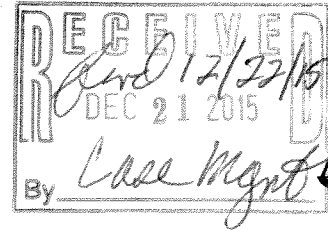




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VIA HAND DELIVERY
 December 17, 2015

State of New Jersey
 Board of Public Utilities
 44 South Clinton Avenue
 9th Floor
 Trenton, NJ 08625-0350

Re: PIVOTAL UTILITY HOLDINGS INC. d/b/a ELIZABETHTOWN GAS FOR APPROVAL OF A SAFETY, MODERATION AND RELIABILITY PROGRAM AND ASSOCIATED COST RECOVERY MECHANISM
DOCKET NO.: GR15091090

Dear Sir/Madam:

This firm represents the environmental defense Fund with respect to the above entitled matter. In that regard, please find enclosed the following:

1. Original and three (3) copies of a Motion for Intervention
2. Original and three (3) copies of a Motion for entry of Michael Panfil, Esq. Pro hac Vice.

Please file and return a conformed copy to my office.

Very truly yours,

Donald J. Meliado Jr.
 DJM/jt

Enc.

Cc: see attached service list ✓

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BOARD OF PUBLIC UTILITIES
 MAIL ROOM

Case Mgmt
M. Lapo
EMERGENCY-TOC

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By *CMG*
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PIVOTAL UTILITY HOLDINGS INC	:	STATE OF NEW JERSEY
d/b/a ELIZABETHTOWN GAS FOR APPROVAL	:	BOARD OF PUBLIC UTILITIES
OF A SAFETY, MODERATION AND RELIABILITY	:	
PROGRAM AND ASSOCIATED COST RECOVERY	:	Docket No. GR15091090
MECHANISM	:	

MOTION FOR ADMISSION PRO HAC VICE

The undersigned counsel, a member in good standing of the bar of the State of New Jersey and serving as attorney of record in this proceeding, hereby moves for the admission *pro hac vice* of Michael Panfil. Mr. Panfil is a member in good standing of the bar of New York. There is good cause for Mr. Panfil to be admitted *pro hac vice* because he has significant experience representing the interests of EDF and EDF's membership. As evidenced by his affidavit attached hereto, Mr. Panfil has paid to the New Jersey Lawyers' Fund for Client Protection the fees required by R. 1:20-1(b).

Respectfully Submitted,



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=====X

PIVOTAL UTILITY HOLDINGS INC	:	STATE OF NEW JERSEY
d/b/a ELIZABETHTOWN GAS FOR APPROVAL	:	BOARD OF PUBLIC UTILITIES
OF A SAFETY, MODERATION AND RELIABILITY	:	
PROGRAM AND ASSOCIATED COST RECOVERY	:	Docket No. GR15091090
MECHANISM	:	

AFFIDAVIT IN SUPPORT OF REQUEST TO APPEAR *PRO HAC VICE*

Washington)
) ss.
 District of Columbia)

I, Michael Panfil, duly sworn and according to law, hereby certify as follows:

1. I am employed by the Environmental Defense Fund ("EDF"), a national, not-for-profit environmental organization headquartered at 257 Park Avenue South, New York, New York 10010 as an attorney.
2. I am an attorney in good standing admitted to practice in the State of New York. My bar number for the New York Bar is 5065800. I am not admitted to practice in New Jersey. I have no disciplinary proceedings pending against me in any jurisdiction and no discipline has been previously imposed on me in any jurisdiction.
3. I am associated in this matter with New Jersey counsel of record, Donald J. Meliado Jr., Esq., who is qualified to practice pursuant to R. 1:21-1.

4. EDF has requested my representation in this matter.
5. There is good cause for my admission *pro hac vice* in that I have considerable experience representing EDF and its members in various proceedings before the Federal Energy Regulatory Commission and State Public Utility Commissions and am employed as an attorney by EDF. I also have experience before the New Jersey Board of Public Utilities in the previous case *In The Matter of the Petition of Public Service Electric and Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recover Mechanism*, Docket No. GR15030272, where I previously received *pro hac vice* admission.
6. I will abide by all court rules and other requirements of rule 1:21-2(c) and agree to:
 - a. Abide by the New Jersey Court Rules, including all disciplinary rules;
 - b. Consent to the appointment of the Clerk of the Supreme Court as agent upon whom service of process may be made for all actions against me or my firm that arise out of my participation in this matter;
 - c. Notify the Board of Public Utilities immediately of any matter affecting my standing at the bar of any court; and
 - d. Have all pleadings, briefs, and other papers filed with the Board of Public Utilities signed by the attorney of record.
7. I will pay or EDF will pay on my behalf a fee in the amount required to the New Jersey Lawyers' Fund for Client Protection as required by R. 1:20-1(b) and 1:20-2.

8. I certify that the foregoing statements by me are true to the best of my knowledge. I am aware that if any of the foregoing statements made by me are willfully false I am subject to punishment.

Dated: _____

Respectfully Submitted,



Michael Panfil, Esq.
1875 Connecticut Avenue NW
Washington D.C. 20009
(202) 572-3280
mpanfil@edf.org
Attorney for Environmental Defense Fund



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2014-08

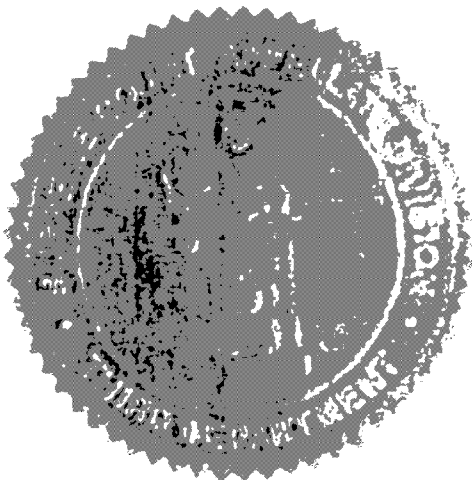
State of New York
Supreme Court, Appellate Division
Third Judicial Department

I, *Robert D. Mayberger*, Clerk of the Appellate Division of the Supreme Court of the State of New York, Third Judicial Department, do hereby certify that

Michael Nolan Panfil

having taken and subscribed the Constitutional Oath of Office as prescribed by law, was duly licensed and admitted to practice by this Court as an Attorney and Counselor at Law in all courts of the State of New York on the 23rd day of August, 2012, is currently in good standing and is registered with the Administrative Office of the Courts as required by section four hundred sixty-eight-a of the Judiciary Law.

In Witness Whereof, I have hereunto set my hand and affixed the Seal of said Court, at the City of Albany, this 22nd day of August, 2014.



Robert D. Mayberger
Clerk

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PIVOTAL UTILITY HOLDINGS INC :
d/b/a ELIZABETHTOWN GAS FOR APPROVAL :
OF A SAFETY, MODERATION AND RELIABILITY :
PROGRAM AND ASSOCIATED COST RECOVERY :
MECHANISM :

STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES
Docket No. GR15091090

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CERTIFICATION OF SERVICE

I hereby certify that I have this day served by electronic mail a copy of the foregoing Motion for Admission *Pro Hac Vice* and supporting affidavit on all parties set forth on the attached service list.

Dated at 12, this 21 day of Dec, 2015.

Respectfully Submitted,



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IN THE MATTER OF THE PETITION OF PIVOTAL UTILITY HOLDINGS, INC. D/B/A
ELIZABETHTOWN GAS FOR APPROVAL OF A SAFETY, MODERNIZATION AND
RELIABILITY PROGRAM AND ASSOCIATED COST RECOVERY MECHANISM
DOCKET NO. GR15091090

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PIVOTAL UTILITY HOLDINGS INC : STATE OF NEW JERSEY
d/b/a ELIZABETHTOWN GAS FOR APPROVAL : BOARD OF PUBLIC UTILITIES
OF A SAFETY, MODERATION AND RELIABILITY :
PROGRAM AND ASSOCIATED COST RECOVERY : Docket No. GR15091090
MECHANISM :

On December 18, 2015, the Environmental Defense Fund (“EDF”) filed a Motion to Intervene in the in the above captioned matter before the New Jersey Board of Public Utilities (“Board”).

New Jersey attorney Donald Meliado now moves for admission *pro hac vice* of Michael Panfil of EDF. Having reviewed the motions for admission *pro hac vice* of Michael Panfil and the supporting affidavits, [and no objections to the motions having been received after due notice to the parties], I **FIND** that Mr. Panfil has [satisfied/not satisfied] the conditions for admission for this matter, [subject to submission of the Board of proof of payment to the New Jersey Lawyer’s Fund for Client Protection of the annual fees required by R. 1:20-1(b) and 1:28-2]. Accordingly he **IS HEREBY** [admitted/denied] to practice before the Board in this matter [provided that he shall:

- (1) Abide by the Board’s rules and all applicable New Jersey court rules, including all disciplinary rules;
- (2) Consent to the appointment of the Clerk of the Supreme Court as agent upon whom service of process may be made for all actions against each of them that may arise out of his participation in this matter;

- (3) Notify the Board immediately of any matter affecting his standing at the bar of any other jurisdiction; and
- (4) Have all pleadings, briefs and other papers filed with the Board signed by an attorney of record authorized to practice in this State, who shall be held responsible for them and for the conduct of this cause and the admitted attorney therein.]

This ruling is provisional and subject to ratification or other alteration by the Board as it deems appropriate during the proceeding in this matter.

Dated: _____

Mary-Anna Holden
COMMISSIONER

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BOARD OF PUBLIC UTILITIES
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PIVOTAL UTILITY HOLDINGS INC	:	STATE OF NEW JERSEY
d/b/a ELIZABETHTOWN GAS FOR APPROVAL	:	BOARD OF PUBLIC UTILITIES
OF A SAFETY, MODERATION AND RELIABILITY	:	
PROGRAM AND ASSOCIATED COST RECOVERY	:	Docket No. GR15091090
MECHANISM	:	

MOTION FOR INTERVENTION OF THE ENVIRONMENTAL DEFENSE FUND

The Environmental Defense Fund (“EDF”) respectfully moves pursuant to the New Jersey Administrative Code (“N.J.S.A.”) 1:1-16.1 *et seq.*, to intervene in the above captioned proceeding for Elizabethtown Gas’s (“EG”) September 22, 2015 petition with the New Jersey Board of Public Utilities (“BPU”) seeking approval of a safety, modernization, and reliability (“SMART”) program, and to implement an associated cost recovery mechanism (the “EG Gas Petition”).¹

BACKGROUND

A. Movant Environmental Defense Fund

1. EDF is a national non-profit membership organization which links science, economics, and law to create innovative, equitable, and cost-effective solutions to society’s most urgent environmental problems. EDF has more than 350,000 dues-paying members nationwide, over 11,000 in New Jersey, and over 1,000 in EG’s service territory. The economic, safety and environmental interests of EDF and its members are directly impacted by the proposed SMART program, and as

¹ See EG, *In The Matter Of The Petition Of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas For Approval Of A Safety, Modernization And Reliability Program And Associated Cost Recovery Mechanism*, September 22, 2015, available at: https://www.elizabethtowngas.com/-/media/Files/ETG/Rates-Tariff/2015_SMART_Filing_9-22-15.pdf.

demonstrated in the Board's recently issued final order in the *In the Matter of Public Service Electric and Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recovery Mechanism* ("PSE&G Gas Case"), EDF can and will make a material contribution to the Board's deliberation of the matters at issue in this proceeding, with the focus of our participation geared towards enhancing the cost-effectiveness of EG's program to replace aging and leak-prone infrastructure. As discussed in greater detail below, EDF is working with utilities throughout the country, including PSE&G, using new methods to better characterize leaking infrastructure in order to prioritize repair and replacement activity so that scarce ratepayer funds are cost-effectively expended by focusing on infrastructure most in need of replacement.

2. EDF, through its current programs aimed at optimizing the benefits of natural gas system modernization, and work with utilities saddled with extensive leak-prone infrastructure, has developed considerable expertise in understanding the scope of methane leakage in local distribution networks, new technologies for detecting and quantifying leaks and techniques for cost effectively reducing leakage rates. EDF's gas system experience and expertise is more fully discussed below.
3. EDF intends to provide evidence and testimony that will elucidate areas where EG's proposed investments can be optimized to cost-effectively improve its natural gas distribution system.

B. Procedural Background

4. It has long been recognized that aging cast iron gas mains are leak-prone and present a high degree of safety risk in comparison to treated steel and plastic mains.² EG's service territory contains significant cast iron pipe on its mains, second most in New Jersey (18.4%; compare with PSE&G, 22.6%).

² See Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011, Pub. L. No. 112-90, 125 Stat. 1904, "Not later than December 31, 2012, and every 2 years thereafter, the Secretary shall conduct a follow-up survey to measure the progress that owners and operators of pipeline facilities have made in adopting and implementing their plans for the safe management and replacement of cast iron gas pipelines."

5. EG has undertaken infrastructure replacement programs since the late 1990s. These programs include the BPU-approved Accelerated Infrastructure Replacement (“AIR”) program and EG Natural Gas Distribution Utility Reinforcement Effort (“ENDURE”) program. Under the AIR program, EG is retiring roughly 74 miles of low pressure cast iron. Under the ENDURE program, EG is retiring roughly 10 miles of such main.
6. EG filed the EG Gas Petition, seeking approval of the SMART program and to implement an associated cost recovery mechanism on September 22, 2015. The EG Gas Petition states that the SMART program will allow EG “to continue to proceed with the modernization of its system in an efficient and cost effective manner over the next ten years.”³
7. EG anticipates that the SMART program will replace approximately 630 miles of main and approximately 67,000 services. The SMART program will also upgrade its legacy low pressure system to an elevated pressure system. EG projects total expenditures associated with the SMART program to be roughly \$1,102 million (in 2014 dollars).
8. EG anticipates that the SMART program will reduce the extent of lost natural gas (paid for by its customers), enhance safety and provide environmental benefit by reducing methane emissions.
9. The BPU docketed the EG Gas Petition on September 23, 2015.
10. In a December 16, 2015 Order, the BPU retained the EG Gas Petition and designated Commissioner Mary-Anna Holden as the presiding officer. The Order directed entities seeking intervention to do so by January 15, 2016.⁴

³ See EG, *In The Matter Of The Petition Of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas For Approval Of A Safety, Modernization And Reliability Program And Associated Cost Recovery Mechanism*, September 22, 2015, available at: https://www.elizabethtowngas.com/-/media/Files/ETG/Rates-Tariff/2015_SMART_Filing_9-22-15.pdf at p. 4-5.

⁴ See BPU, *In The Matter Of The Petition Of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas For Approval Of A Safety, Modernization And Reliability Program And Associated Cost Recovery Mechanism*, January 15, 2015.

C. EDF's Expertise in Natural Gas Distribution Systems

11. EDF has extensive expertise and experience in presenting evaluative frameworks and project solutions to increase the cost effectiveness, and environmental, consumer, grid, and market benefits of gas system plans and projects.
12. EDF has previously provided this expertise and experience within New Jersey before the BPU. In the recently BPU-approved PSE&G Gas Case, EDF was granted intervenor status.⁵ EDF participated in the discovery process, and presented at a technical conference, providing detailed information on cutting edge leak quantification methods to prioritize pipeline replacement activities, and enhance the cost-effectiveness of PSE&G's proposed infrastructure modernization project. Recognizing the multidimensional benefits of this approach from the perspective of ratepayers and the environment, the BPU approved settlement agreement entered into by all parties to the proceeding, included measures put forth by EDF for prioritizing PSE&G's replacement expenditures and safeguarding the economic interests of customers. The BPU decision and order includes a stipulation agreed to by all signatories:

that for grids [with infrastructure in need of replacement] with comparable Hazard Index/Mile, available methane emissions survey data estimating flow volumes, as prepared by the Environmental Defense Fund using Program plans, system information and maps provided by PSE&G, will be used, as appropriate, in sub-prioritizing replacement activities, considering additional factors such as construction efficiencies and logistics.⁶

⁵ See BPU Decision and Order Approving Stipulation, *In the Matter of Public Service Electric and Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recovery Mechanism*, GR15030272, November 16, 2015, available at: <http://www.nj.gov/bpu/pdf/boardorders/2015/20151120/11-16-15-2F.pdf>.

⁶ *Id.*, at 8.

13. The leak survey and quantification methodology used by EDF to allow PSE&G to prioritize its expenditures for leak prone infrastructure replacement derives from a unique project that uses sensors attached to Google Street View cars along with an algorithm developed by researchers at Colorado State University to detect and quantify methane leaks from local distribution systems (the “mapping project”).⁷ The data collected by the cars is being used to create detailed maps of areas where natural gas is leaking from utility pipelines and the approximate amount of gas being emitted as of the time of EDF’s survey. This information can inform the extent of need for utility investment for infrastructure repairs and/or replacement, and to prioritize areas most in need of such expenditures, as funded by customers. Appendix A contains an example leak map, developed using randomly generated data, to illustrate the type of customized maps developed by EDF in the PSE&G Gas Case. These maps were developed using methane emissions data collected through EDF’s survey of sections of PSE&G’s distribution system that are being targeted as part of its infrastructure modernization program. Each map corresponds to a “grid” or parcel of pipelines targeted by PSE&G for replacement, and attributes leaks detected through EDF’s leak survey to particular segments of pipelines in that grid. Appendix B contains a sample spreadsheet (also based on randomly generated data) reflecting, for purposes of illustration, a summary of leak data and a ranking of all pipeline grids based on total estimated methane leak flow rate, allowing for grids to be prioritized for replacement activities on this basis. Appendix C contains an explanation of the methodological approach used to generate the leak maps attributing leaks to particular segments of the utility’s pipes.
14. Data collected as part of the mapping project, as validated by independent analyses⁸, makes it clear that typically, a small number of large leaks are responsible for a disproportionate share of

⁷ See generally, EDF, Methane Maps, available at: <http://www.edf.org/climate/methanemaps/partnership>.

⁸ A.R. Brandt et al., “Methane Leaks from North American Natural Gas Systems”, *Science*, Vol 343, 14 February 2014, at 733-35.

methane emissions from natural gas systems. Therefore, there are significant ratepayer and environmental benefits to identifying the sections of infrastructure that are leaking the largest volumes of gas, and prioritizing them for replacement, while also considering the public safety implications.

15. EDF has drawn on its extensive expertise relating to emerging technologies to find and quantify sub-surface methane leaks from natural gas mains and techniques for reducing leakage rates from natural gas distribution systems in a number of recent utility rate proceedings before public utilities commissions in California, Pennsylvania, New York and New Jersey.
16. In the instant proceeding, the expertise and/or methodology brought to bear by EDF will provide similar value to the review of and final determination on the EG Gas Petition.
17. EDF is also involved in a collaboration with Consolidated Edison (New York)⁹ and other utilities throughout the country on a project to identify mobile mounted technologies that can be deployed to quantify methane emission rates of non-hazardous leaks from gas distribution pipeline infrastructure in urban and suburban areas. The project is designed to improve utilities' leak abatement programs by finding and targeting the largest leaks by volume for repair. The project aims for utility-scale rollouts of the best-performing technology by 2016.

LEGAL GROUNDS FOR INTERVENTION

18. Under the N.J.A.C., any person or entity not yet a party "who will be substantially, specifically, and directly affected by the outcome of a contested case" may seek leave to intervene.¹⁰
19. When ruling on a motion to intervene, the judge shall take into consideration the following factors: (1) the nature and extent of the moving party's interest in the outcome of the case; (2)

⁹ See Appendix V, "Amended Phase Two Collaborative Storm Hardening Report 11-14-14", filed by Consolidated Edison Company of New York, Inc. in Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Gas Service, *available at*: <http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=13-g-0031>.

¹⁰ N.J.A.C. 1:1-16.1.

whether that interest is sufficiently different from that of any other party so as to add measurably and constructively to the scope of the case, (3) the prospect for confusion or undue delay arising from including of the party, and (4) other appropriate matters.¹¹

ARGUMENT

A. EDF will be Directly Affected by the Outcome of the EG Gas Petition

20. EDF and its New Jersey members will be substantially, specifically, and directly affected by the outcome of the EG Gas Petition. EG's proposed investments will have an amplified impact upon EDF's membership in EG's service territory, as the costs of the proposed projects would be borne by EG's customers, as are the costs of leaked gas. EDF and its members have a material interest in ensuring that the proposed investments are beneficial and cost-effective, and that the retail market for natural gas distribution operates efficiently in minimizing wasted (leaked) natural gas.
21. The EG Gas Petition asks the BPU to approve a requested \$1,102 million capital expenditure, over ten years, to improve its natural gas pipeline distribution system. If approved, EG anticipates that approximately 630 miles of main and approximately 67,000 services would be replaced.¹²
22. These pipelines are, by their very nature, more prone to natural gas leakage than newer types of pipeline. As announced in a U.S. Department of Transportation ("DOT") "Call to Action", pipeline upgrade investments immediately enhance public safety, as older and/or leakier pipelines are more prone to explosion. The EG Gas Petition notes that if approved, the SMART program would reduce methane emissions equivalent to roughly 58,100 metric tons of CO2 per year once the program is completed.

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¹¹ N.J.A.C. 1:1-16.3(a).

¹² See EG Gas Petition at p.2.

23. The outcome of this case (1) has significant implications for the provision of utility service and the functioning of the market as it relates to safety, economic, and environmental welfare, and (2) goes to the heart of EDF's mission with regard to optimizing the efficiency of the natural gas distribution system. Both of these issues are of the utmost importance to EDF and its membership, including its members in New Jersey.

24. The EG Gas Petition, if structured to maximize the full range of environmental and consumer benefits, will further EDF's mission, to achieve 1% or less leakage throughout the nation's natural gas supply chain.

25. EDF's mission with respect to natural gas delivery will be harmed in the event of a sub-optimal or negative outcome of the case. As discussed above, EDF has been actively engaged in efforts to reduce methane emissions from local distribution systems throughout the United States and New Jersey. EDF was granted intervention, provided expertise, and materially contributed to the outcome in the similarly positioned PSE&G Gas Case. EDF would provide similar expertise and benefit to the EG Gas Petition.

26. In summary, for the reasons discussed above, EDF and its members, including its New Jersey members, will be directly affected by the outcome of this case.

B. EDF Interest is Sufficiently Different from Any Other Party so as to add Measurably and Constructively to the Case.

27. EDF's unique expertise will measurably and constructively advance this proceeding in accordance with N.J.A.C. 1:1-16.3(a). In its filing, EG proposes measures to improve its natural gas distribution pipeline system through replacement of roughly 630 miles of main and approximately 67,000 services. EDF's experience, as discussed above, will add substantive value to this proceeding by (1) bringing to bear unique expertise and analyses on natural gas distribution systems; (2) being able to provide specific data regarding the extent of leaking

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methane in the areas in which EG proposes to replace mains by mapping relevant sections of EG's service territory, as appropriate and practicable, as part of EDF's mapping project described above (EDF is currently finalizing a drive plan for surveying EG's service territory); and (3) enabling a full development of the record.

28. Expertise and Analysis. EDF plans to review EG's proposals, drawing on its natural gas expertise and experience in employing practical, market-based solutions to cost-effectively minimize the loss of natural gas from distribution pipelines, in order to optimize investments in EG's distribution pipeline system proposed by the EG Gas Petition. EDF's work with utilities throughout the country including methane surveying and mapping in New Jersey, makes it particularly well qualified to evaluate EG's proposed investments in its distribution system, and propose ways to optimize these investments. EDF additionally plans to review and comment on comments, proposals, and other information brought throughout the course of this proceeding to the extent that customer, safety, cost, and environmental implications of the EG Gas Petition are raised. This contemplated analysis will help enable the BPU to ensure that the EG Gas Petition achieves the greatest result possible.

29. Full Development of the Record. EDF's intervention can assist with the development of a full record, through testimony, cross-examination, and briefing, in areas where other intervenors do not share EDF's particular expertise. If EDF is not permitted to intervene in this instant proceeding, evidence that it intends to present regarding vital ways to improve the EG Gas Petition for greater consumer, grid, and environmental benefits will not be available to the BPU on the record. Nor will the BPU have the opportunity to explore or inquire into the information or expertise which EDF intends to offer. In addition, receiving a different status would deny EDF access to the discovery process, which would preclude it from further developing and refining its

position and arguments as the proceeding progresses, in a manner that is maximally beneficial for the proceeding as a whole.

C. Intervention by EDF will not Cause Confusion or Result in Undue Delay.

30. EDF will work with other parties to ensure that it avoids duplicating efforts being made by other parties to this proceeding so as to prevent confusion and undue delay. In addition, EDF will strictly abide by the schedule and other rulings made by Commissioner Mary-Anna Holden.

CONCLUSION

EDF has met the criteria for intervention in the EG Gas Petition and respectfully requests that an Order be issued granting it intervenor status.

December 18, 2015



Respectfully Submitted,

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Overlap of Utility Pipes and Observed Data from EDF Methane Mapping

Overlap of Utility Pipes and Verified from EDF Methane Mapping

Observed Readings

Clusters of readings that contribute to one verified leak of the following size:

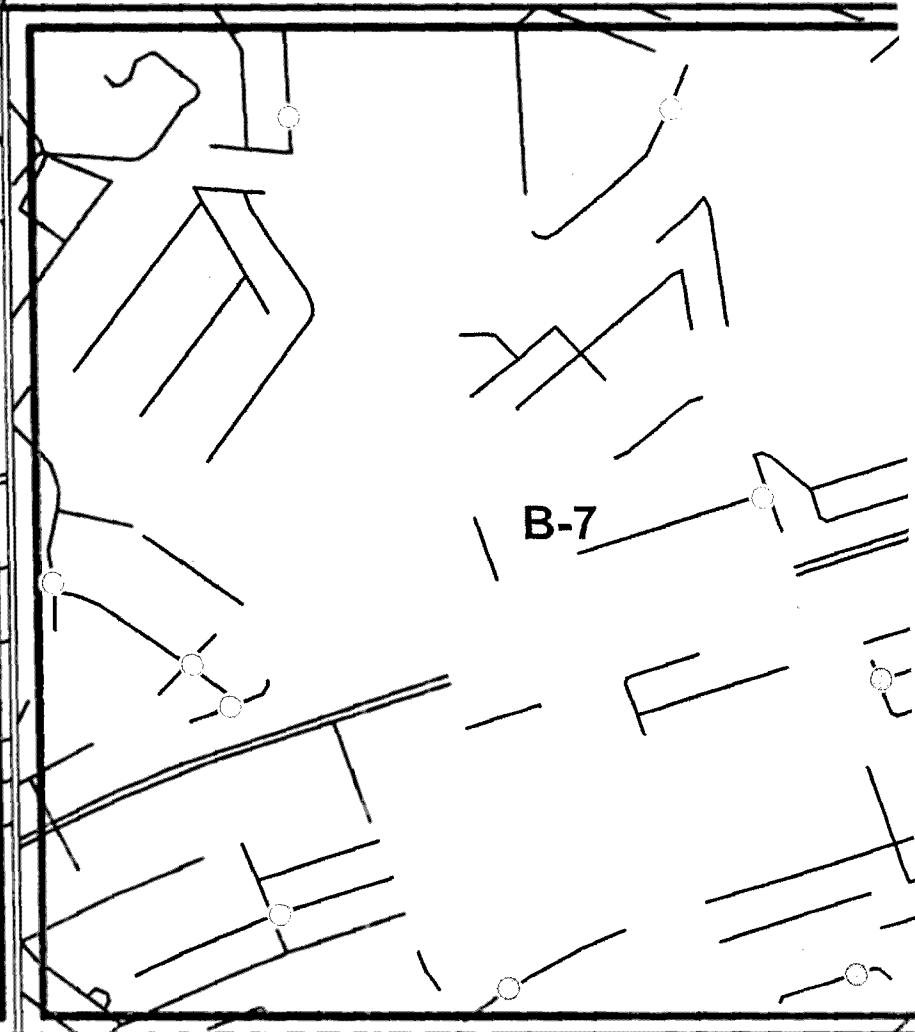
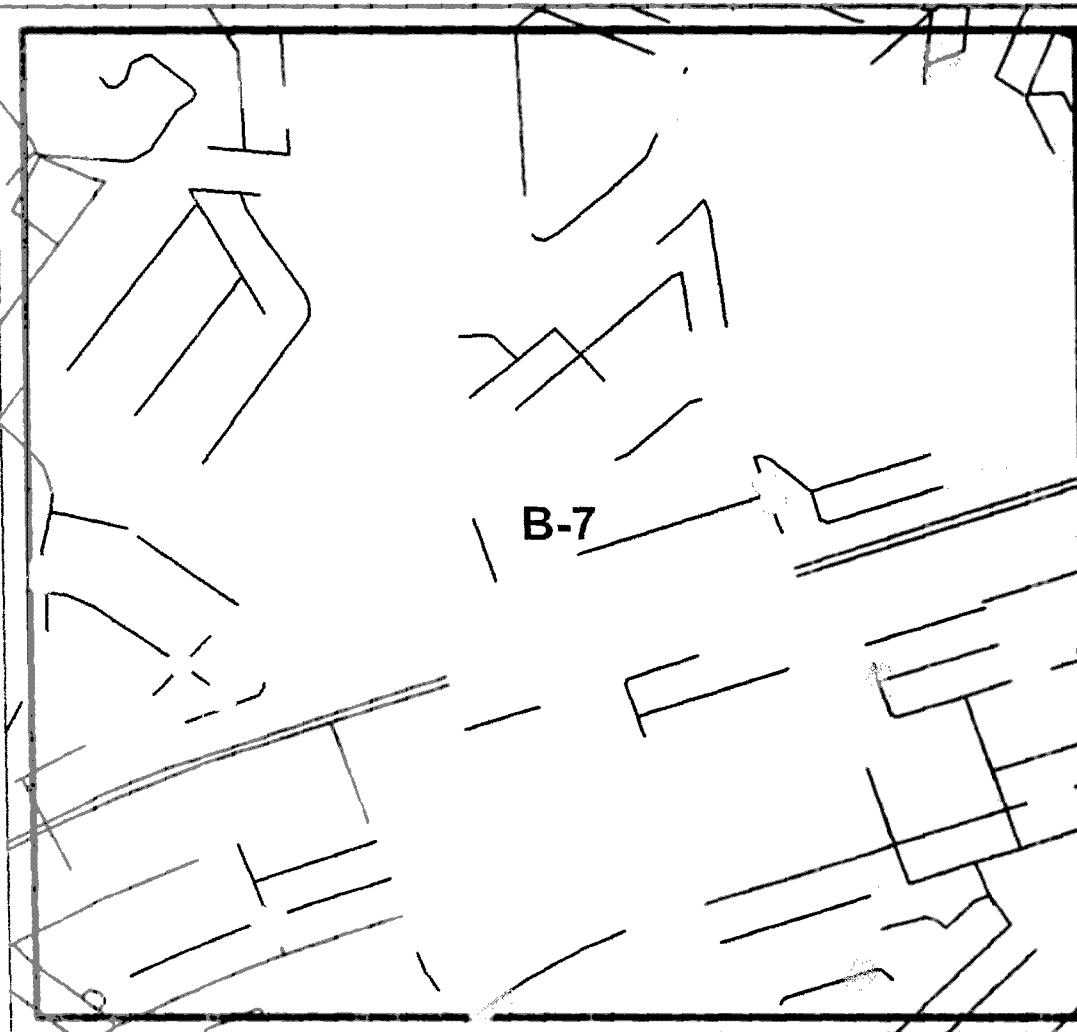
- 700 to 9,000 liters/day
- 9,000 to 60,000 liters/day
- More than 60,000 liters/day

- Grid No.
- Utility Pipes

Verified Leaks

- 700 to 9,000 liters/day
- 9,000 to 60,000 liters/day
- More than 60,000 liters/day
- Grid No.
- Utility Pipes

Estimated Total Flow Rate: 34.6 (±)
Number of Verified Leaks: 12
Miles of Pipe: 7.4 miles
Flow Rate/Mile Pipe: 4.7 (± 0.8*)
Rank: 17
* Represents 95% confidence of t



Grid	Drive Order	No. Verified Leaks in Grid	Total Estimated Flow Rate (L/min)	Measure of Uncertainty	Miles of UPCI Pipe in Grid
A-1	1	10	142.0	26.94	19.3
A-2	2	17	98.7	14.36	16.8
A-4	3	6	30.2	7.40	3.9
A-7	4	13	90.6	15.08	24
B-2	5	12	45.5	7.88	8.8
B-3	6	8	88.4	18.75	18.7
B-5	7	22	183.3	23.45	9.3
B-7	8	12	34.6	5.99	7.4
B-8	9	24	166.8	20.43	11.3
C-1	10	13	142.3	23.68	17.1
D-5	11	8	24.2	5.13	3.2
D-6	12	0	0.0	N/A	7.2
D-8	13	26	163.9	19.29	9.7
F-2	14	16	55.5	8.33	7.3
F-3	15	11	66.6	12.05	9.3
F-6	16	4	27.8	8.34	6.5
G-1	17	6	93.0	22.78	7.1
H-2	18	10	88.5	16.79	11
H-4	19	5	60.6	16.26	6.2
H-6	20	19	102.9	14.16	8.8

Total Estimated Flow Rate	1,705.40
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Estimated Flow Rate (L/min) per Mile	Measure of Uncertainty	Rank By Total Estimated Flow Rate	Rank by Estimated Flow Rate per Mile
7.36	1.40	5	12
5.88	0.85	7	14
7.74	1.90	17	9
3.78	0.63	9	19
5.17	0.90	15	15
4.73	1.00	11	16
19.71	2.52	1	1
4.68	0.81	16	17
14.76	1.81	2	3
8.32	1.38	4	7
7.56	1.60	19	11
0.00	N/A	20	20
16.90	1.99	3	2
7.60	1.14	14	10
7.16	1.30	12	13
4.28	1.28	18	18
13.10	3.21	8	4
8.05	1.53	10	8
9.77	2.62	13	6
11.69	1.61	6	5

Description of Methodology Used to Develop Leak Maps

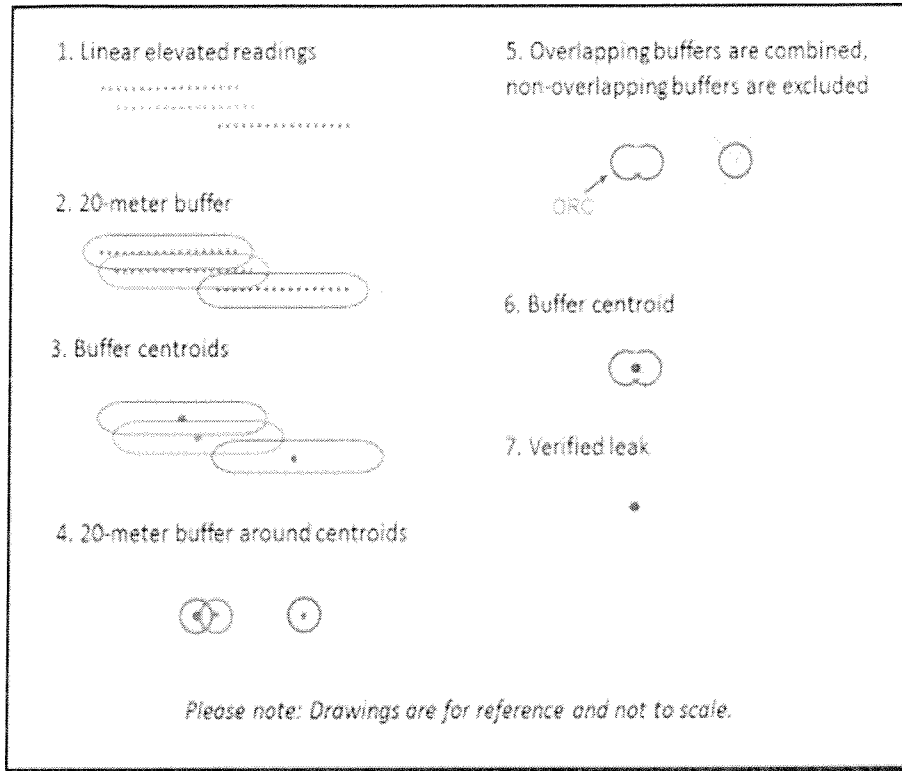
1. Methodology

Note: The following description of the procedure used to attribute leaks to particular segments of a utility's pipeline infrastructure and develop leak attribution maps, is a summary and does not include a description of the quality assurance and quality control checks employed in relation to the leak data.

The methane sensors used to detect leaks are attached to a Google Street View car and collect methane concentrations twice per second. When a vehicle passes through a plume of natural gas, it results in a linear series of elevated methane readings, the length of which depends on the size and shape of the gas plume and the speed of the vehicle, the latter being relatively constant on most city streets.

To attribute an elevated reading to a location, a series of buffering and consolidation procedures are used, which are graphically represented in sequential order in Figure 1 below. First, the series of points representing an elevated methane reading is buffered using a 20 meter buffer (Steps 1 and 2). This buffer distance represents the average width of a plume of gas at the distances from curbside likely to be encountered while driving a city street, as identified by controlled release testing conducted by EDF's collaborator on the mapping project, Colorado State University (CSU). Each 20 meter buffer is then consolidated into a single point, i.e. the centroid (Step 3), each of which is again buffered using a 20 meter buffer (Step 4). Overlapping buffers (hereafter an "Observed Reading Cluster" or ORC) are then merged into a single buffer, the centroid of which is the location assigned to a "verified leak" (Steps 5, 6 and 7). A verified leak is constituted of at least two overlapping buffers; in other words, a leak must have been detected on at least two separate sampling drives for it to constitute a verified leak.

Figure 1: Graphical Representation of Methodology



Any verified leak with an associated ORC intersecting the utility's pipe is attributed to that pipe. In instances where an ORC intersects multiple pipes, such as pipeline intersections, a leak cannot be attributed to a specific utility pipe segment, but can still generally be attributed to the utility's infrastructure.

The size of the mapped ORCs represents the relative uncertainty of verified leak locations. The larger the plume of leaked gas, and the resulting ORC, the greater the uncertainty of the actual leak location. Therefore, larger ORCs are associated with more uncertain verified leak locations.

Only ORCs and verified leaks attributable to the utility's infrastructure are included on the leak maps. As such, these maps represent only a subset of the total number of leaks identified for each drive area comprising a particular "grid" or parcel of a utility's pipelines.

2. Leak Maps

For each of the grids driven, two maps are developed (see Appendix A for sample map). The map on the left represents ORCs that intersect the utility's pipe and are therefore attributable to the utility's infrastructure. The map on the right reflects the corresponding verified leaks. The map on the left is important in that it reflects the relative locational uncertainty of each leak (locational

uncertainty of each leak is reflected in the size of the corresponding ORC, as discussed above). By way of clarification, while legends for the map on the left relate to the relative size of each ORC, i.e. each *cluster* of observed readings, the legends for the map on the right relate to the size of each *individual* verified leak.