GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY) PAGE 1 OF 3

CODE: International Mechanical Code SECTION: 1109.3.2

PROPONENT: Greg Johnson DATE: 12-07-2024

EMAIL: gjohnsonconsulting@gmail.com

ADDRESS: 4748 Copper Circle; Woodbury MN 55129

TELEPHONE NUMBER: 651-235-1215 FAX NUMBER: _____

CHECK X Revise section to read as follows: _____

_____ _____

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

1109.3.2 Shaft ventilation.

~~Refrigerant~~ Required refrigerant pipe shafts with systems using Group A2L or B2L refrigerant shall be naturally or mechanically ventilated. Refrigerant pipe shafts with one or more systems using any Group A2, A3, B2 or B3 refrigerant shall be continuously mechanically ventilated and shall include a refrigerant detector. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Naturally ventilated shafts shall have a pipe, duct or conduit not less than 4 inches (102 mm) in diameter that connects to the lowest point of the shaft and extends to the outdoors. The pipe, duct or conduit shall be level or pitched downward to the outdoors. Mechanically ventilated shafts shall have a minimum airflow velocity in accordance with Table 1109.3.2. The mechanical ventilation shall be continuously operated or activated by a refrigerant detector. Systems utilizing a refrigerant detector shall activate the mechanical ventilation at a maximum refrigerant concentration of 25 percent of the lower flammable limit of the refrigerant. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The shaft shall not be required to be ventilated for double-wall refrigerant pipe where the interstitial space of the double-wall pipe is vented to the outdoors.

REASON/INTENT:

This is a companion proposal to a proposal to amend IMC Section 1109.2.5 to allow exception 2 for all refrigerants as is permitted by ASHRAE 15-2022, *Safety Standard for Refrigeration Systems,* and will be permitted by the 2027 IMC (M75-24 is on the consent agenda for the 2027 IMC). If that proposal is accepted many refrigerant pipe shafts for A2L refrigerants would no longer be required because the maximum amount of refrigerant that could be released would be within the safe release limits specified by the IMC in Table 1103.1.

Where no shaft is required, A2L refrigerant piping could be run through stud cavities as permitted by Sec. 1109.2.2. (Note that Sec. 1109.3 requires that A2L piping systems comply with the provisions of Sec. 1109.3.1 for protection against physical damage).

If a shaft is not required, but the designer chooses to run A2L refrigerant piping in a shaft anyway for ease of construction, the requirements of Sec. 1109.3.2 should not apply. A refrigerant leak in a non-required shaft would be no more hazardous than a refrigerant leak in a stud cavity. If the stud cavity would not require ventilation and drainage, then a non-required shaft should not require ventilation and drainage.

FINANCIAL IMPACT OF PROPOSED AMENDMENT:

The cost burden of providing ventilated and drained shafts is considerable; multifamily designers say some developers estimate $250K to provide these shafts in a 300-unit multifamily building.

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM INSTRUCTION SHEET

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8. Under the "Reason" section, provide the reasoning behind the proposed code amendment. The reason should be clear and concise. Test reports, standards or other supporting information and documentation may be submitted with the proposed amendment and must be attached to the amendment form.

9. **A Statement of Financial Impact must accompany all proposed code amendments.** The statement should be clear and concise. Test reports, standards or other supporting information and documentation may be submitted with the proposed amendment and must be attached to the amendment form.

10. **All proposed amendments must be typed and completed in full and the original submitted to the Codes and Industrialized Buildings Section of the Department of Community Affairs NO LATER THAN DECEMBER 15TH.** The proposed code change shall be submitted for review to the State Codes Advisory Committee at their quarterly meeting in January. An incomplete form will be sent back to the proponent for completion. An amendment submitted after the submittal deadline date will be returned to the proponent.

11. The proponent will be notified when the proposed amendment will be considered by the State Codes Advisory Committee.

12. Information concerning submittal of code amendments, including deadline dates for submittal, can be obtained by contacting the Codes and Industrialized Buildings Section at (404) 679-3118. All proposed code amendments should be submitted to:

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Codes and Industrialized Buildings Section
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Atlanta, Georgia 30329-2231

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY) PAGE 1 OF 5

CODE: International Mechanical Code SECTION: 1109.3.2

PROPONENT: Greg Johnson DATE: 12-07-2024

EMAIL: gjohnsonconsulting@gmail.com

ADDRESS: 4748 Copper Circle; Woodbury MN 55129

TELEPHONE NUMBER: 651-235-1215 FAX NUMBER: _____

CHECK X Revise section to read as follows: _____

_____ _____

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

1109.3.2 Shaft ventilation.

Refrigerant pipe shafts with systems using Group A2L or B2L refrigerant shall be naturally or mechanically ventilated. Refrigerant pipe shafts with one or more systems using any Group A2, A3, B2 or B3 refrigerant shall be continuously mechanically ventilated and shall include a refrigerant detector. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Naturally ventilated shafts shall have a pipe, duct or conduit not less than 4 inches (102 mm) in diameter that connects to the lowest point of the shaft and extends to the outdoors. The pipe, duct or conduit shall be level or pitched downward to the outdoors. Mechanically ventilated shafts shall have a minimum airflow velocity in accordance with Table 1109.3.2. The mechanical ventilation shall be continuously operated or activated by a refrigerant detector. Systems utilizing a refrigerant detector shall activate the mechanical ventilation at a maximum refrigerant concentration of 25 percent of the lower flammable limit of the refrigerant. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The shaft shall not be required to be ventilated for double-wall refrigerant pipe where the interstitial space of the double-wall pipe is vented to the outdoors. For refrigeration systems used in residential occupancies serving only a single dwelling unit or sleeping unit, shaft ventilation shall not be required where the pipe or tube is continuous without fittings in the shaft.

REASON/INTENT:

The proposed language is taken from code change M62-24 which passed the ICC's IMC hearing committee by 13-1 and which received no public comments. M62-24 is therefore on the consent agenda for the 2027 IMC and will be the content of the 2027 IMC. M62 is appended.

This language is also consistent with provisions addressing shaft ventilation in Section 8.5.2.2 of ASHRAE 15.2-2022, *Safety Standard for Refrigeration Systems in Residential Applications* and Addendum a to ASHRAE 15-2024, *Safety Standard for Refrigeration Systems.*

There is almost no chance of refrigerant piping without connections leaking refrigerant into the shaft where it is located. As such there is almost no chance of a need to ventilate the shaft, particularly since this allowance is limited to piping serving a single unit, meaning a limited quantity of A2L refrigerant which could potentially be released.

Given the limited hazard, it is unwarranted to require the expense of ventilating shafts with low volume, continuous A2L refrigerant piping.

FINANCIAL IMPACT OF PROPOSED AMENDMENT:

The cost burden of providing ventilated and drained shafts is considerable; multifamily designers say some developers estimate $250K to provide these shafts in a 300-unit multifamily building.

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

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GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY) PAGE 1 OF 10

CODE: International Mechanical Code SECTION: 1109.2.5

PROPONENT: Greg Johnson DATE: 12-07-2024

EMAIL: gjohnsonconsulting@gmail.com

ADDRESS: 4748 Copper Circle; Woodbury MN 55129

TELEPHONE NUMBER: 651-235-1215 FAX NUMBER: _____

CHECK X Revise section to read as follows: _____

_____ _____

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

DESCRIPTION: revise IMC as follows:

1109.2.5 Refrigerant pipe shafts.

Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistance-rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with Section 713 of the *International Building Code*.

Exceptions:

1. *Refrigeration* systems using R-718 refrigerant (water).
2. Piping in a direct refrigeration system ~~using Group A1 refrigerant~~ where the refrigerant quantity does not exceed the limits of Table 1103.1 for the smallest occupied space through which the piping passes.
3. Piping located on the exterior of the *building* where vented to the outdoors.

REASON/INTENT:

There is a significant problem with the shaft requirements of the 2021 and 2024 International Mechanical Code (IMC) for refrigerant piping which - according to the original proponent at the ICC - unintentionally codified a provision that requires ventilated and drained fire-resistance rated shafts for Group A2L refrigerant piping - regardless of the quantity of refrigerant in the piping - where the piping penetrates two or more floor/ceiling assemblies.

Regarding Exception 2, IMC Table 1103.1, *Refrigerant Classification, Amount and OEL* provides limits for the quantity of refrigerant that can be released to the atmosphere without creating a fire or human health hazard. IMC Table 1103.1 is duplicated from ASHRAE Standard 34, *Designation and Safety Classification of Refrigerants* Table 4-1, *Refrigerant Data and Safety Classifications.*

Restricting the shaft exception to systems using Group A1 refrigerants is inconsistent with the safe limits premise of IMC Table 1103.1 and Standard 34, Table 4-1. There is no need to restrict the use of any refrigerant provided the release of which does not exceed the tabular safety limits.

This interpretation is supported by the provisions of Exception b of Section 9.12.1.5 of ASHRAE 15-2022, *Safety Standard for Refrigeration Systems* which says*:*

"9.12.1.5.1 Shaft Alternative. *A* ***shaft enclosure shall not be required*** *for the refrigerant piping for any of the following refrigerating systems:*

a. Systems using R-718 (water) refrigerant
b. Piping in a high-probability system ***where the refrigerant concentration does not exceed the amounts shown in ASHRAE Standard 34****, Table 4-1 or 4-2, for the smallest occupied space through which the piping passes* ***<emphasis added>***
c. Piping located on the exterior of the building where vented to the outdoors"

Research of past editions of ASHRAE 15 shows that the exception (shaft alternative) for limited concentrations of refrigerant has applied to all refrigerants and not just A1 refrigerants since at least 1994.

Code change M75-24 (appended) makes the same amendment as this proposal. It has been heard and passed unanimously by the IMC hearing committee and received no public comments. Under ICC's process M75-24 is now on the consent agenda for the 2027 IMC; in other words, this proposal is requesting that the refrigerant pipe shaft exception of the 2027 IMC be adopted instead of that of the 2021 or 2024 IMC.

An engineering analysis by Julius Ballanco, P.E., is appended to this request. Mr. Ballanco was the proponent of the code change that introduced the language being asked to be amended. Mr. Ballanco explains that restricting Exception 2 of IMC Section 1109.2.5 to only A-1 refrigerants was an unintended result of a working draft document being codified and that the exception should be applied to all refrigerants and Group A2L, particularly.

FINANCIAL IMPACT OF PROPOSED AMENDMENT:

The cost burden of providing these unnecessary shafts is considerable; multifamily designers say some developers estimate $250K to provide these shafts in a 300-unit multifamily building.

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proponent for completion. An amendment submitted after the submittal deadline date will be returned to the proponent.

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Atlanta, Georgia 30329-2231

M62-24

IMC®: CHAPTER 11, SECTION 1101, 1101.1, 1101.1.1, 1107.4, 1107.5, 1109.2.7, 1109.3.2, ASHRAE Chapter 15 (New)

Proponents: Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

CHAPTER 11
REFRIGERATION

SECTION 1101
GENERAL

1101.1 Scope. This chapter shall govern the design, installation, construction and repair of *refrigeration systems* . Permanently installed refrigerant storage systems and other components shall be considered as part of the *refrigeration system* to which they are attached.

Revise as follows:

1101.1.1 Refrigerants other than ammonia. *Refrigeration systems* using a refrigerant other than ammonia shall comply with this chapter, the International Fire Code, and either ASHRAE 15 or ASHRAE 15.2, as applicable~~and the *International Fire Code*~~. *Refrigeration systems* containing carbon dioxide as the refrigerant shall also comply with IIAR CO2 .

1107.4 Piping materials standards. Refrigerant pipe shall conform to one or more of the standards *listed* in Table 1107.4. For refrigeration systems used in residential occupancies serving only a single dwelling unit or sleeping unit, refrigerant piping and tubing shall be limited to aluminum, copper, and copper alloy. The exterior of the pipe shall be protected from corrosion and degradation.

1107.5 Pipe fittings. Refrigerant pipe fittings shall be *approved* for installation with the piping materials to be installed, and shall conform to one of more of the standards listed in Table 1107.5 or shall be *listed* and *labeled* as complying with UL 207. For refrigeration systems used in residential occupancies serving only a single dwelling unit or sleeping unit, refrigerant fittings shall be limited to aluminum, copper, copper alloys, stainless steel, and steel.

1109.2.7 Pipe identification. Refrigerant pipe located in areas other than the room or space where the refrigerating *equipment* is located shall be identified. The pipe identification shall be located at intervals not exceeding 20 feet (6096 mm) on the refrigerant piping or pipe insulation. The minimum height of lettering of the identification label shall be $^{1}/_{2}$ inch (12.7 mm). The identification shall indicate the *refrigerant designation* and safety group classification of refrigerant used in the piping system. For Group A2L and B2L refrigerants, the identification shall also include the following statement: “WARNING—Risk of Fire. Flammable Refrigerant.” For Group A2, A3, B2 and B3 refrigerants, the identification shall also include the following statement: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant.” For any Group B refrigerant, the identification shall also include the following statement: “DANGER—Toxic Refrigerant.”

Exception: For refrigeration systems used in residential occupancies serving only a single dwelling unit or sleeping unit pipe identification shall not be required.

1109.3.2 Shaft ventilation. Refrigerant pipe shafts with systems using Group A2L or B2L refrigerant shall be naturally or mechanically ventilated. Refrigerant pipe shafts with one or more systems using any Group A2, A3, B2 or B3 refrigerant shall be continuously mechanically ventilated and shall include a refrigerant detector. The shaft ventilation exhaust outlet shall comply with Section 501.3.1. Naturally ventilated shafts shall have a pipe, duct or conduit not less than 4 inches (102 mm) in diameter that connects to the lowest point of the shaft and extends to the outdoors. The pipe, duct or conduit shall be level or pitched downward to the outdoors. Mechanically ventilated shafts shall have a minimum airflow velocity in accordance with Table 1109.3.2. The mechanical ventilation shall be continuously operated or activated by a refrigerant detector. Systems utilizing a refrigerant detector shall activate the mechanical ventilation at a maximum refrigerant concentration of 25 percent of the lower flammable limit of the refrigerant. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The shaft shall not

be required to be ventilated for double-wall refrigerant pipe where the interstitial space of the double-wall pipe is vented to the outdoors. For refrigeration systems used in residential occupancies serving only a single dwelling unit or sleeping unit, shaft ventilation shall not be required where the pipe or tube is continuous without fittings in the shaft.

Add new standard(s) as follows:

15.2-2022 Safety Standard for Refrigeration Systems in Residential Applications

Reason: This code change proposal adds the reference to ASHRAE 15.2, the installation standard for residential air conditioning systems used for a single dwelling or sleeping unit. This addition addresses a gap created in the Code when ASHRAE 15 split its scope between standards 15 and 15.2. As some systems covered by the scope of ASHRAE 15.2 are also covered by the IMC, its inclusion within the IMC is necessary.With the separation between ASHRAE 15 and ASHRAE 15.2, there were certain changes that impact the refrigerant piping requirements. For residential systems, the piping material is limited to aluminum, copper, and copper alloy pipe or tube. The fitting requirements are similar material requirements with the addition of stainless steel and steel.

Pipe identification is not required for piping system regulated by ASHRAE 15.2. The reason for this is that the refrigerant piping is obvious not needing to be individually identified. Whereas in commercial buildings there are often multiple piping systems where the type of piping system is not obvious.

For shaft ventilation, there is an allowance in residential systems to eliminate the ventilation of the shaft when the piping system is continuous without fittings in the shaft. This provision was added to the end of the section.

Cost Impact: The change proposal is editorial in nature or a clarification and has no cost impact on the cost of construction

Justification for no cost impact:

The inclusion of ASHRAE 15.2 into the IMC is editorial in nature, and as such will not impact the cost of construction. Changes to piping for ASHRAE 15.2 may actually reduce the cost of construction, by not requiring shaft ventilation when no joints are present in the shaft.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASHREA 15.2 Safety Standard for Refrigeration Systems in Residential Applications, with regard to some of the key ICC criteria for referenced standards (Section 4.6 of CP#28) will be posted on the ICC website on or before March 18, 2024.

M75-24

IMC®: 1109.2.5

Proponents: Greg Johnson, Johnson & Associates Consulting Services, National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Vladimir G. Kochkin, National Association of Home Builders - NAHB, NAHB (vkochkin@nahb.org); Andrew Klein, A S Klein Engineering, PLLC, BOMA International (andrew@asklein.com); Emily Toto, ASHRAE, ASHRAE (etoto@ashrae.org)

2024 International Mechanical Code

Revise as follows:

1109.2.5 Refrigerant pipe shafts. Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistance-rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with Section 713 of the International Building Code.

Exceptions:

1. *Refrigeration* systems using R-718 refrigerant (water).
2. Piping in a direct refrigeration system ~~using Group A1 refrigerant~~ where the refrigerant quantity does not exceed the limits of Table 1103.1 for the smallest occupied space through which the piping passes.
3. Piping located on the exterior of the *building* where vented to the outdoors.

Reason: JOHNSON: This will make the IMC consistent with Section 9.12.1.5 of ASHRAE 15-2022. Note that IMC Section 1109.2.2 still requires piping protection, either within building elements or protective enclosures.

TOTO: This section was added to the IMC before the completion of the changes to ASHRAE 15. ASHRAE 15 removed the limitation in exception 2 as applying only to Group A1 refrigerants. It was determined that any refrigerant meeting the limitations of Table 1103.1 are safe to install without a shaft enclosure. This modification is consistent with ASHRAE 15-2022.

Cost Impact: Decrease

Estimated Immediate Cost Impact:

JOHNSON: Costs are estimated to be reduced by roughly $1,000 per piping run per floor of an R-2 multifamily building.
TOTO: This may reduce the cost of construction by eliminating the shaft requirements for all refrigerants that do not exceed the safe limitations in the code. $22,400 estimated avoided total cost per mechanical room.

Estimated Immediate Cost Impact Justification (methodology and variables):

JOHNSON: Lineal feet of shaft-wall system avoided estimated to be 20 feet. Height of ceiling estimated to be 9 feet. Cost of installed shaft system estimated to be $7.00 per square foot. 20 X 9 X $7 = $960. $960 was rounded to $1,000.
TOTO: This change provides a lower cost alternative to the installation of a pipe shaft. Assumed area of avoided shaft wall system = 10 ft high X 40 lineal ft ($ sided enclosure) = 400 sf of shaft wall area. Assume shaft liner wall board is $34 per sf (kamcoboston.com), assume shaft framing materials are $8 per sf (schillings.com), assume $4 per sf labor (forbes.com), = $56 per sf for installed shaft wall without finishing. $56 per sf X 400 sf = **$22,400 estimated avoided total cost per mechanical room.**

Estimated Life Cycle Cost Impact:

JOHNSON: N/A

Estimated Life Cycle Cost Impact Justification (methodology and variables):

JOHNSON: N/A

JB ENGINEERING AND CODE CONSULTING, P.C.
1661 Cardinal Drive • Munster, IN 46321
Phone: 219-922-6171 • Cellular: 219-689-1699
E-Mail: JBEngineer@aol.com

JULIUS A. BALLANCO, P.E.
President

July 10, 2024

Refrigerant Piping Connecting (or Passing Through) Multiple Floor Levels
Based on ASHRAE 15 with a Reference to the ICC International Mechanical Code

Executive Summary: Where refrigerant piping passes through different floor levels in a building, design professionals have the option of locating the piping in a fire-resistance rated pipe shaft, or within the building elements with each floor/ceiling penetration properly protected.

The 2021 and 2024 editions of the ICC International Mechanical Code have a limitation on refrigeration systems using Group A1 refrigerants for exceptions to the pipe shaft requirements. This limitation was only proposed, but not accepted, by ASHRAE 15. The limitation is being removed in the 2027 edition of the Mechanical Code. Code Officials should accept the allowance of the exceptions for any system, in accordance with alternative approval.

Pipe Shaft Option: When refrigerant piping is located in a pipe shaft, the Building Code regulates the fire-resistant rating of the shaft. Shafts that connect three stories or less must be 1 hour fire-resistance rated. Shafts connecting four or more stories must be 2-hour fire-resistance rated. Every pipe penetration of the shaft wall, whether horizontal or vertical, must be protected with a through penetration pipe protection to maintain the fire-resistance rating of the shaft.

When the refrigerant piping contains a Group A2L refrigerant, the pipe shaft must be ventilated. The ventilation can either be by natural or mechanical means. If natural ventilation is selected, a 4-inch round duct or pipe must be at the base of the shaft and open to the outdoors. There must also be an opening at the top of the shaft, to allow the free flow of air for natural ventilation.

If the shaft is mechanically ventilated, a refrigerant detector is required at the base of the shaft to detect any leaking refrigerant, thus activating the mechanical ventilation. The ventilation rate is based on the inside area of the shaft. ASHRAE 15 specifies the ventilation rate for the given size of the shaft.

Penetration Protection Option: Piping is typically enclosed within the building elements. Refrigerant piping may also be enclosed within the building elements. Where the refrigerant piping passes through a floor/ceiling assembly, the annular space around the pipe must be protected with a through penetration protection means. This is typically accomplished with a fire rated caulking material.

If the refrigerant piping passes through a fire-resistance rated wall assembly, the annular space must be protected with a through penetration protection means. The through penetration protection must be the same or higher rating than the wall assembly.

Substantiation Detailing the Executive Summary

The refrigerant piping requirements in the 2022 edition of ASHRAE 15 have been completely rewritten. The new requirements were developed by the Refrigerant Piping Working Group of SSPC 15. Many of the piping requirements remain the same as previous editions of the standard, merely coordinated into a new format.

One of the issues that appears confusing is the installation of refrigerant piping between multiple floors, specifically three or more floors. Section 9.12.1.5 states, in part, "*Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistance-rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with the requirements of the building code."*

The following section, 9.12.1.5.1, lists alternatives to installing refrigerant piping in a fire-resistance rated shaft. The second item listed for shaft alternatives states, "*Piping in a high-probability system where the refrigerant concentration does not exceed the amounts shown in ASHRAE Standard 34[3], Table 4-1 or 4-2, for the smallest occupied space through which the piping passes*."

While both Section 9.12.1.5 and 9.12.1.5.1 appear to be new requirements, they are actually a rewrite of Section 8.10.3 of the 2019 and prior editions of ASHRAE 15. Rather than including exceptions to the shaft requirements, the new Section 9.12.1.5.1 uses the term, "shaft alternative." In effect, shaft alternatives are exceptions to the shaft requirements.

The requirement for a pipe shaft dates back to when the Building Code mandated pipe shafts where piping extended three or more stories in a building. The 1984 BOCA Building Code had the following statement in Section 1410.4:

Section 1410.4 Ducts and pipe shafts: *In all buildings other than buildings of Use Group R-3, vertical pipes arranged in groups of two or more which penetrate two or more floors and occupy and area of more than 1 square foot …. shall be enclosed by construction having a fireresistance rating specified in Table 401.*

It should be noted that Use Group R-3 is the classification for one- and two-family dwellings.

Section 9.12.2.2 of ASHRAE 15 specifies requirements to ventilate a pipe shaft where refrigerant piping using Group A2L refrigerants is used. Shaft ventilation can be accomplished by either natural or mechanical means. For natural ventilation, Item a of Section 9.12.2.2 requires a minimum of a 4-inch diameter pipe, duct, or conduit at the lowest point of the shaft and open to the outdoors. A means of make up air must be at the top of the shaft.

Mechanical ventilation, identified in Item b of Section 9.12.2.2, is based on the area of the pipe shaft. Table 9-12 specifies the minimum ventilation rate. A pipe shaft of 20 square inches or less requires a minimum of 100 cfm of ventilation. A pipe shaft greater than 20 square inches, and less than or equal to 250 square inches, requires a minimum of 200 cfm of ventilation.

A pipe shaft remains an option for enclosing refrigerant piping. The ICC International Building Code has the following requirement for a shaft fire-resistance rating:

713.4 Fire-resistance rating. *Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours. Shaft enclosures shall meet the requirements of Section 703.2.1.1.*

By 1987, all of the model building codes were revised to remove the mandatory requirement for a pipe shaft. A pipe shaft was still permitted as an optional design, however, the building codes added extensive pipe penetration requirements for floor/ceiling penetrations when a pipe shaft is not installed. Those requirements remain in the current ICC International Building Code. Section 714 specifies penetration protection requirements. When a through penetration firestop system is used to protect the annular space, the system must be tested to ASTM E814 or UL 1479.

There are special exceptions for penetrations of copper and steel pipe 6 inches in diameter or less. When passing through concrete or masonry, the annular space can be filled with mortar, provided the penetration does not allow the passage of smoke or flame.

Item b in Section 9.12.1.5.1 of ASHRAE 15 is consistent with the International Building Code allowance for multi-floor piping with penetration protection rather than a pipe shaft. ASHRAE 15 directs the user to the Building Code to determine the requirements for penetration protection.

When utilizing Item b in Section 9.12.1.5.1, the design professional must perform an analysis of the potential leak of refrigerant into the smallest space in which the piping passes. The 2022 edition of ASHRAE 15 added new requirements for analyzing potential refrigerant leaks. This included the addition of effective dispersal volume charge (EDVC), as well as, effective dispersal volume (EDV). Section 7.2.3.1.1 added exempted spaces when determining the EDV. The section reads, "*The areas that contain only continuous refrigerant piping, or contain only joints and connections that have been tested in accordance with Section 9.13, are exempt from the effective dispersal volume calculation unless these areas are part of connected spaces per Section 7.2.3.2*."

Section 9.13, referenced in the exempted spaces section, is the new robust testing requirements for field installed refrigerant piping. Testing is required for all field installed refrigerant piping, hence, if the piping installation complies with ASHRAE 15, spaces containing only the piping, including joints and connections, are exempt from the EDV calculations.

Where the refrigerant piping, connecting three or more stories, is not located in a fire-resistance rated shaft, Item b of Section 9.12.1.5.1 requires an analysis of the leak potential into the spaces in which the piping passes through. However, Section 7.2.3.2 exempts spaces from the EDV calculation if the space only contains tested refrigerant piping, joints, and connections. When installed in such a manner, the International Building Code requires all pipe penetrations of floor/ceiling assemblies to be properly protected.

ICC International Mechanical Code: At the time the ASHRAE SSPC 15 Refrigerant Piping Working Group began rewriting the refrigerant piping requirements in ASHRAE 15, it was noted that the refrigerant piping requirements in the 2018 edition of the ICC International Mechanical Code were woefully inadequate. A code change was submitted, using an early draft of the changes to the refrigerant piping requirements in

ASHRAE 15. Included in that early draft were the refrigerant pipe shaft provisions listed as Section 1109.2.5. Rather than shaft alternatives, the code change listed exceptions to a refrigerant pipe shaft section.

The second exception in the proposed code change added a limitation as only being applicable to refrigeration systems using Group A1 refrigerants. The exception reads:

2. Piping in a direct system using Group A1 refrigerant where the refrigerant quantity does not exceed the limits of Table 1103.1 for the smallest occupied space through which the piping passes.

This limitation for systems using Group A1 refrigerants was part of a very large code change. Most of the emphasis and review were of the other sections in the proposed change. Exception 2 was not identified in the code change substantiation, nor was it discussed during testimony on the code change.

SSPC 15 Refrigerant Piping Working Group had nine revisions to the original draft of the piping requirements. During those revisions, the limitation for shaft alternatives to only systems using Group A1 refrigerants was removed. There was no technical justification for limiting the shaft alternative to a single group of refrigerants. With the anticipated increased use of Group A2L refrigerants, it was noted that the shaft alternative must also apply to these refrigeration systems.

When the exception to Section 1109.2.5 was added to the 2021 ICC International Mechanical Code, the code became inconsistent with ASHRAE 15. The 2019 edition of ASHRAE 15 did not include the update from the Refrigerant Piping Working Group, however, the standard always permitted the shaft exception for a system using any refrigerant.

The final approval of the refrigerant piping rewrite to ASHRAE 15 occurred in the early part of 2022, after the final consideration of code changes to the 2024 ICC International Mechanical Code. In accordance with ASHRAE policy, a code change could not be submitted to ICC to correct exception 2 to Section 1109.2.5 since the piping change had not been accepted by ASHRAE.

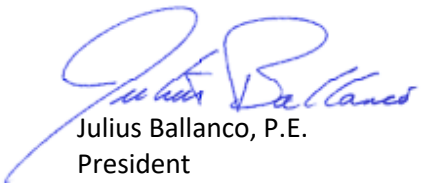
The 2022 edition of ASHRAE 15, which is referenced in the 2024 edition of the ICC International Mechanical Code, updated the refrigerant piping requirements. The shaft alternatives allowable for all refrigerants was included in the 2022 edition of ASHRAE 15. Thus, there is a conflict between the Mechanical Code and the referenced standards regarding the exception or alternative to refrigerant pipe shafts.

The SSPC 15 Code Change Working Group noted this conflict and proposed a change, M75-24, to the 2027 edition of the ICC International Mechanical Code to remove the limitation applying to only Group A1 refrigerants. Code change M75-24, sponsored by ASHRAE and others, was unanimously approved by the Mechanical Code Committee. The result of this code change will make the Mechanical Code consistent with ASHRAE 15 regarding the allowance of the exception, or shaft alternative, being applicable to all refrigeration systems.

It is appropriate for code officials to grant an alternative approval in accordance with Section 104.2.3 of the ICC International Mechanical Code. The alternative approval would be to allow the use of Exception 2 to Section 1109.2.5 as applying to a refrigeration system using any refrigerant. The alternative approval would be consistent with ASHRAE 15 and the 2027 edition of the ICC International Mechanical Code.

Summary: ASHRAE 15 grants the design professional the option to install refrigerant piping in a fire-resistance rated shaft, or to protect every floor/ceiling penetration in accordance with the Building Code. Code Officials enforcing the 2021 or 2024 edition of the ICC International Mechanical Code should grant an alternative approval for refrigeration systems using refrigerants, other than Group A1 refrigerants, to not be located in a pipe shaft based on the requirements in ASHRAE 15.

Respectfully submitted,



Julius Ballanco, P.E.
President

(Note: Julius Ballanco was the Chair of the SSPC 15 Refrigerant Piping Working Group and proponent of the ICC refrigerant piping code change.)

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY) PAGE 1 OF 6

CODE: IMC SECTION: 312.2 Humidity Control

PROPONENT: Richard Johnson DATE: 2/9/25

EMAIL: RAJohnson CSP@MSN.com

ADDRESS: 2041 Hessian Court Stone Mountain GA 30087

TELEPHONE NUMBER: 678 438 4314 FAX NUMBER: _____

CHECK ONE:
- ☐ Revise section to read as follows:
- ☐ Delete section and substitute the following:
- ☒ Add new section to read as follows:
- ☐ Delete without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED:~~ UNDERLINE MATERIAL TO BE ADDED

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

Description: **312.2 Humidity control**. *(new section)*
Dehumidification shall be provided by the HVAC system capable of maintaining the humidity near or below 50 percent (ideally 30-50%) at 70 degrees controlled by a humidistat co-located with the thermostat.

Reason/Intent:
30 studies, experts, professionals, and countless others have confirmed that inadequate humidity control in the indoor environment leads to the proliferation of mold, dust mites, and cockroaches. 74 studies have confirmed the wide variety of minor to severe adverse health effects that exposure to mold can cause. Dozens of studies regarding the effects of inadequate humidity control on chronic diseases are included in the previously distributed notebooks and can be found online at www.airallergen.com/studies.

Financial Impact of Proposed Amendment:
A whole-house dehumidifier can reduce healthcare costs in Georgia by improving indoor air quality, which can lead to fewer respiratory issues, allergies, and mold-related illnesses. While the exact savings depend on individual circumstances, published data indicates that if a household spends $3,500 on a whole-house dehumidifier, potential first-year savings could range from $800 to $5,000+, depending on health conditions and home damage risks. Break-even point could be 2–5 years, with continued savings afterward. The following pages contain some key ways it can impact healthcare expenses.

1. **Reduced Respiratory Issues** – Lower indoor humidity (ideally 30-50%) can prevent mold growth and dust mites, which trigger asthma and allergies. This could mean fewer doctor visits, medications, and hospitalizations.
2. **Fewer Sick Days** – Better air quality can reduce colds, sinus infections, and bronchitis, leading to fewer missed workdays and lower indirect healthcare costs.
3. **Lower Medication Costs** – Those with asthma and allergies may use fewer inhalers, antihistamines, and steroids if triggers like mold and dust mites are reduced.
4. **Prevention of Mold-Related Illnesses** – Chronic exposure to mold can cause long-term respiratory conditions. Preventing mold growth can reduce future medical bills.

Estimated Cost Impact:

- **Short-term savings:** Fewer urgent doctor visits ($100–$200 per visit).
- **Long-term savings:** Reduced hospitalizations for asthma or severe allergies (which can cost thousands).

1. Cost of a Whole-House Dehumidifier in Georgia

- **Unit Cost:** $1,500 – $3,500
- **Installation:** $500 – $2,000
- **Annual Maintenance & Energy Costs:** $100 – $400

Total First-Year Cost: $2,000 – $5,500
Ongoing Annual Cost: $100 – $400

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2. Potential Healthcare Savings
Asthma & Allergy Treatment Costs:

- **Doctor Visits:** $100–$300 per visit
- **ER Visits for Asthma Attacks:** $500–$2,000 per visit
- **Hospital Stays for Severe Cases:** $10,000+
- **Medications (Inhalers, Antihistamines, Steroids):** $300–$1,500 annually

A dehumidifier can reduce humidity-related triggers (mold, dust mites, mildew), potentially lowering asthma and allergy expenses by **20–50%** depending on severity.

- **Estimated Savings per Person:**
  - Mild allergy sufferers: $200–$500 per year
  - Moderate asthma/allergy patients: $500–$2,000 per year
  - Severe cases (frequent ER visits or hospital stays): $2,000–$10,000+ per year

For a **family of four**, annual savings could range from **$800 to $5,000+**.

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3. Other Indirect Savings

- **Fewer Sick Days (Work Productivity Gains):**

- Average missed workdays due to allergies/asthma: **3–5 days per year**
- Estimated lost wages per day: **$150–$300**
- Potential earnings retained: **$450–$1,500 per person annually**
- **Home Damage Prevention (Mold Remediation Costs):**
- Mold removal: **$1,000–$6,000**
- Preventing moisture damage avoids costly home repairs.

Inadequate Humidity Control in the Indoor Environment

30 studies, experts, professionals, and countless others have confirmed that inadequate humidity control in the indoor environment leads to the proliferation of mold, dust mites, and cockroaches. The ideal relative humidity in the indoor environment should be within 30-50% to keep these allergens at bay. 74 studies have confirmed the wide variety of minor to severe adverse health effects that exposure to mold can cause.

References: 3, 7, 5, 10, 13, 18, 19, 20, 21, 32, 34, 35, 36, 37, 38, 41, 43, 46, 47, 48, 60, 63, 64, 65, 67, 76, 79, 89, 90, 98, 101, 105, 106, 110, 111, 113, 114, 121, 122, 130, 131, 139, 140, 141, 144, 145, 151, 154, 160, 162, 164, 166, 169, 171, 174, 175, 177, 178, 181, 182, 184, 188, 191, 192, 194, 196, 200, 201, 202, 205, 210, 211, 214, 217, 218, 219, 220, 221, 224, 227, 232, 233, 234, 243, 244, 245, 253

Health Effects from exposure to mold and their mycotoxins, dust mites, and cockroaches				
Respiratory		**Neurological**	**Other**	
Irritation in the eyes, nose, and throat	Acute bronchitis	Short term memory	Hemorrhaging disorders	Seizures
Asthma exacerbation	Allergic rhinitis	Executive function/judgement	Altered brain flow	Vitamin B12 deficiency
Asthma Induction	Allergic bronchopulmonary mycosis	Attention deficit	Dizziness	Organic Toxic Dust Syndrome
Allergy	Hypersensitivity pneumonitis	Hand/eye coordination	Musculoskeletal pain	Gait imbalance
Wheezing	Sick Building Syndrome	Depression	Headaches	Numbness and/or tingling
Chronic Rhinosinusitis	Shortness of breath	Cognitive deficit	Anxiety	Areflexia
Coughing	Bronchopulmonary aspergillosis	Autism Spectrum Disorder	Fatigue	Nausea
Chest tightness			Carcinogenic, mutagenic, and teratogenic	Sleep Disturbances
			Skin irritation	Fever
			Gastrointestinal problems	

Fast Facts:

- Molds and dust mites thrive in indoor environments where the humidity is above 60%.

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- Mold proliferates indoors where there is any type of water intrusion or leakage that is not promptly cleaned up. Mold can also grow because of poorly controlled humidity.
- Dust mites are known asthma triggers and live in bedding and upholstery where humidity is sufficient.
- Several studies have confirmed that occupying a water-damaged building or home contaminated with high amounts of mold increases the risk of developing asthma before the age of 7 by 7.5 times.
- Mold significantly increases asthma morbidity in both adults and children.
- Mold is primarily responsible for Sick Building Syndrome cases or Water-Damaged Building related illnesses.
- Molds have the potential to produce known carcinogens and mutagens, known as mycotoxins.
- Mold is difficult and expensive to remediate, and the best course of action is prevention.
- Mold affects multiple systems of the body, including the respiratory, nervous, digestive, vascular, cutaneous, reproductive, and immune systems.
- Many people in the US are allergic to several species of molds.
- Landlords often do not repair or remediate water leaks/intrusions or mold infestations, leading to expensive litigation and adverse health effects in the residents.

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	National							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% us afflict	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	327 B	30,000,000	8.98%	71,000	148 B	22.65 B	142 B	4,933	2,400	4,733	1.635 B	109 B	
dney Disea	278.8 B	37,000,000	11.07%	52,547	62.9 B	88.8 B	45.47 B	3,500	42,000	22,444	.350 B	65.7 B	
Parkinson's	52 B	1,000,000	0.30%	N/A	13.5 B	10 B	14 B	13,551	10,000	14,177	8.985 B		
Alzheimer's	309 B	6,000,000	1.80%	4,221	30.5 B	N/A	168 B	57,289	N/A	28,000	70.1 B		22.57 B
ltiple Sclero	63.3 B	400,000	0.12%	18,932	26.24 B	14.06 B	24 B	65,612	35,154	60,000	.316 B		
ADHD	12.03 B	5,400,000	1.62%	2x G. pop.	8.06 B	N/A	3.97 B	1,493	N/A	735	8 M		
Migraines	55.5 B	3,900,000	1.17%	N/A	25.6 B	1.4354 B	29.9	6,575	8,500	7,680	75 M		
ronary Hea	248.6 B	18,000,000	5.39%	697,000	195.4 B	5.13 B	48.1 B	10,737	2,400	2,643	14.8 B		
Heart Failure	57.14 B	6,900,000	2.06%	397,000	11 B	9.94 B	36.2 B	1,594	1,441	5,256	5.66 B		
Hypertensio	164 B	116,000,000	34.71%	670,000	131 B	2.86 B	2.86 B	21,094	2,400	336	21.38 B		
Stroke	103 8	795,000	0.24%	137,000	25.43 B	34.7 B	42.87 B	43,652	2,400	17,081	5.17 B		
Asthma	81 B	25,200,000	7.54%	4,000	1.78 B	2.76 B	46 B	640	2,400	1,825.40	.118 B	15 B	9.25 B
COPD	50 B	16,400,000	4.91%	150,000	4.89 B	1.33 B	10.9 B	298.17	2,400	664.63	6.88 B		6.74 B
ute Bronchi	73.4 B	16,340,000	4.89%	166,500	.267 B	42.48 B	30.65 B	3,799	2,400	1,876	781.8 MIL	2.1 B	
lergic Rhini	24.8 B	60,000,000	17.95%	N/A	.248 B	156 B	16.86 B	281	2,400	281	781.8 MIL	4.7 B	
Rinosinsitis	32.5 B	28,900,000	8.65%	RARE	13B	.144 B	11.5 B	20,748	2,400	2,100	781.8 MIL	4.75 B	
Pneumonia	16.2 B	4,900,000	1.47%	47,601	731M	12.74 B	613.97 M	7,166	2,400	125.3	.167 B Mor	2.5 B	
Cancer	208 B	1,918,030	0.57%	608,570	287.7 B	4.99 B	79.8 B	150,000	2,400	42,000	11.5 B		
ndhand Sm	10 B	58,000,000	17.35%	40,000	3.8 B	0.8 B	N/A	2,682	2,400	N/A	10 B	N/A	N/A
ot ex COVI	1.341 T		0.00%	3,064,371	487.5 B	406.3 B	666.9 B	415,644	125,895	211,957	158.673 B	35.71	
COVID	3.83 T	86,800,000	25.97%	1,128,903	3.611 T	225.68 B	46 B	41,611	2,400	530	3.4 B Mor	.705 B	
ot incl COVID													
		References 260 through 322											

	Georgia							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% afflicted	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	14.9 B	1,013,000	9.47%	2,833	5.03 B	9.725 B	240 M	4,933	2,400	4,733	52 M		
dney Disea	53 B	453,600	4.24%	1,475	42.1 B	1.08 B	10.16 B	3,500	42,000	22,444	39 M		
Parkinson's	5.35 B	669,600	6.26%	354	9.07 B	6.69 B	9.49 B	13,551	10,000	14,177	21 M		
Alzheimer's	12.7 B	150,000	1.40%	4,222	8.59 B	N/A	4.2 B	57,289	N/A	28,000	2.92 B		939.8 M
ltiple Sclero	192.91 M	1200	0.01%	32	78.73 M	42.18 M	72 M	65,612	35,154	60,000	10.1 M		
ADHD	1.3 B	259812	2.43%	2x gen pop	387.9 M	N/A	191 M	1,493	N/A	735	256 K		
Migraines	15.96 B	702,000	6.56%	N/A	4.615 B	5.967 B	5.391 B	6,575	8,500	7,680	2.4 M		
ronary Hea	4.1 B	18,507	0.17%	22,000	1.6 B	55.5 M	.023 B	11,055	3,000	15,540	2.7 B		
Heart Failure	798 MIL	66,670	0.62%	11,000	.352 B	96.07 M	350.4 M	1,594	1,441	5,256	.24 B		
Hypertensio	5.2 B	3,700,000	34.58%	102,052	3.6 B	.090 B	2.2 B	974.13	2,400	336	1.49 B		
Stroke	1.68 B	20,929	0.20%	4,349	.60 B	913.5 M	1.13 B	43,652	43,652	17,081	.08 B		
Asthma	2.6 B	918,000	8.58%	136	177M	2.2 B	1.65 B	640	2,400	1,825.40	.011 B	.480 B	0.293 B
COPD	1.5 B	532,000	4.97%	5,000	.159 B	.042 B	.392 B	298.17	2,400	664.63	.206 B	.200 B	.609 B
ute Bronchi	1.420 B	540000	5.05%	4,039	8.82 M	1.404 B	1.01 B	16.34	2,400	1,876		.073 B	
lergic Rhini	5.687 B	1,920,000	17.94%	N/A	539.5 M	4.99 B	209.2 M	281	2,400	281		.150 B	
Rinosinsitis	33.1 B	1,300,000	12.15%	N/A	26.9 B	.005B	.369 B	20,748	2,400	2,100		.151 B	
Pneumonia	.518 B	1,145,000	10.70%	1,339	.426 B	.029 B	.259 B	7,166	2,400	125.3	0.004 mor	.075 B	
Cancer	1.93	54,000	0.50%	18,750	8.1 B	140.4 B	2.27 B	150,000	2,400	42,000	.700 B	.700 B	
ndhand Sm	.32 B	19,500	0.18%	1,500	52.3 M	N/A	N/A	2,682	N/A	N/A	N/A	N/A	N/A
ot ex COVI	27.33 B	13,483,818	126.02%	179,081	121 B	173.23 B	39.55 B	392,060	165,347	224,854	7.152 B	1.83 B	.902 B
COVID	128 B	2,870,000	26.82%	39,748	119.4 B	7.46 B	1.52 B	41,611	2,400	530	0.11 B	21.3 B	
						Cost of Disease divided by chronic disease							

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY) PAGE 1 OF 4

CODE: IMC SECTION: 504.7 MAKE-up Air

PROPONENT: Richard Johnson DATE: 2/7/25

EMAIL: RAJohnson CTP@MSN.Com

ADDRESS: 2041 Hessian Court Stone Mountain GA 30087

TELEPHONE NUMBER: 6784384314 FAX NUMBER: _____

CHECK ONE: ☒ Revise section to read as follows: ☐ Add new section to read as follows:

☐ Delete section and substitute the following: ☐ Delete without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED:~~ UNDERLINE MATERIAL TO BE ADDED

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

Description: 504.7 Makeup air.

Installations exhausting more than ~~200 cfm (0.09 m³/s)~~ 50 cfm (0.0225 m³/s) shall be provided with *makeup air*. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches (0.0645 m²) shall be provided in the closet enclosure or *makeup air* shall be provided by other *approved* means.

Reason/Intent:

Air exhausted from residential clothes dryers averages 150-200 CFM. High-end dryers can blow up to 300 CFM. The exhaust rate for a kitchen exhaust fan is 100 cfm. According to ASHRAE standard 62.1-2010, the exhaust CFM for a private toilet/bathroom is 50 CFM. At 150 CFM for 50 minutes, a typical dryer cycle exhausts 7500 cubic feet of air, equivalent to a 10' X 11' room. Exhausted air is replaced by unconditioned and unfiltered air through walls, from basements, attics and crawlspaces. Unconditioned and unfiltered air from these sources have been implicated in virtually all chronic diseases.

Financial Impact of Proposed Amenment:

The cost of providing a pipe to the outdoor air is estimated to be $400. The annual savings is expected to exceed $500. The drawing of air from outside to slightly pressurize the air indoors when the exhaust devices are not in use will cause air to leak outward and dilute chemicals introduced into the living space. Investigators have identified hundreds of potential chemicals in the indoor air, some of which are shown to be carcinogenic. The notebook previously provided includes dozens of health-related studies in support of better filtration. The synopsis of these studies can also be found online at www.airallergen.com/studies.

Inadequate Ventilation in the Indoor Environment

20 studies, experts, and professionals have dictated that adequate ventilation above current ASHRAE standards successfully dilutes and rids of any volatile indoor pollutants within the home or workplace. Adequate ventilation is primarily responsible for decreasing the concentration of VOCs indoors. 27 studies have shown that exposure to high concentrations of VOCs has adverse health effects. Several studies have also shown that with increased ventilation comes increased worker productivity and student performance.

References: 14, 22, 23, 33, 39, 46, 52, 57, 59, 73, 74, 87, 102, 107, 112, 117, 118, 119, 122, 128, 149, 152, 155, 167, 170, 198, 206, 223, 230, 246-249, 252

Adverse Health Effects from VOC Exposure		
Respiratory	**Other**	**Neurological**
Irritation in eyes, nose, and throat	Cancer	Dizziness
Chest tightness	Hypersensitivity	Memory Impairment
Wheezing	Headaches	Lightheadedness
Asthma exacerbation	Skin irritation	
Asthma Induction	Nausea	
Pneumonitis	Fatigue	
Allergic Rhinitis	Birth defects	
Lower airway inflammation	Impaired learning or decision-making skills	
Pulmonary Infection	Liver toxicity	
Bronchial obstruction		

Fast Facts:

- The concentration of VOCs indoors is often significantly higher than the concentration outdoors.
- Common indoor pollutant sources of VOCs include combustion sources such as a gas stoves or fireplaces, candles, or incense, as well as pressed wood products, gypsum board, carpet, and more.
- The World Health Organization has deemed air pollution as the biggest environmental killer, killing 7 million people each year. We spend 90% of our time indoors.
- Increased ventilation in schools and workplaces has been proven to increase productivity and cognitive skills in reading, writing, and math. It has also led to decreased absenteeism and increased worker health. This has significant economic benefits.
- Many VOCs are known to be human carcinogens, such as benzene and formaldehyde.
- Several studies have linked different VOCs (i.e. formaldehyde and aromatic compounds) to the diagnosis of asthma and other chronic and acute respiratory conditions.
- The increase of ventilation rate has minimal energy consumption impact or cost. The environmental impact is also minimal when using an energy recovery system.
- The best control method for levels of bioaerosols and other VOCs is through the HVAC system.
- Experts have confirmed that several COVID-19 outbreaks in public spaces have been due to inadequate ventilation.

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Disease	Annual $	# afflict	% us afflict	Basis for inc risk of disease due to increased PM2.5
Diabetes	327 B	30,000,000	8.98%	10ug/m3 inc in PM2.5 = 25% inc in Diabetes Mellitus
Kidney Disease	278.8 B	37,000,000	11.07%	1ug/m3 inc in PM2.5 = .75% inc in diagnosed Kidney Dis
Parkinson's	52 B	1,000,000	0.30%	14ug/m3 inc in PM2.5 = 25% higher rates of Parkinsons
Alzheimer's	309 B	6,000,000	1.80%	10ug/m3 inc in PM2.5 = 2% to 5% inc risk of Alzheimers
Multiple Sclerosis	63.3 B	400,000	0.12%	5ug/m3 inc in PM2.5 = 25% inc risk of Multiple Sclerosis
ADHD	12.03 B	5,400,000	1.62%	1ug/m3 inc in PM2.5 = 2.6% increase in diagnosed ADHD
Migraines	55.5 B	3,900,000	1.17%	1ug/m3 inc in PM2.5 = .75% inc in diagnosed Migraine
Coronary Heart	248.6 B	18,000,000	5.39%	5ug/m3 inc in PM2.5 =13% inc risk of Coronary Events
Heart Failure	57.14 B	6,900,000	2.06%	10ug/m3 inc in PM10 = 12% inc in Coronary Events
Hypertension	164 B	116,000,000	34.71%	1ug/m3 inc in PM2.5 = 2.67% inc in Hypertension
Stroke	103 8	795,000	0.24%	5ug/m3 inc in PM2.5 = 24% inc in risk of first Stroke
Asthma	81 B	25,200,000	7.54%	1ug/m3 inc in PM2.5 = 2.3% inc in diagnosed Asthma *
COPD	50 B	16,400,000	4.91%	1ug/m3 inc in PM2.5 = .2% inc in diagnosed COPD
Acute Bronchitis	73.4 B	16,340,000	4.89%	1ug/m3 inc in PM2.5 = 5.8% inc in diagnosed A. Bronchitis
Allergic Rhinitis	24.8 B	60,000,000	17.95%	1 ug/m3 inc in PM2.5 = 2% inc in diagnosed Allergic Rhinitis
Rinosinsitis	32.5 B	28,900,000	8.65%	1ug/m3 inc in PM2.5 = 5.8% inc in diagnosed Rhinosinusitis
Pneumonia	16.2 B	4,900,000	1.47%	1 ug/m3 inc in PM2.5 = .022% inc in diagnosed Pneumonia
Cancer	208 B	1,918,030	0.57%	1 ug/m3 inc in PM2.5 = 8% increase in diagnosed Cancer
Secondhand Smoke	10 B	58,000,000	17.35%	1ug/m3 inc in PM2.5 = .45% increase in diagnosed SHSmoke
Tot ex COVID	1.341 T		0.00%	
COVID	3.83 T	86,800,000	25.97%	1ug/m3 inc in PM2.5 = 8% increase in diagnosed Covid 19
Tot incl COVID				

	National							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% us afflict	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	327 B	30,000,000	8.98%	71,000	148 B	12.65 B	142 B	4,933	2,400	4,733	1.635 B	109 B	
dney Disea	278.8 B	37,000,000	11.07%	52,547	62.9 B	88.8 B	45.47 B	3,500	42,000	22,444	.350 B	65.7 B	
Parkinson's	52 B	1,000,000	0.30%	N/A	13.5 B	10 B	14 B	13,551	10,000	14,177	8.985 B		
Alzheimer's	309 B	6,000,000	1.80%	4,221	30.5 B	N/A	168 B	57,289	N/A	28,000	70.1 B		22.57 B
ltiple Sclero	63.3 B	400,000	0.12%	18,932	26.24 B	14.06 B	24 B	65,612	35,154	60,000	.316 B		
ADHD	12.03 B	5,400,000	1.62%	2x G. pop.	8.06 B	N/A	3.97 B	1,493	N/A	735	8 M		
Migraines	55.5 B	3,900,000	1.17%	N/A	25.6 B	14354 B	29.9	6,575	8,500	7,680	75 M		
ronary Hea	248.6 B	18,000,000	5.39%	697,000	195.4 B	5.13 B	48.1 B	10,737	2,400	2,643	14.8 B		
Heart Failure	57.14 B	6,900,000	2.06%	397,000	11 B	9.94 B	36.2 B	1,594	1,441	5,256	5.66 B		
lypertensio	164 B	116,000,000	34.71%	670,000	131 B	2.86 B	2.86 B	21,094	2,400	336	21.38 B		
Stroke	103 8	795,000	0.24%	137,000	25.43 B	34.7 B	42.87 B	43,652	2,400	17,081	5.17 B		
Asthma	81 B	25,200,000	7.54%	4,000	1.78 B	2.76 B	46 B	640	2,400	1,825.40	.118 B	15 B	9.25 B
COPD	50 B	16,400,000	4.91%	150,000	4.89 B	1.33 B	10.9 B	298.17	2,400	664.63	6.88 B		6.74 B
ute Bronchi	73.4 B	16,340,000	4.89%	166,500	.267 B	42.48 B	30.65 B	3,799	2,400	1,876	781.8 MIL	2.1 B	
lergic Rhini	24.8 B	60,000,000	17.95%	N/A	.248 B	156 B	16.86 B	281	2,400	281	781.8 MIL	4.7 B	
Rinosinsitis	32.5 B	28,900,000	8.65%	RARE	13B	.144 B	11.5 B	2C, `3	2,400	2,100	781.8 MIL	4.75 B	
Pneumonia	16.2 B	4,900,000	1.47%	47,601	731M	12.74 B	613.97 M	7,166	2,400	125.3	.167 B Mor	2.5 B	
Cancer	208 B	1,918,030	0.57%	608,570	287.7 B	4.99 B	79.8 B	150,000	2,400	42,000	11.5 B		
ndhand Sm	10 B	58,000,000	17.35%	40,000	3.8 B	0.8 B	N/A	2,682	2,400	N/A	10 B	N/A	N/A
ot ex COVI	1.341 T		0.00%	3,064,371	487.5 B	406.3 B	666.9 B	415,644	125,895	211,957	158.673 B	35.71	
COVID	3.83 T	86,800,000	25.97%	1,128,903	3.611 T	225.68 B	46 B	41,611	2,400	530	3.4 B Mor	.705 B	
ot incl COVID													
		References 260 through 322											

	Georgia							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% afflicted	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	14.9 B	1,013,000	9.47%	2,833	5.03 B	9.725 B	240 M	4,933	2,400	4,733	52 M		
dney Disea	53 B	453,600	4.24%	1,475	42.1 B	1.08 B	10.16 B	3,500	42,000	22,444	39 M		
Parkinson's	5.35 B	669,600	6.26%	354	9.07 B	6.69 B	9.49 B	13,551	10,000	14,177	21 M		
Alzheimer's	12.7 B	150,000	1.40%	4,222	8.59 B	N/A	4.2 B	57,289	N/A	28,000	2.92 B		939.8 M
ltiple Sclero	192.91 M	1200	0.01%	32	78.73 M	42.18 M	72 M	65,612	35,154	60,000	10.1 M		
ADHD	1.3 B	259812	2.43%	2x gen pop	387.9 M	N/A	191 M	1,493	N/A	735	256 K		
Migraines	15.96 B	702,000	6.56%	N/A	4.615 B	5.967 B	5.391 B	6,575	8,500	7,680	2.4 M		
ronary Hea	4.1 B	18,507	0.17%	22,000	1.6 B	55.5 M	.023 B	11,055	3,000	15,540	2.7 B		
Heart Failure	798 MIL	66,670	0.62%	11,000	.352 B	96.07 M	350.4 M	1,594	1,441	5,256	.24 B		
lypertensio	5.2 B	3,700,000	34.58%	102,052	3.6 B	.090 B	2.2 B	974.13	2,400	336	1.49 B		
Stroke	1.68 B	20,929	0.20%	4,349	.60 B	913.5 M	1.13 B	43,652	43,652	17,081	.08 B		
Asthma	2.6 B	918,000	8.58%	136	177M	2.2 B	1.65 B	640	2,400	1,825.40	.011 B	.480 B	0.293 B
COPD	1.5 B	532,000	4.97%	5,000	.159 B	.042 B	.392 B	298.17	2,400	664.63	.206 B	.200 B	.609 B
ute Bronchi	1.420 B	540000	5.05%	4,039	8.82 M	1.404 B	1.01 B	16.34	2,400	1,876		.073 B	
lergic Rhini	5.687 B	1,920,000	17.94%	N/A	539.5 M	4.99 B	209.2 M	281	2,400	281		.150 B	
Rinosinsitis	33.1 B	1,300,000	12.15%	N/A	26.9 B	.005B	.369 B	20,748	2,400	2,100		.151 B	
Pneumonia	.518 B	1,145,000	10.70%	1,339	.426 B	.029 B	.259 B	7,166	2,400	125.3	0.004 mor	.075 B	
Cancer	1.93	54,000	0.50%	18,750	8.1 B	140.4 B	2.27 B	150,000	2,400	42,000	.700 B	.700 B	
ndhand Sm	.32 B	19,500	0.18%	1,500	52.3 M	N/A	N/A	2,682	N/A	N/A	N/A	N/A	N/A
ot ex COVI	27.33 B	13,483,818	126.02%	179,081	121 B	173.23 B	39.55 B	392,060	165,347	224,854	7.152 B	1.83 B	1402 B
COVID	128 B	2,870,000	26.82%	39,748	119.4 B	7.46 B	1.52 B	41,611	2,400	530	0.11 B	21.3 B	
						Cost of Disease divided by chronic disease							

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: _____ (DCA USE ONLY)

PAGE 1 OF 4

CODE: IMC

SECTION: 605.1 General

PROPONENT: Richard Johnson

DATE: 1/2/25

EMAIL: RAJohnsonCTP@MSN.com

ADDRESS: 2041 Hessian Court Stone Mountain GA 30087

TELEPHONE NUMBER: 678 438 4314

FAX NUMBER: _____

CHECK ONE:
- ☒ Revise section to read as follows:
- ☐ Delete section and substitute the following:
- ☐ Add new section to read as follows:
- ☐ Delete without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED:~~

UNDERLINE MATERIAL TO BE ADDED

(DCA STAFF ONLY) ☐ Approve ☐ Approve as amended ☐ Disapprove ☐ Withdrawn

Description: 605.1 General.
Heating and air-conditioning systems shall be provided with an approved air filters with ~~approved air filters~~ *a filter box or tray that can accommodate an approved air filter up to 6 inches thick with a minimum of a MERV 13 rating.* Filters shall be installed such that all return air, outdoor air and makeup air is filtered upstream from any heat exchanger or coil. Filters shall be installed in an approved convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325° F (163 ° C).

Reason/Intent:
PM2.5 has been shown to be associated with every major chronic disease. The EPA and ASHRAE recommend a MERV 13 filter when able to be supported by the air handler fan. A MERV 13 filter has been shown to capture up to 75% of PM2.5. The notebook previously provided includes 20 pages of health-related studies in support of better filtration. The synopsis of these studies can also be found online at www.airallergen.com/studies.

Financial Impact:
There are 3.8M households in GA. Our data indicates that reducing PM2.5 by 75% may lower the cost of healthcare in GA by as much as $5.3B. See separate chronic disease summary sheet. ($7.15 X .75 = $5.36B which is equivalent to $1,410 per year per household. The estimated one time additional cost per HVAC unit is expected to be under $500 including a stronger fan motor if necessary. The increased annual expense for a higher rated filter is estimated to be $80. A study done by the Lawerence Livermore National Lab indicated that money spent on additional filtration always had a positive return and, in some cases, saved as much as 22 times the expense.

Inadequate Filtration in the Indoor Environment

13 studies, experts, and professionals have confirmed the effectiveness of using high-efficiency filters (MERV 10+) in the indoor environment to filter out harmful pollutants such as particulate matter and secondhand smoke. 36 studies have found significant or suggestive links between high concentrations of particulate matter and smoke to the increased burden of cardiovascular diseases, respiratory conditions, and other adverse health effects.

References: 2, 9, 15, 31, 39, 44, 45, 53, 55, 68, 71, 77, 80, 85, 91, 96, 113, 115, 118, 122, 128, 135, 148, 156, 159, 163, 170, 173, 185, 189, 190, 212, 215, 229, 230, 237, 249, 251, 257, 258, 259

Adverse Health Effects from Particulate Matter Exposure			
Respiratory		Cardiovascular	Other
Asthma Exacerbation	Coughing	Heart attacks	Premature death
Decreased lung function	Wheezing	Dysrhythmia mortality	Cognitive decline
Difficulty breathing	Chest tightness	Heart failure mortality	Reproductive toxicity
Pneumonia	Acute lower respiratory disease	Cardiac arrest mortality	Immune dysfunction
COPD	Allergy exacerbation	Ischemic Heart Disease Mortality	Endocrine disruption
Bronchitis and bronchiolitis	Lung cancer	Stroke	Insulin resistance, Type 2 Diabetes

Fast Facts:

- Particulate Matter comes in different sizes, often categorized as PM 2.5, (2.5 microns or smaller);
- PM 10 (between 2.5 and 10 microns) and above PM 10. PM2.5 is the most damaging to human health.
- Homes often exceed the national PM 2.5 and PM 10 National Ambient Air Quality Standard (NAAQS) for outdoor air.
- Children are more vulnerable to PM due to their faster respiration rates and small lungs.
- Particulate Matter exposure accounts for 10-30% of the total burden of disease in the US.
- There is an 8-18% increase in mortality rate per 10ug/m^3 increase in PM2.5.
- There is a 13% increased risk of cardiovascular disease with each 5ug/m^3 increase in PM2.5.
- Increased particulate matter levels leads to increased ER visits and/or hospitalizations.
- Particulate matter is a significant trigger for asthma attacks and secondhand smoke is significantly associated with the development of asthma in children.
- Secondhand smoke is a significant health and economic burden on the US.
- High efficiency filters effectively filter out particulate, secondhand smoke, pet allergens, mold spores, small microbials, and more.
- A decrease in allergy/asthma symptoms has been observed when using a MERV 10+ filter.

Air Allergen & Mold Testing
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(770) 938-4861
www.airallergen.com

Disease	Annual $	# afflict	% us afflict	Basis for inc risk of disease due to increased PM2.5
Diabetes	327 B	30,000,000	8.98%	10ug/m3 inc in PM2.5 = 25% inc in Diabetes Mellitus
Kidney Disease	278.8 B	37,000,000	11.07%	1ug/m3 inc in PM2.5 = .75% inc in diagnosed Kidney Dis
Parkinson's	52 B	1,000,000	0.30%	14ug/m3 inc in PM2.5 = 25% higher rates of Parkinsons
Alzheimer's	309 B	6,000,000	1.80%	10ug/m3 inc in PM2.5 = 2% to 5% inc risk of Alzheimers
Multiple Sclerosis	63.3 B	400,000	0.12%	5ug/m3 inc in PM2.5 = 25% inc risk of Multiple Sclerosis
ADHD	12.03 B	5,400,000	1.62%	1ug/m3 inc in PM2.5 = 2.6% increase in diagnosed ADHD
Migraines	55.5 B	3,900,000	1.17%	1ug/m3 inc in PM2.5 = .75% inc in diagnosed Migraine
Coronary Heart	248.6 B	18,000,000	5.39%	5ug/m3 inc in PM2.5 =13% inc risk of Coronary Events
Heart Failure	57.14 B	6,900,000	2.06%	10ug/m3 inc in PM10 = 12% inc in Coronary Events
Hypertension	164 B	116,000,000	34.71%	1ug/m3 inc in PM2.5 = 2.67% inc in Hypertension
Stroke	103 8	795,000	0.24%	5ug/m3 inc in PM2.5 = 24% inc in risk of first Stroke
Asthma	81 B	25,200,000	7.54%	1ug/m3 inc in PM2.5 = 2.3% inc in diagnosed Asthma *
COPD	50 B	16,400,000	4.91%	1ug/m3 inc in PM2.5 = .2% inc in diagnosed COPD
Acute Bronchitis	73.4 B	16,340,000	4.89%	1ug/m3 inc in PM2.5 = 5.8% inc in diagnosed A. Bronchitis
Allergic Rhinitis	24.8 B	60,000,000	17.95%	1 ug/m3 inc in PM2.5 = 2% inc in diagnosed Allergic Rhinitis
Rinosinsitis	32.5 B	28,900,000	8.65%	1ug/m3 inc in PM2.5 = 5.8% inc in diagnosed Rhinosinusitis
Pneumonia	16.2 B	4,900,000	1.47%	1 ug/m3 inc in PM2.5 = .022% inc in diagnosed Pneumonia
Cancer	208 B	1,918,030	0.57%	1 ug/m3 inc in PM2.5 = 8% increase in diagnosed Cancer
Secondhand Smoke	10 B	58,000,000	17.35%	1ug/m3 inc in PM2.5 = .45% increase in diagnosed SHSmoke
Tot ex COVID	1.341 T		0.00%	
COVID	3.83 T	86,800,000	25.97%	1ug/m3 inc in PM2.5 = 8% increase in diagnosed Covid 19
Tot incl COVID				

	National							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% us afflict	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	327 B	30,000,000	8.98%	71,000	148 B	22.65 B	142 B	4,933	2,400	4,733	1.635 B	109 B	
dney Disea	278.8 B	37,000,000	11.07%	52,547	62.9 B	88.8 B	45.47 B	3,500	42,000	22,444	.350 B	65.7 B	
Parkinson's	52 B	1,000,000	0.30%	N/A	13.5 B	10 B	14 B	13,551	10,000	14,177	8.985 B		
Alzheimer's	309 B	6,000,000	1.80%	4,221	30.5 B	N/A	168 B	57,289	N/A	28,000	70.1 B		22.57 B
ltiple Sclero	63.3 B	400,000	0.12%	18,932	26.24 B	14.06 B	24 B	65,612	35,154	60,000	.316 B		
ADHD	12.03 B	5,400,000	1.62%	2x G. pop.	8.06 B	N/A	3.97 B	1,493	N/A	735	8 M		
Migraines	55.5 B	3,900,000	1.17%	N/A	25.6 B	1.4354 B	29.9	6,575	8,500	7,680	75 M		
ronary Hea	248.6 B	18,000,000	5.39%	697,000	195.4 B	5.13 B	48.1 B	10,737	2,400	2,643	14.8 B		
Heart Failur	57.14 B	6,900,000	2.06%	397,000	11 B	9.94 B	36.2 B	1,594	1,441	5,256	5.66 B		
lypertensio	164 B	116,000,000	34.71%	670,000	131 B	2.86 B	2.86 B	21,094	2,400	336	21.38 B		
Stroke	103 B	795,000	0.24%	137,000	25.43 B	34.7 B	42.87 B	43,652	2,400	17,081	5.17 B		
Asthma	81 B	25,200,000	7.54%	4,000	1.78 B	2.76 B	46 B	640	2,400	1,825.40	.118 B	15 B	9.25 B
COPD	50 B	16,400,000	4.91%	150,000	4.89 B	1.33 B	10.9 B	298.17	2,400	664.63	6.88 B		6.74 B
ute Bronchi	73.4 B	16,340,000	4.89%	166,500	.267 B	42.48 B	30.65 B	3,799	2,400	1,876	781.8 MIL	2.1 B	
lergic Rhini	24.8 B	60,000,000	17.95%	N/A	.248 B	156 B	16.86 B	281	2,400	281	781.8 MIL	4.7 B	
Rinosinsitis	32.5 B	28,900,000	8.65%	RARE	13B	.144 B	11.5 B	20,748	2,400	2,100	781.8 MIL	4.75 B	
Pneumonia	16.2 B	4,900,000	1.47%	47,601	731M	12.74 B	613.97 M	7,166	2,400	125.3	.167 B Mor	2.5 B	
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ot ex COVII	1.341 T		0.00%	3,064,371	487.5 B	406.3 B	666.9 B	415,644	125,895	211,957	158.673 B	35.71	
COVID	3.83 T	86,800,000	25.97%	1,128,903	3.611 T	225.68 B	46 B	41,611	2,400	530	3.4 B Mor	.705 B	
ot incl COVID													
		References 260 through 322											

	Georgia							Individual cost per patient			Attributable to		
Disease	Annual $	# afflict	% afflicted	Deaths	Hosp	ER visits	Pharma	Hosp	ER visits	Pharma	Particule	Mold	VOC's
Diabetes	14.9 B	1,013,000	9.47%	2,833	5.03 B	9.725 B	240 M	4,933	2,400	4,733	52 M		
dney Disea	53 B	453,600	4.24%	1,475	42.1 B	1.08 B	10.16 B	3,500	42,000	22,444	39 M		
Parkinson's	5.35 B	669,600	6.26%	354	9.07 B	6.69 B	9.49 B	13,551	10,000	14,177	21 M		
Alzheimer's	12.7 B	150,000	1.40%	4,222	8.59 B	N/A	4.2 B	57,289	N/A	28,000	2.92 B		939.8 M
ltiple Sclero	192.91 M	1200	0.01%	32	78.73 M	42.18 M	72 M	65,612	35,154	60,000	10.1 M		
ADHD	1.3 B	259812	2.43%	2x gen pop	387.9 M	N/A	191 M	1,493	N/A	735	256 K		
Migraines	15.96 B	702,000	6.56%	N/A	4.615 B	5.967 B	5.391 B	6,575	8,500	7,680	2.4 M		
ronary Hea	4.1 B	18,507	0.17%	22,000	1.6 B	55.5 M	.023 B	11,055	3,000	15,540	2.7 B		
Heart Failur	798 MIL	66,670	0.62%	11,000	.352 B	96.07 M	350.4 M	1,594	1,441	5,256	.24 B		
lypertensio	5.2 B	3,700,000	34.58%	102,052	3.6 B	.090 B	2.2 B	974.13	2,400	336	1.49 B		
Stroke	1.68 B	20,929	0.20%	4,349	.60 B	913.5 M	1.13 B	43,652	43,652	17,081	.08 B		
Asthma	2.6 B	918,000	8.58%	136	177M	2.2 B	1.65 B	640	2,400	1,825.40	.011 B	.480 B	0.293 B
COPD	1.5 B	532,000	4.97%	5,000	.159 B	.042 B	.392 B	298.17	2,400	664.63	.206 B	.200 B	.609 B
ute Bronchi	1.420 B	540000	5.05%	4,039	8.82 M	1.404 B	1.01 B	16.34	2,400	1,876		.073 B	
lergic Rhini	5.687 B	1,920,000	17.94%	N/A	539.5 M	4.99 B	209.2 M	281	2,400	281		.150 B	
Rinosinsitis	33.1 B	1,300,000	12.15%	N/A	26.9 B	.005B	.369 B	20,748	2,400	2,100		.151 B	
Pneumonia	.518 B	1,145,000	10.70%	1,339	.426 B	.029 B	.259 B	7,166	2,400	125.3	0.004 mor	.075 B	
Cancer	1.93	54,000	0.50%	18,750	8.1 B	140.4 B	2.27 B	150,000	2,400	42,000	.700 B	.700 B	
ndhand Sm	.32 B	19,500	0.18%	1,500	52.3 M	N/A	N/A	2,682	N/A	N/A	N/A	N/A	N/A
ot ex COVII	27.33 B	13,483,818	126.02%	179,081	121 B	173.23 B	39.55 B	392,060	165,347	224,854	7.152 B	1.83 B	.902 B
COVID	128 B	2,870,000	26.82%	39,748	119.4 B	7.46 B	1.52 B	41,611	2,400	530	0.11 B	21.3 B	
						Cost of Disease divided by chronic disease							