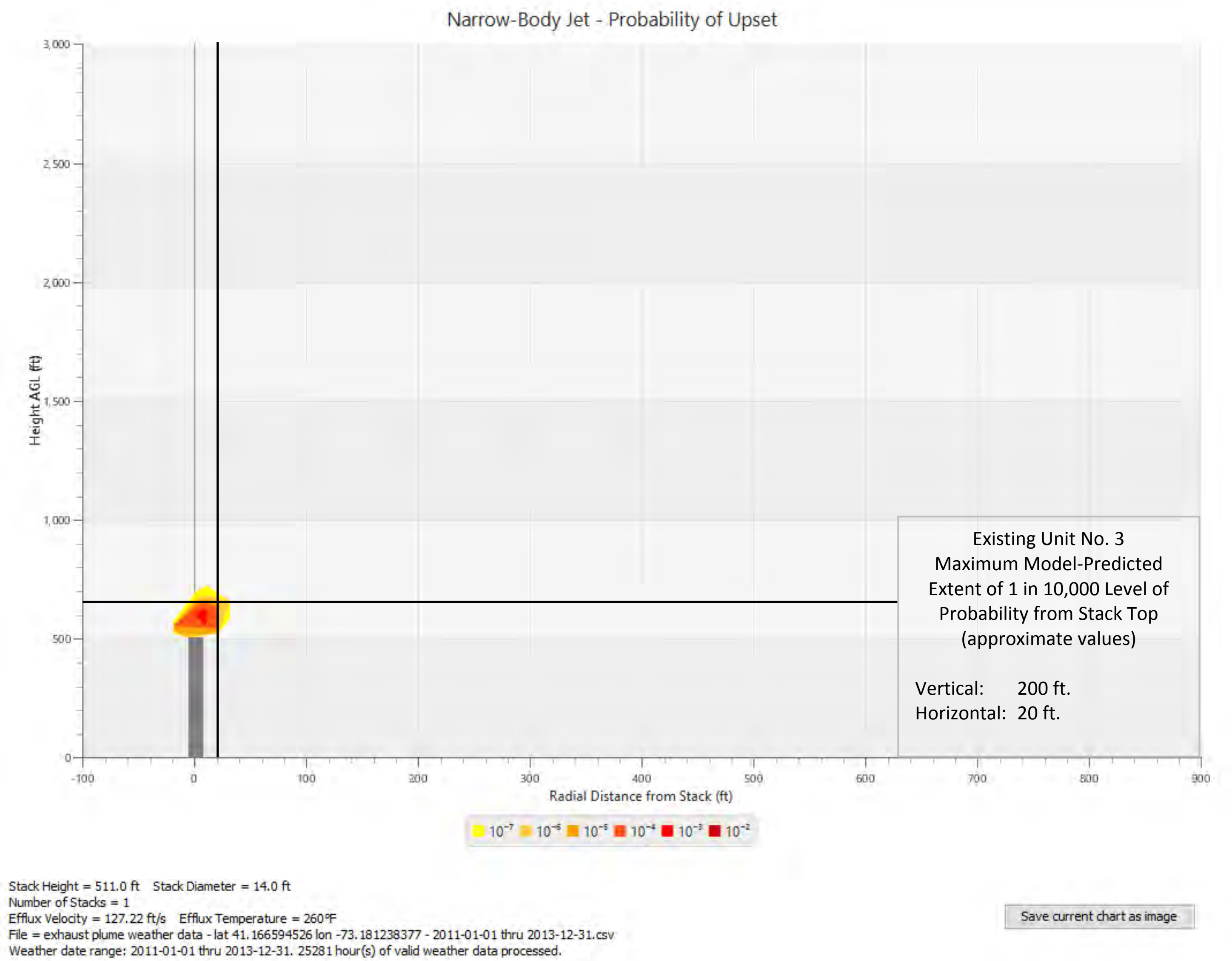

Narrow-Body Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 200 ft.
Horizontal: 20 ft.
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure 36


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Existing Unit No. 3
Maximum Model-Predicted
Extent of 1 in 10,000 Level of
Probability from Stack Top
(approximate values)
Vertical: 200 ft.
Horizontal: 20 ft.
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

APPENDIX A
Exhaust Plume Analyzer Output

Figures A1 through A7

GE Case 2.1 – Natural Gas – Summer

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure A1

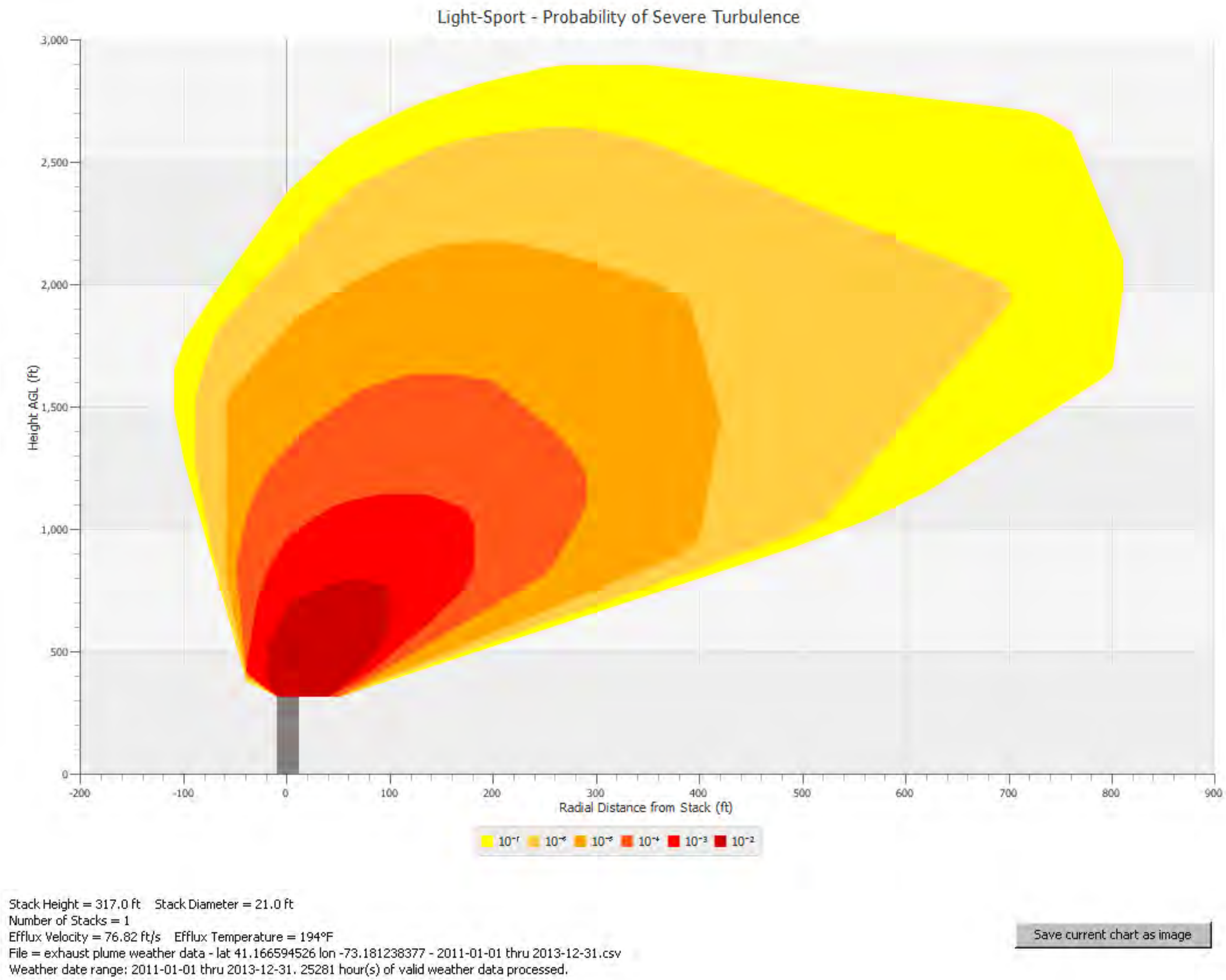

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A2

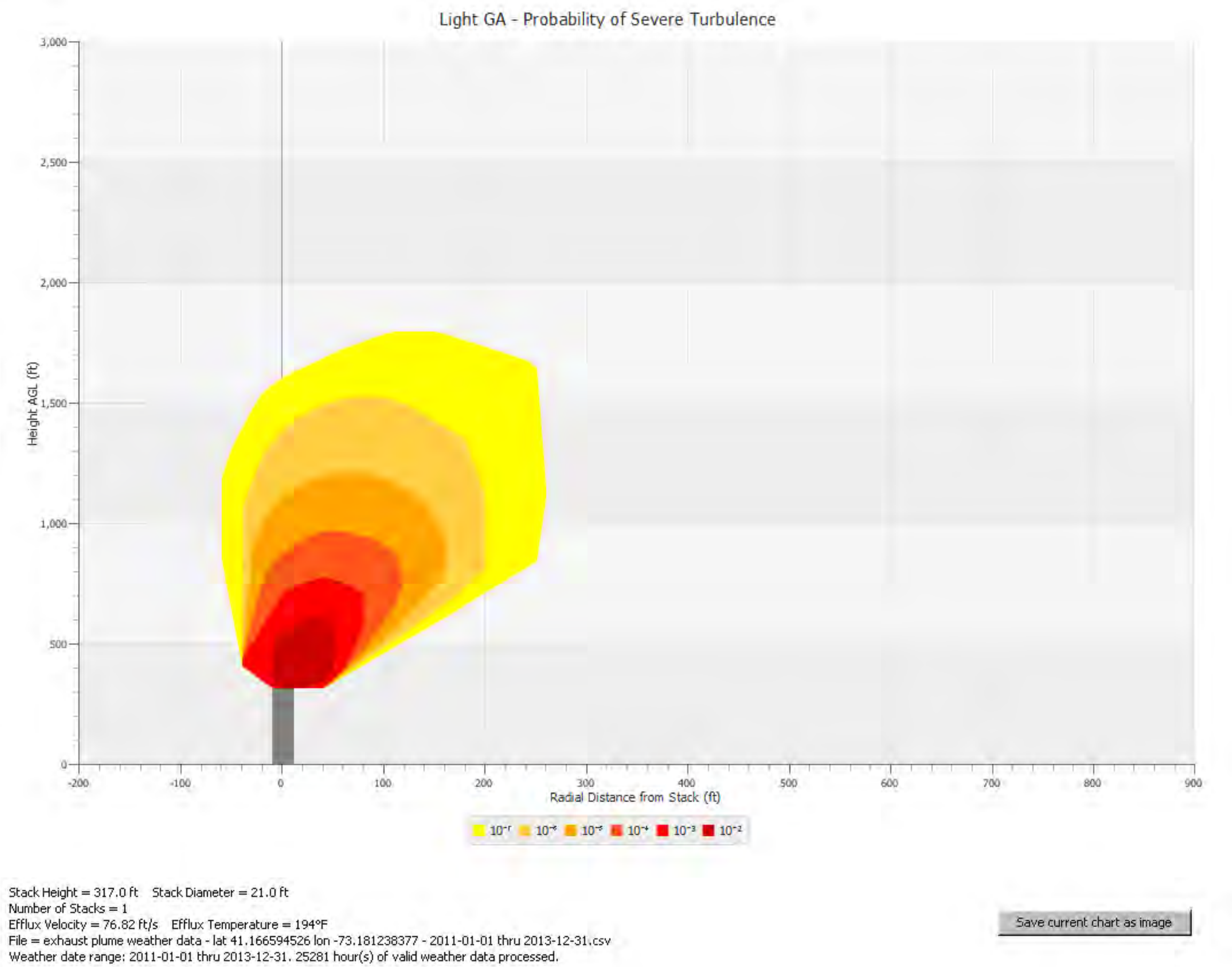
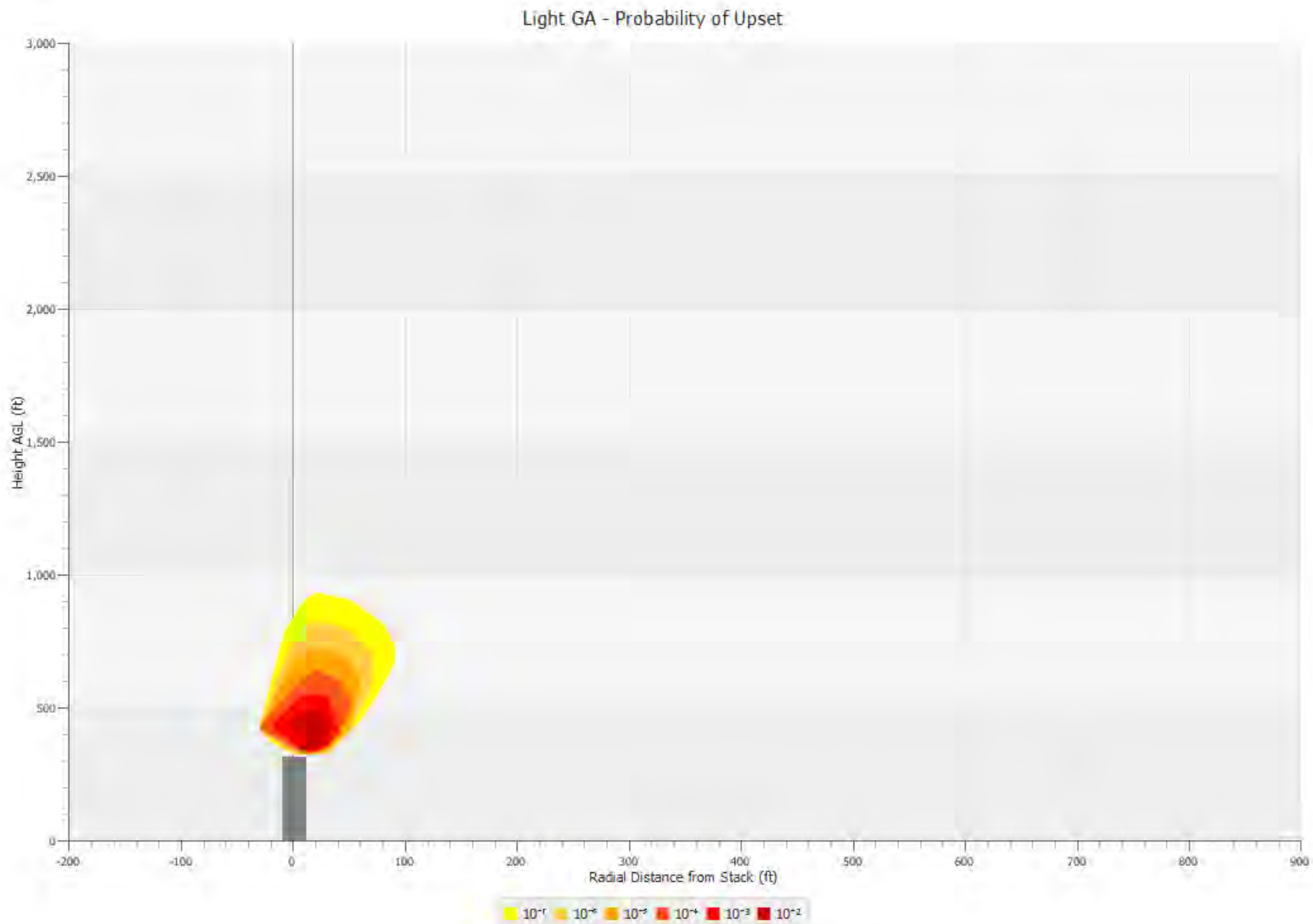

Light GA - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

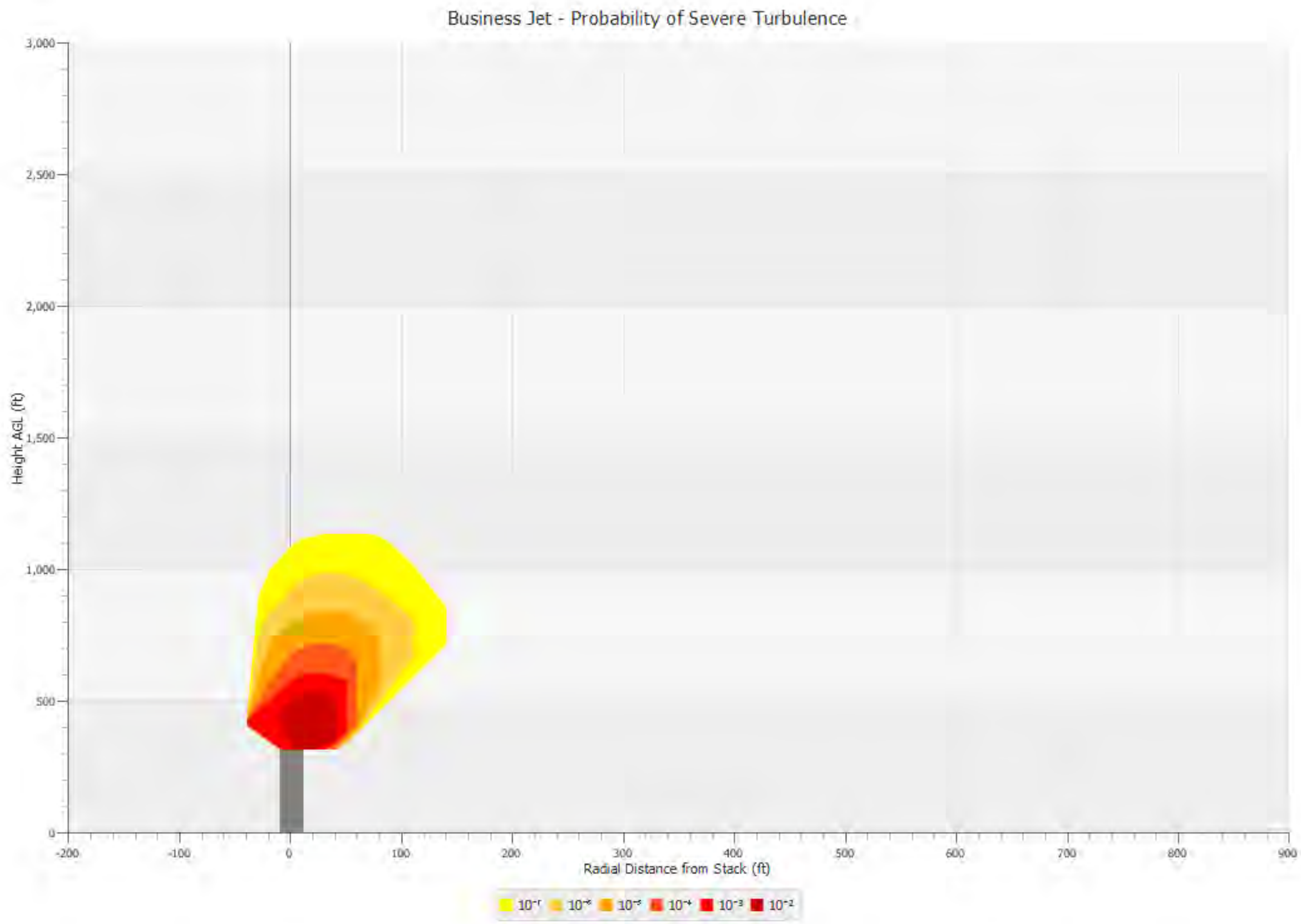
Figure A3



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A4



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s   Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

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Figure A5

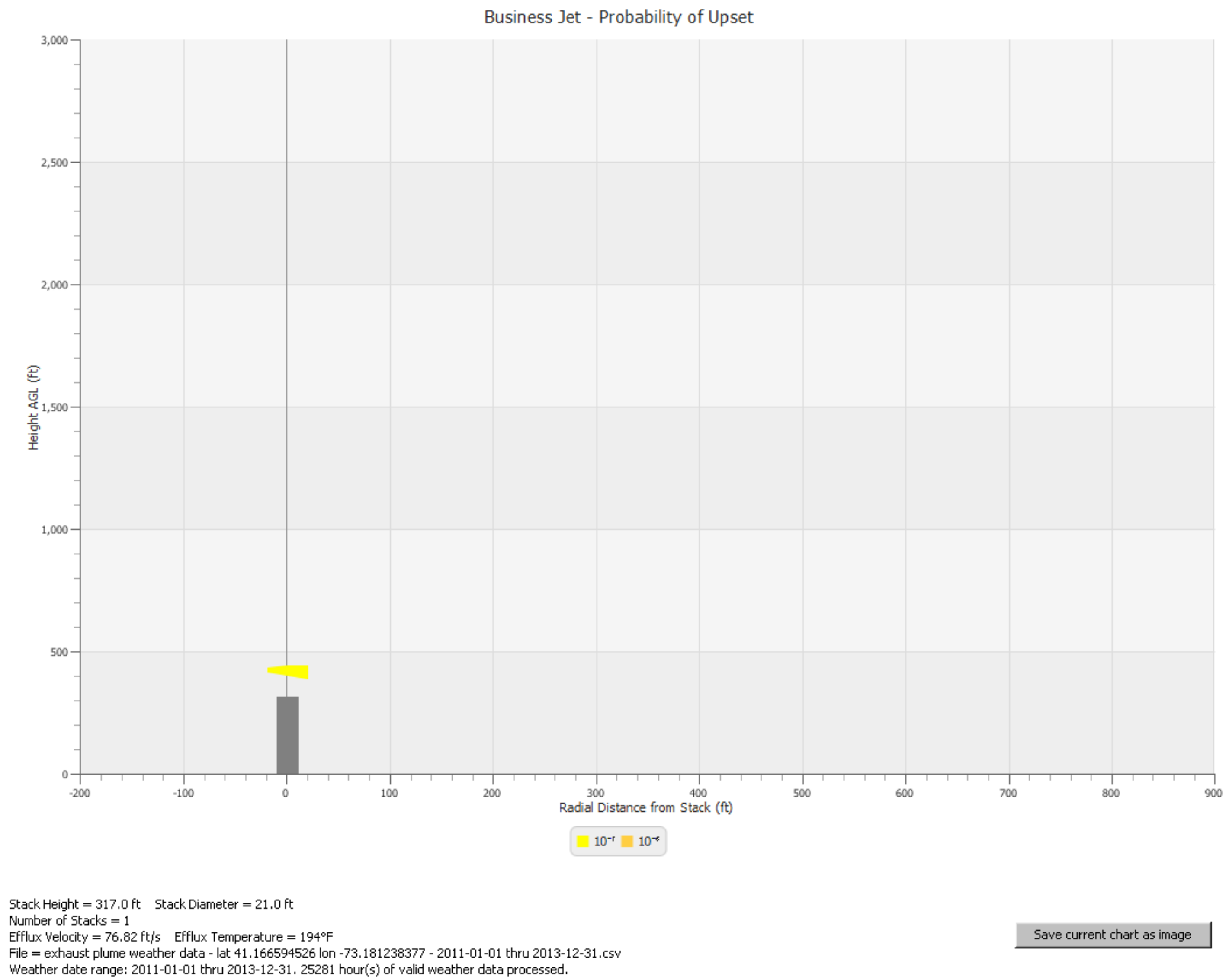
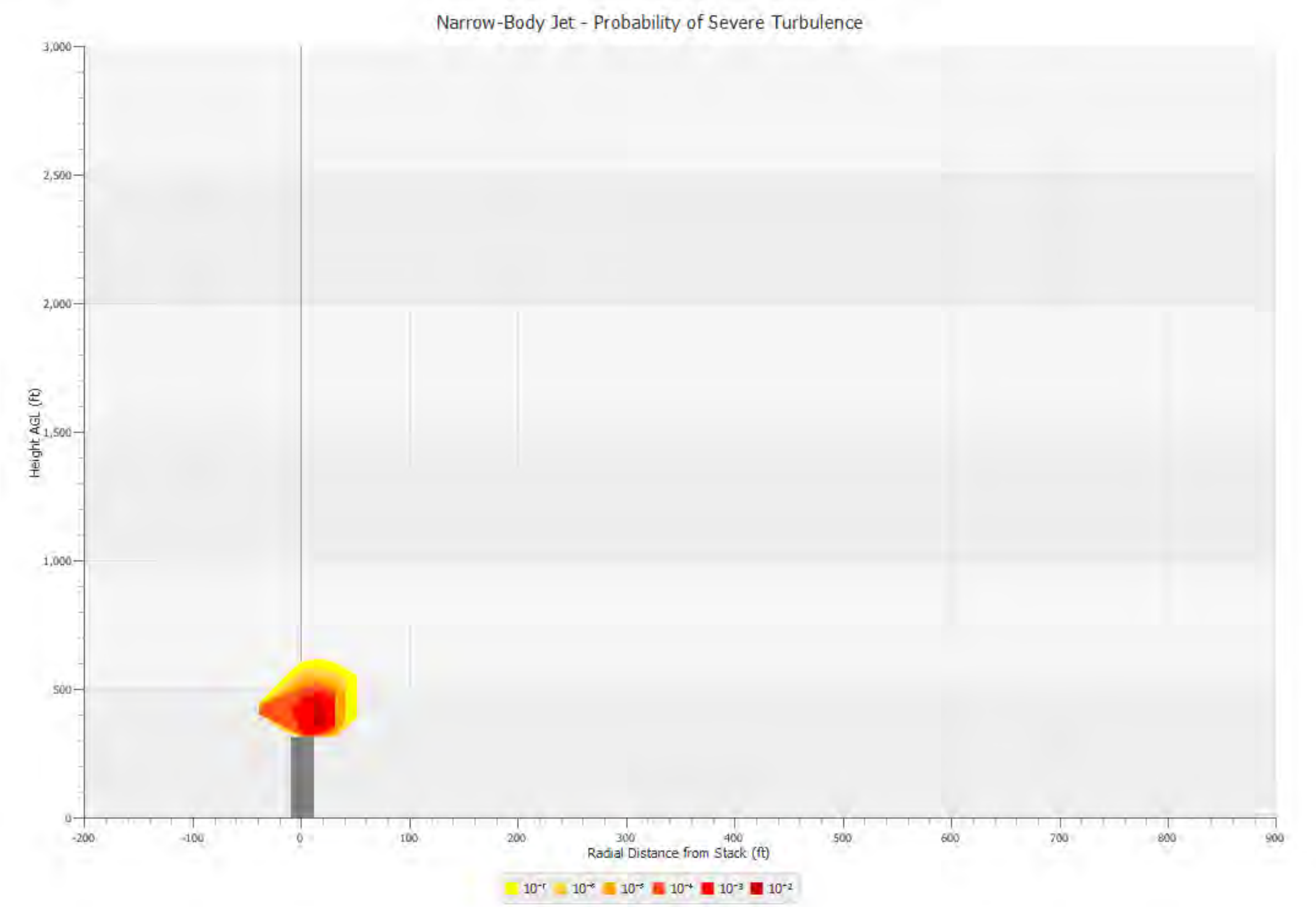
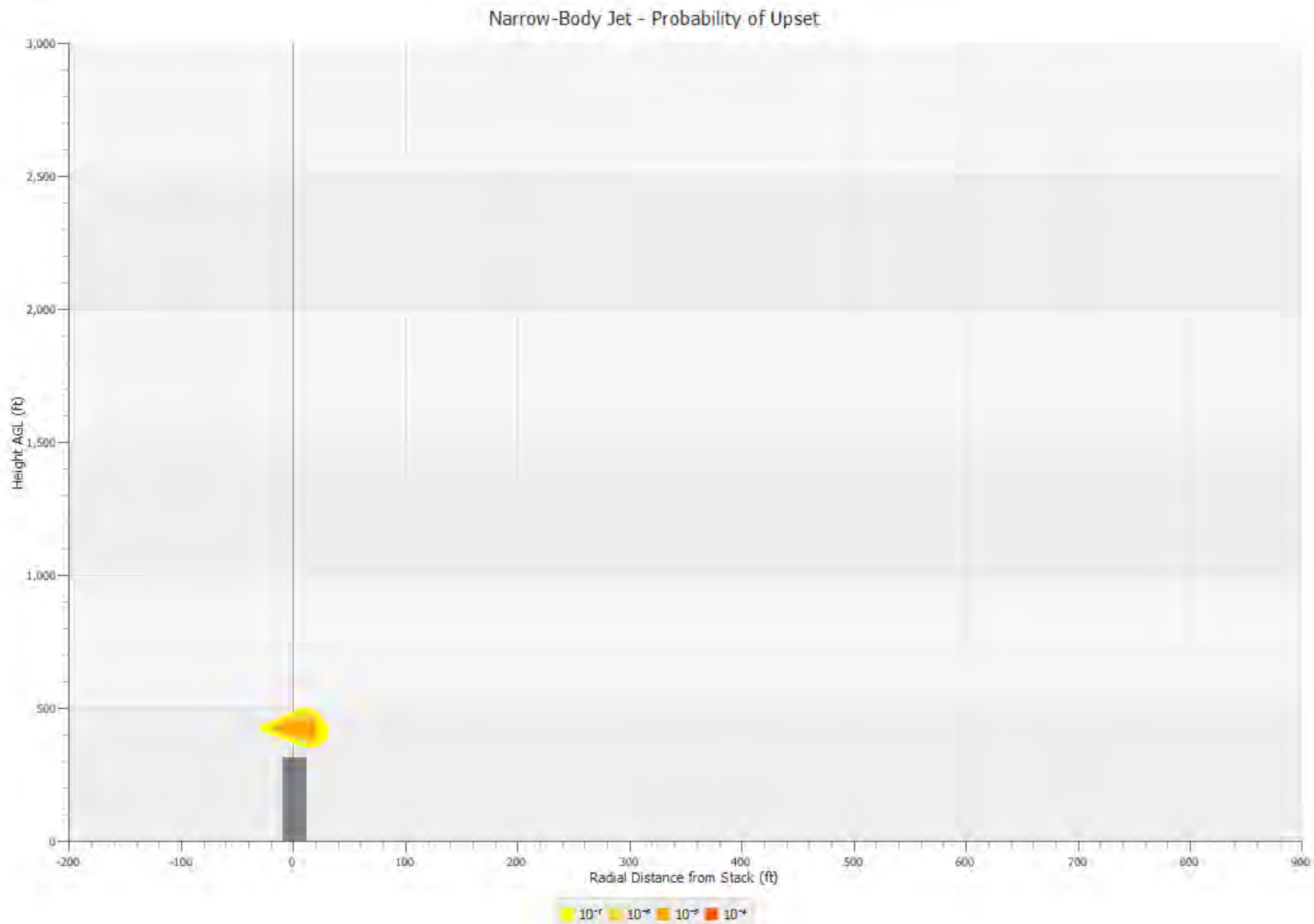


Figure A6



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Figure A7



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 76.82 ft/s   Efflux Temperature = 194°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

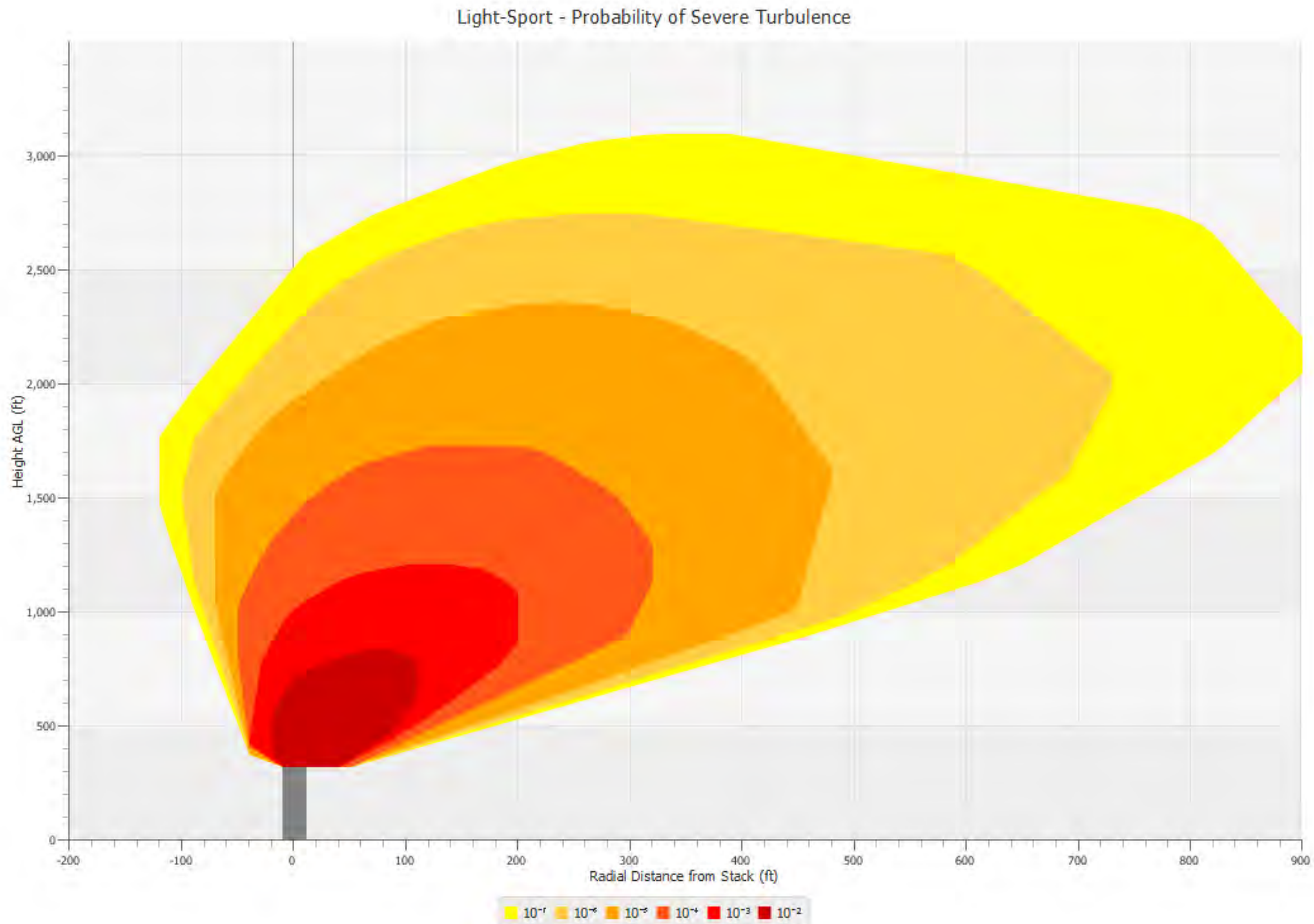
Save current chart as image

Figures A8 through A14

GE Case 2.1 – ULSD – Summer

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure A8



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s   Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A9

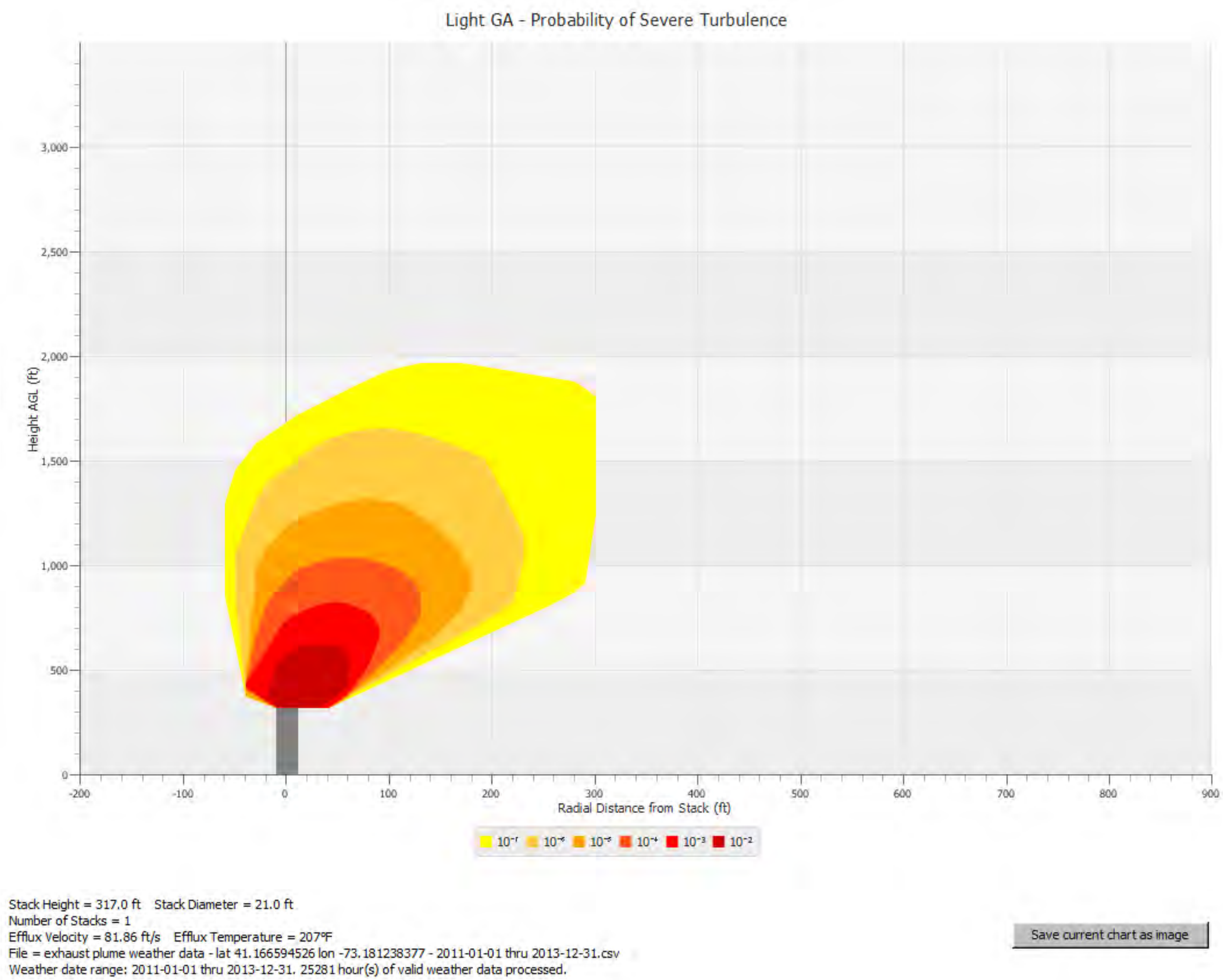
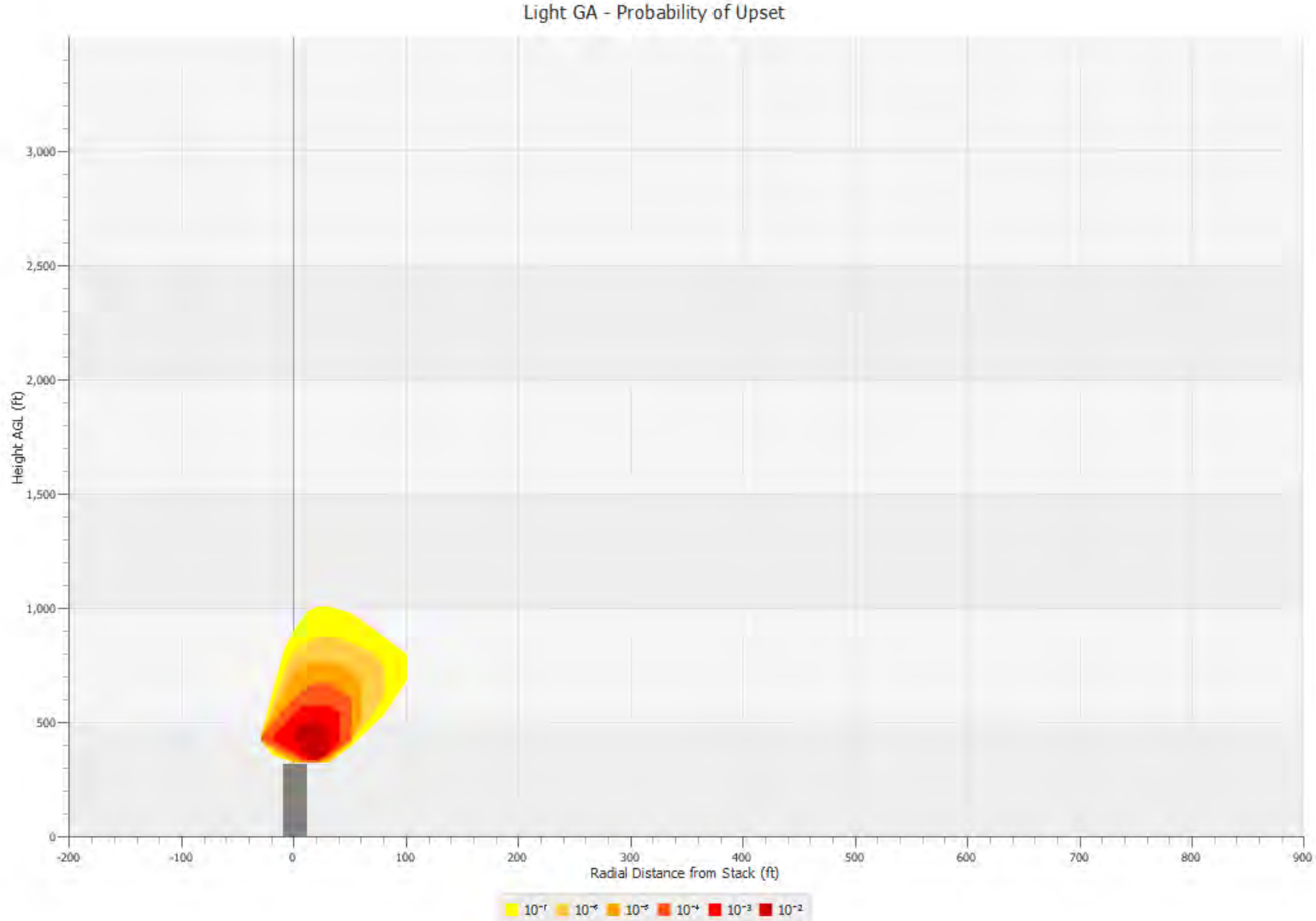

Light GA - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A10



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s   Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A11

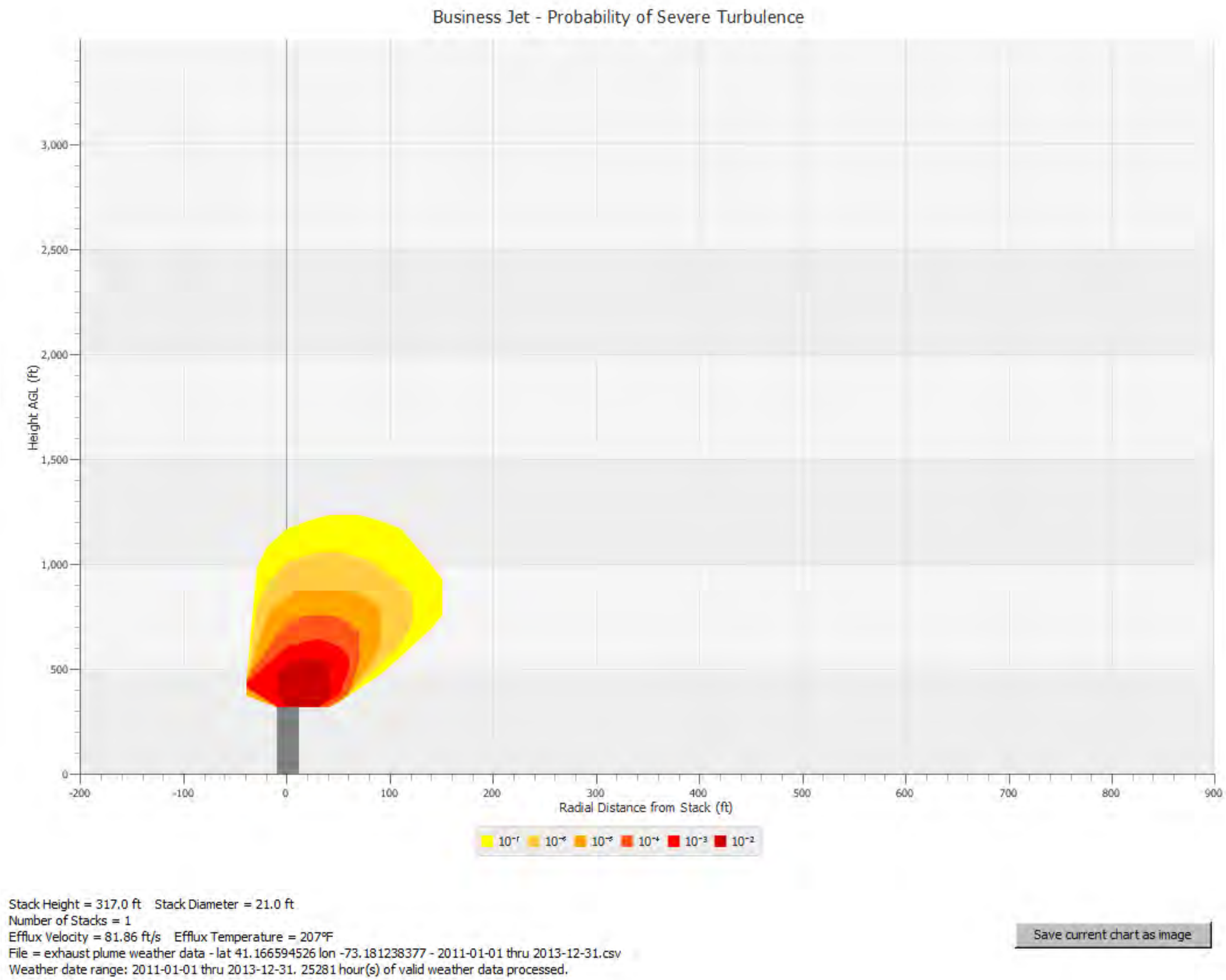
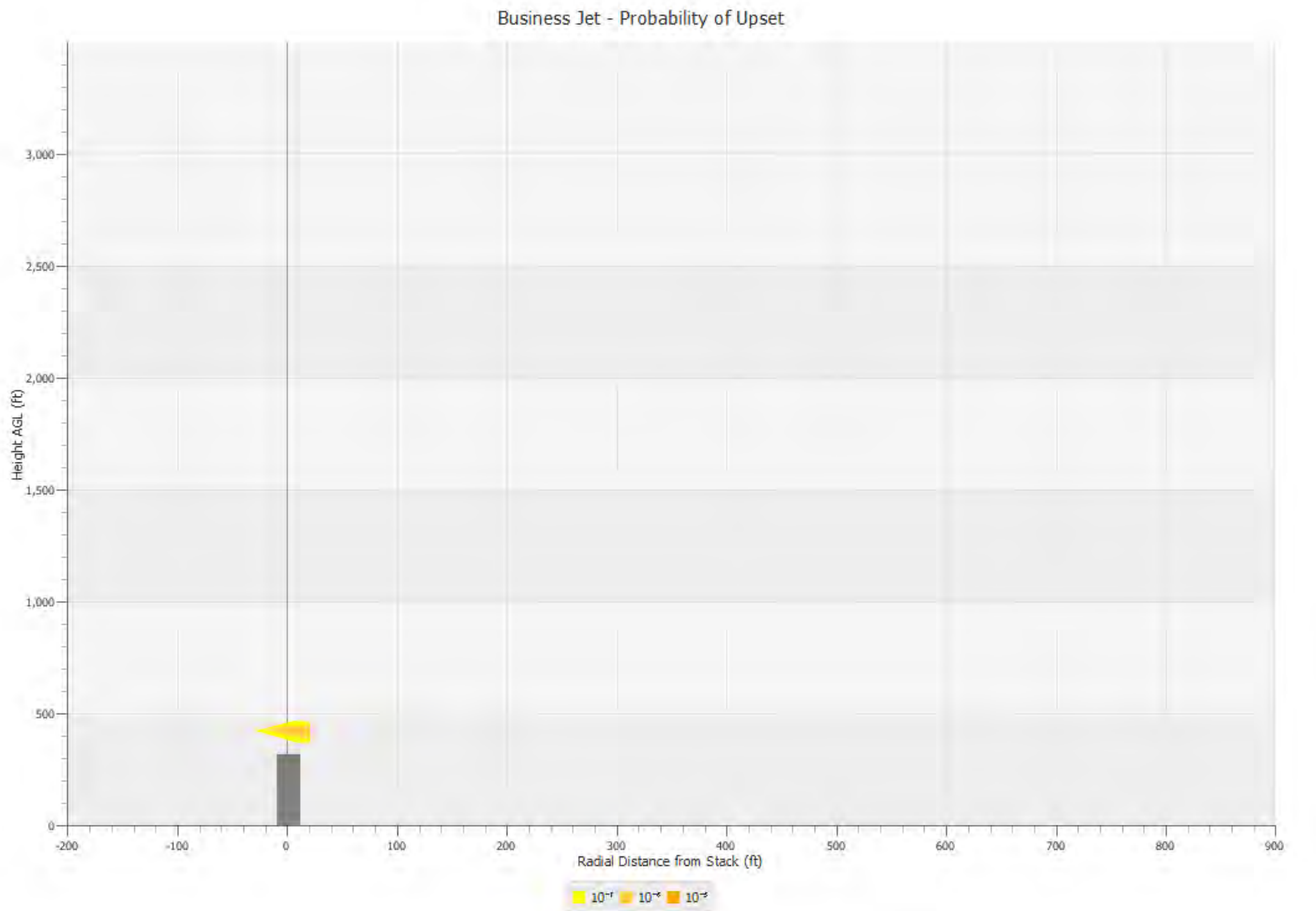

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
Radial Distance from Stack (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A12



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

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Figure A13

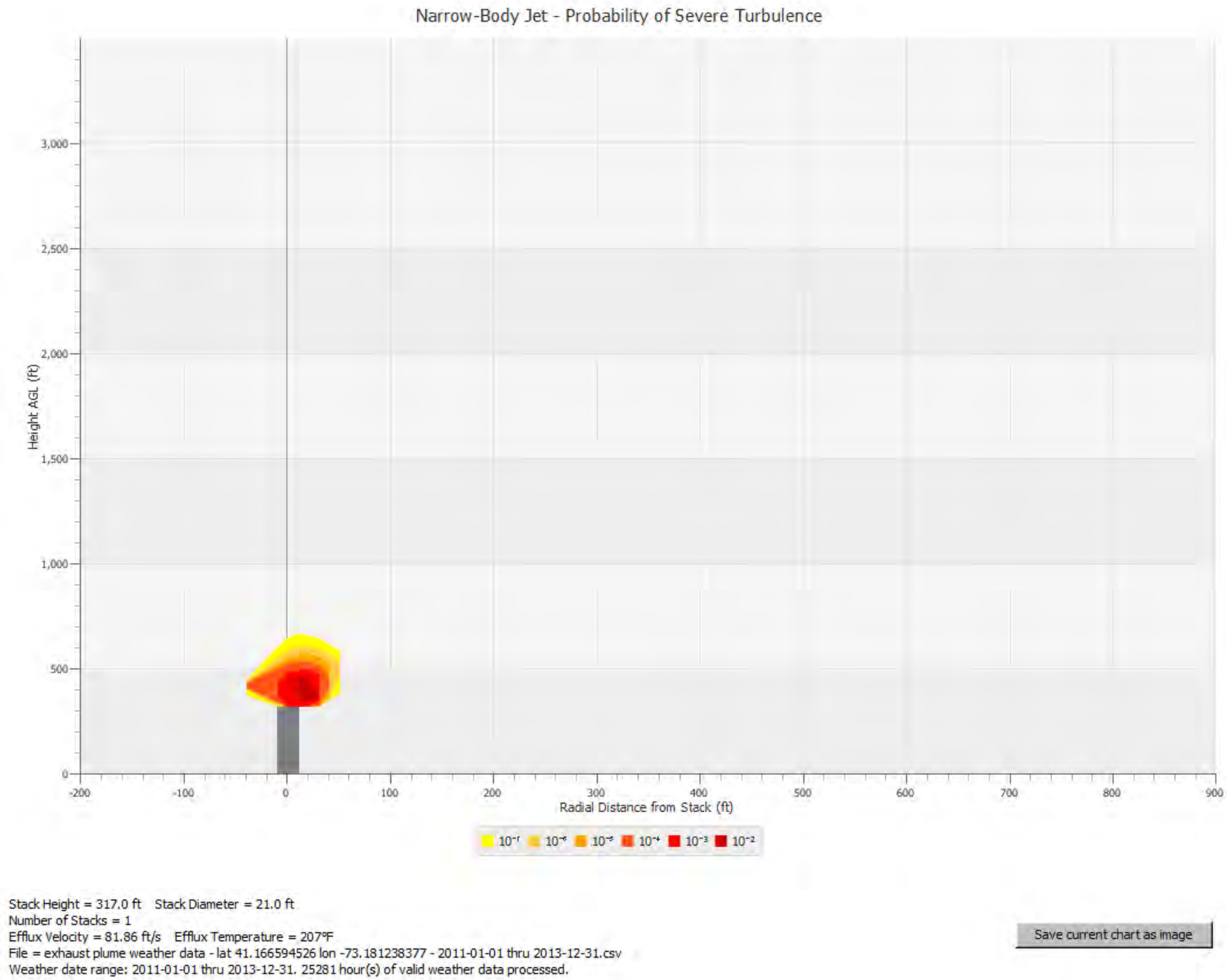

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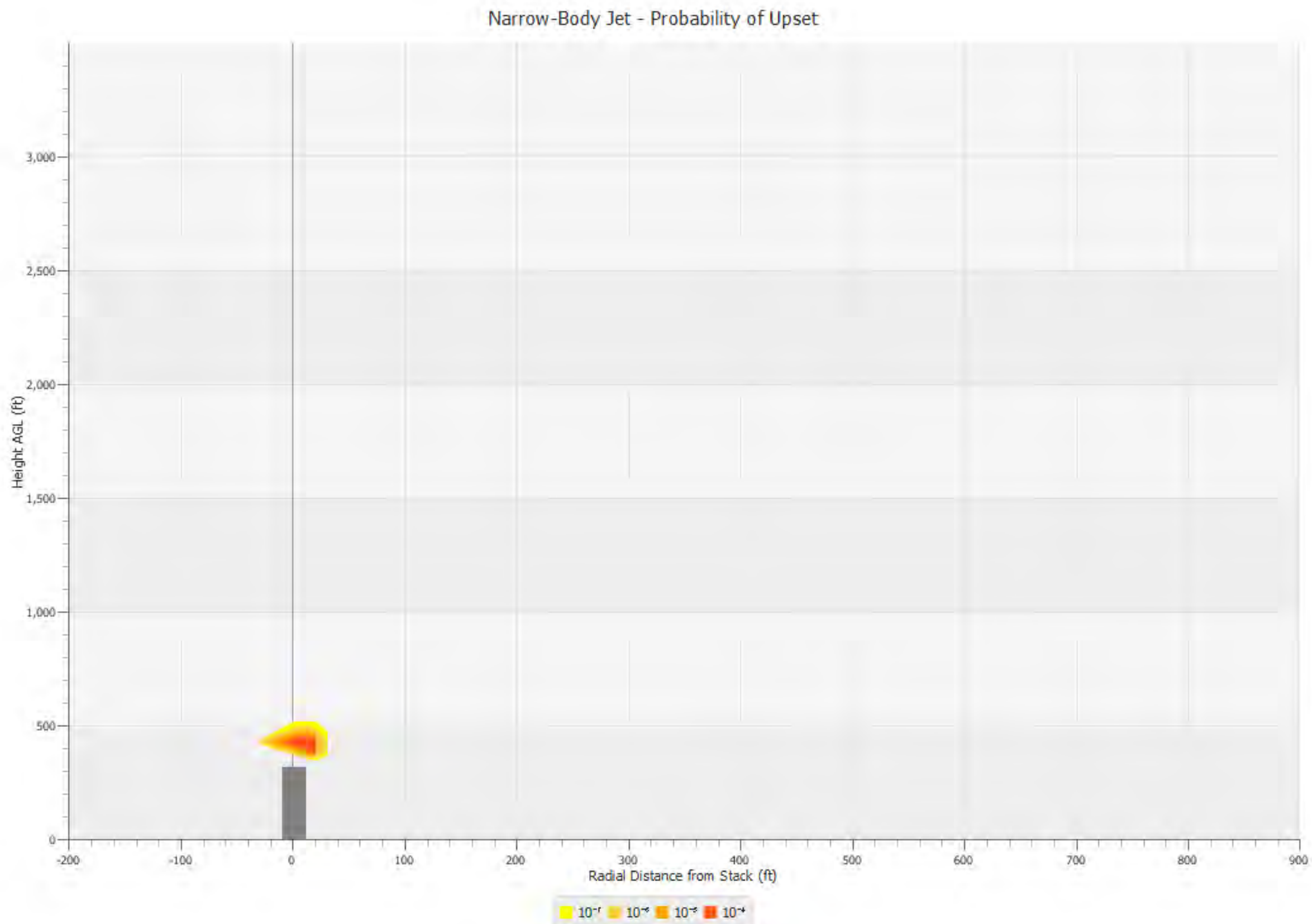
Figure A14



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 81.86 ft/s Efflux Temperature = 207°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figures A15 through A21

GE Case 8.1B – Natural Gas – Winter

Seven Probability Plots for Severe Turbulence and Aircraft Upset

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Figure A15

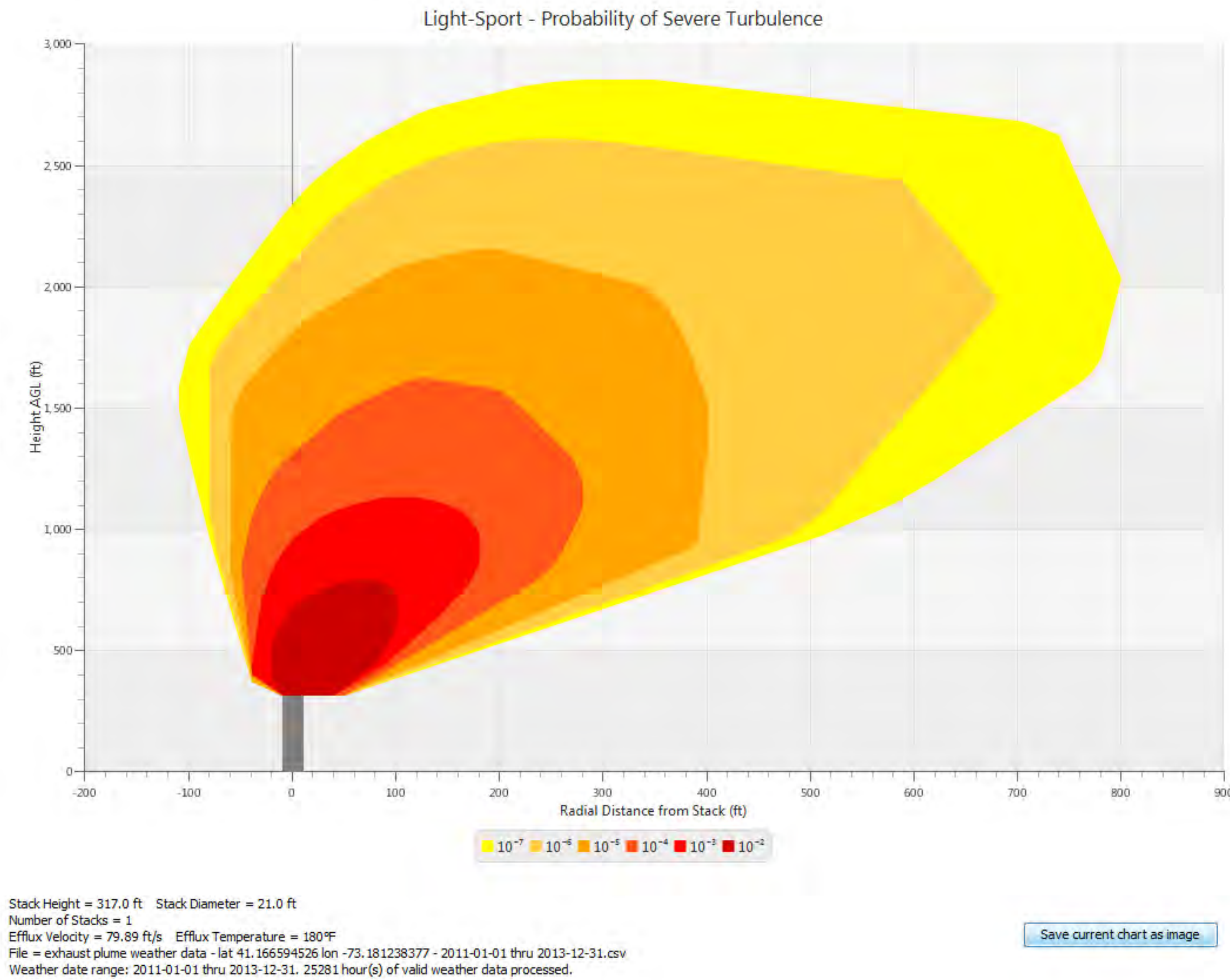
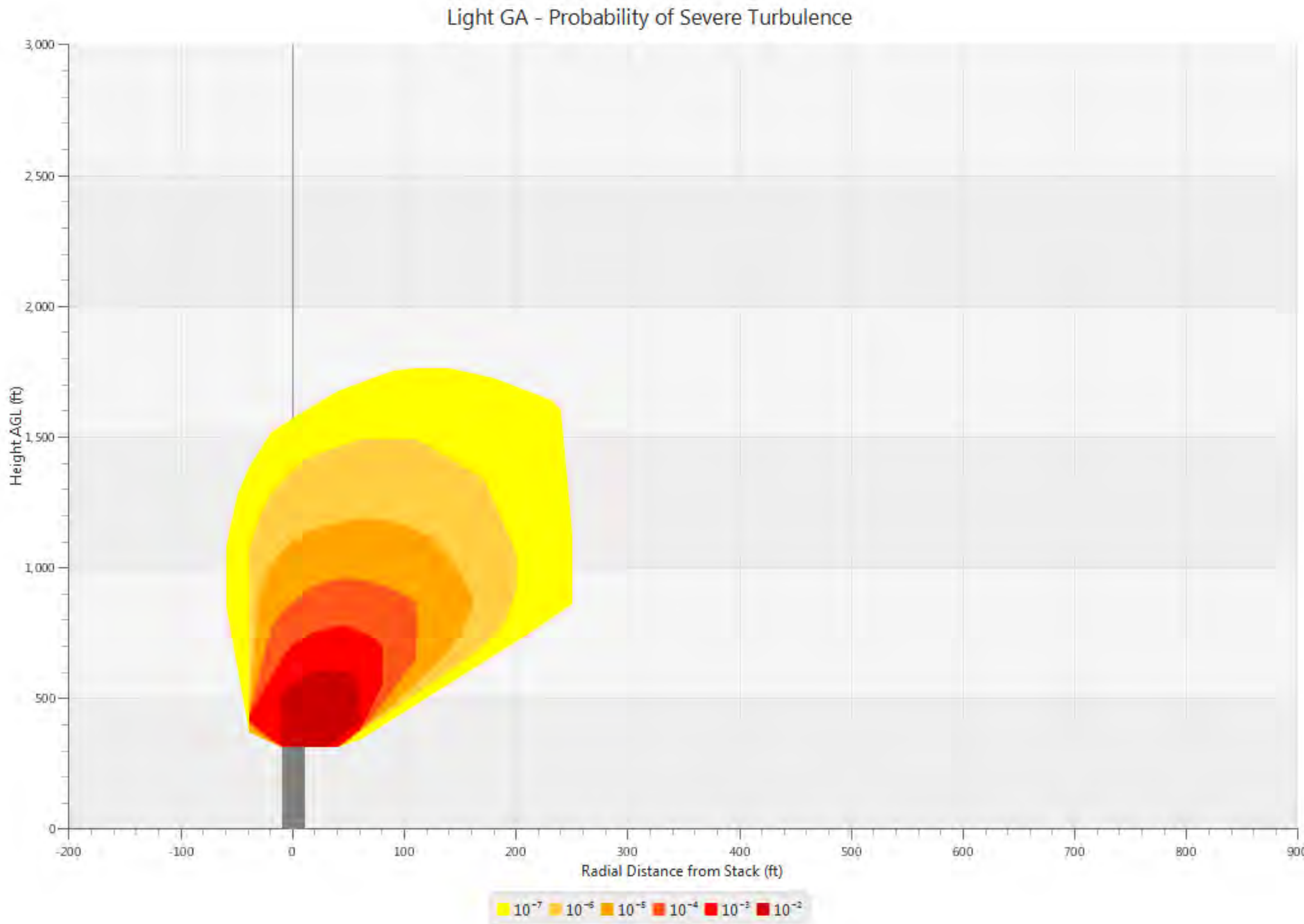


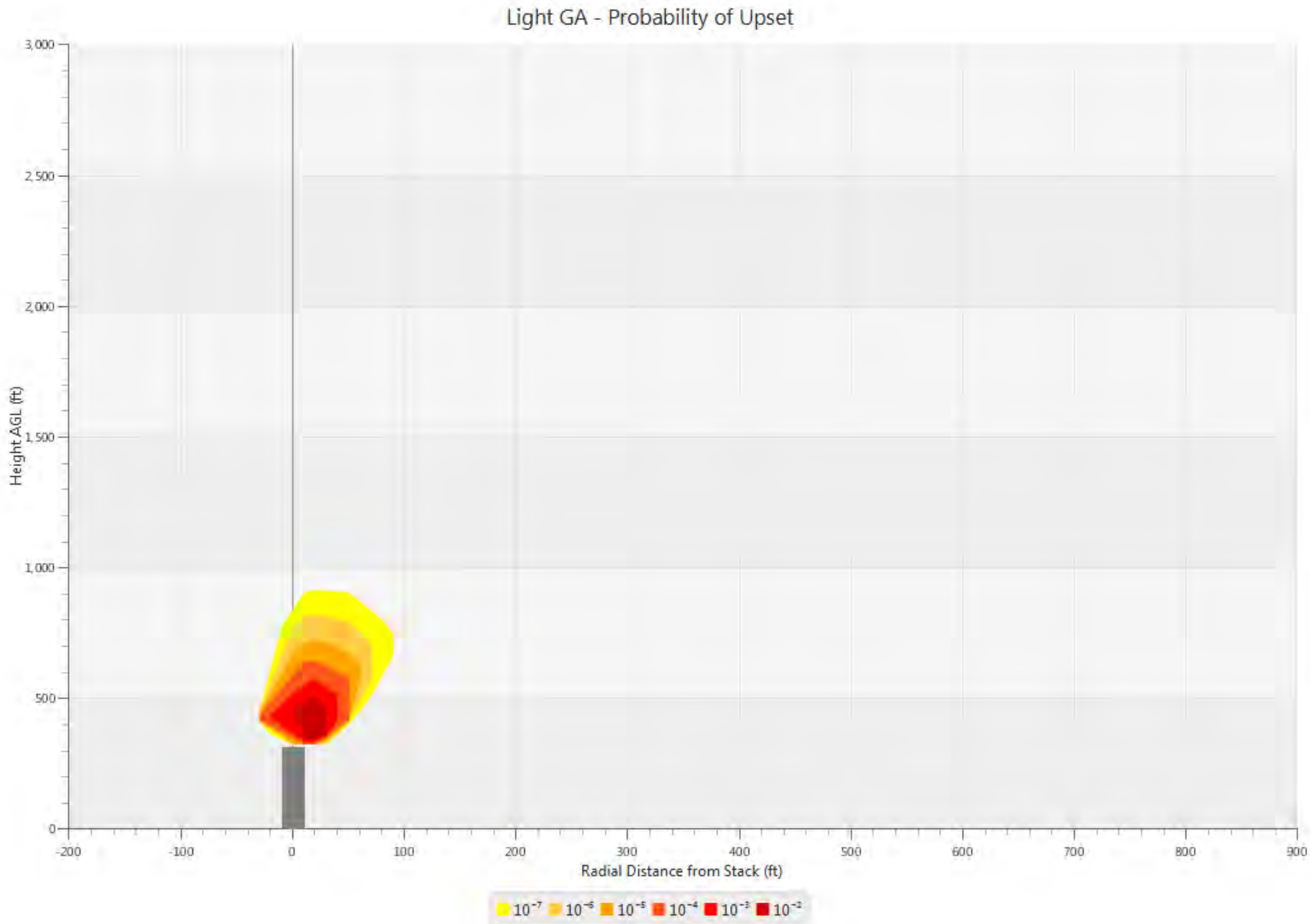
Figure A16



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A17



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A18

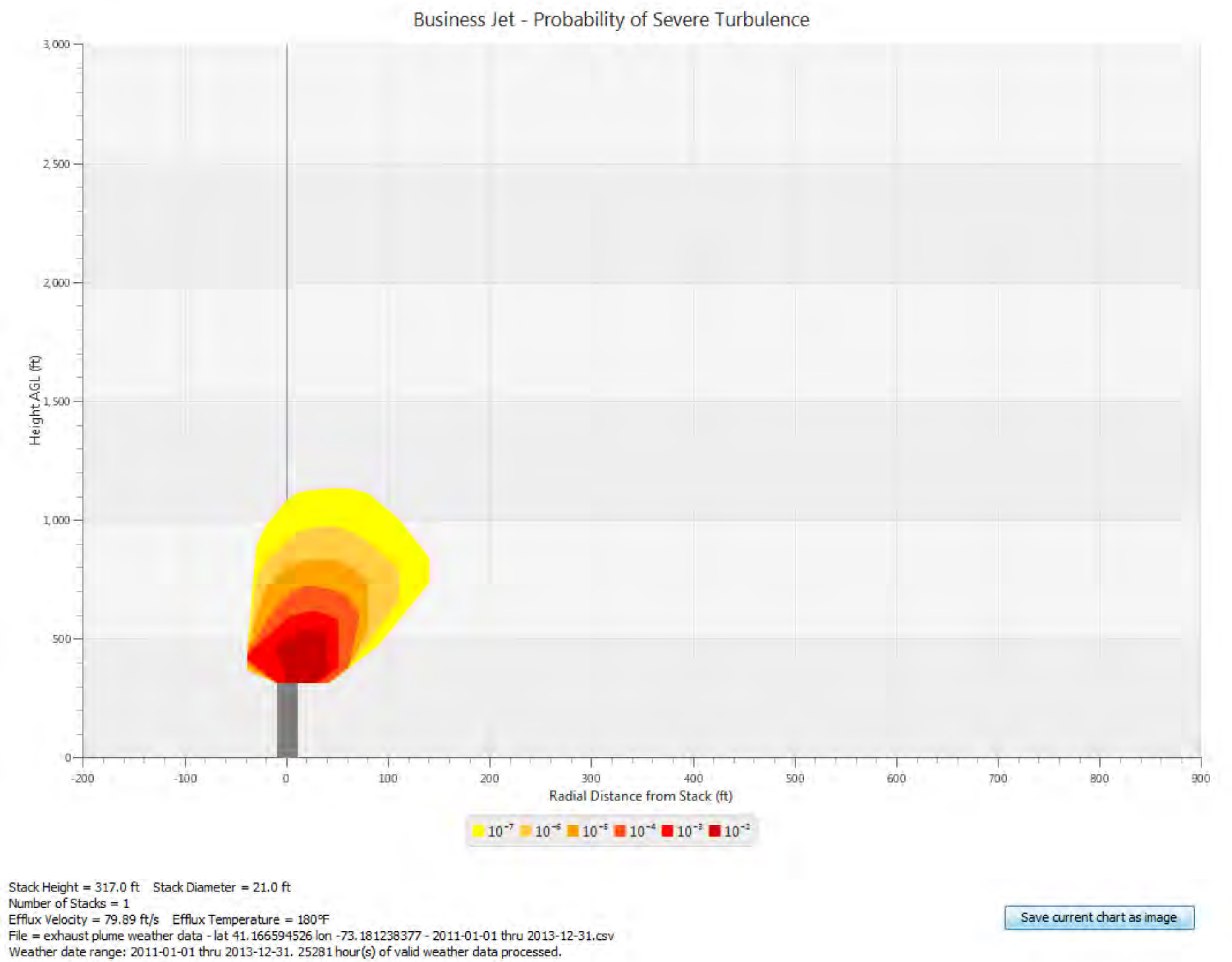
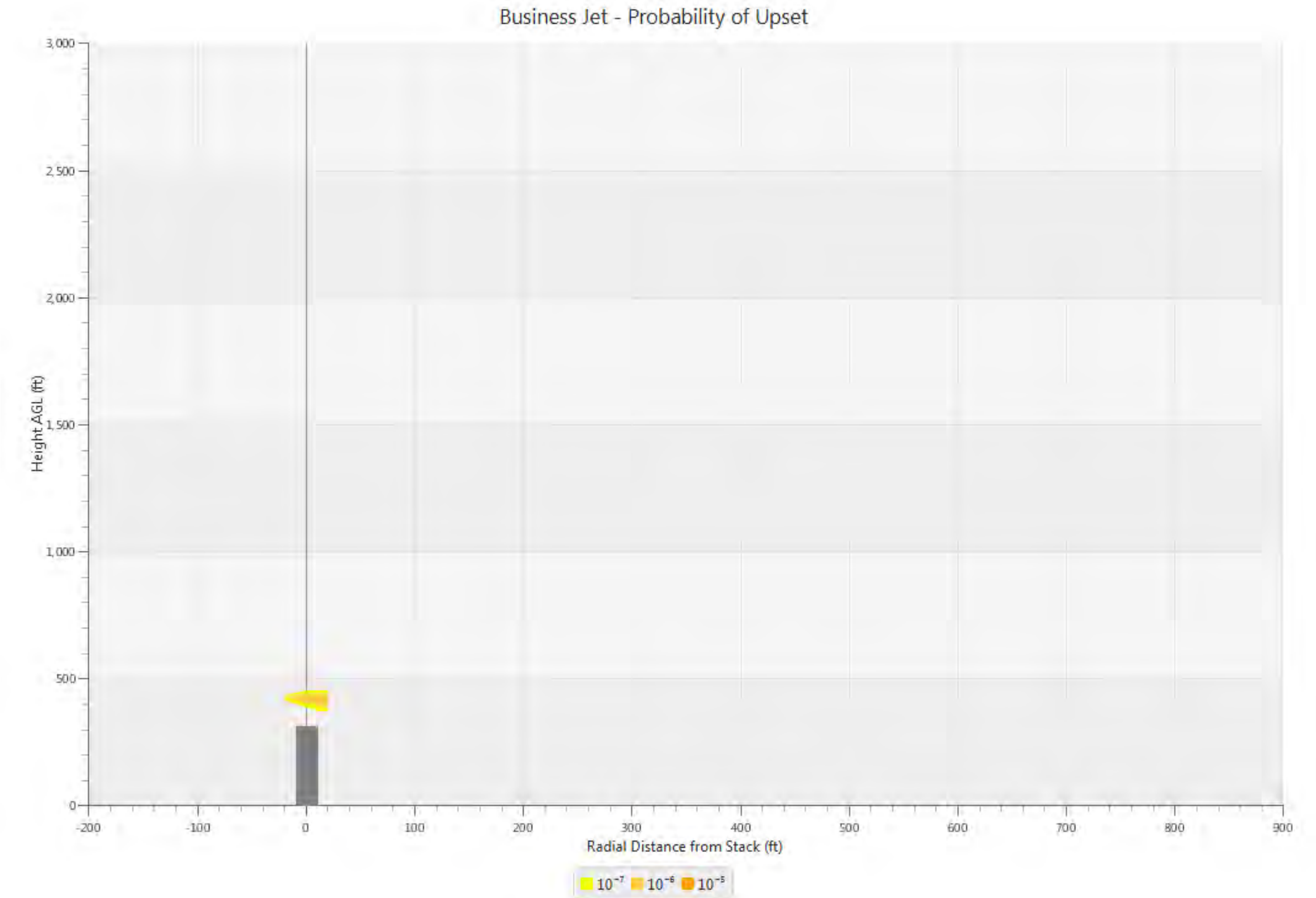
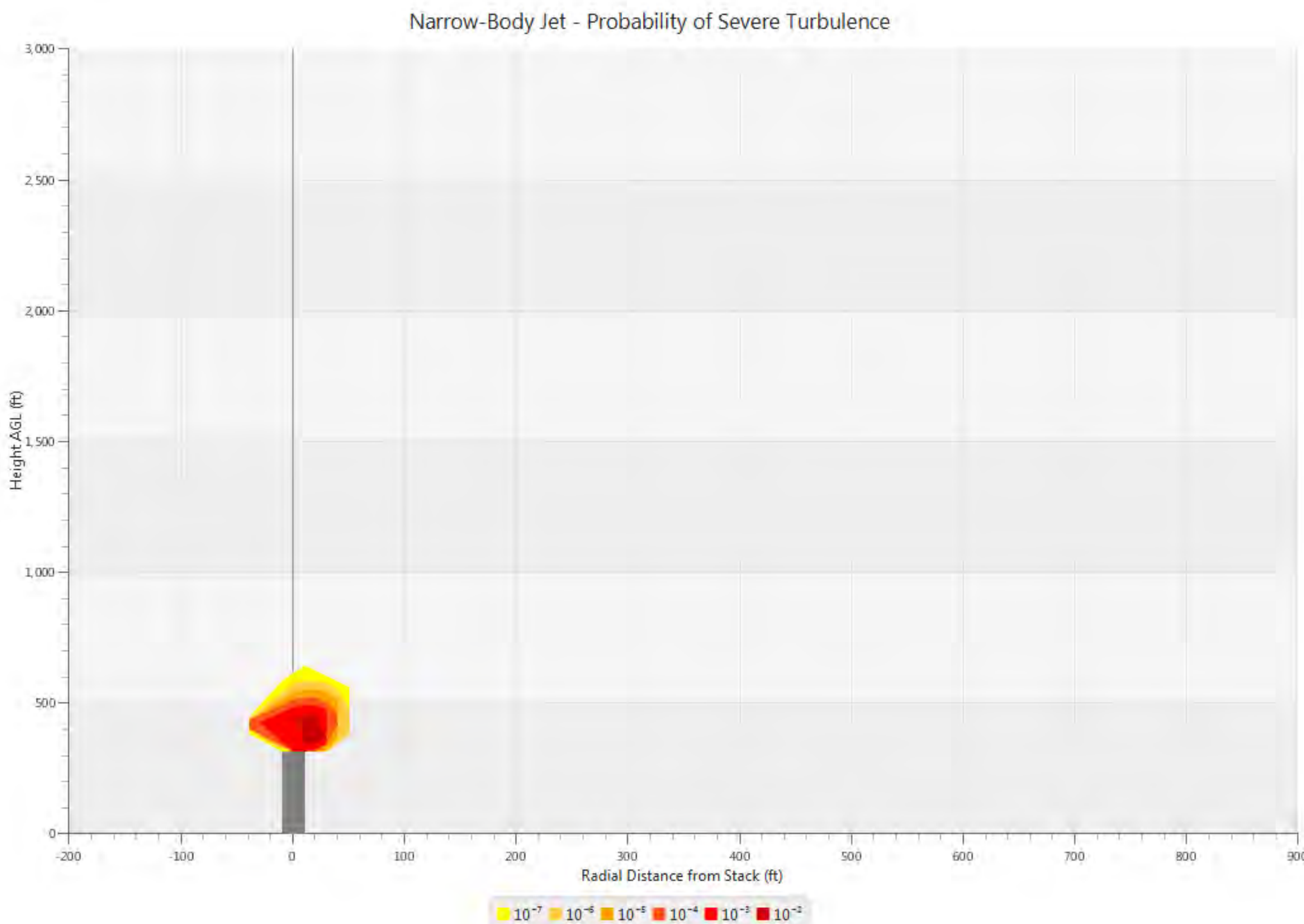

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A19



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

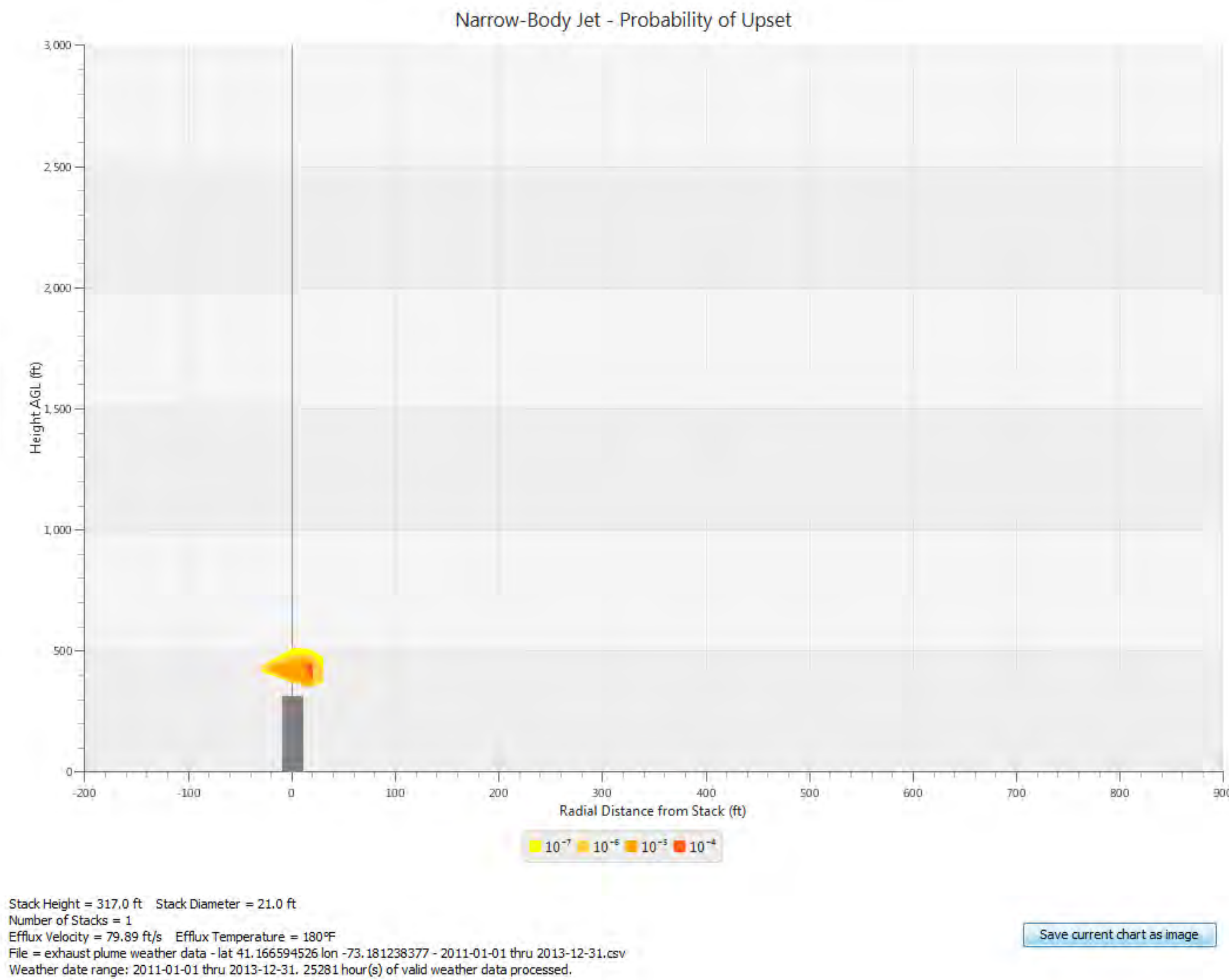
Figure A20



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A21


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4}
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 79.89 ft/s Efflux Temperature = 180°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figures A22 through A28

GE Case 8.1 – ULSD – Winter

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure A22

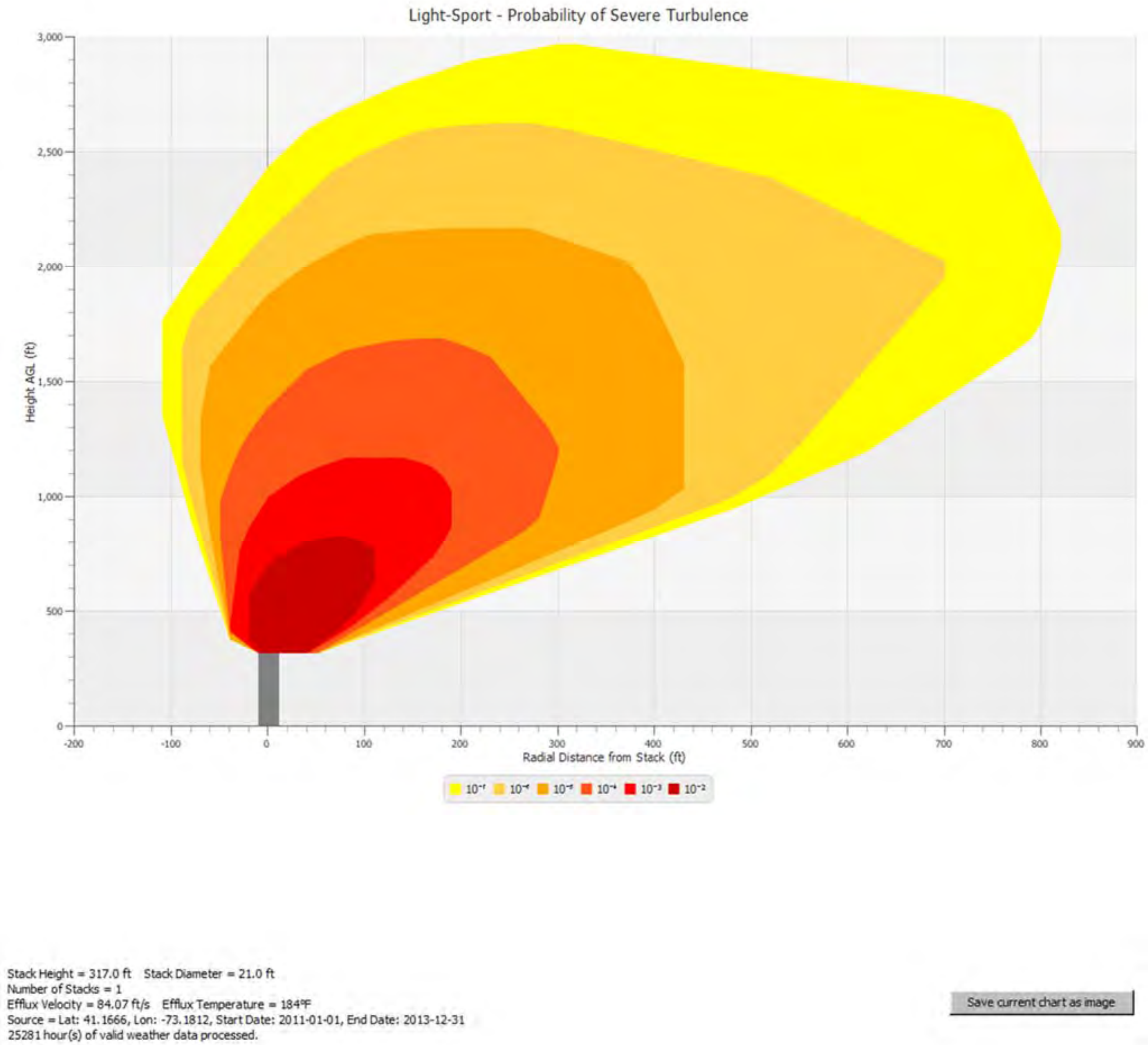
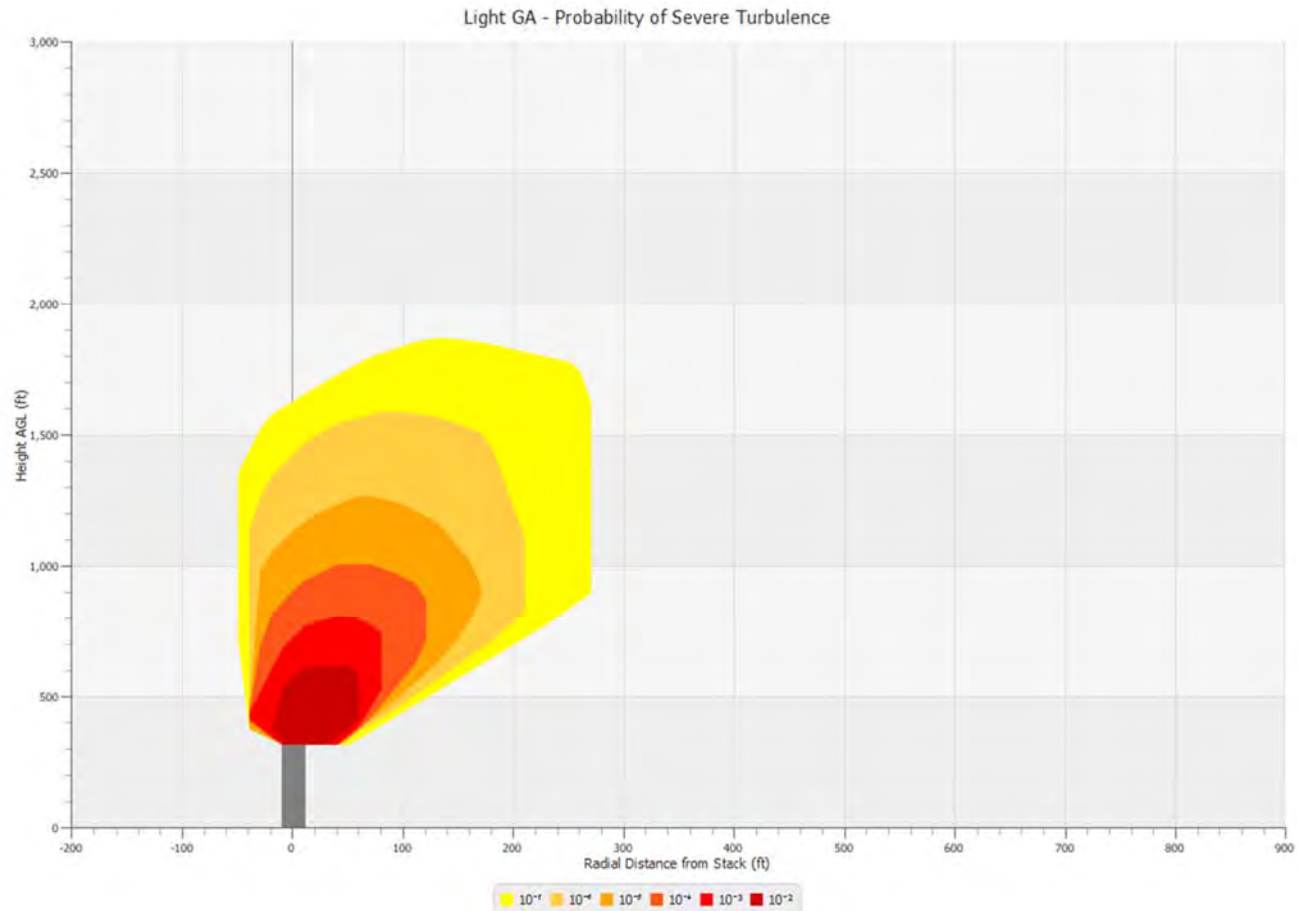

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

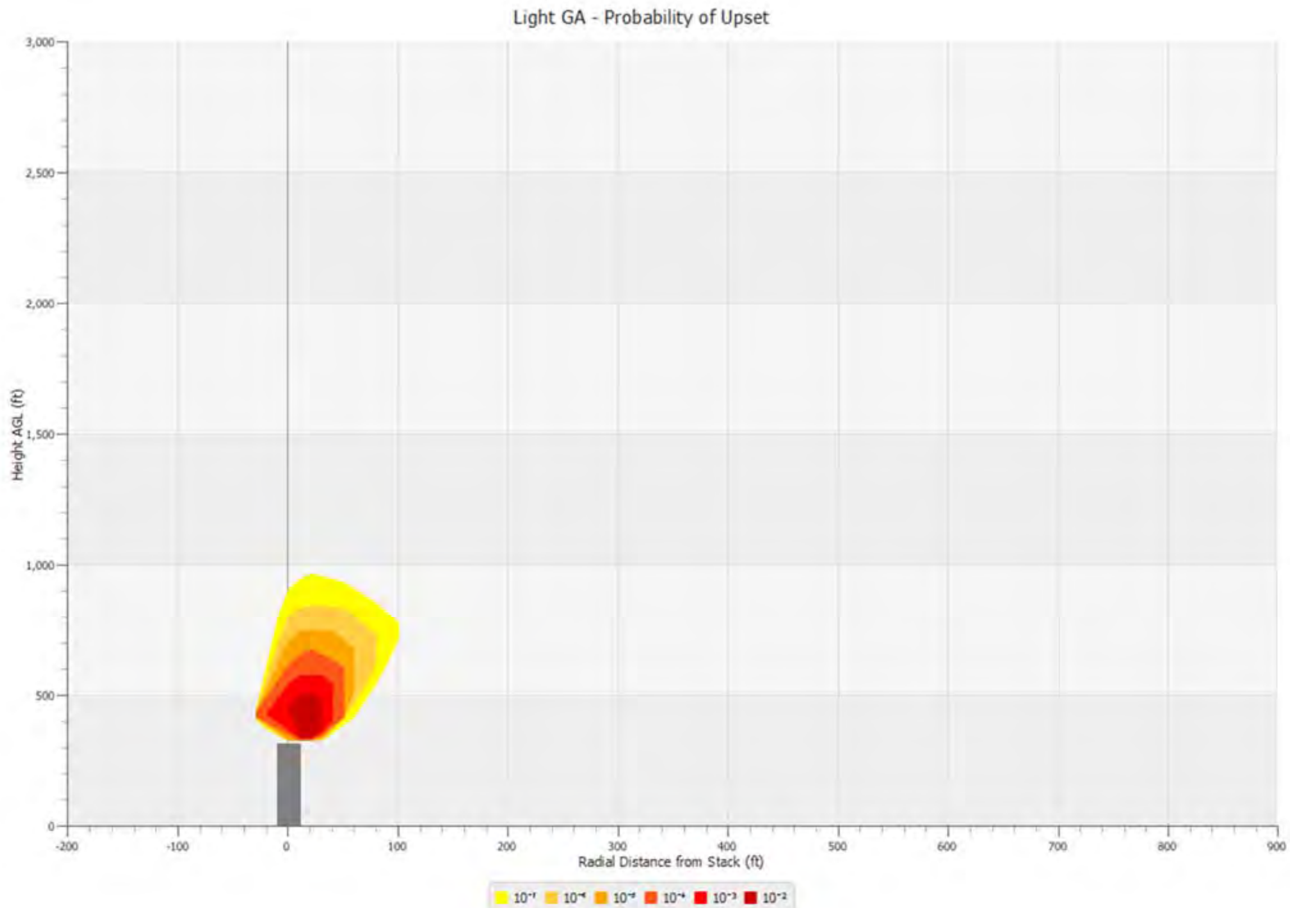
Figure A23



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A24



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184ºF
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A25

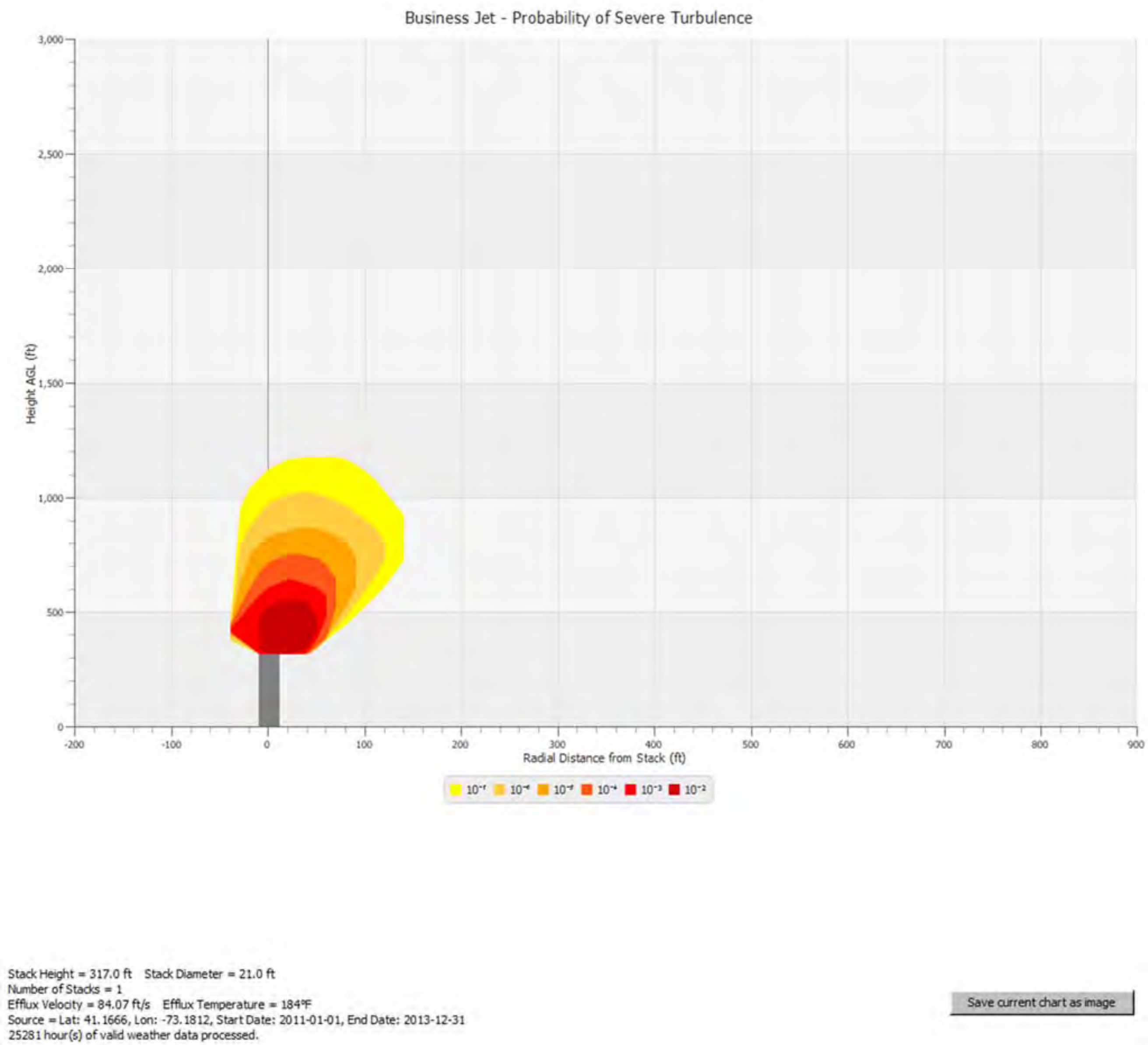
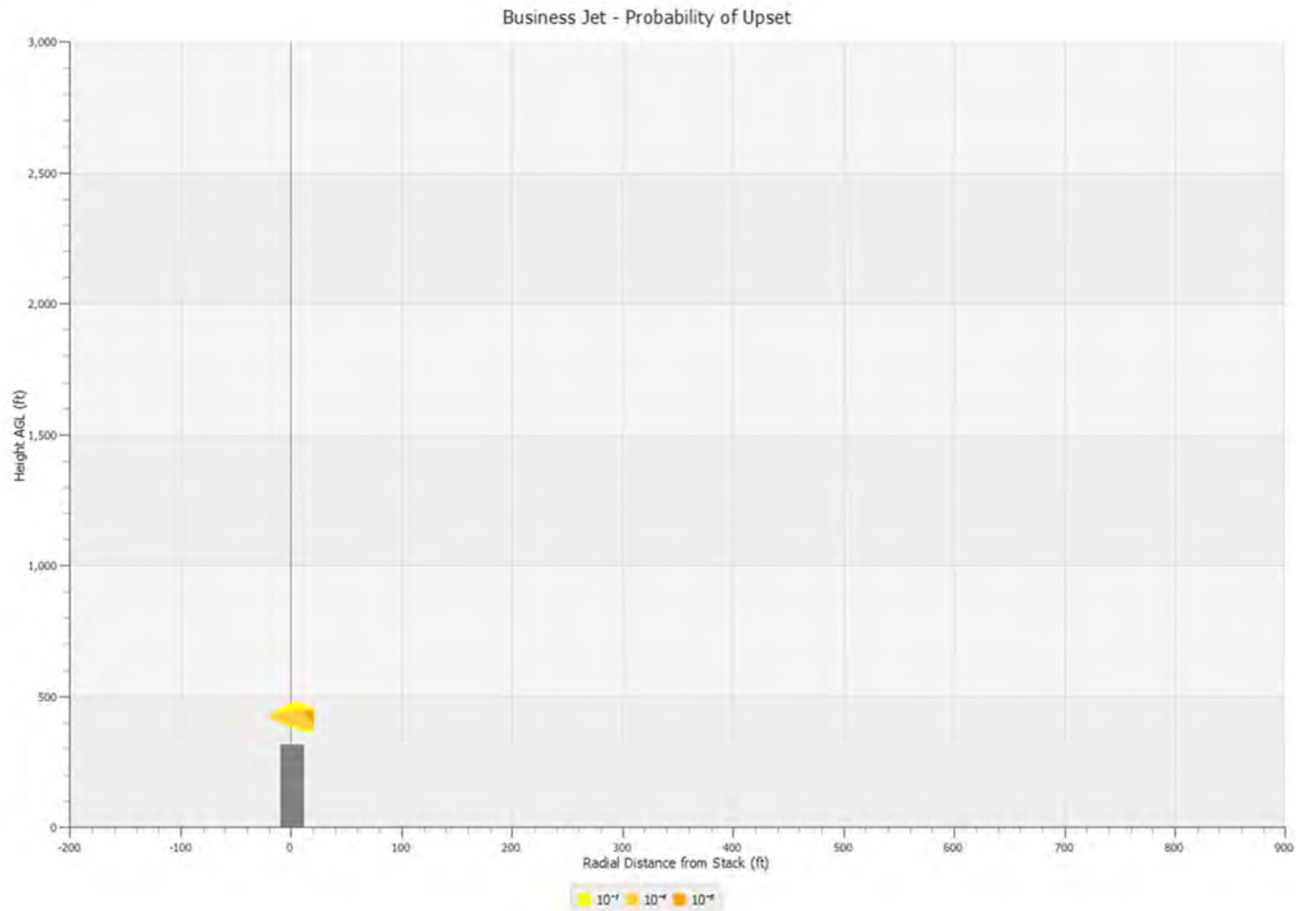

Business Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻³
10⁻²
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

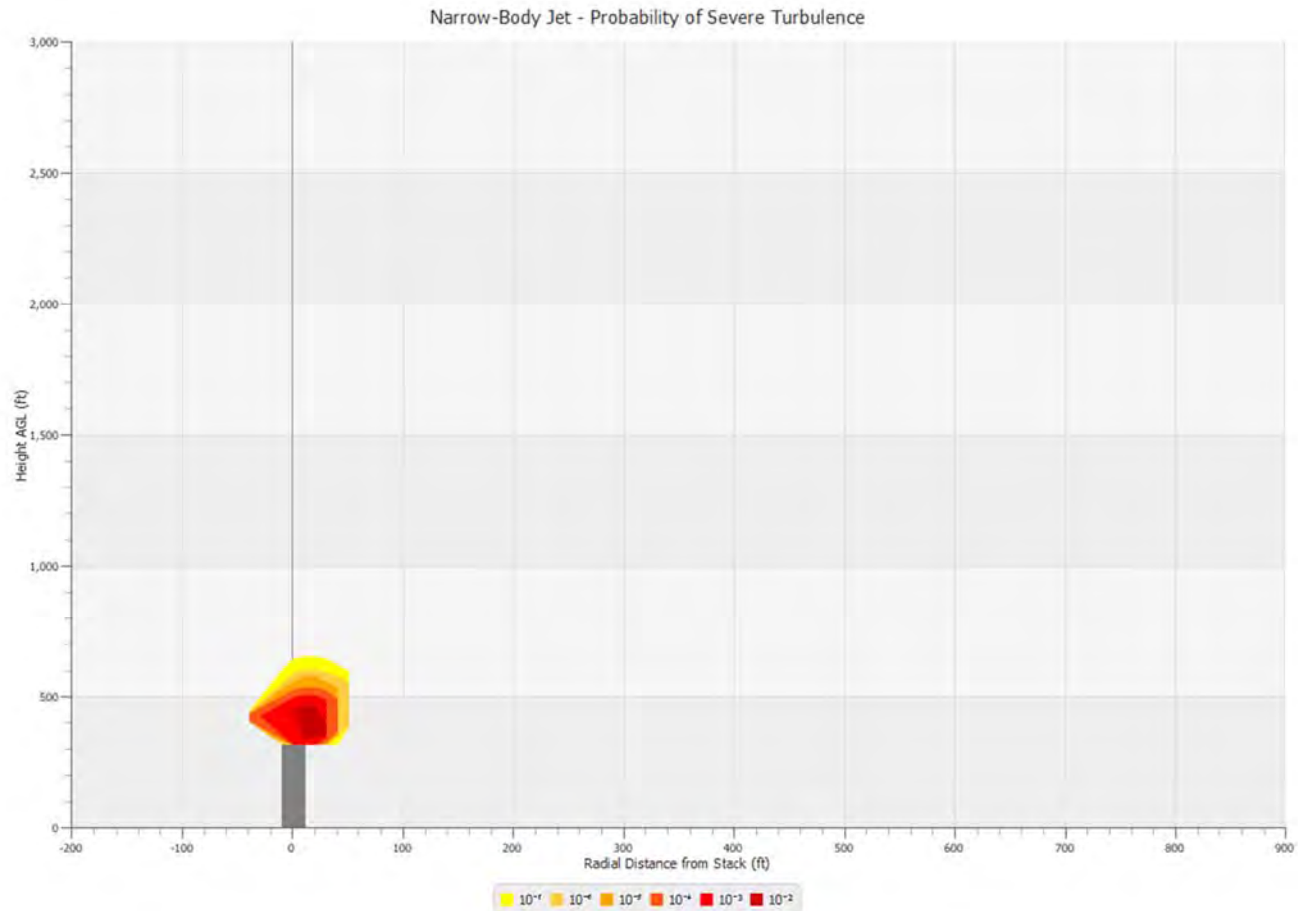
Figure A26



Stack Height = 317.0 ft   Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s   Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.

Save current chart as image

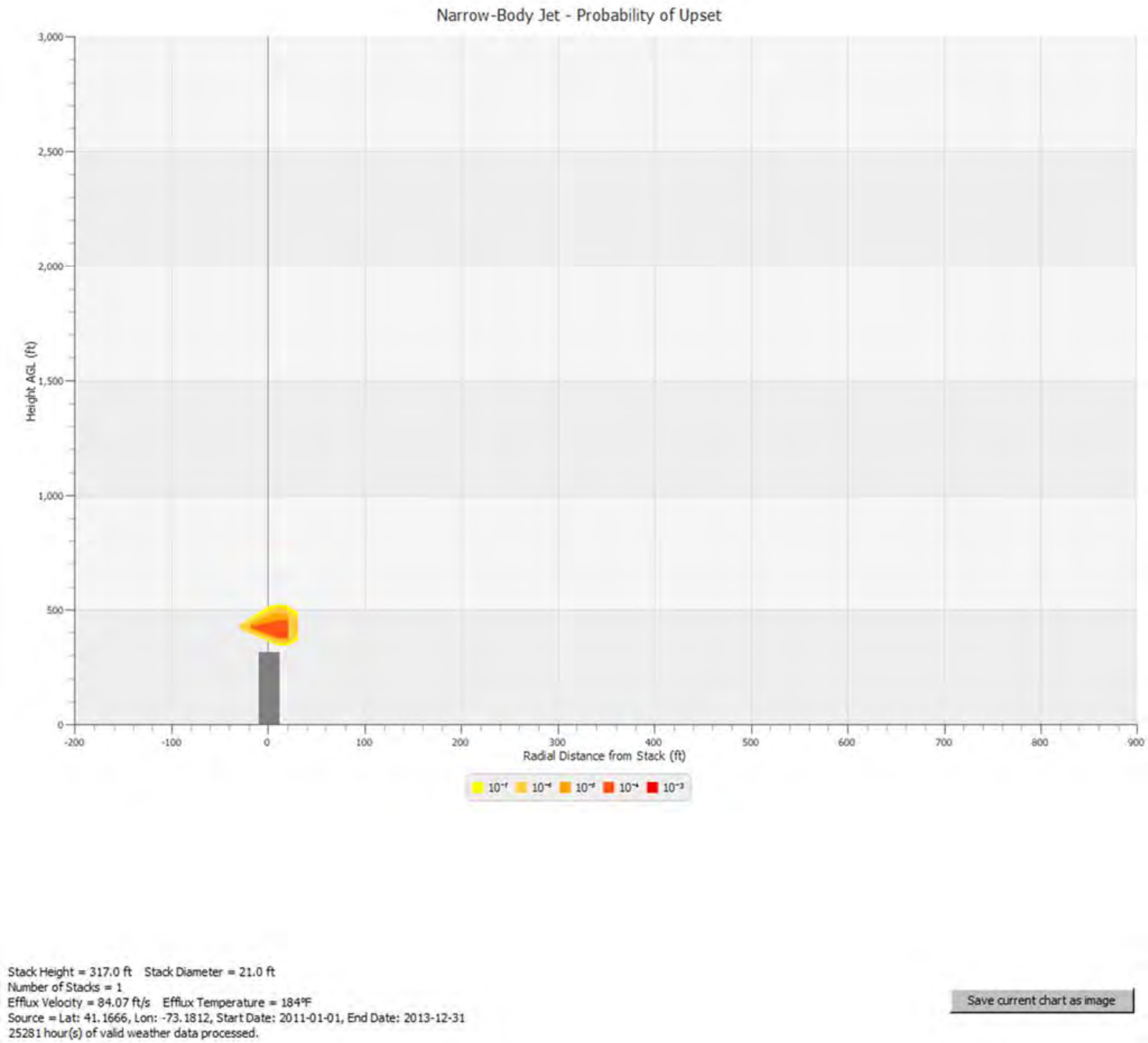
Figure A27



Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.

Save current chart as image

Figure A28


Narrow-Body Jet - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-200
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
Stack Height = 317.0 ft Stack Diameter = 21.0 ft
Number of Stacks = 1
Efflux Velocity = 84.07 ft/s Efflux Temperature = 184°F
Source = Lat: 41.1666, Lon: -73.1812, Start Date: 2011-01-01, End Date: 2013-12-31
25281 hour(s) of valid weather data processed.
Save current chart as image

Figures A29 through A35

Bridgeport Harbor Existing Unit No. 3 Under Full Load Conditions

Seven Probability Plots for Severe Turbulence and Aircraft Upset

Figure A29

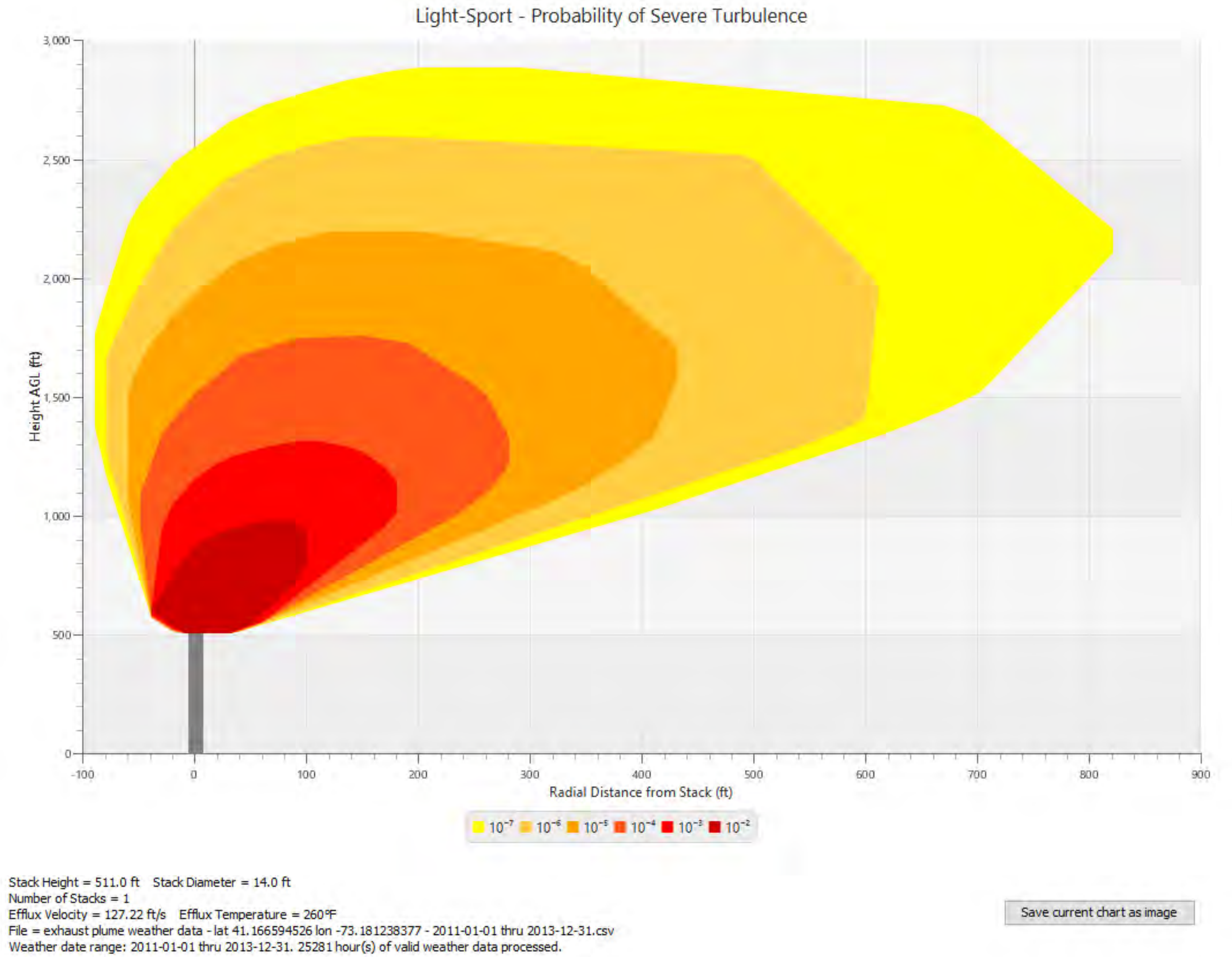

Light-Sport - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A30

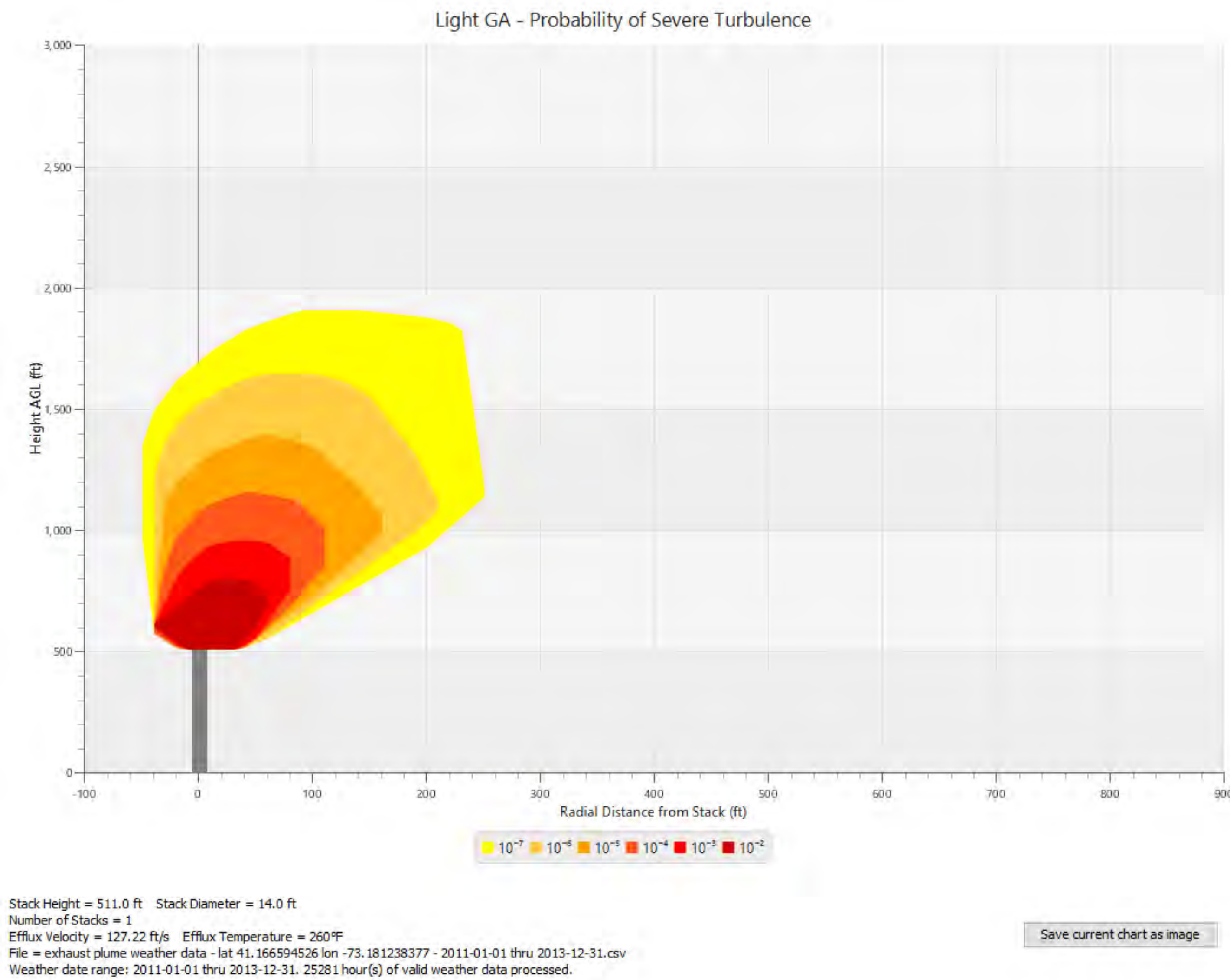

Light GA - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A31

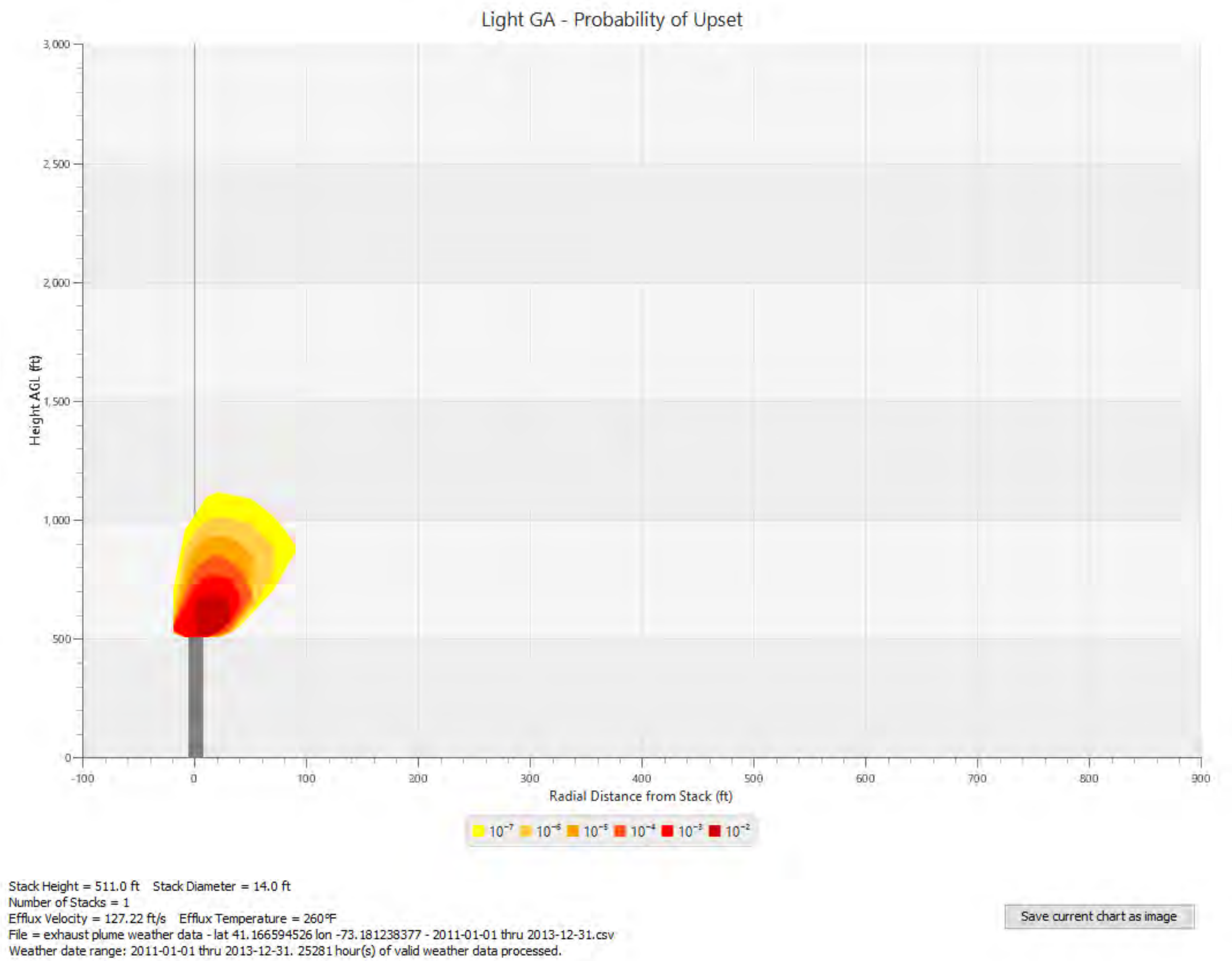
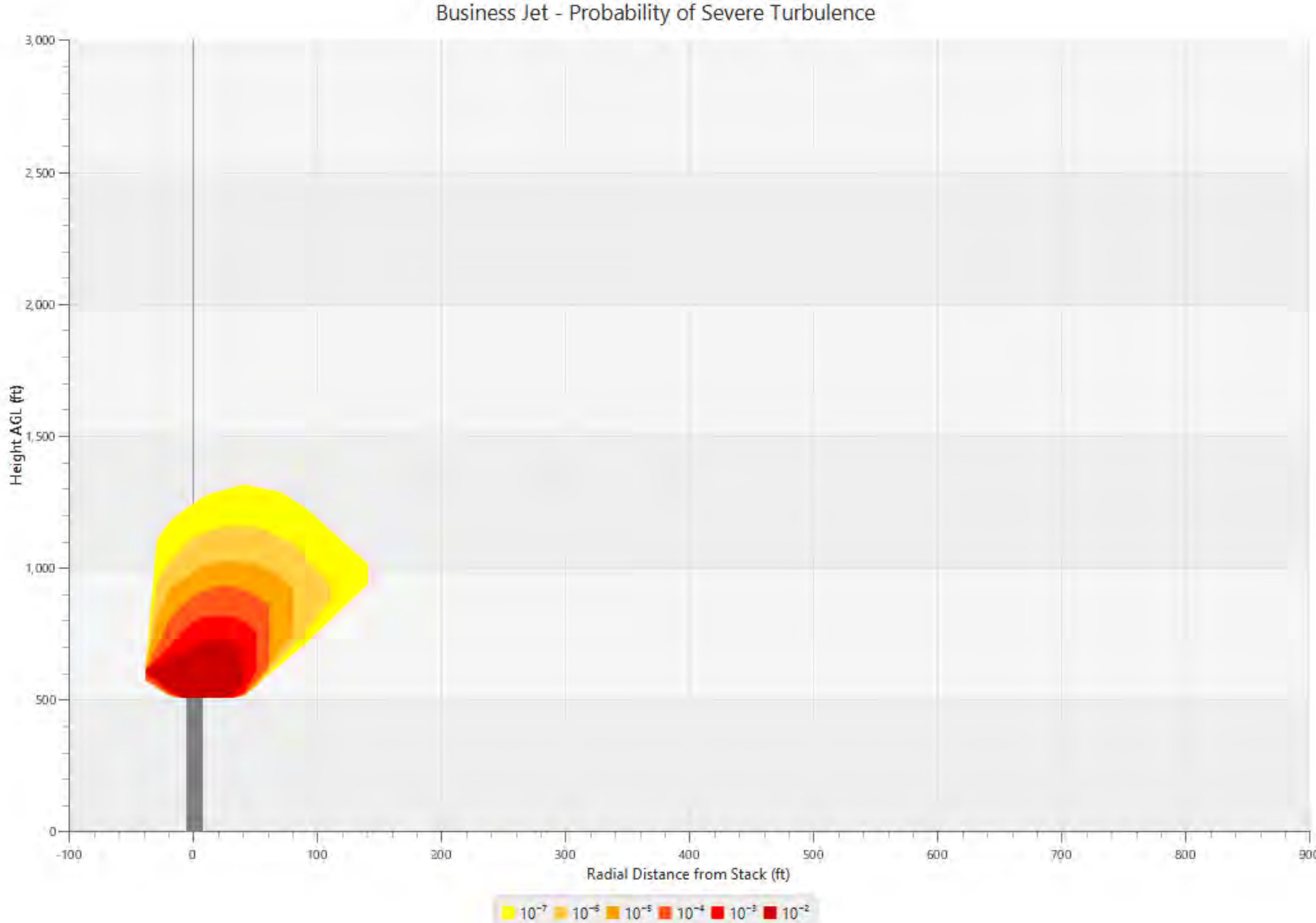

Light GA - Probability of Upset
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A32



Stack Height = 511.0 ft   Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s   Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.

Save current chart as image

May 11, 2016

Figure A33

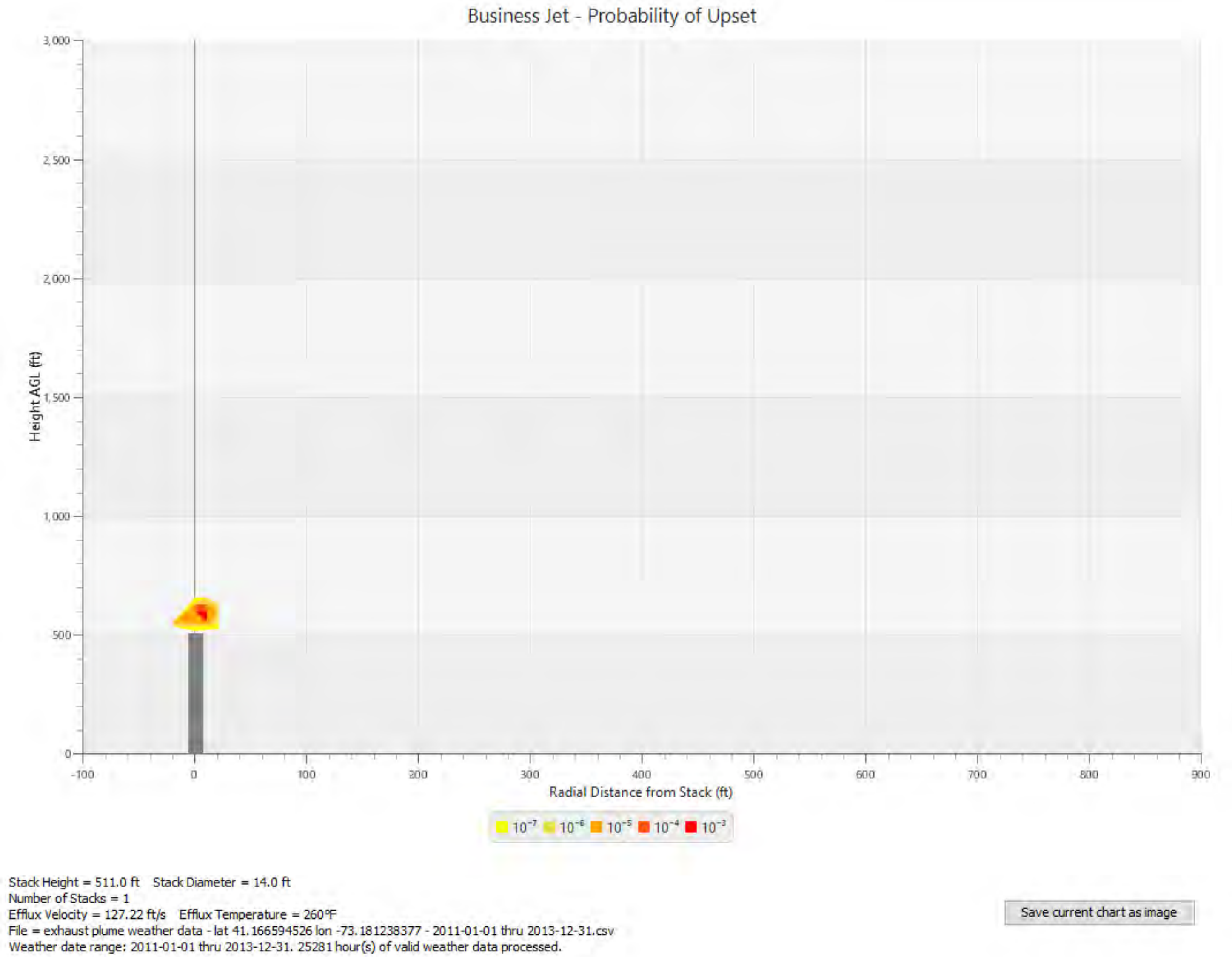


Figure A34

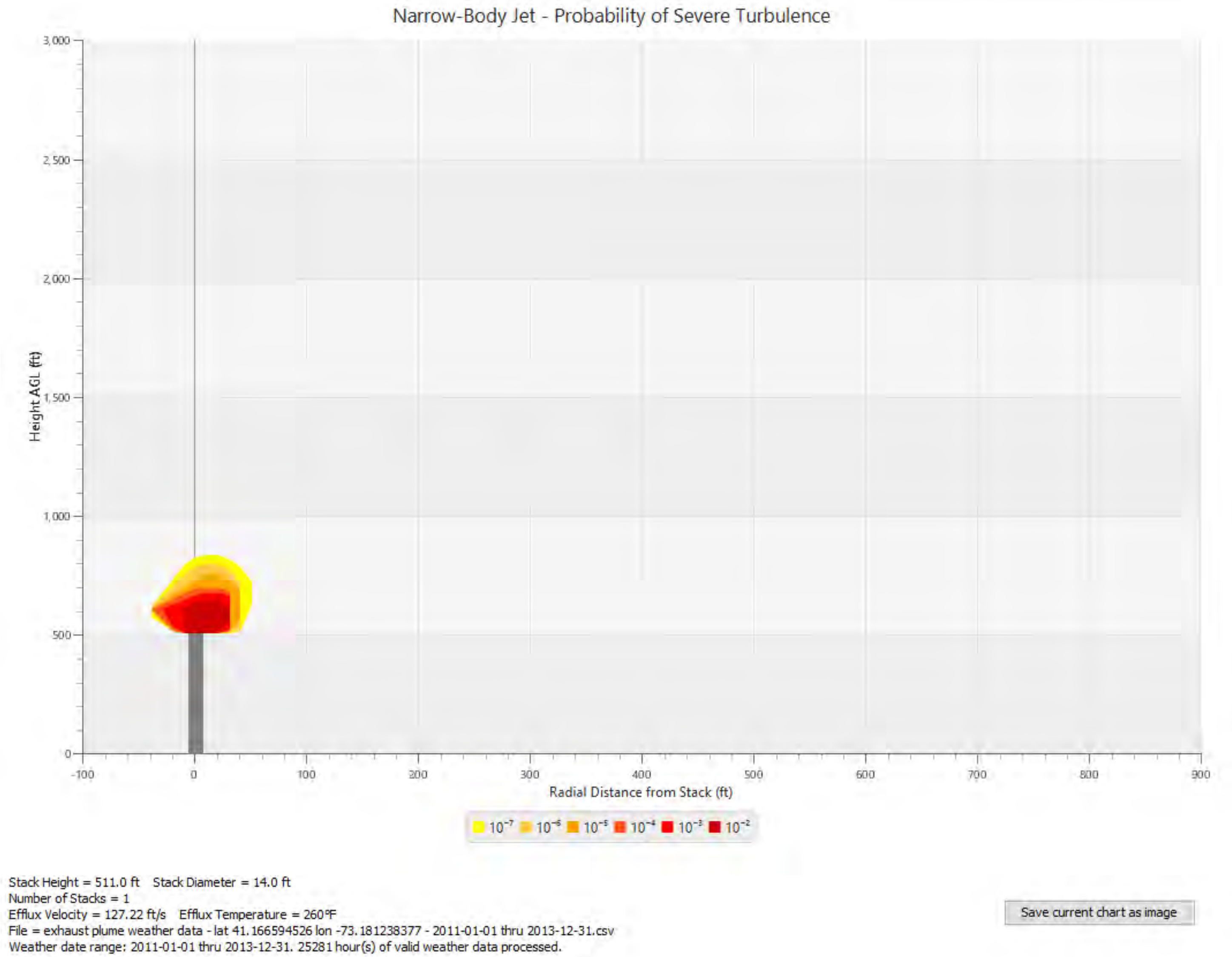

Narrow-Body Jet - Probability of Severe Turbulence
Height AGL (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
Radial Distance from Stack (ft)
10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Figure A35

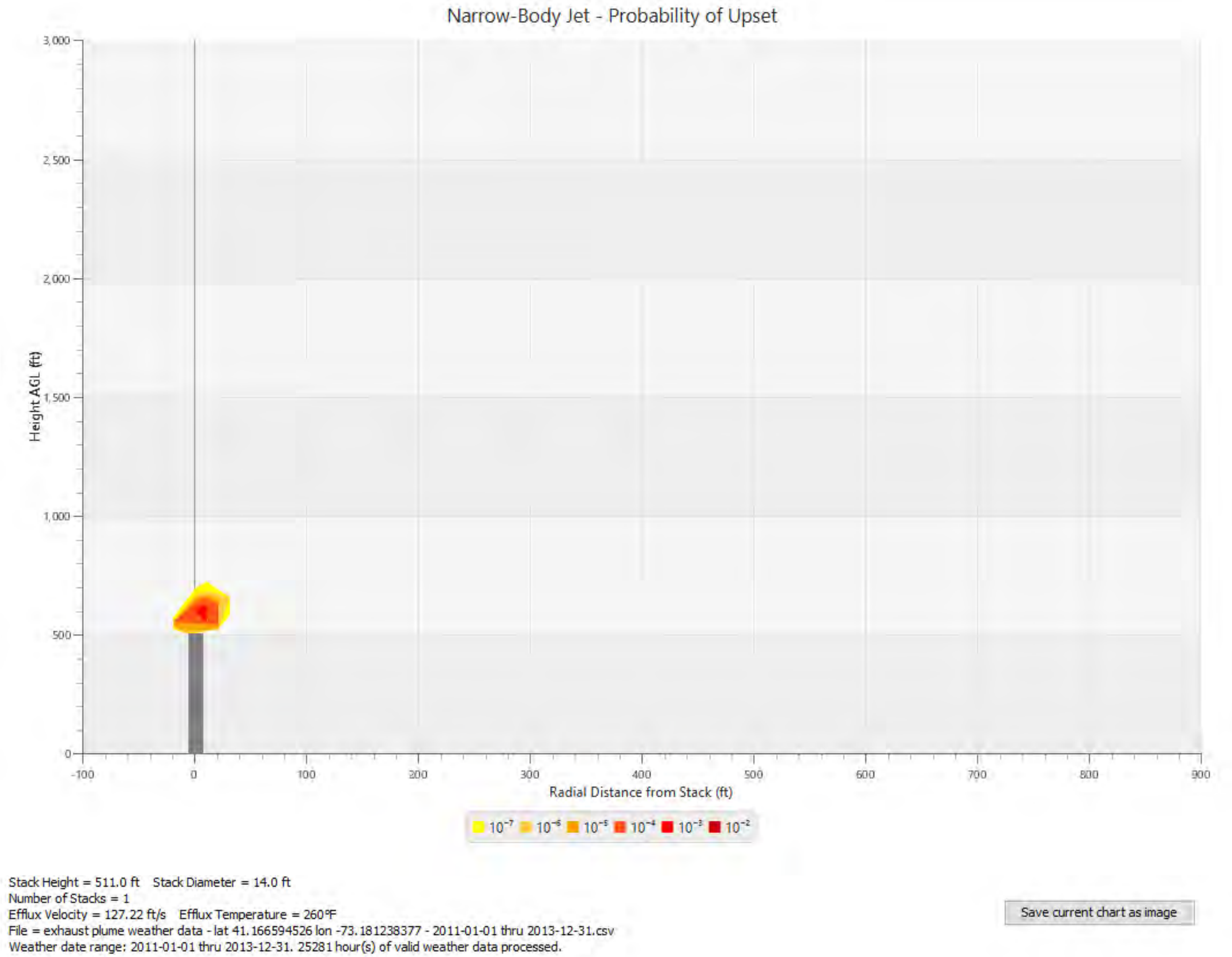

Narrow-Body Jet - Probability of Upset
Height AGL (ft)
Radial Distance from Stack (ft)
3,000
2,500
2,000
1,500
1,000
500
0
-100
0
100
200
300
400
500
600
700
800
900
10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²
Stack Height = 511.0 ft Stack Diameter = 14.0 ft
Number of Stacks = 1
Efflux Velocity = 127.22 ft/s Efflux Temperature = 260°F
File = exhaust plume weather data - lat 41.166594526 lon -73.181238377 - 2011-01-01 thru 2013-12-31.csv
Weather date range: 2011-01-01 thru 2013-12-31. 25281 hour(s) of valid weather data processed.
Save current chart as image

Exhibit 1

DEPARTURE ROUTE DESCRIPTION

TAKEOFF RUNWAY 6: Climb heading 058°, thence. . . .
TAKEOFF RUNWAY 11: Climb heading 111°, thence. . . .
TAKEOFF RUNWAY 24: Climb heading 238°, thence. . . .
TAKEOFF RUNWAY 29: Climb heading 291°, thence. . . .

. . . .Expect vectors to assigned route/fix. Maintain 2000. Expect clearance to filed altitude/flight level within ten (10) minutes after departure.

TAKEOFF OBSTACLE NOTES:

Rwy 6: Fence 14′ from DER, 95′ left of centerline, 17′ AGL/18′ MSL.
Vehicles on road beginning 79′ from DER, 1′ right of centerline, up to 15′ AGL/25′ MSL.

Rwy 11: Vehicles on road beginning 195′ from DER, 127′ left of centerline, up to 15′ AGL/28′ MSL.
Vehicles on road and poles beginning 207′ from DER, 6′ right of centerline, up to 73′ AGL/73′ MSL.

Rwy 24: Vehicles on road beginning 484′ from DER, 537′ right of centerline, up to 15′ AGL/25′ MSL.

Rwy 29: Building 555′ from DER, 622′ right of centerline, 57′ AGL/59′ MSL.
Stack 2.2 NM from DER, 275′ left of centerline, 497′ AGL/512′ MSL.

NE-1, 28 APR 2016 to 26 MAY 2016

BRIDGEPORT, CONNECTICUT — AL-621 (FAA) — 16035

RNAV (GPS) RWY 29
IGOR I. SIKORSKY MEMORIAL (BDR)

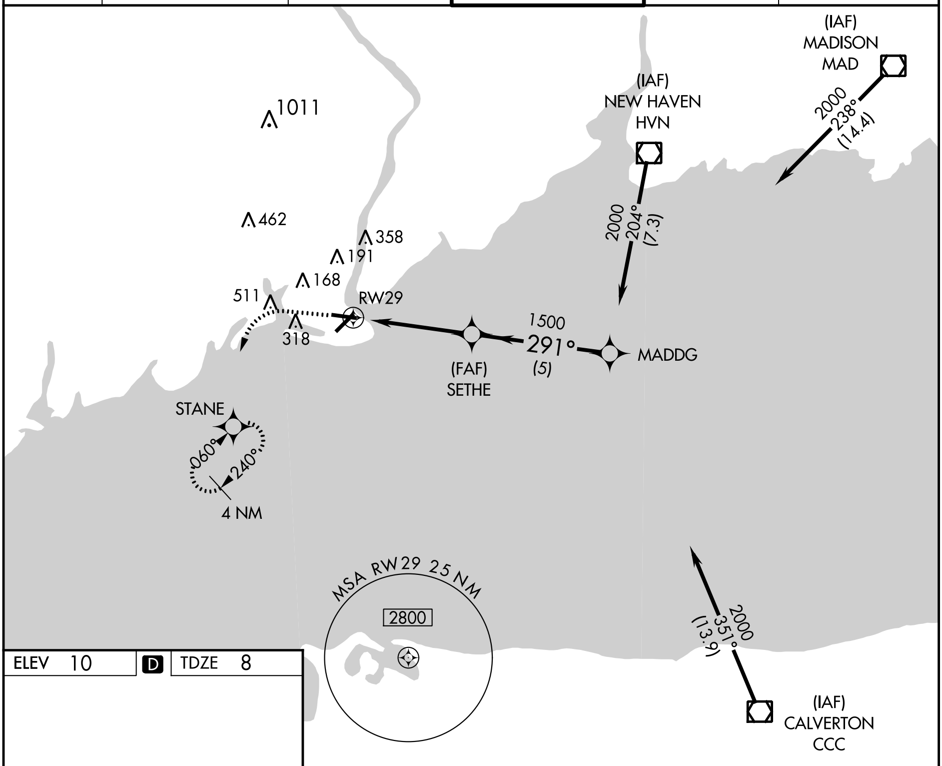
APP CRS	Rwy ldg	4397
291°	TDZE	8
	Apt Elev	10

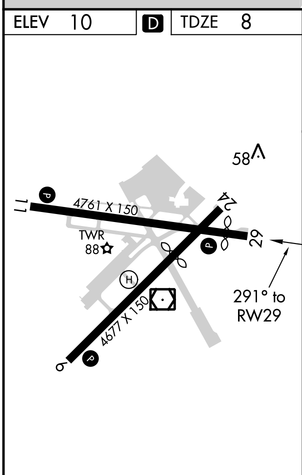
T ▲ NA — GPS or RNP-0.3 required. DME/DME RNP-0.3 NA.

MISSED APPROACH: Climb to 500, then climbing left turn to 1800 direct STANE WP and hold.

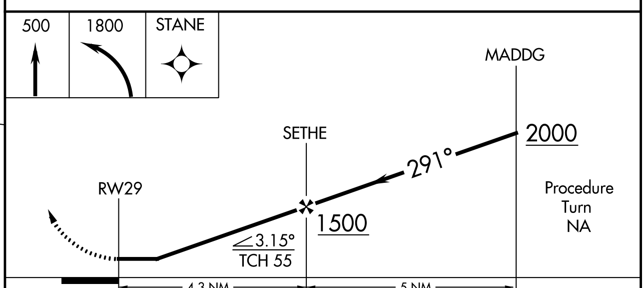
ATIS	NEW YORK APP CON	BRIDGEPORT RADIO	BRIDGEPORT TOWER★	GND CON	CLNC DEL
119.15	124.075 343.65	122.2	120.9 L (CTAF) 257.8	121.75 257.8	121.75 *124.075 *when tower closed

NE-1, 28 APR 2016 to 26 MAY 2016





REIL Rwys 6, 11, 24, and 29 L
HIRL Rwys 6-24 and 11-29 L



CATEGORY	A	B	C	D
LNAV MDA	380-1 372 (400-1)			380-1¼ 372 (400-1¼)
CIRCLING	420-1 410 (500-1)	620-1 610 (700-1)	620-1¾ 610 (700-1¾)	820-2½ 810 (900-2½)

NE-1, 28 APR 2016 to 26 MAY 2016

BRIDGEPORT, CONNECTICUT
Orig 06SEP01

41°10′N-73°08′W

IGOR I. SIKORSKY MEMORIAL (BDR)
RNAV (GPS) RWY 29

Exhibit 2

FastLicense

Exhaust Plume Analyzer | TTO

Exhaust plumes emanating from smoke stacks at power plants or other industrial facilities can have adverse impacts on local aviation during periods of calm winds. Adverse impacts can be exacerbated if the temperature is low or the atmosphere is unstable. While low oxygen concentrations and elevated temperatures inside the plume can be detrimental to slow-flying or hovering helicopters, the turbulence generated from the upward motion of the plume is the main potential hazard to light, fixed-wing aircraft at low altitudes.

Description of Model

The Exhaust Plume Analyzer consists of three main parts: a convective flow model describing the mean flow of the plume, two aircraft response models judging the required vertical gust to achieve severe turbulence or aircraft upset, and a turbulence model computing the probability of experiencing a gust capable of causing severe turbulence or aircraft upset.

An exhaust plume can be described as a vertical turbulent buoyant jet consisting of two main parts: a momentum-dominated region (jet region) and a buoyancy-dominated region (plume region), as shown in Figure 1. After comparing several models to experimental data (both laboratory and full-scale), the Spillane1 model was found to be the most accurate for these purposes. It can accurately describe the mean flow behavior of the exhaust plume in its various regions for a single stack or multiple aligned stacks.

Two aircraft response models were adopted to determine how aircraft are affected by vertical gusts created by exhaust plumes. The Exhaust Plume Analyzer uses the Gust Loads Formula to predict the vertical gust required to experience severe turbulence, which is defined as a 1g vertical acceleration per the National Oceanic and Atmospheric Administration's (NOAA) *Forecasting Guide on Turbulence Intensity*. In addition, the Exhaust Plume Analyzer uses the Houbolt2 roll model to determine the vertical gust that would cause aircraft upset (a bank angle of 45 degrees) if the vertical gust was concentrated

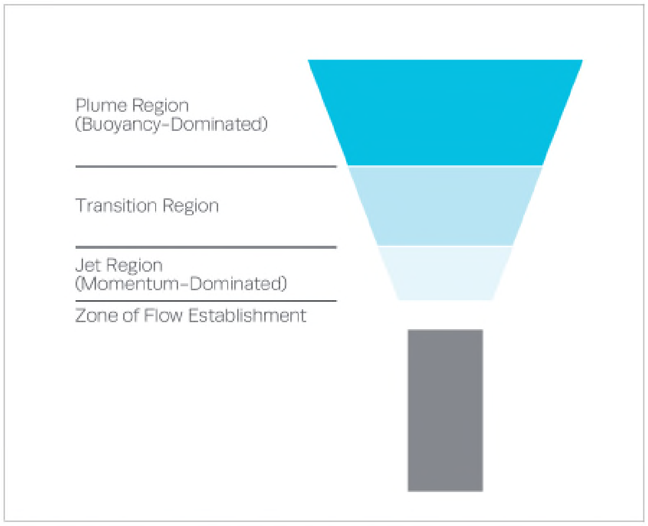


Figure 1. Nominal Structure of an Exhaust Plume

on the tip of the wing and the flight crew or Flight Management System (FMS) did not take corrective action. Since these aircraft response models require detailed aircraft parameters, the Exhaust Plume Analyzer provides aircraft parameters for four aircraft types representing light-sport aircraft, light General Aviation (GA) aircraft, business jets, and large jets. Furthermore, advanced users interested in modeling additional aircraft have the option to provide parameters for a user-defined aircraft type.

While the Spillane model computes the average plume flow, there could be much stronger turbulent gusts inside the plume. A model derived from the empirical data of Papanicaloau and List[3] was leveraged to determine the likelihood of experiencing a gust that would cause severe turbulence or aircraft upset. By using this combination of models, the Exhaust Plume Analyzer calculates the probability of experiencing severe turbulence or aircraft upset at any point in the vicinity of an exhaust plume.

The behavior of an exhaust plume depends greatly on the local weather conditions. During windier periods, the plume will turn over in the direction of the wind, resulting in a lower risk for experiencing severe turbulence. On the other hand, the risk increases during periods of calm winds as the plume rises uninhibited. Therefore, to accurately portray the likelihood of a severe turbulence or aircraft upset event, it is necessary to examine several years of historical weather data. The Exhaust Plume Analyzer provides the option for the user to query an external MITRE server for hourly atmospheric conditions at a specific location. Three years of weather data are recommended to account for seasonal effects and anomalous weather conditions.

Sample Output

The Exhaust Plume Analyzer was executed over three years of environmental data to calculate the probability of a light GA aircraft experiencing severe turbulence at the Ft. Martin Power Station near Morgantown, WV. As seen in Figure 2, the areas closer to the top of the stack have the highest probability of experiencing severe turbulence. Typically, as the size of the aircraft increases, the likelihood of experiencing severe turbulence or aircraft upset decreases substantially.

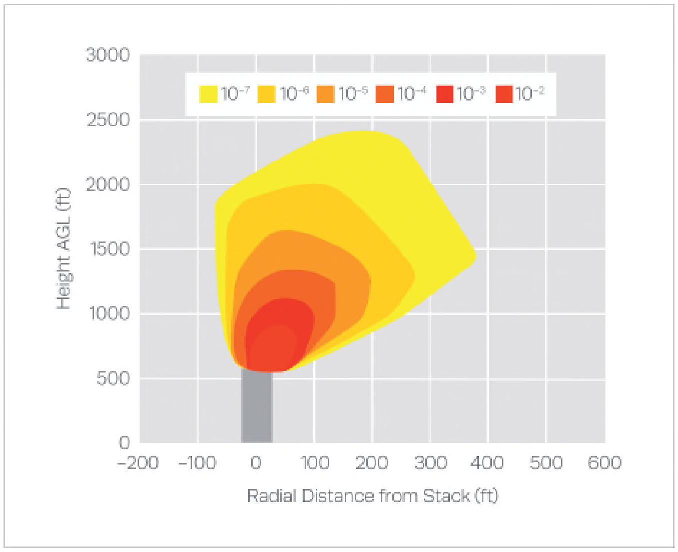


Figure 2. The Probability of a Light GA Aircraft Experiencing Severe Turbulence in the Vicinity of the Fort Martin Power Station Near Morgantown, WV

Exhaust Plume Analyzer Access

The Exhaust Plume Analyzer will be hosted through MITRE's FastLicense process. Interested parties should follow the instructions provided at www.mitre.org/research/technology-transfer/about-fastlicense to apply for access to the model.

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- Non-exclusive commercial use licenses, with simple, pre-established terms (fees or no-fees)
- Non-exclusive, no-fee, limited-use (academic, research, and internal)

1. K. T. Spillane, "The Rise of Wet Plumes – Conservation Equations and Entrainment Assumptions," Report No. S0/80/10, State Electricity Commission of Victoria, Research and Development Department, Engineering Research Division, 1980.

2. J. C. Houbolt and A. Sen, "Single-Degree-of-Freedom Roll Response Due to Two-Dimensional Vertical Gusts," NASA CR-111966, Aeronautical Research Associates of Princeton, Inc., Princeton, NJ, 1971.

3. P. N. Papanicolaou and E. J. List, "Investigations of round vertical turbulent buoyant jets," Journal of Fluid Mechanics, vol. 195, 341-391, 1988.

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The MITRE Corporation www.mitre.org

Attachment D

FAA Memorandum – Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations Dated September 24, 2015

Federal Aviation
Administration

Memorandum

Date: SEP 24 2015

To: Regional Division Managers
610 Branch Managers
620 Branch Managers
Airports District Office Managers

From: Director, Office of Airport Planning and Programming, (APP-1)

Director, Office of Airport Safety and Standards (AAS-1)

Subject: Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations

The Federal Aviation Administration (FAA) has received several inquiries and requests from state and local government and airport operators for guidance on the appropriate separation distance between power plants and airports where exhaust plumes from power plant smoke stacks and cooling towers may cause disruption to aircraft near Federally-obligated airports. The only related FAA regulations address the physical restrictions of the exhaust stack height. There are no FAA regulations protecting for plumes and other emissions from exhaust stacks.

In response, the FAA's Airport Obstruction Standards Committee (AOSC) was tasked to study the impact exhaust plumes may have on flight safety. The AOSC study evaluated the following:

1. How much turbulence is created by the exhaust plumes?
2. Is this turbulence great enough to cause loss of pilot control?
   If so, what size aircraft are impacted?
3. Is there a lack of oxygen (within a plume) causing loss of engine or danger to pilot/passengers?
4. Are there harmful health effects to the pilot or passengers from flying through the plume?

After thorough analysis, the FAA has determined the overall risk associated with thermal exhaust plumes in causing a disruption of flight is low. However, the FAA has determined that thermal exhaust plumes in the vicinity of airports may pose a unique hazard to aircraft in critical phases of flight (particularly takeoff, landing and within the pattern) and therefore are incompatible with airport operations.

Flight within the airport traffic pattern, approach and departure corridors, and existing or planned flight procedures may be adversely affected by thermal exhaust plumes[1]. The FAA-sponsored research indicates that the plume size and severity of impact on flight can vary greatly depending on several factors at a site such as:

- Stack size, number, and height; type of exhaust or effluent (e.g., coolant tower cloud, power plant smoke, etc.);
- Proximity of stacks to the airport flight paths;
- Temperature and vertical speed of the effluent;
- Size and speed of aircraft encountering exhaust plumes; and
- Local winds, ambient temperatures, stratification of the atmosphere at the plume site.

Airport sponsors and land use planning and permitting agencies around airports are encouraged to evaluate and take into account potential flight impacts from existing and planned development that produce plumes, (such as power plants or other land uses that employ smoke stacks, cooling towers or facilities that create thermal exhaust plumes).

To aid these reviews the FAA contracted MITRE Corporation to develop a model to predict plume size and severity of flight impact from a site of thermal exhaust plume(s). MITRE developed the "Exhaust-Plume-Analyzer" and it is available for no cost. Access can be found for licensing and downloading from MITRE at: http://www.mitre.org/research/technology-transfer/technology-licensing/exhaust-plume-analyzer.

The MITRE Exhaust-Plume-Analyzer can be an effective tool to assess the impact exhaust plumes may impose on flight operations at an existing or proposed site in the vicinity of an airport.

The FAA Advisory Circular (AC) 5190-4, A Model Zoning Ordinance to Limit the Height of Objects Around Airports (Airport Compatible Land Use Planning), is currently being updated to include comprehensive guidance to airport sponsors and local community planners on airport compatible land use issues, including evaluation of thermal exhaust plumes. The updated AC is expected to be issued in FY 2016.

---

[1] On July 24, 2014, the FAA issued a change to the Aeronautical Information Manual (AIM) to update terminology and provide more detail regarding the associated hazards of exhaust plumes. See the updated AIM flight instruction to pilots at Section 7-5-15, Avoid Flight in the Vicinity of Exhaust Plumes (Smoke Stacks, Cooling Towers) at http://www.faa.gov/air_traffic/publications/media/aim_chg1.pdfl.

In the interim, please provide this technical memorandum to airport sponsors to advise them of the availability of the Exhaust-Plume-Analyzer. Sponsors, state and local planning organizations, and permitting jurisdictions now have the opportunity to ensure that their planning and land use development decisions adequately evaluate the potential effects of thermal exhaust plumes on airport operations.

Should you have any questions concerning this memorandum please contact Rick Etter, Airport Planning and Environmental, (APP-400) at 202-267-8773 or by email at rick.etter@faa.gov.

Witness: Witness Panel

Request from: Connecticut Siting Council

LF-02. Provide resumes for the witnesses.

Response: The resumes of the PSEG witnesses are attached as follows:

- Michael Stagliola – Exhibit LF-02-A
- Robert Silvestri – Exhibit LF-02-B
- Kate Gerlach, Director – Exhibit LF-02-C
- Joel Gordon, Director – Exhibit LF-02-D
- Bruce Na, Manager – Exhibit LF-02-E
- Doug Gordon – Exhibit LF-02-F
- Neil Brown, Manager – Exhibit LF-02-G
- Jeffrey Pantazes, AKRF, Inc. – Exhibit LF-02-H
- William H. Bailey, Exponent – Exhibit LF-02-I

MICHAEL STAGLIOLA

~ Professional Biography ~

Mr. Stagliola is currently assigned to Bridgeport Combined Cycle Project as Director of Projects, to lead construction and commissioning efforts for PSEG.

For the last two years, Mr. Stagliola has been assigned by PSEG Power as Director, Combustion Turbine Engineering managing long term service contracts and planning major combined cycle turbine outages. The majority of his career has been in Operations operating and managing several power stations for PSEG Fossil.

Prior to coming to PSEG, Mr. Stagliola served as Operations Manager of a new power generating station in Boston, tasked with building a new organization during the construction and start-up phase of the Project. He also developed initial training programs, reviewed technical specifications and drawings and established all functional activities readying the staff for commercial operations.

Michael Stagliola holds a Master of Business Administration degree from Anna Maria College, and a Bachelor of Science degree in Marine Engineering from the Massachusetts Maritime Academy. Additionally, he earned and maintains several Commonwealth of Massachusetts technical licenses.

Robert Silvestri

1140 Mount Carmel Avenue, Hamden, CT 06518-1610 | (203) 288-7423 | robert.silvestri@snet.net

PROFESSIONAL PROFILE

- Environmental Manager with 28 years of experience in all facets of the electric utility industry
- Adept at facility reporting and compliance, permitting, interdepartmental coordination and communication
- Possess comprehensive knowledge of environmental, safety, and security statutes and regulations
- Experienced in statute and regulation development

PROFESSIONAL EXPERIENCE

PSEG Power Connecticut LLC
Fossil Environmental Affairs Manager | Bridgeport and New Haven, CT | December 2002 – present

- Coordinated the transition of environmental operations from Wisconsin Energy to PSEG in the latter's purchase of the Bridgeport and New Haven electric power plants, and instituted environmental and security policies and procedures
- Oversee and assist all departments to ensure compliance with Federal, State and local environmental permits, laws and regulations, including reporting and inspections
- Continue proactive approach to the environmental regulatory arena that encompasses the analyses of proposed and final laws and regulations for the effect on Company operations, the coordination of Company responses and lobbying where appropriate, and the implementation of new or revised procedures to comply with the changing regulatory climate.
- Major permitting activities include the construction of a state-of-the-art natural gas fired, 485 MW combustion turbine unit in Bridgeport and three dual-fueled 50 MW peaking units in New Haven; the addition of add-on air pollution controls for acid gas and mercury removal from the existing 400 MW coal-fired unit in Bridgeport; modifications to the existing coal unit to incorporate ultra-low sulfur coal combustion; conversion of the main unit at New Haven to solely burn natural gas at low demand loads; marine terminal dock upgrades and dredging; NPDES and storm water modifications and renewals; and site remediation
- Maintain facility security in partnership with Federal, State and local law enforcement agencies.

Wisvest Connecticut, LLC, a subsidiary of Wisconsin Energy
Environmental Manager | Bridgeport and New Haven, CT | April 1999 – December 2002

- Coordinated the transition of environmental operations from Wisconsin Energy to PSEG in the latter's purchase of the Bridgeport and New Haven electric power plants, and instituted environmental and security policies and procedures
- Compliance assistance, program development and implementation, and statute / regulation review and coordination parallel PSEG activities above
- Major permitting activities included the construction of an on-site electrical substation and the installation of a temporary steam boiler, both at the Bridgeport facility; marine terminal security and access upgrades; wastewater treatment system upgrades; and site remediation.

The United Illuminating Company
Environmental Management | Fairfield and New Haven, CT Counties | March 1989 – April 1999

- Management positions advanced from Supervisor of Environmental Reporting and Support Services, to Manager of Environmental Licensing and Regulatory Affairs, to Manager of Environmental Operations and Safety
- Responsibilities encompassed all areas of the electric public utility operations including distribution, transmission, generation and ancillary services for environmental matters and safety concerns, and for special projects

- Operations and Safety Team included two environmental professionals, two safety professionals, one laboratory supervisor, two laboratory technicians and administrative support
- Major permitting activities included continuous emission monitor (CEM) system certifications; Title V air permits; the siting of new substations and transmission lines, relocation and upgrading of new transmission lines; fuel blending; the installation of heating boilers; and facility modifications
- Implemented the Company-wide recycling programs.

Clearwater Analytical Laboratories
Director | Hamden, CT | February 1981 – March 1989

- Responsible for the instruction and management of laboratory chemists, microbiologists, technicians and support staff in the areas of water, wastewater, food, air, sludge and metal finishing analyses; QA/QC and reporting.

Mitchell-Bradford Chemical Company
Development Chemist | Milford, CT | January 1977 – February 1981

- Responsible for product formulation and process development for the surface finishing of various metals and substrates
- Performed technical service assistance to customers in the continental United States and in Canada.

Yale University
Instructor – Sterling Chemistry Laboratory | New Haven, CT | Summer 1976

- Supervised an undergraduate organic chemistry laboratory and performed research in organic syntheses.

E D U C A T I O N

University of New Haven, West Haven, CT
- M.S. Environmental Science, 1986
- GPA: 3.92 / 4.0
- Graduate Fellow for the 1984-1985 Academic Year

Fairfield University, Fairfield, CT
- B.S. Chemistry, 1976
- GPA: 3.23 / 4.0
- Dean's List

A D D I T I O N A L

- Creator and Publisher – "Air Waves," a free monthly publication that started in 1996 as a summary of State and Federal regulatory and legislative initiatives that pertain to air emissions and air permitting. The year 2016 marks the 20th year for this publication
- 2015 Graduate – FBI New Haven Citizen's Academy
- Recipient - CTDEEP's Green Circle Award, 2013
- Recipient – Governor Malloy's Letter of Recognition for "Air Waves," 2012
- Certified Safety Professional
- Certified Hazardous Materials Manager, 40-Hour HazMat Trained, CPR and First Aid Certified
- Active Member – Various Legislative, State and Local Task Forces, Councils and Advisory Committees
- Licensed High School and Youth Soccer Coach
- Professional Affiliations Include:
    - The Connecticut Business & Industry Association (Environmental Policies Chair 2000 -2004)
    - The Air & Waste Management Association (New England Director 1993 to present)
    - The Connecticut Environmental Forum (Director 1993 to present)
    - Connecticut's Water Planning Council Advisory Group (2011 to present)
    - The Long Island Sound Assembly (2000 – 2015).

Kate Gerlach
Director-Generation Development
PSEG Power LLC

Kate Gerlach is Director-Generation Development at PSEG Power, where she is responsible for developing new infrastructure opportunities at PSEG Power's existing generating sites. Since joining PSEG in 2003, Ms. Gerlach has served as Portfolio Strategy Manager for New England and New York, and Manager-M&A- and Development. In these roles, Ms. Gerlach was responsible for development of regional strategy, market analysis, and maximizing the financial performance of PSEG Power's New England and New York assets, as well as performing financial valuation analysis for potential mergers, acquisitions and other strategic initiatives. She recently served as a witness in the annual Rate Case for PSEG New Haven's newly constructed peaking units. In 2009-2010, Ms. Gerlach participated in a rotation program with the Nuclear Energy Institute, where she served as a Senior Project Manager for Industry Infrastructure and was responsible for nuclear manufacturing infrastructure and supplier-related activities. Prior to joining PSEG, Ms. Gerlach worked for Deutsche Bank Alex. Brown as a financial analyst in the Media and Telecom group.

Ms. Gerlach holds a Master of Business Administration degree from Wharton and a Bachelor of Arts from Wesleyan University.

Joel S. Gordon

Director of Market Policy

Joel Gordon serves as the Director of Market Policy for the PSEG companies within the NEPOOL stakeholder process. He has held similar positions over the past 15 years with other generators in NEPOOL, including NRG Energy and PG&E National Energy Group, representing almost 30% of the total installed generation in New England - more than 75 different generating assets operating across the entire dispatch range of the power pool.

Joel is current serving in his third term as the Chairman of the New England Power Pool Participants Committee and in his sixth term as a representative of the Supplier Sector, whose 171 Participant members are engaged in, or authorized to engage in, power marketing, virtual trading, power brokering or load aggregation within the New England Control Area.

Before participating in NEPOOL, Joel was Financial Vice President for independent energy development firms Eco-Gen Technologies and Bio Development Corporation. He began in the industry as a commercial banker with State Street Bank in Boston. As Vice President in the bank's project finance group he focused on lending to alternative energy generation projects, including hydro, waste, wood and gas-fired cogeneration, and also managed the bank's portfolio of gas distribution and water utilities. Joel holds a BA in Economics from Brandeis University and an MBA from Babson College.

BRUCE STEVEN NA, PE

Public Service Enterprise Group (PSEG Fossil)
2008 to date Manager – Construction & Design Engineering Department
Responsible to manage all Project Engineering Managers, fossil engineers, fossil designers and contractors in all disciplines; Responsible to set goals and direction of the engineering department; Responsible to oversee development of department work plans, staffing requirements; Responsible to develop and assess performance and development goals for all department personnel; Oversee capital project program implementation and emergent O&M work for all fossil fired generating stations (coal fired and natural gas combined cycle); Responsible to hire and manage contractors, Architect Engineers; Responsible to establish and adhere to departmental and project schedule & budgets; Oversees department involvement in development efforts for new generating facilities;

Hitachi America, Ltd. (1997-2008)
2003 to 2008 Council Bluffs Energy Center 790 MW Supercritical coal fired EPC project (Council Bluffs, IA). Site Chief Liaison Engineer & Chief Manager Project Controls.
Responsibilities include:
* Serving as the primary focal point with public entities for all related project issues (City, County, State entities; US Army Corps. of Engineers, US Fish & Wildlife, Iowa State Environmental Dept.). Ensured compliance with regulatory requirements;
* Project controls & reporting;
* Contract administration (both EPC contract and various subcontracts);
* Proactively identify problems/areas of concern (engineering, construction, startup, project close-out) and develop resolution with project management team as well as upper management;
* Manage various safety, engineering, construction, startup activities, training, environmental issues as directed by the General Manager;
* Team with customer to resolve project issues at the site;

1997 to 2003 Senior Manager in charge of Contract Management Dept. (Tarrytown, NY. Hitachi America's Eastern Regional Headquarters
Accomplishments include:
* Overall project management and execution for all contracts & subcontracts from contract signing to project completion for all projects;
* Management of all Project Managers and contract administration group;
* Planning and scheduling with Hitachi factories and end users;
* Timely delivery, quality, & compliance with contract scope as well as achieving expected profitability;
* Served as customer's additional focal point for all technical & commercial issues;
* Shipping, commercial documentation, installation & commissioning;
* Proactively identify problems/areas of concern and develop resolution for project related issues as well as department management organization issues;
* New business development;
* Reporting & interface with upper management;

DOUGLAS GORDON
Air Permitting Program Manager

PSEG Power LLC **2012–Present**

Burns and Roe Enterprises **2008–2012**

TRC Environmental Corporation **1997–2008**

Mr. Douglas Gordon has nineteen (19) years of experience in air quality permitting and environmental compliance management in the power generating industry. His background includes leading the development of air permit applications for power generating and cogeneration facilities rated up to 1,000 megawatts (MW) in electrical output capacity fueled by natural gas, oil, coal, refuse coal, and biomass. Mr. Gordon also has provided senior level oversight on various permitting projects, including minor source permitting, major source federal PSD/NSR permitting, and Title V Operating Permits for electric utilities, as well as other industries. As the subject matter expert for air quality permitting at PSEG, responsibilities include the management of the Title V Operating Permit program for the PSEG Fossil fleet in New Jersey, New York, and Connecticut. Permitting activities include modifying existing Title V operating permits, obtaining Title V operating permit renewals, and developing air permit applications for capital projects. Mr. Gordon develops and/or modifies permit compliance plans that incorporate all applicable state and federal regulations, while maintaining operating flexibility.

In previous roles, Mr. Gordon has performed due diligence audits, regulatory assessments, and emissions inventories to internally evaluate the compliance status of existing facilities. He has coordinated post-permit activities including emission offset procurement, start-up notification requirements, CEMS equipment, CEMS Performance Specification Test and stacks emission testing protocols. Mr. Gordon performed routine preparation of quarterly EDR's to U.S. EPA, Excess Emission Reports, annual Title V certification, semi-annual Title V monitoring certification, Acid Rain Program/NO_x Budget Program allowance reconciliation and certification on Federal and State levels, and annual emissions reporting for various electric utility facilities.

Education

B.S., in Chemical Engineering, Manhattan College, Riverdale, NY (1997)

Certifications

Engineering In Training-NJ

Training/Skills

Knowledge of: 40 CFR 75, NSPS, SARA Title III and MACT standards, PSD/NSR, BACT/LAER, CWA 316(b)

Neil R. Brown

Manager-External Affairs

Neil R. Brown is Manager-External Affairs for PSEG and is primarily responsible for public affairs and government relations supporting PSEG assets outside of New Jersey. He's handled various government and public affairs, media relations, and corporate communications responsibilities over his 35 year career with PSEG and has served as chief corporate spokesperson and Manager-Federal Affairs. Prior to joining the company, he held corporate communications positions with AT&T and was a newspaper reporter and editor in New Jersey and New York. Brown is a registered lobbyist in Connecticut and New York.

JEFFREY J. PANTAZES

SENIOR CONSULTANT

Jeff Pantazes is a broadly experienced environmental professional who specializes in regulatory matters, environmental compliance, and permitting for projects in the Northeast and Mid-Atlantic region. Mr. Pantazes has over 36 years of engineering, environmental and management experience in impact assessment and ecological studies for restoration, land use / environmental planning, and utility projects. He has held progressively more responsible positions and assignments including field construction management, environmental project engineering and design, plant operations support, and direction of multi-discipline teams. He is an experienced project manager of environmental restoration and remediation, field biological and physical monitoring, land selection and acquisition, and regulatory interfaces.

BACKGROUND

Education

B.S., Civil Engineering, Bucknell University, 1979

M.S., Civil Engineering (Construction Management), New Jersey Institute of Technology, 1985

Professional Memberships

Board of Directors Vice President / Executive Committee – Delaware Nature Society [Hockessin, Delaware]

Board of Directors – Water Resources Association of the Delaware Valley

Years of Experience

Year started in company: 2013 Year started in industry: 1979

RELEVANT EXPERIENCE

Combined Cycle Power Plant Development - Project Manager – Environmental/Permitting, Connecticut (September 2015 to present)

Mr. Pantazes is leading the team responsible for all environmental permitting for a new combined cycle power plant in Connecticut. The project has cleared the Independent System Operators auction and is scheduled to start construction in the spring of 2017. AKRF is providing full scope permitting for this project, including New Source Review Air Permitting, and all federal, state, regional and local land use and construction approvals. Approximately 55 to 75 different regulatory authorizations and permits are necessary to construct and operate the plant. Mr. Pantazes and his team have completed regulatory analyses, permitting schedule development and initial Siting Council, Coastal Site Plan and other applications, incorporating both regulatory strategy and risk reduction contingencies.

Federal Land Exchange, New Jersey (September 2013 to January 2015)

Mr. Pantazes prepared an Environmental Assessment (EA) to support a proposed land exchange and development of a Confined Disposal Facility (CDF) in New Jersey. He developed the EA to be consistent with the National Environmental Policy Act (NEPA) regulations, and incorporated engineering, agency and client inputs, developed responses to public and private comments for the USACE, and finalized the EA for approval. The land exchange involves privately held land to be developed as a CDF with other federally owned CDF property being exchanged with the private party. The Final FONSI was approved by the USACE. Mr. Pantazes performed consultation with other federal and state agencies to support the EA approval. Currently, Mr. Pantazes is managing other state permitting for USACE related to the project.

United States Army Corps of Engineers Sections 10 and 404 Permitting for Future Nuclear Development (September 2013 to present)

As project manager for an integrated team, Mr. Pantazes led the preparation and agency interactions with the USACE, state and other federal resource agencies for a comprehensive land development application for a new nuclear plant site in New Jersey. The project included significant wetland and dredging impacts, including the need for a federal conformity analysis, pile driving noise ecological assessment, wetland mitigation plans and other unique elements. The development includes a 4.5 mile elevated causeway and encompasses a site impact area of over 200 acres, adding to the complexity and level of detail necessary to address regulatory and public concerns. Additionally, the project is subject to a separate United States Nuclear Regulatory Commission siting approval, which mandated coordination of the USACE documentation and interactions with the federal Final Environmental Impact Statement. The project is ongoing with Responses to Comments as the next process step.

Permitting Planning and Schedule Development, Confidential Client (March 2014 to March 2015)

Mr. Pantazes developed a detailed permitting plan and integrated schedule logic for a new combined cycle power plant in New England. The permitting plan addressed regulatory risks, anticipated critical licensing issues and detailed permitting requirements, regulatory schedules and logic, scoping for engineering products required for permitting, and inputs into several siting board and environmental justice regulatory requirements.

Manager - Nuclear Environmental Affairs, PSEG Nuclear, New Jersey (PSEG 1979 to 2013)

Prior to joining AKRF, Mr. Pantazes led the integrated environmental organization and program for the PSEG Nuclear business with responsibility for developing environmental strategy, oversight of line environmental compliance, regulatory / stakeholder outreach and permitting current operations and new nuclear development. Mr. Pantazes provided leadership and direction for the development of environmental compliance programs, and project permitting strategies for PSEG Nuclear, including the day-to-day environmental regulatory compliance program as the Corporate Functional Area Manager - Environmental. He also developed strategy for the preparation and management of the environmental filings for major business projects and initiatives including the NRC Early Site Permit [ESP] Application for a new nuclear power plant, and the Clean Water Act Section 316 (a) and (b) NPDES renewals.

Mr. Pantazes was responsible for NRC environmental, offsite radiological monitoring programs and reporting, groundwater protection programs, other federal, state and regional / local environmental regulations, permitting requirements, impacts and costs associated with the environmental operations of PSEG Nuclear assets.

Previously at PSEG he was accountable for implementation of the Estuary Enhancement Program (EEP), the largest privately funded wetland restoration program in the United States. This project met compliance objectives each year and was funded in excess of $100M. He directed the engineering, construction, land acquisition, property management, and field operations for restoration and preservation of over 20,000 acres of degraded salt marsh and adjacent uplands in New Jersey and Delaware, fish ladder construction, plant intake modifications, sound, light and bubble curtain deterrent feasibility testing and comprehensive biological monitoring programs. This included planning and implementation of public communications and outreach to regional environmental, regulatory, and government / elected stakeholders for PSEG environmental activities. Overall, the EEP obtained approximately 200 implementation permits and regulatory approvals and the implementation team Mr. Panatzes led was in excess of 50 field, technical and support associates, contractors and consultants performing program implementation.

Nuclear Development Electric Generation Permitting, New Jersey (2008 to present)

In both his prior positions and current role with AKRF, Mr. Pantazes led the environmental and technical teams that developed the Environmental Report for a potential new nuclear plant (PSEG), engagement with the United States Nuclear Regulatory Commission and other state / federal agencies during the NEPA reviews, and preparation of various permit applications for Nuclear Development. The ongoing scope includes significant external outreach and stakeholder interfaces, and integrated permitting for NJDEP, USACE, and other federal, regional and local agencies. A USACE Section 10 / 404 application has been prepared under Mr. Pantazes' direction, and initial development of an NJDEP Coastal Area Facility Review Act application is in process.

Clean Water Act §316(b) Permitting and Implementation Engineering Oversight and Planning (June 2014 to present)

Mr. Pantazes is performing project management for several clients to develop and implement strategies associated with the newly issued USEPA Clean Water Act Section 316(b) regulations for existing sources. He has developed project planning tools, and is managing the implementation of the studies under various engagements. He has also provided oversight to third party engineering firms to provide operational and field inputs to the various designs for intake technology under development to support permitting actions.

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William H. Bailey, Ph.D.
Principal Scientist

Professional Profile

Dr. William H. Bailey is a Principal Scientist in Exponent's Health Sciences practice. Dr. Bailey specializes in applying state-of-the-art assessment methods to environmental and occupational health issues. His 30 years of training and experience include laboratory and epidemiologic research, health risk assessment, and comprehensive exposure analysis. Dr. Bailey has investigated exposures to alternating current, direct current, and radiofrequency electromagnetic fields, 'stray voltage', and electrical shock, as well as to a variety of chemical agents and air pollutants. He is particularly well known for his research on potential health effects of electromagnetic fields and has served as an advisor to numerous state, federal, and international agencies. Currently, he is involved in research on exposures to marine life from submarine cables and respiratory exposures to ultrafine- and nanoparticles. Dr. Bailey is a visiting scientist at the Cornell University Medical College and has lectured at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. He was formerly Head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research, Staten Island, New York, and an Assistant Professor and NIH postdoctoral fellow in Neurochemistry at The Rockefeller University in New York.

Academic Credentials and Professional Honors

Ph.D., Neuropsychology, City University of New York, 1975
M.B.A., University of Chicago, 1969
B.A., Dartmouth College, 1966

Sigma Xi; The Institute of Electrical and Electronics Engineers/International Committee on Electromagnetic Safety (Subcommitee 3, Safety Levels with Respect to Human Exposure to Fields (0 to –3 kHz) and Subcommittee 4, Safety Levels with Respect to Human Exposure to Radiofrequency Fields (3 kHz to 3 GHz); Elected member of the Committee on Man and Radiation (COMAR) of the IEEE Engineering in Medicine and Biology Society, 1998–2001

Publications

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Prior Experience

President, Bailey Research Associates, Inc., 1991–2000
Vice President, Environmental Research Information, Inc., 1987–1990
Head of Laboratory of Environmental Toxicology and Neuropharmacology, New York State Institute for Basic Research, 1983–1987
Assistant Professor, The Rockefeller University, 1976–1983

Academic Appointment

- Visiting Fellow, Department of Pharmacology, Cornell University Medical College, New York, NY, 1986–present

Prior Academic Appointments

- Visiting Scientist, The Jackson Laboratory, Bar Harbor, ME, 1984–1985
- Head, Laboratory of Neuropharmacology and Environmental Toxicology, NYS Institute for Basic Research in Developmental Disabilities, Staten Island, NY, 1983–1987
- Assistant Professor, The Rockefeller University, New York, NY, 1976–1983
- Postdoctoral Fellow, Neurochemistry, The Rockefeller University, New York, NY, 1974–1976
- Dissertation Research, The Rockefeller University, New York, NY, 1972–1974
- CUNY Research Fellow, Dept. of Psychology, Queens College, City University of New York, Flushing, NY, 1969–1971
- Clinical Research Assistant, Department of Psychiatry, University of Chicago; Psychiatric Psychosomatic Inst., Michael Reese Hospital, and Illinois State Psychiatric Inst, Chicago, IL, 1968–1969

Teaching Appointments

- Lecturer, University of Texas Health Science Center, Center for Environmental Radiation Toxicology, San Antonio, TX, 1998
- Lecturer, Harvard School of Public Health, Office of Continuing Education, Boston, MA, 1995, 1997
- Lecturer, Rutgers University, Office of Continuing Education, New Brunswick, NJ, 1991–1995
- Adjunct Assistant Professor, Queens College, CUNY, Flushing, NY, 1978
- Lecturer, Queens College, CUNY, Flushing, NY, 1969–1974

Editorship

- Associate Editor, Non-Ionizing Radiation, *Health Physics*, 1996–present

Advisory Positions

- RWTH Aachen University. Workshop on human perception thresholds in static electric fields from high-voltage direct current (HVDC) transmission lines, 2015
- ZonMw – Netherlands Organization for Health Research and Development, 2012; 2007-2008, reviewer for National Programme on EMF and Health
- US Bureau of Ocean Energy Management, Regulation and Enforcement, 2009–2010
- Canadian National Collaborating Centre for Environmental Health, reviewer of Centre reports, 2008
- Island Regulatory and Appeals Commission, province of Prince Edward Island, Canada, 2008
- National Institute of Environmental Health Sciences/ National Institutes of Health, Review Committee, Neurotoxicology, Superfund Hazardous Substances Basic Research and Training Program, 2004
- National Institute of Environmental Health Sciences, Review Committee Role of Air Pollutants in Cardiovascular Disease, 2004
- Working Group on Non-Ionizing Radiation, Static and Extremely Low-Frequency Electromagnetic Fields, International Agency for Research on Cancer, 2000–2002
- Working Group, EMF Risk Perception and Communication, World Health Organization, 1998–2005
- Member, International Committee on Electromagnetic Safety, Subcommittee 3 - Safety Levels with Respect to Human Exposure to Fields (0 to 3 kHz) and Subcommitee 4 - Safety Levels with Respect to Human Exposure (3kHz to 3GHz) Institute of Electrical and Electronics Engineers (IEEE), 1996–present
- Invited participant, National Institute of Environmental Health Sciences EMF Science Review Symposium: Clinical and In Vivo Laboratory Findings, 1998
- Working Group, EMF Risk Perception and Communication, International Commission on Non-Ionizing Radiation Protection, 1997
- U.S. Department of Energy, RAPID EMF Engineering Review, 1997

- Oak Ridge National Laboratory, 1996
- American Arbitration Association International Center for Dispute Resolution, 1995–1996
- U.S. Department of Energy, 1995
- National Institute for Occupational Safety and Health, 1994–1995
- Federal Rail Administration, 1993–1996
- U.S. Forest Service, 1993
- New York State Department of Environmental Conservation, 1993
- National Science Foundation
- National Institutes of Health, Special Study Section—Electromagnetics, 1991–1993
- Maryland Public Service Commission and Maryland Department of Natural Resources, Scientific Advisor on health issues pertaining to HVAC Transmission Lines, 1988–1989
- Scientific advisor on biological aspects of electromagnetic fields, Electric Power Research Institute, Palo Alto, CA, 1985–1989
- U.S. Public Health Service, NIMH: Psychopharmacology and Neuropsychology Review Committee, 1984
- Consultant on biochemical analysis, Colgan Institute of Nutritional Science, Carlsbad, CA, 1982–1983
- Behavioral Medicine Abstracts, Editor, animal behavior and physiology, 1981–1983
- Consultant on biological and behavioral effects of high-voltage DC transmission lines, Vermont Department of Public Service, Montpelier, VT, 1981–1982
- Scientific advisory committee on health and safety effects of a high-voltage DC transmission line, Minnesota Environmental Quality Board, St. Paul, MN, 1981–1982
- Consultant on biochemical diagnostics, Biokinetix Corp., Stamford, CT, 1978–1980

Professional Affiliations

- The Health Physics Society (Affiliate of the International Radiation Protection Society)
- Society for Risk Analysis
- International Society of Exposure Analysis
- New York Academy of Sciences
- American Association for the Advancement of Science
- Air and Waste Management Association
- Society for Neuroscience/International Brain Research Organization
- Bioelectromagnetics Society
- The Institute of Electrical and Electronics Engineers/Engineering in Medicine and Biology Society
- Conseil International des Grands Réseaux Électriques

PSEG Power Connecticut LLC
Petition No. 1218

Late Filed Exhibit 03
Dated: 05/13/2016
LF-03

Witness: Witness Panel

Request from: Connecticut Siting Council

LF-03. Provide a Wetland Analysis.

Response: Attached is a Wetland Assessment Report for select areas of Bridgeport Harbor Station from GEI Consultants, Inc., dated May, 2014.

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Wetland Assessment Report

Bridgeport Harbor Station
Select Areas
1 Atlantic Street
Bridgeport, Connecticut

Submitted to:
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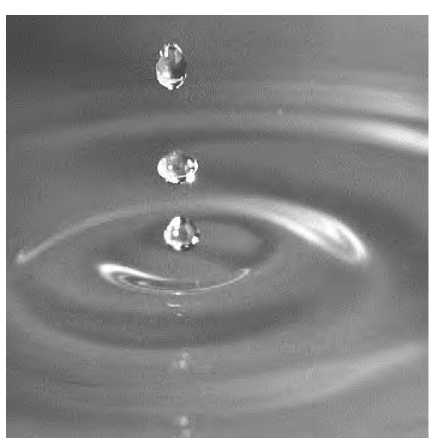

Revised May 2014

Project 1404240

Martin Brogie, LEP
Senior Consultant

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1. Introduction

GEI Consultants, Inc. (GEI) completed wetland delineation and assessment for land located at the Bridgeport Harbor Station generation facility located along the west side of Bridgeport Harbor, in Bridgeport, Connecticut. The site location is provided on Figure 1. Specific areas reviewed included: the southern end of the facility east, south and west of the fuel oil storage tank farm; the tank farm area; and, a rectangular, primarily grassed, area west of the coal pile and conveyor system.

The project included the following components:

- Field delineation of wetland resources in the project areas;
- Characterization of wetland resources;
- Evaluation of adjacent upland/buffer areas, and;
- A wetland mitigation feasibility analysis.

The wetland services were provided in support of planning associated with potential site improvements.

2. Wetlands and Waterbodies Definitions and Regulatory Jurisdiction

2.1 Connecticut Wetlands and Watercourses

Connecticut General Statutes Chapter 440 Wetlands and Watercourses provide definitions for Inland and Tidal Wetlands. Tidal Wetlands are regulated by the Connecticut Department of Energy and Environmental Protection (CTDEEP) Office of Long Island Sound Programs, and Inland Wetlands are regulated by Municipal Inland Wetlands Commissions using model regulations prepared by CTDEEP.

2.1.1 Inland Wetlands

Connecticut Inland Wetlands, as defined in CGS Chapter 440 Section 22a-38 include land where "soil types are designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soils Survey, as may be amended from time to time, of the Natural Resources Conservation Service of the United States Department of Agriculture" and "rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, vernal or intermittent, public or private, which are contained within, flow through or border upon this state or any portion thereof, not regulated pursuant to sections 22a-28 to 22a-35, inclusive. Intermittent watercourses shall be delineated by a defined permanent channel and bank and the occurrence of two or more of the following characteristics: (A) Evidence of scour or deposits of recent alluvium or detritus, (B) the presence of standing or flowing water for a duration longer than a particular storm incident, and (C) the presence of hydrophytic vegetation".

2.1.2 Connecticut Tidal Wetlands

Connecticut Tidal Wetlands, as defined in CGS Chapter 440 Section 22a-29 include:
"those areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marsh, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow or be capable of growing some, but not necessarily all, of the following: Salt meadow grass (Spartina patens), spike grass (Distichlis spicata), black grass (Juncus gerardi), saltmarsh grass (Spartina alterniflora), saltworts (Salicornia Europaea, and Salicornia bigelovii), sea lavender (Limonium carolinianum), saltmarsh bulrushes (Scirpus robustus and Scirpus paludosus var. atlanticus), sand spurrey (Spergularia marina), switch grass (Panicum virgatum), tall cordgrass (Spartina pectinata), high-tide bush (Iva frutescens var. oraria), cattails (Typha angustifolia, and Typha latifolia), spike rush

(Eleocharis rostellata), chairmaker's rush (Scirpus americana), bent grass (Agrostis palustris), and sweet grass (Hierochloe odorata), royal fern (Osmunda regalis), interrupted fern (Osmunda claytoniana), cinnamon fern (Osmunda cinnamomea), sensitive fern (Onoclea sensibilis), marsh fern (Dryopteris thelypteris), bur-reed family (Sparganium eurycarpum, Sparganium androcladum, Sparganium americanum, Sparganium chlorocarpum, Sparganium angustifolium, Sparganium fluctuans, Sparganium minimum), horned pondweed (Zannichellia palustris), water-plantain (Alisma triviale), arrowhead (Sagittaria subulata, Sagittaria graminea, Sagittaria eatoni, Sagittaria engelmanniania), wild rice (Zizania aquatica), tuckahoe (Peltandra virginica), water-arum (Calla palustris), skunk cabbage (Symplocarpus foetidus), sweet flag (Acorus calamus), pickerelweed (Pontederia cordata), water stargrass (Heteranthera dubia), soft rush (Juncus effusus), false hellebore (Veratrum viride), slender blue flag (Iris prismatica pursh), blue flag (Iris versicolor), yellow iris (Iris pseudacorus), lizard's tail (Saururus cernuus), speckled alder (Alnus rugosa), common alder (Alnus serrulata), arrow-leaved tearthumb (Polygonum sagittatum), halberd-leaved tearthumb (Polygonum arifolium), spatter-dock (Nuphar variegatum nuphar advena), marsh marigold (Caltha palustris), swamp rose (Rosa palustris), poison ivy (Rhus radicans), poison sumac (Rhus vernix), red maple (Acer rubrum), jewelweed (Impatiens capensis), marshmallow (Hibiscus palustris), loosestrife (Lythrum alatum, lythrum salicaria), red osier (Cornus stolonifera), red willow (Cornus amomum), silky dogwood (Cornus obliqua), sweet pepper-bush (Clethra alnifolia), swamp honeysuckle (Rhododendron viscosum), high-bush blueberry (Vaccinium corymbosum), cranberry (Vaccinium macrocarpon), sea lavender (Limonium nashii), climbing hemp-weed (Mikania scandens), joe pye weed (Eupatorium purpureum), joe pye weed (Eupatorium maculatum), thoroughwort (Eupatorium perfoliatum)".

2.1.2.1 Connecticut Coastal Jurisdiction Line

In 2012, the Connecticut General Assembly passed PA 12-101 which included a revision to the State's regulatory jurisdiction of Tidal resources. This revision changes the state's Coastal regulatory jurisdiction limit from the "high tide line" to the area up to and including the elevation of the "coastal jurisdiction line" (CJL). For Bridgeport, the CJL was established at an elevation of 5.0' (NAVD88). Based on preliminary survey maps provided by PSEG for the purposes of scoping this project, the coastline and the two wetland "basins" in the southeastern portion of the facility fall within the CJL. As such, the Connecticut Department of Energy and Environmental Protection (CTDEEP) Office of Long Island Sound Programs (OLISP) would review proposed projects impacting, or potentially impacting land in these areas.

2.2 Federal Wetlands

Wetlands are defined by the United States Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA) as "an area that is inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation". Wetland is a collective term for swamps, bogs, marshes, wet meadows, and similar transition areas between open water and upland habitats.

USACE claims jurisdiction over all defined "waters of the United States". Certain activities in these waters are regulated by the USACE under Section 404 of the Clean Water Act (33 U.S.C. 1344) or Section 10 of the Rivers and Harbors Act of 1899 (22 U.S.C. 403). Jurisdictional wetlands must have positive wetland indicators for all three environmental parameters: hydrology, soil and vegetation. USACE authorizes/issues preliminary jurisdictional determinations, comprehensive jurisdictional determinations, nationwide permits and individual permits.

Waterbodies are defined as ranging from open water habitats to waterways which have surface flowing or standing water to the extent of evidence of an ordinary high water mark. This includes rivers, streams, lakes, ponds, bays, and conduits such as canals or ditches. USACE defines ordinary high water mark as a "line of the shore coincident with the elevation contour that represents the approximate location of the line of shore established by fluctuations of water and indicated by physical characteristics such as shelving, destruction of terrestrial vegetation, presence of litter or debris, or changes in the character of soil". Examples of "waterbodies" include streams, rivers, lakes, ponds, and wetlands.

3. Project Methodology

3.1 Desktop Analysis

Prior to the field delineation and assessment, GEI conducted a desktop review of the site study areas by reviewing the following resources:

- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Maps;
- U.S. Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS) Web Soil Maps;
- CTDEEP Natural Diversity Database Map;
- U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle Map; and
- Current and 1965 aerial views.

This review assisted in the planning and execution of the field survey and determination of the potential jurisdictional status of wetlands and waterbodies in the study areas.

3.2 Wetland Field Delineation

The field delineation and assessment was conducted by GEI personnel on April 9, 2014. Field personnel included Erin Brosnan, a Wetland Ecologist and Martin Brogie, a Soil Scientist. Wetlands and water bodies were physically evaluated through observation of:

- hydrologic features including surface water, rack lines, soil saturation, and staining;
- vegetation including prevalence, species, and adaptations, and;
- soil characteristics including slope/topography, color, texture and composition.

The protocol for the wetland investigation included the following methodologies.

3.2.1 USACOE 3 Parameter Method

Information obtained from the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (April 2012) was utilized for the delineation. This manual was designed to provide technical guidance and procedures for identifying and/or delineating wetlands that may be subject to regulatory jurisdiction. According to the manual, identification of wetlands is based on a three-factor approach involving indicators of hydrophytic vegetation, hydric soil, and wetland hydrology.

According to the USACE Manual, areas must exhibit all three indicator factors to be considered wetlands:

- "The prevalent vegetation must consist of plants adapted to life in hydric soil conditions. These species, due to morphological, physiological, and/or reproductive adaptions, can and do persist in anaerobic soil conditions.

- Soils in wetlands must be classified as hydric or they must possess characteristics that are associated with reducing soil conditions.
- The area must be inundated or saturated either permanently or periodically for at least 2 weeks during the growing season."

USACOE Data Sheets for identified wetland areas (other than the shoreline) are provided in Appendix A.

3.2.2 Connecticut Wetland Soils

Connecticut Inland Wetlands as defined in the Connecticut Inland Wetlands and Watercourses Act (Chapter 440 Section 22a-38(15)&(16)) were delineated by the above-referenced Soil Scientist registered with the Society of Soil Scientists of Southern New England. The delineation consisted of evaluating the soil texture and color, evidence of hydrology, and soil organic matter composition and thicknesses. Soil assessment was conducted through visual and manual evaluation of subsurface soils to a depth of 30 inches below the surface. Numerous test pits were completed using a spade and auger and soil color was evaluated by comparison to *Munsell Soil Color Chart* standards.

The wetland evaluation consisted initially of a survey of surface drainage/hydrology and vegetation, and then considered topography before initiating subsurface soils exploration.

3.2.3 Connecticut Tidal Wetlands

A determination in the field was completed to assess apparent tidal waters and those areas now or formerly connected to tidal waters as well as an evaluation of the specific listed plant species indicated in the Connecticut Tidal Wetlands definition.

4. Findings

4.1 Desktop Analysis

4.1.1 National Wetlands Inventory

According to the USFWS NWI Map, there are mapped wetlands located within and adjacent to the study areas. (http://www.fws.gov/wetlands/Wetlands-Mapper.html). Located within the southeast section of the study area is a 2.46 acre PEM1Eh system generally consistent with the southern wetland basin as further described below. The demarcated area does extend slightly in to the northern basin area, but this is likely the result of map generalization. Bordering the site to the south and east is a 2.48 acre E2US2P zone and then an E1UBL system (Long Island Sound). These wetland codes are associated with the Cowardin et al (1979) classification system. (http://137.227.242.85/Data/interpreters/wetlands.aspx?CodeURL=E2SS1/EM5P).

- PEM1Eh is characterized as palustrine (P), emergent (EM), persistent (1), seasonally flooded/saturated (E), and diked/impounded (h).
- E2US2P is characterized as estuarine (E), intertidal (2), unconsolidated shore (US), with a sand subclass (2) irregularly flooded (P).
- E1UBL is characterized as estuarine (E), subtidal (1), unconsolidated bottom (UB), subtidal (L).

These designations are generally consistent with observed conditions although the impounded wetland basin is connected to the intertidal zone.

4.1.2 USDA NRCS Soil Survey

According to the USDA NRCS Soil Survey, the project vicinity is mapped as Udorthents Urban Land Complex. This complex consists of moderately well drained to excessively drained soils that have been disturbed by cuffing or filling, and areas that are covered by buildings and pavement. The areas are mostly larger than 5 acres. The complex is about 70 percent Udorthents, 20 percent Urban land, and 10 percent other soils. Most areas of these components are so intermingled that is was not practical to map them separately. Udorthents are in areas that have been cut to a depth of 2 feet or more or are on areas with more than 2 feet of fill. Udorthents consist primarily of moderately coarse textured soil material and a few small areas of medium textured material.

Urban land is not a hydric soil indicator. While the soil survey does not appear to support the presence of wetlands on the site, changes in site conditions since the soil survey are not represented on these maps. Also, as noted on the soil survey, the map scale does not show the small areas of contrasting soils. As a result, field verification is necessary to determine onsite conditions. (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx)

The mapped information does not indicate the presence of wetland soils in the two identified wetland basins.

NWI and NRCS maps are provided as Figures 2 and 3, respectively.

4.1.3 Natural Diversity Database

The Connecticut Department of Energy and Environmental Protection maintains a Natural Diversity Data Base (NDDB) map representing approximate locations of endangered, threatened and special concern species and significant natural communities in Connecticut. The December 2013 map for Bridgeport indicates the presence of species/communities along the shoreline throughout the site. To determine the listing information in detail, a project specific inquiry must be submitted to CTDEEP.

4.2 Field Delineation

4.2.1 Identified Water Bodies

The Site borders Long Island Sound to the south and east. A rock revetment buffers the Sound from the access road located along the southern and eastern portions of the site. This area was identified during the desktop study as a mapped estuarine intertidal system by the National Wetland Inventory. GEI flagged the spring high tide line along the rock revetment using pin flags (WF#1-WF#52) wedged among the rocks. The spring high tide line was evident by water staining on rocks and wrack and debris accumulation between rocks. Along the south facing revetment a coarse sand beach is exposed at low tide. No vegetation was observed along the beach or revetment. Herring Gulls (*Larus argentatus*) and Grebes (*Podicipedidae sp.*) were observed in the open water. A pair of Osprey (*Pandion haliaetus)* was observed overhead and an apparent osprey nest was located above of the dock platform extending from the south of the Site.

4.2.2 Identified Wetlands

During the field assessment and delineation, two vegetated pocket wetland systems were identified in the southeast portion of the Site. Based on historic aerials, the majority of these wetland areas were part of Bridgeport Harbor. "Tongue Point" extended through the southern wetland and apparent industrial development extended up to the west side of both wetlands. The two areas are separated from the Sound by a fill embankment topped by a paved road which is generally oriented north to south on the east side of the wetlands and east to west along the south side of the wetlands. The fill embankment is typically 20 to 40 feet wide on the east side and approximately 60 to 100 feet wide to the south. A lighthouse is located at the southeast corner (on the outside of the 90 degree bend) of the roadway.

While NWI mapped this area as a single wetland system, an east-west vegetated berm separates the area into two distinct systems.

4.2.2.1 Northern Wetland Area

The northern wetland area is an isolated system, approximately rectangular in shape, and is within a bermed perimeter. The filled side slopes are generally 3:1 or steeper and the bottom is nearly flat and at an approximate elevation of 3 feet. Pockets of standing water were noted and no surface water is directed in to the wetland. Hand augered exploration at the time of the delineation indicated groundwater at approximately 10 inches below grade throughout much of the area.

Wetland soils (poorly drained and hydric) consisted of a gleyed silt. The non-wetland side slopes consisted of sand and gravel intermixed with varying amounts of brick, concrete and coal slag.

The northern pocket system is a freshwater wetland dominated by common reed (*Phragmites australis*) and gray birch (*Betula populifolia*). It corresponds to the NWI's Cowardin classification of PEM1Eh: palustrine (P), emergent (EM), persistent (1), seasonally flooded/saturated (E), and diked/impounded (h). The invasive vine, dodder (*Cuscuta sp.*), blankets vegetation throughout the wetland. The wetland is characterized by variations in ground surface (microtopography) within the common reed stands and around fallen trees. The side slopes and road edge upland areas are dominated by quackgrass (*Elymus repens*), mugwort (*Artemisia vulgaris*), black locust (*Robinia pseudoacacia*), oak (*Quercus sp*.), and mowed lawn.

The wetland boundary was determined to be along the fill slope and was demarcated using wetland flags numbered WF#3-1 to WF# 3-20.

4.2.2.2 Southern Wetland Area

The southern wetland area has a tidal connection, is approximately rectangular in shape, and is within a bermed or otherwise filled perimeter. The filled side slopes are generally 2:1 or steeper. The wetland interior has varying topography including hummocks, concrete, an interior low berm in the southeast corner, and shallow fill along the west side. Standing water occupies approximately half of the wetland and the bottom elevation is 2 to 3 feet below the northern wetland bottom.

Wetland soils (very poorly drained and hydric) consisted of a black, muck and peat. The non-wetland side slopes on the north and east sides consisted of sand and gravel intermixed with varying amounts of brick, concrete and coal slag. These materials including larger pieces of concrete and metal were noted along the southern and western side slopes. Areas along the eastern and southern side of the southern wetland contained debris apparently from the overtopping of the roadway, likely during Hurricane sandy.

A culvert, located along the east side of the wetland connects to the intertidal zone through the east berm and beneath the roadway. The construction of the culvert could not be ascertained as it was inundated. Surface water on the west side of the culvert, within the wetland, was clearly subject to tidal action. The pipe outfall is located below the spring high water mark within the rock revetment

The southern wetland pocket system is a salt marsh habitat dominated by common reed. However, many native plants were identified in each tidal zone including smooth cordgrass (*Spartina alterniflora*) in the low marsh, sea lavender (*Limonium carolinianum*) and saltmeadow cordgrass (*Spartina patens*) in the high marsh, and marsh elder (*Iva frutescens*) and groundseltree (*Baccharis halimifolia*) in the spring tide zone. This wetland system corresponds to the NWI's Cowardin classification of PEM1Eh: estuarine (E), intertidal (2), emergent (EM), persistent (1), irregularly flooded (P), and diked/impounded (h). Sections of the wetland appear to be open water habitat that are permanently flooded at low tide.

The wetland area transitions abruptly along the north berm and eastern road edge slopes; these areas are dominated by weedy groundcovers, black locust and tree-of-heaven (*Ailanthus altissima*). The wetland transition is more gradual to the south and west shifting into a forest fringe dominated by black locust and oak species. Ribbed mussels were abundant along the hummocks bordering the open water zone. Great egret (*Ardea alba*), mallard (*Anas platyrhunchos*), Canada goose (*Branta canadensis*), mourning dove (*Zenaida macroura*), and redwing blackbird (*Agelaius phoeniceus*) were observed and wild turkey (*Meleagris gallopavo*) tracks were noted.

The wetland limits were demarcated with wetland flags WF#2-1 to WF#2-47.

A photographic log is provided in Appendix A, a complete plant species is provided in Appendix B and Wetland Determination Data Forms are provided in Appendix C.

4.2.3 Adjacent Uplands

Uplands observed adjacent to the delineated wetlands consisted of the filled berm and roadway to the east and a broader, filled elevated roadway to the south. An unpaved equipment storage and contractor laydown area is located to the west of the southern wetland area and a disturbed, overgrown/grassed area is located to the west of the northern wetland. Mowed grass is located to the north.

Shallow standing water on mowed grass was noted near the northwest corner of the northern wetland as well as a mound of common reed. The surface water appeared to be the result of a recent storm. Soil in the area consisted of bright orange sand and gravel. Further to the south of this area, west of the northern wetland is a swale, partially formed by the west side of the berm along the northern wetland. Quackgrass, common reed, multiflora rose, and black locust were noted in the area. Soil exploration revealed disturbed conditions including irregularly distributed, decomposed organic material and small fragments of building materials.

The tank farm area consisted of grassed or bare slopes (berm) and flat, interior tank farm areas consisting of sand and gravel. The grassed area west of the coal pile included an area of standing water on the central/east portion of the area. No wetland vegetation was noted. Soils consisted of fill materials including sand and gravel, coal, and coal ash.

5. Mitigation

GEI evaluated conceptual options for wetland mitigation, based on the observed site conditions, our experience with similar projects, and our understanding of the recent regulatory changes and trends at CTDEEP.

Increasing storm storage capacities and buffering shoreline areas from the physical impacts of severe weather events without the use of hard barriers are common themes at the CTDEEP OLISP in recent months. Recent revisions to the CTDEEP Stormwater Permitting process has also increased the requirements for project stormwater treatment. Therefore, these concepts/conditions should be integrated into the wetland mitigation options for the site.

The southern wetland area offers a significant opportunity for increasing storage capacity due to the presence of fill materials and solid waste along the southern and western wetland limits. Some removal of wetland interior fill materials such as the southeast low berm and large pieces of concrete also appears to be an option. Increased capacity of the northern wetland could be accomplished by shallow excavation of the bottom which could be effective in the removal of the invasive plants as well.

The implementation of a "Living Shorelines" enhancement for storm protection consisting potentially of the installation of "reef balls", tidal and intertidal vegetation and combinations of hard and soft engineering practices south and east of the project area is a potential option. However, the efficacy of these undertakings would require site specific evaluation beyond the scope of this study.

The extensive presence of common reed presents a mitigation "opportunity" in that adjacent seed beds and root stock are not present. Therefore, long term eradication success is possible. Removal of much of the reed could be accomplished in consort with fill removal and re-grading, while the remainder of the removal would be accomplished through other manual means including cutting and herbicide applications. In any case, common reed eradication for the site would be a significant undertaking, but could have excellent results if integrated with a native species planting regimen.

New wetland habitat could also be created by extending existing wetland areas north and west into areas currently characterized as disturbed upland / road edge habitat. A wetland creation plan may include tree and debris removal, excavation, slope reconfiguration, invasive plant treatment, and native planting.

New wetland habitat creation could also be integrated in to a stormwater treatment system for the site to avoid direct stormwater discharges.

Figures

SOURCE:
1. USGS TOPOGRAPHIC MAP BRIDGEPORT QUADRANGLE ACCESSED VIA ARCGISONLINE.COM.

0 2,000 4,000
SCALE: 1" = 2000'

Wetlands Assessment Bridgeport Harbor Station Bridgeport, Connecticut	GEI Consultants	**SITE LOCATION**
PSEG Newark, New Jersey	Project 1404240	April 2014 Fig. 1

J:\Projects\PSEG-Bridgeport\Bridgeport Harbor Station\Site Location.mxd

SOURCE:
1. US FISH AND WILDLIFE NATIONAL WETLANDS INVENTORY WWW.FWS.GOV/WETLANDS

0 200 400
SCALE: 1" = 200'

LEGEND

Wetland Type

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland

Wetlands Assessment Bridgeport Harbor Station Bridgeport, Connecticut	GEI Consultants	**NATIONAL WETLANDS INVENTORY (NWI)**
PSEG Newark, New Jersey	Project 1404240	April 2014 Fig. 2

J:\Projects\PSEG-Bridgeport\Bridgeport Harbor Station\NWI.mxd

LEGEND

Soil Map Unit

Symbol, Description

306 Udorthents-Urban land complex

307 Urban land

W Water

SOURCE:

1.Soil Survey Geographic (SSURGO) database for the State of Connecticut, CT DEEP GIS

0 200 400

SCALE: 1" = 200'

Wetlands Assessment Bridgeport Harbor Station Bridgeport, Connecticut	GEI Consultants	**NRCS SOILS**
PSEG Newark, New Jersey	Project 1404240	April 2014 Fig. 3

J:\Projects\PSEG-Bridgeport\Bridgeport Harbor Station\Soils.mxd

SOURCE:
1. 2011 ESRI WORLD IMAGERY

Wetlands Assessment Bridgeport Harbor Station Bridgeport, Connecticut	GEI Consultants	**APPROXIMATE WETLAND BOUNDARIES**
PSEG Newark, New Jersey	Project 1404240	April 2014 Fig. 2

Appendix A

Photographic Log

PHOTO LOG **Bridgeport Harbor Station Bridgeport, CT**
South Wetland


Looking north across central portion.


Looking south along east boundary. Fill materials.


Culvert on east side connecting wetland to harbor.

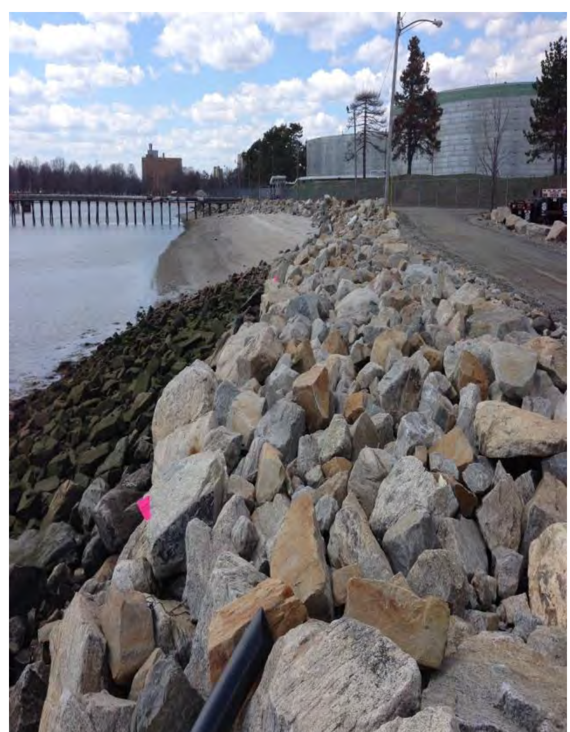
Buttressed Black Locust in area of shallow fill on west side.

PHOTO LOG **Bridgeport Harbor Station Bridgeport, CT**
North Wetland & Harbor

View across wetland looking west

Invasive *Cuscuta spp*. on Grey Birch

West side of coastal delineation near intake structure.



South side of coastal delineation looking west.

Appendix B

Plant List

Bridgeport Harbor Station - Southeast Wetlands - Plant Species
Date: 4/9/2014

SOUTH

Location	**Common Name**	**Scientific Name**	**Regional Plant ID/Status**		
Wet	Common reed	*Phragmites austrailis*		FACW	
Wet	Smooth cordgrass	*Spartina alterniflora*		OBL	
Wet	Saltmeadow cordgrass	*Spartina patens*		FACW	
Wet	Spikegrass	*Distichlis spicata*		FACW	
Wet	Switchgrass	*Panicum virgatum*		FAC	
Wet	Purple loosestrife	*Lythrum salicaria*		OBL	
Wet	Sea lavender	*Limonium carolinianum*		OBL	
Wet	Seaside goldenrod	*Solidago sempervirens*		FACW	
Wet/Upl	Mugwort	*Artemisia vulgaris*		UPL	
Wet	Marsh elder	*Iva frutescens*		FACW	
Wet	Groundseltree	*Baccharis halimifolia*		FACW	
Wet/Upl	Black locust	*Rohinia pseudoacacia*		FACU	
Upl	Tree-of-heaven	*Ailanthus altissima*		UPL	
Upl	Oak sp. (red or black)	*Quercus sp.*		FACU/NI	
Wet/Upl	Red maple	*Acer rubrum*		FAC	
Upl	Northern bayberry	*Morella pensylvanica*		FAC	
Upl	Multiflora Rose	*Rosa multiflora*		FACU	
Upl	Poison ivy	*Toxicodendron radicans*		FAC	
Upl	Common evening primrose	*Oenothera biennis*		FACU	
Upl	Asiatic bittersweet	*Celastrus orbiculatus*		UPL	

NORTH

	Common Name	**Scientific Name**	**Indicator Status**		
Wet	Common reed	*Phragmites australis*		FACW	
Wet	Gray birch	*Betula populifolia*		FAC	
Wet/Upl	Dodder	*Cuscuta sp.*		NI	
Upl	Black locust	*Rohinia pseudoacacia*		FACU	
Upl	Oak sp. (red or black)	*Quercus sp.*		FACU/NI	
Upl	Mugwort	*Artemisia vulgaris*		UPL	
Upl	Asiatic bittersweet	*Celastrus orbiculatus*		UPL	
Upl	Multiflora Rose	*Rosa multiflora*		FACU	
Upl	Poison Ivy	*Toxicodendron radicans*		FAC	
Upl	Eastern cottonwood	*Populus deltoides*		FAC	
Upl	Honeysuckle	*Lonicera Sp.*		FACU	
Upl	Common mullein	*Verbascum thapsus*		UPL	
Upl	Quackgrass	*Elymus repens*		FACU	
Upl	Field pepperweed	*Lepidium campestre*		NI	

Appendix C

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Bridgeport Harbor Station City/County: Bridgeport/Fairfield Sampling Date: 4/9/14
Applicant/Owner: PSEG State: CT Sampling Point: South Wetland
Investigator(s): GEI - M. Brogie, E. Brosnan Section, Township, Range: —
Landform (hillslope, terrace, etc.): Man-made depression Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR or MLRA): LRR R Lat: 41° 10' 03.76" Long: 73° 10' 43.46" Datum: ______
Soil Map Unit Name: Udorthents - Urban land complex (306) NWI classification: PEM1Eh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____	Hydric Soil Present? Yes X No ____	Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? Yes X No ____
If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)
Wetland is man-made; filled former harbor area.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- __ Sediment Deposits (B2)
- X Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9)
- X Aquatic Fauna (B13)
- __ Marl Deposits (B15)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres on Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- __ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- __ Moss Trim Lines (B16)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ Microtopographic Relief (D4)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): 4 - 16"
Water Table Present? Yes X No ____ Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): ______

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Culvert connection under roadway to navigable water, Long Island Sound - tidal regime

B13 - ribbed mussels observed

VEGETATION – Use scientific names of plants.

Sampling Point: South Wetland

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Robinia pseudoacacia	10	✓	FACU
2. Ailanthus altissima	2		UPL
3. Acer rubrum	2		FAC
4.			
5.			
6.			
7.			
	12	= Total Cover	

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Robinia pseudoacacia	5		FACU
2. Baccharis halimifolia	10	✓	FACW
3. Iva frutescens	5		FACW
4.			
5.			
6.			
7.			
	20	= Total Cover	

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Phragmites australis	60	✓	FACW
2. Spartina alterniflora	10		OBL
3. Spartina patens	8		FACW
4. Distichlis spicata	5		FACW
5. Panicum virgatum	2		FAC
6. Lythrum salicaria	2		OBL
7. Limonium carolinianum	10		OBL
8. Solidago sempervirens	2		FACW
9. Artemisia vulgaris	2		UPL
10.			
11.			
12.			
	101	= Total Cover	

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	22	x 1 = 22
FACW species	90	x 2 = 180
FAC species	4	x 3 = 12
FACU species	8	x 4 = 32
UPL species	4	x 5 = 20
Column Totals:	128 (A)	266 (B)

Prevalence Index = B/A = 2.08

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Upslope/upland species around wetland pocket include: black locust, tree-of-heaven, bayberry, red maple, mugwort, poison ivy, multiflora rose, evening primrose, asiatic bittersweet

SOIL

Sampling Point: South Wetland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12"	10yr 2/1						muck	fibric

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- X Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR R, MLRA 149B)**
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Dark Surface (S7) **(LRR K, L)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Bridgeport Harbor Station City/County: Bridgeport/Fairfield Sampling Date: 4/9/14
Applicant/Owner: PSEG State: CT Sampling Point: North Wetland
Investigator(s): GEI - M. Brogle, E. Brosnan Section, Township, Range: —
Landform (hillslope, terrace, etc.): Manmade depression Local relief (concave, convex, none): concave Slope (%): 0
Subregion (LRR or MLRA): LRR R Lat: 41° 10' 04.66" Long: 73° 10' 45.81 Datum: ______
Soil Map Unit Name: Udorthents-Urban land complex (308) NWI classification: PEM1Eh
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ✓, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	Is the Sampled Area within a Wetland? Yes X No ____
Hydric Soil Present?	Yes X No ____	
Wetland Hydrology Present?	Yes X No ____	If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)
Wetland is man-made; filled former harbor area.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)
- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9)
- __ Aquatic Fauna (B13)
- __ Marl Deposits (B15)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres on Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)
- __ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- __ Moss Trim Lines (B16)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ Microtopographic Relief (D4)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ____	Depth (inches): ______	
Water Table Present?	Yes X No ____	Depth (inches): 10"	
Saturation Present? (includes capillary fringe)	Yes X No ____	Depth (inches): ______	**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
2:1 slopes or steeper on all sides of the depression (approx. 150' x 250')
Standing water observed

VEGETATION – Use scientific names of plants.

Sampling Point: North

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Betula populifolia	40	✓	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1. Betula populifolia	15	✓	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	____ = Total Cover		
Herb Stratum (Plot size: ______)			
1. Phragmites australis	70	✓	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. Cuscuta sp.	30		NI
2.			
3.			
4.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	1	x 2 = 2
FAC species	1	x 3 = 3
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	2 (A)	5 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Upslope/upland species around wetland pocket include: black locust, cottonwood, oak sp., shrub honeysuckle, mugwort multiflora rose, mullein, poison ivy, asiatic bittersweet, dodder

Note assessment conducted on April 9, 2014 prior to last frost - tender emergents not evident

SOIL

Sampling Point: North

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2"	10yr 2/1						peat	
2-9"	Gley 1 4/10y						fssilt	
9-16"	Gley 1 4/10y		10yr 5/8	50	RM	M	fssilt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- X Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Witness: Witness Panel

Request from: Connecticut Siting Council

LF-04. Provide an Air Emissions comparison table for the proposed facility versus the existing facility for applicable air emissions pollutants including but not limited to carbon dioxide. The comparison, at a minimum, should be on a tons per year basis. A per megawatt-hour basis comparison can be included if available.

Response: As of July 1, 2021, the permanent shutdown of the coal-fired Unit 3 will provide significant reductions in air emissions at the Bridgeport Harbor Station facility. The proposed Unit 5 is a highly efficient combined cycle combustion turbine unit with advanced emission control technologies, such as dry low-NO_x combustors, water injection for ultra low sulfur diesel (ULSD) operation, Selective Catalytic Reduction (SCR) for additional NO_x control and an oxidation catalyst for CO and VOC control. Additionally, both fuels are the cleanest readily available gaseous and liquid fuels that will minimize emissions of SO_2 and particulate matter. The following is a table comparing the tons per year reductions from the retirement of Unit 3 and operation of the proposed Unit 5 assuming equal capacity factors for each unit. In order to provide an accurate comparison of the two units, actual 2015 emissions from Unit 3 were adjusted to the same projected actual capacity factor for Unit 5 (80% capacity factor).

TONS PER YEAR EMISSION RATES COMPARISON			
Pollutant	Unit 3 Actual Emission Rates Adjusted to 80% Capacity Factor (tons/yr)	Unit 5 Projected Actual Emission Rates at 80% Capacity Factor (tons/yr)	Percent Decreases
NO_x	1,957	103	(94.7%)
SO_2	3,145	19	(99.4%)
CO_2	2,983,183	1,315,283	(55.9%)
PM-10	177	52	(70.6%)
CO	403	83	(79.4%)
VOC	48	30	(37.5%)

POUNDS PER MW-HOUR EMISSION RATES COMPARISON			
Pollutant	Unit 3 Past Actual Emission Rates (lb/MW-hr gross)	Unit 5 Projected Actual Emission Rates (lb/MW-hr gross)	Percent Decreases
NO_x	1.35	0.05	(96.3%)
SO_2	2.17	0.01	(99.5%)
CO_2	2,056	735	(64.3%)
PM-10	0.12	0.03	(75.0%)
CO	0.28	0.02	(92.9%)
VOC	0.03	0.01	(66.7%)

Unit 3 emission rates are based on the following:

1) Continuous Emission Monitoring Systems (CEMS) for NO_x and SO_2;
2) 40 CFR 98, Subpart C, Table C-1 for CO_2;
3) EPA AP-42 Emission Factor Guidance Document, Section 1.1 for PM-10, CO and VOC; and
4) Boiler heat rate of 10,000 Btu/kW-hr (gross).

Unit 5 projected actual emission rates are based on annual average emission rates assuming 10 days of ULSD operation, 3,500 hrs/yr of natural gas operation with duct firing, 3,048 hrs/yr of natural gas operation without duct firing, and associated start-ups and shutdowns.