STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

North Shore Gas Company	**)**	
	)	
The Peoples Gas Light and Coke Company	**)**	
	)	
	)	**Docket No. 13-0550**
Petition Pursuant to Section 8-104 of the Public	**)**	
Utilities Act to Submit an Energy Efficiency Plan	**)**	

DIRECT TESTIMONY OF PAUL W. FRANCISCO
ON BEHALF OFTHE CITIZENS UTILITY BOARD AND THE CITY OF CHICAGO

CUB/City Exhibit 2.0

December 20, 2013

QUALIFICATIONS AND SUMMARY OF TESTIMONY

QUALIFICATIONS

Q. What is your name and on whose behalf are you testifying?

A. My name is Paul W. Francisco. I am testifying on behalf of the Citizens Utility Board ("CUB") and the City of Chicago ("City").

Q. Have you previously testified before the Illinois Commerce Commission (the "Commission")?

A. No I have not.

Q. What is your background and experience with respect to energy efficiency?

A. I am currently Program Coordinator and Research Engineer of Indoor Climate Research and Training at the Illinois Sustainable Technology Center of the University of Illinois at Urbana-Champaign. In that role, I research energy efficiency and its effect on indoor air quality in buildings, evaluate building leakage, and participate in various studies regarding measures to inhibit radon migration. I am also Director of the University of Illinois' Weatherization Training Center. Before this role, I was a Research Specialist in the University of Illinois' School of Architecture Building Research Council for eight years. Prior to that, I was a Research Scientist at Ecotope, Incorporated for 10 years, where I researched thermal duct efficiency, airflow and leakage in conditioning systems, building and zone ventilation rates, and heating system energy consumption.

In my work, I have been intimately involved with ASHRAE (formerly, the American Society of Heating, Refrigerating, and Air Conditioning Engineers). I have served as Chair of various committees, including the committees for Standard 62.2 (Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential Buildings), Standard 152

(Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems), and Development of Position Document on the Use of Unvented Combustion Appliances. I have also served as the Vice-Chair and Technical Committee Chair of various other ASHRAE Committees, listed fully in my Resume which has been submitted as CUB/City Exhibit 2.1.

I have also published numerous articles and provided multiple presentations with colleagues, including "Weatherization and Indoor Environmental Quality: Measured Impacts in Single-Family Homes Under the Weatherization Assistance Program," "Indoor Air Quality in Weatherization Homes: Study Design and Pilot Results," "Indoor Air Quality in Low-Income Homes," "Indoor Air Performance Calculations and Values with Obscure Origins," and "Measured Duct Leakage and Resulting Envelope Pressure Differences," among many others. My publications that deal specifically with energy efficiency or building envelope tightness are listed in CUB/City Exhibit 2.1

SUMMARY OF TESTIMONY

Q. What is the main conclusion of your testimony?

A. Air sealing, or the sealing of gaps between the conditioned space of a home and unconditioned spaces (such as outside, attics, garages, etc.), is one of the most cost-effective energy efficiency measures that a residential homeowner or tenant could implement. Any perceived risk of overexposure to radon due to air sealing is misplaced in the People's Gas Light and Coke Company ("PGL") or North Shore Gas Company ("NS") service territories. Other subsidiaries of Integrys Energy Group (the parent company of both PGL and NS) including air sealing in their energy efficiency programs. No study that I am aware of finds a statistically significant correlation between air sealing

and changes in radon levels. I am aware of no lawsuits tying air sealing to radon levels. PGL and NS should offer air sealing to their residential customers as part of their energy efficiency portfolio.

Q. Upon what bases do you make your conclusion?

A. Based upon my review of their filing in this Commission proceeding, it appears that neither PGL nor NS have included home air sealing as a measure in their energy efficiency retrofit programs. Although I have no first-hand knowledge of why air sealing is not included, based on direction from City counsel, it appears that PGL and NS have concerns about radon overexposure due to air sealing. This decision is ill-advised from a number of perspectives.

Air sealing should be included in the PGL and NS portfolios due to its standing as one of the most cost-effective measures on its own and also as an important step in realizing full savings from other insulation measures. Based on common leakage reductions using blower-door-guided air sealing the savings in homes in the Chicago area would be expected to increase by about 60-70 therms per year, on average.

Moreover, the risk of radon overexposure in PGL/NS service territories is lower than in many other locations in Illinois and the Midwest due primarily to the proximity to Lake Michigan. Multiple studies that were performed on the issue have failed to find a significant correlation between air sealing and changes in radon levels. On the basis of these studies, I believe that radon testing and mitigation should not be a necessary part of an air sealing program, if included in the PGL/NS energy efficiency portfolios. The PGL/NS energy efficiency portfolios should be consistent with other programs run by

subsidiaries of Integrys as well as other programs in Illinois – all of which include air sealing.

Q. Although you believe that radon testing and mitigation should not be a necessary part of an air sealing program, what radon overexposure risk mitigation options are available to PGL and NS?

A. In the unfortunate event that mitigation and testing is deemed to be required for an air sealing program against my recommendation, a reasonable option would be to withhold air sealing incentives if the account location being considered contains sump pumps or dirt floors which remain uncovered after air sealing.

IMPORTANCE OF AIR SEALING TO SAVINGS

Q. How cost-effective can air sealing be for residential gas customers?

A. Air sealing of existing homes has been found to be one of the most cost-effective measures in retrofit programs. The best evaluation work of retrofit programs has been done by Michael Blasnik, who has done savings evaluations of numerous programs. In 2007, Mr. Blasnik presented summary results from many evaluations at the National Low Income Energy Conference. In his presentation, which was based on data from approximately 25,000 homes, he concluded that there were 3 major measures that contribute to large savings and are focused on the building envelope. These are wall insulation, ceiling insulation, and air sealing.

Q. What savings effect does air sealing have on other energy efficiency measures?

A. Mr. Blasnik also found that not only was air sealing itself a major savings measure, but attic insulation was also often not worthwhile unless bypasses between the house and the attic were sealed. The distinction between direct air sealing savings and a quantified

impact on insulation if air sealing is not done is not readily available, but insulation performance is based on the assumption of no air movement through the insulation. If there is air movement through the insulation then the insulating value decreases. Additionally, air leakage can be viewed as akin to unintentional windows. When a house is well insulated but the windows are left open then clearly the insulation is not sufficient to keep the house as warm as would be possible.

Q. What is the implication of air sealing's effect on other energy efficiency measures for PGL and NS?

A. If air sealing is not among the energy efficiency measures offered, savings from two of the three most beneficial envelope measures (air sealing and attic insulation) will be lost or substantially reduced.

Q. Can you quantify how much in energy savings can be expected from air sealing?

A. Mr. Blasnik showed that blower-door-guided air sealing was typically responsible for savings of 50-100 therms per year. These savings would represent a marked increase in the overall savings achieved by the PGL and NS portfolios.

Q. How widely is air sealing adopted in energy efficiency programs?

A. Air sealing has become a standard measure adopted by most residential retrofit programs. In fact, air sealing is a centerpiece of the Low-Income Weatherization Assistance Program ("WAP") run by the U.S. Department of Energy. Residential audit standards written by organizations such as the Building Performance Institute ("BPI") and the Air-Conditioning Contractors of America ("ACCA") include blower door testing as a basic requirement and air sealing as a standard recommended measure based on the blower door test result.

It is clear that air sealing is widely used and useful for residential energy savings programs. Additionally, it is clear that air tightness is viewed as a critical part of a low-energy home given that the 2012 International Residential Code has specified a minimum tightness level that is tighter than most existing homes achieve even after air sealing.

RELATIONSHIP OF HOUSING TO OCCUPANT HEALTH

Q. What is the relationship between a resident's cost to heat their home and that resident's health?

A. There are many ways in which housing impacts health beyond the alleged risk of radon overexposure. Multiple studies have concluded that lower-energy housing contributes to improved health in residents. Bhattacharya et al. (2003) found that lower-income residents' nutrition worsened during cold spells because of the cost of heating. These results imply that by reducing the cost of heating the nutrition, and therefore, the health of the residents will improve.

Q. What is the relationship between air sealing in particular and resident health?

A. The National Center for Healthy Housing (2013) concluded that air sealing produces both energy savings and significant health benefits such as nutrition, child health, and respiratory illness. Wilson et al. (2013) found that after implementation of energy conservation programs, which included air sealing and ventilation improvements, there were statistically significant improvements in occupant general health, asthma medication use, and sinusitis, though asthma symptoms were mixed.

RELATIONSHIP OF RADON OVEREXPOSURE TO AIR TIGHTNESS

Q. What basis, if any, exists in the literature that would support a concern that air sealing can lead to radon overexposure?

A. Although PGL and NS may have decided not to include air sealing as a measure in their portfolios because of the concern that radon levels will rise, there is little in the literature to support this concern.

Q. What effect can air sealing have on a building's "tightness"?

A. From a scientific perspective, not all air sealing is the same. Air sealing between the first floor and a crawl space should both reduce energy use and reduce migration of radon into the home. Air sealing at the ceiling does reduce air exchange without directly obstructing radon, but it also has the effect of reducing the pressure difference at the floor. The balance between reduced air exchange and reduced driving force for radon entry is not clear.

Q. Besides the tightness of a home, what other factors can affect whether occupants are overexposed to radon?

A. Radon levels in homes are dependent on radon levels in soils. The PGL and NS service territories are in EPA Radon Zone 2, which is characterized as having a moderate potential and is predicted to have an average indoor radon level between 2 and 4 picocurie per liter ("pCi/l") (below the EPA action level). On the other hand, EPA Radon Zone 1 is characterized as having a high potential, with average indoor levels above 4 pCi/l.

Q. What are some evaluations that you are aware of regarding air sealing and its effect on radon levels?

A. Dyess (1994) evaluated 60 treated homes, 32 of which received standard weatherization (approximately 10-20% leakage reduction) and 28 of which received enhanced weatherization (up to 50% leakage reduction). Dyess found that weatherization did not

negatively impact radon levels, and that the standard weatherization homes may have actually experienced a decrease in radon. Dyess concluded that the primary factor influencing radon levels was not weatherization but rather rainfall.

Nero et al. (1983) and Harris (1987) both found that air exchange rate was a poor indicator of radon level.

Chi and Laquatra (1990) evaluated 245 homes in 4 counties in New York (all in EPA Radon Zone 1) and found that there was no statistical evidence that radon was impacted by weatherization, including air sealing. In conjunction with previous studies, they concluded that "we should not decrease our energy-conservation activities because of fear of radon contamination in the home".

Tohn et al. (2013) evaluated the impact of weatherization, including air sealing, on radon in homes in Aroostook County, Maine (EPA Radon Zone 1) and found that weatherization was not statistically correlated with radon changes. They found that the best predictors of potential radon increases were uncovered sump pumps and dirt floors. In this study, dirt floors were typically covered during the course of weatherization but not at a level of quality that would sufficiently prevent radon from entering the home through those floors.

Q. What conclusion do you draw from these evaluations?

A. Taken together, these findings do not support the exclusion of air sealing from energy efficiency measures based on a perceived risk of radon.

COMPARISON OF PEOPLE'S GAS AND NORTH SHORE GAS PROPOSALS TO OTHER PROGRAMS

Q. How does the PGL/NS exclusion of air sealing in their energy efficiency portfolios compare to other utilities?

A. The proposals by PGL and NS to not include air sealing as part of their energy efficiency programs is a significant departure from most other programs, including those of other utilities that are subsidiaries of Integrys.

Q. How do federal energy efficiency programs treat air sealing?

A. The U.S. Department of Energy's WAP program prioritizes air sealing. Additionally, through Weatherization Program Notice 11-6 (DOE 2011) WAP requires that grantees install ground covers over all dirt floors. WPN 11-6 also states that precautions should be taken to reduce the likelihood of making radon conditions worse if there is reason to believe that radon may be present in a home. WAP allows, but does not require, testing in areas with high radon potential. Further, WPN 11-6 requires mechanical ventilation to be installed in most homes, in compliance with ASHRAE Standard 62.2 (ASHRAE 2010).

It should be noted that the objective in WPN 11-6 is in line with the U.S. EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades, which clearly provides a pathway in the retrofit market for applying the "do no harm" principle, which focuses on not increasing radon from pre-existing levels rather than focusing on whether the levels were above or below the 4 pCi/l action level set by EPA.

Q. How do other subsidiaries of Integrys treat air sealing?

A. Within the Integrys family of utilities, all but PGL and NS include air sealing as part of their energy efficiency programs. This is true despite the fact that PGL and NS operate in Radon Zone 2, whereas many locations within the service territory of other Integrys

utilities are in Radon Zone 1, which has a greater risk of radon overexposure. The counties in which PGL and NS operate have lower radon potential primarily due to the proximity to Lake Michigan. The EPA Map of Radon Zones shows that counties near the Great Lakes typically have lower radon potential than other counties further inland. Integrys utility Minnesota Energy Resources provides up to a $300 rebate for a minimum 25% reduction in air leakage, or up to $650 when attic insulation is added to R-44. Most counties served by Minnesota Energy Resources are in Radon Zone 1 with the remainder in Radon Zone 2.

Integrys utility Upper Peninsula Power Company in Michigan runs a residential HVAC program which includes both home air sealing (10, 20, and 30% levels) and duct sealing. Most counties served by Upper Peninsula Power Company are in Radon Zone 2.

Integrys utility Michigan Gas Utilities, which operates in Radon Zones 1-3, has a residential HVAC program with rebates similar to Upper Peninsula Power Company.

Integrys utility Wisconsin Public Service, which operates in Radon Zones 1-2, has a residential HVAC program with rebates similar to Upper Peninsula Power Company.

Q. What conclusion do you draw from the adoption of air sealing by other utilities?

A. It is clear that many entities include air sealing as a major focus of energy efficiency retrofit programs, and can do so in a manner that is consistent with federal guidelines regarding radon. To date, I am aware of no lawsuits nationwide tying air sealing to radon levels.

ISSUES REGARDING RADON TESTING

Q. Do you believe that testing or mitigation should be required for air sealing to be offered by PGL and NS?

A. No. If it is determined that air sealing would only be included in PG and NSG's energy efficiency portfolios if testing were included, that testing should be designed with best practices in mind. It is common for people to do 2-4 day radon tests, primarily to make quick decisions in real estate transactions. However, a study by Steck (2005) showed that a 2-day test has a standard deviation of 76% of the actual annual mean, and the standard deviation is 70% of the annual mean for a 4-day test. This means that these tests are not reliable indicators of elevated radon in many cases, especially when trying to determine any changes due to retrofit efforts. The World Health Organization (2009) has stated that in order to get a reasonable approximation of the annual average a minimum 90-day test should be done. Steck showed that a 90-day test would have a standard deviation of about 25% of the annual average, which may be sufficiently good to determine whether levels are likely above 4 pCi/l but which still will leave substantial uncertainty regarding any changes due to retrofit.

Given the challenges with getting a representative radon test result in the context of retrofit programs – both regarding work flow and ability to determine radon changes due to retrofit – I recommend against testing in the PGL and NS programs. If, however, radon testing or a surrogate measure to minimize risks was deemed necessary, one option would be to tie air sealing incentives to ensuring that sump pumps or dirt floors are covered, since uncovered sump pumps and dirt floors have been identified as factors increasing the risk of radon level increases.

Q. Does this conclude your direct testimony?

A. Yes.

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