NORTH CAROLINA
DEPARTMENT OF INSURANCE
OSFM
OFFICE OF STATE FIRE MARSHAL

Engineering Newsletter

WAYNE GOODWIN, Commissioner of Insurance

322 Chapanoke Road, Suite 200, Raleigh, NC 27603 (Street Address)

1202 Mail Service Center, Raleigh, NC 27699-1202 (Mailing Address)

(919) 661-5880

www.ncdoi.com/OSFM

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Contents

Introduction

Feature Articles

2014 NC Electrical Code Update

The 2014 NC Electrical Code proposal[1] is slated to be voted on at the December 2015 BCC meeting. It will appear on the December Agenda as a D-Item. If it is approved by the Building Code Council in December, and subsequent Rules Review Approval, an effective date can be provided. Until this occurs, however, there is not an effective date that can be provided to the reader. If this is an issue you wish to follow, please refer to the NC Building Code Council webpage and view the minutes and agendas for the meetings.

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=BCC_-_Minutes&user=Building_Code_Council&sub=BCC_Meeting

Session Law 2015-145 Reminder (House Bill 255)

This is a reminder of the recent legislation that became effective October 1, 2015. This notice was sent to holders of code enforcement certificates via postcards and e-mails, and is repeated here in this newsletter.

SESSION LAW 2015-145 - Building Code Regulatory Reform

Session Law 2015-145 (House Bill 255) "Building Code Regulatory Reform" becomes effective October 1, 2015. All NC Code Enforcement Officials (CEOs) should know of the changes related to the General Statutes enacted by this legislation through the NC General Assembly web site link http://www.ncleg.net/Sessions/2015/Bills/House/PDF/H255v8.pdf . One change applicable to the authority of the NCCOQB is noted below.

> **PART III. CLARIFY OFFICIAL MISCONDUCT FOR CODE OFFICIALS**
>
> **SECTION 3.(a)** G.S. 143-151.8 is amended by adding a new subsection to read:
> "(c) For purposes of this Article, "willful misconduct, gross negligence, or gross incompetence" in addition to the meaning of those terms under other provisions of the General Statutes or at common law, shall include any of the following:
> (1) The enforcement of a Code requirement applicable to a certain area or set of circumstances in other areas or circumstances not specified in the requirement.
> (2) For an alternative design or construction method that has been appealed under G.S. 143-140.1 and found by the Department of Insurance to comply with the Code, to refuse to accept the decision by the Department to allow that alternative design or construction method under the conditions or circumstances set forth in the Department's decision for that appeal.
> (3) For an alternative construction method currently included in the Building Code, to refuse to allow the alternative method under the conditions or circumstances set forth in the Code for that alternative method.

[1] The title of the document as of this writing is the 2014 NC Electrical Code. It likely will not be fully adopted until 2016, but as of this writing it is titled the 2014 NC Electrical Code.

(4) The enforcement of a requirement that is more stringent than or otherwise exceeds the Code requirement.
(5) To refuse to implement or adhere to an interpretation of the Building Code issued by the Building Code Council or the Department of Insurance.
(6) The habitual failure to provide requested inspections in a timely manner."

SECTION 3.(b) The North Carolina Code Officials Qualification Board shall, no later than October 1, 2015, notify all Code enforcement officials in the State of the clarification to the grounds for disciplinary action enacted by this act.

As stated in SECTION 3.(b) above, this legislation requires the NCCOQB to notify all CEOs of the clarification to the grounds for disciplinary action enacted by this act by October 1, 2015. To fulfill this statutory requirement, the Board staff is taking two direct actions in addition to posting this information on the web site.

1. Mail a 4x6 postcard to each CEO listed on "active" status in care of the address on record for the Authority Having Jurisdiction (AHJ) listed as the CEOs primary employer as of September 4, 2015. - completed
2. Send an email via the NCCOQB listserve to all CEOs with email addresses on record as of September 4, 2015. – completed (for all code officials with a valid e-mails)

Building Code Council Approved Rule Changes

At the March and June 2015 NC Building Code Council meeting, there were 10 D-Items, and 7 of these were adopted in March, and 12 D-Items of which 10 were adopted in June at the respective quarterly meetings. Please refer to the following link to review the list of D-Items from the March 2015 Building Code Council Meeting:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/BCC_Minutes/2015%2003%2015~March%2015,%202015_.pdf

And June 2015 Minutes:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/BCC_Minutes/2015%2006%2009~June%209,%202015_.pdf

Assuming the BCC-approved D-Items are approved by the Rule Review Commission, the adopted rules will be placed on the NCDOI Engineering website. The compilation of previously approved rules is located in the document "**2014-2016 Approved Cumulative Amendments**". See **Building 1003.3** - Barrier Height Requirements for Sloped Ceilings Under Stairways.doc

	1103.2.3 - Accessible Path for Church Sound Booths.doc
	1104.2 - 48” Minimum Width of Exterior Accessible Path.doc
	1103.2.3 - Accessible Path to Church Baptismal Fonts.doc
	1103.2.3 - Accessible Path to School Sound Booths.doc
	1104.3.1 - Accessible Employee Work Areas and Bartenders.doc
	1101.2 - Barrier Height Requirements for Sloped Ceilings Under Stairways.doc
	1715.5 - Window Replacement - Design Pressure Rating.doc
	1609.1.2 - Replacement Windows - Windborne Debris Protection.doc
	3412.6.9 - Existing Building Evaluation - Fire Alarm System Values.doc
Energy	402.3.6 - Window Replacement for Residential Buildings.doc
	101.4.3 - Energy Requirements - Reroofing.doc
Existing Building	0610 - Energy Requirements - Reroofing.doc
	0602.2 - Window Replacement - Design Pressure Rating.doc
	1102.3.6 - Window Replacement for Residential Buildings.doc
	0610.3 - Window Replacement for Residential Buildings
	0707 - Energy Requirements – Reroofing
	0407 - Change of Occupancy
	0602.4 - Replacement Windows - Windborne Debris Protection.doc
	1401.6.9 - Existing Building Evaluation - Fire Alarm System Values.doc
Residential	4502 - Window Replacement - Design Pressure Rating.doc
	0612.9 - Replacement Windows - Windborne Debris Protection.doc
Mechanical	312.1 - Load Calculations.doc
	0313 - Carbon Monoxide Alarms in One-and-Two-Family Dwellings and Townhouses.doc
Fuel Gas	311 - Carbon Monoxide Alarms in One-and-Two-Family Dwellings and Townhouses.doc
Plumbing	0315 - Carbon Monoxide Alarms in One-and-Two-Family Dwellings and Townhouses.doc
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Fire Prevention	0503.1.1 - Fire Apparatus Access Roads.doc

In addition to the generic code interpretations, job-specific Formal Interpretations and subsequent Appeals, if any, are being posted on the same webpage as the general interpretations. They are located under the table heading “SPECIFIC ACTIONS”. There are several Formal Interpretations posted, including:

Formal Interpretations	150402 Letendre Formal Interpretation.pdf
	150604 A 204.3.5 Seals Required.pdf
	150605 Guards confirmation of interpretation.pdf

Appeals	150528 Letendre NCDOI Decision.pdf .pdf 150821 Letendre BCC Order.pdf .pdf Amarr Garages Doors Order.pdf .pdf Faustin Order.pdf .pdf Quality Built Advantage Final Order.pdf .pdf Robertson Order.pdf .pdf VIM signed order and final agency decision.pdf

Cumulative Supplements article under the Engineering Department section for link.

The full review of the 17 approved code amendments is left to the reader, but items D-3, D-4, and D-8 pertain to the requirements for carbon monoxide alarms in commercial buildings, with companion language for the Mechanical, Fuel Gas, and Plumbing Code.

June Item D-3, D-4, and D-8

Item D – 3 Request by Richard Strickland, representing NCDOI-Engineering, to amend the 2012 NC Fire Prevention Code, Section 106.
Item D – 4 Request by Richard Strickland, representing NCDOI-Engineering, to amend the 2012 NC Fire Prevention Code, Section 908.7.
Item D – 8 Request by Leon Skinner, representing the NCEBC Ad-Hoc Committee, to amend the 2015 NC Existing Building Code, Sections 202, 403.7, 703.2, 1203.13, and 1401.2.6.

June Item D-11 has several related amendments, and the limited exception to SHGC requirements in the Residential Energy Code requirements related to issues of damage caused by reflected sunshine.

Item D-11 Request by David Smith, representing the Residential Standing Committee, and Ralph Euchner representing the Energy Standing Committee, to amend the 2012 NC Energy Conservation Code, Tables 402.1.1 and 402.1.3 and Sections 402.3.5 and 402.5; the 2012 NC Residential Code, Tables N1102.1, N1102.1.2 and Sections N1102.3.5 and N1102.5.

March Item D-8 addresses the installation requirements of solar photovoltaic systems with respect to the fire service aspect.

Item D – 8 Request by Wayne Hamilton, representing the NC Fire Service Code Revision Committee, to amend the 2012 NC Fire Code, Section 605.11.

The full text of the amendments is left to the reader.

Qualification Board Update

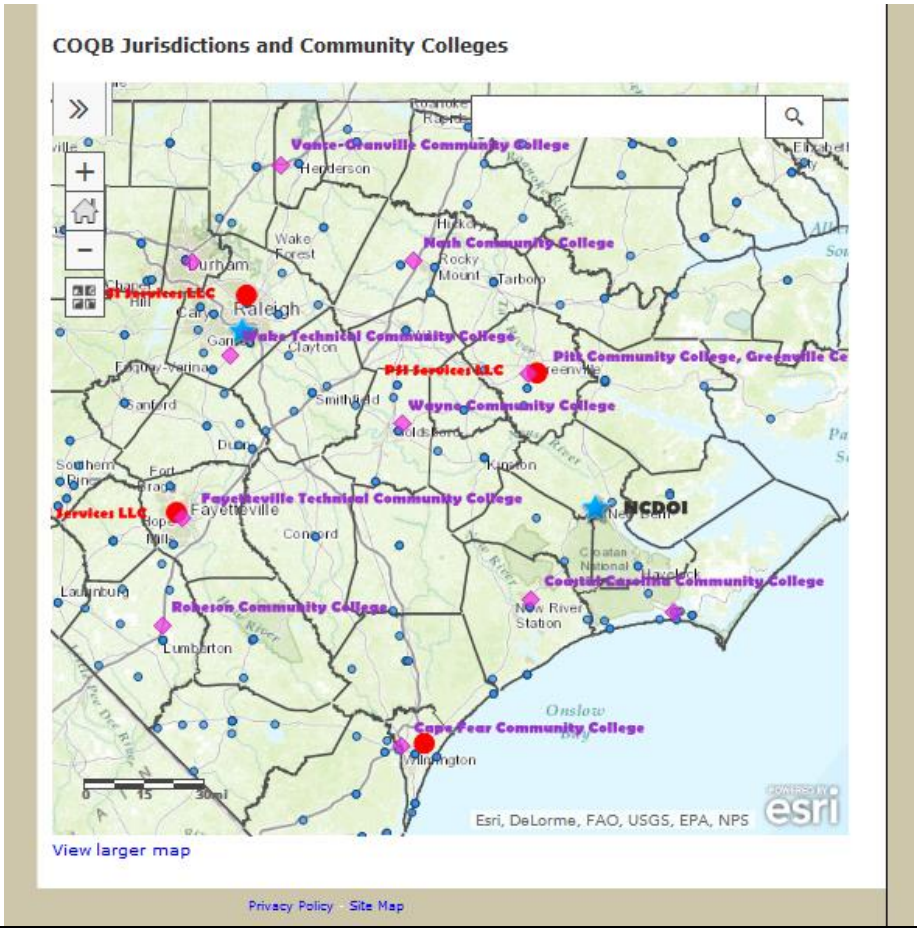
Minutes

The minutes of the April 28, 2015 Board Meeting are available at the following link:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=COQB_-_Minutes&user=Code_Officials_Qualification_Board&sub=COQB_Meeting

The minutes of the July 28, 2015 Board Meeting will be available upon Board approval at the October 27, 2015 meeting.

In Item 7, Staff Reports, Director Mike Hejduk demonstrated an interactive map that could show all the jurisdictions in the state with additional "pop up" identifying information such as primary contact, email, address, etc. Hejduk stated that this may be a more convenient way to represent and access large amounts of information that have a location/geographic component. Hejduk stated the interactive map is for demonstration purposes and that the value of such a representation was also as a means of feedback. Hejduk stated that the database did not effectively track information on inter-local agreements between cities and counties. The tool has proven useful, to the extent it is populated, for companies pursuing business opportunities across the state that may not be familiar with the territories of individual inspection jurisdictions. Also, construction companies from outside of North Carolina can use the map to effectively locate the individual inspection agencies. Individuals wishing to provide feedback are encouraged to contact Mike Hejduk at mike.hejduk@ncdoi.gov.



Model Code Development – ICC Hearings Available On-Line

The International Code Council (ICC) hearings for the 2018 model codes took place this past quarter in Long Beach, CA. The hearings were available to the general public via streaming video, and the archived streaming video available for the proposed changes to the model code available on-line for viewing for those with voting privilege. The proposed changes in written format are available at the following links for the Group A codes. The changes discussed in these documents are for the 2018 I-Codes, but they are many times informative in helping understand the history of the existing code sections.

http://www.iccsafe.org/codes-tech-support/codes/code-development/2015-group-a-public-comment-agenda/

Department Notes

Engineering Department

Personnel Recognition

On September 30th, 2015, Richard Strickland retired from the department as the Chief Fire Code Consultant. Respected by numerous fire inspectors, Richard showed multiple talents such as settling difficult arguments, conveying complex concepts in simple to understand terms and making himself available in difficult times. Richard will be missed by the department.

Dan Austin has taken over as the Chief Fire Code Consultant on October 1, 2015 and will be available at the same phone number (x255).

New Code Interpretations Posted

Since the last Engineering Newsletter was posted, the following web interpretations have been posted to the interpretations webpage, at the following link:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Interpretations&user=State_Building_Codes

Building	1003.3 - Barrier Height Requirements for Sloped Ceilings Under Stairways.doc
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	150821 Letendre BCC Order.pdf .pdf
	Amarr Garages Doors Order.pdf .pdf
	Faustin Order.pdf .pdf
	Quality Built Advantage Final Order.pdf .pdf
	Robertson Order.pdf .pdf
	VIM signed order and final agency decision.pdf

Cumulative Supplements

Cumulative code changes and their adoption dates can be found on the DOI website at:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Codes_-_Current_and_Past&user=State_Building_Codes

You may have to scroll down on the screen that is accessed at the above link to see another link to the "**2012-2015 Approved Cumulative Amendments**." The batch of code changes that had effective dates on or before January 1, 2015, is in the "2012-2015 Approved Cumulative Amendments" document. Starting with the September 2014 code changes, another document has been added, titled "**2014-2016 Approved Cumulative Amendments**" that will accumulate all the changes with effective dates taking place on or before January 1, 2016.

Remember; refer to NC Administrative Code section **102.4 Effective date of rules**, and **102.5 Interim use of approved rules** for clarification of effective dates and the process for using approved rules prior to the effective date.

Qualifications Assurance Section – *COQB, HILB & PYRO*

June 30, 2015 marked the end of another Fiscal Year as well as the annual Standard Certificate renewal cycle. From staff's perspective the majority of online renewals proceeded smoothly. A substantial number of jurisdictions had CEOs who had met all CE requirements. Thank you for your patience to those who experienced delays due to computer problems. Typically the end of year payment of fees prompts jurisdictions to remove inspector's names who are no longer employed. There were several instances in which an "inspector retired 5 years ago". Please don't be one of those departments. Also, jurisdiction Primary and Secondary Contacts should remember that a CERTIFICATE OF EMPLOYMENT is required for all newly employed individuals performing code enforcement duties. This should be uploaded via the web site for processing by staff.

Training Summary

A review of the Standard Course offerings for FY 2014-2015 showed nearly 1,400 student names were submitted on 140 class rosters for F,B,M,E,P (excluding Law and Admin courses). This is an average of about 10 students per class. Of the 58 community colleges, about 22 actually offer Standard Courses. These classes are open to the public, and are an excellent chance for a code official to get trained or for anyone associated with the building trade to obtain the same basic training the code officials receive. For locations of all the NC Community Colleges (and proximity to Authorities Having Jurisdiction) see the interactive map on the COQB home page at the link below (scroll down to the bottom of the web page after you click the link). Clicking on a diamond symbol will "pop-up" additional information. Please note that not all Community Colleges offer all Standard Courses:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Officials_Qualification_Board_USER&user=Code_Officials_Qualification_Board

Staff email addresses:

Rodney Daughtry, Customer Service Rep.	Rodney.Daughtry@ncdoi.gov
Mike Hejduk, Director	Mike.Hejduk@ncdoi.gov
Kathy Williams, Examinations	Kathy.Williams@ncdoi.gov
Jessica Yelverton, Education Coordinator(COQB)	Jessica.yelverton@ncdoi.gov
Jennifer Hollyfield, Education Coordinator(HILB)	Jennifer.hollyfield@ncdoi.gov
Terri Tart, Certification/Licensing (COQB, HILB)	Terri.Tart@ncdoi.gov
Shuranda Bryant, Licensing (PYRO)	Shuranda.bryant@ncdoi.gov
Sam Whittington, Investigation (COQB)	sam.whittington@ncdoi.gov
Phil Joyner, Investigation (HILB)	phil.joyner@ncdoi.gov

NC Building Code Training

The most up-to-date training schedule for all building codes are available at the following link:

http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Education_-_Student_Main&user=Code_Education_Resources

Once the web page is accessed, click the "**FIND A CLASS**" button to refine your search. As discussed in previous newsletters, please consider the use of the Standard Classes if you are a design professional, contractor, or code official, as they are an underutilized offering.

The NC Building Inspectors Association, NC Plumbing Inspectors Association, NC Mechanical Inspectors Association and NC Fire Marshal's Association will soon be publishing there winter/spring course offerings for 2016, please refer to their following websites for further information.

http://www.ncbia.org/

http://ncpia.us/

http://ncmia.com/

http://www.ncfma.com/

The North Carolina Electrical Inspectors Association (Ellis Cannaday Chapter) has already published their training list, it is available at the following website. Remember, the electrical code did not go to a six-year adoption cycle, there is a 2014 Electrical Code being adopted, and training is available for this.

http://www.nciaei.org/

Engineer's Corner

Condensate Freeze Protection

As previously discussed in past newsletters, the agency that determines whether or not a condensate stream is permitted to be discharged to the local wastewater system would be the water treatment department for the community served The building code does not determine if the condensate can be discharged to the local wastewater system, but instead has provisions on minimum connection requirements if discharge is allowed. The NC Legislature recently approved a statute that requires all NC public and community wastewater treatment facilities to accept the condensate discharge from residential heating and cooling systems. This is a change to the governing statutes for water treatment facilities, so it does not appear in the building code.

Here is a reprint of the change, and a link to the full text for the reader:

SESSION LAW 2015-207 HOUSE BILL 538

"§ 130A-345. Disposal of liquid condensate from residential heating and cooling systems.
Notwithstanding any other provision of law, every public or community wastewater system, as defined in G.S. 130A-334(8), shall provide for the collection of liquid condensate from residential heating and cooling systems by the public or community wastewater system."

http://www.ncleg.net/Sessions/2015/Bills/House/PDF/H538v7.pdf

The code section that is most applicable is NC Plumbing Code Section 802.1.5, which generically sets minimum requirements for discharge of nonpotable clear-water wastes to the building drainage system. Further guidelines are being proposed for the code, but the code, as is, and combined with good plumbing knowledge can be followed without waiting for any code amendments. Manufacturer's installation instructions are of course the common-sense requirement that are still required to provide a completely functional system under all weather conditions.

NC Plumbing Code excerpt
802.1.5 Nonpotable clear-water waste. Where devices and equipment such as process tanks, filters, drips and boilers discharge nonpotable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an *air break* or an *air gap*.

How much Condensate to Expect

People's opinions on the amount of condensate vary widely, from "a few drops" to "lots". Fortunately, the amount can be quantified using your old chemistry book. As you know, the combustion waste stream of hydrocarbons has water in it, most times in the form of water vapor, but in the case of condensing appliances, you are extracting the latent heat out of the water vapor so it gives more usable heat to the owner. Therefore the water vapor turns to liquid water and must be drained instead of going up and out the vent. Think of it as condensing on your property instead of on your neighbor's property like would be the case with a non-condensing appliance. The chemical formula for the reaction is:

Balanced Equation[2]:

$CH_4 + 2O_2 + 3.76\ (2)\ N_2 \dashrightarrow CO_2 + 2H_2O + 3.76\ (2)\ N_2$

Prior to Combustion, left hand side of equation:

CH_4 = Fuel in this case methane, which makes up the vast majority of natural gas

$2O_2 + 3.76\ (2)\ N_2$ = the air needed to provide combustion, which is predominantly oxygen and the inert gas nitrogen

After combustion, right hand side of equation:

CO_2 = Carbon dioxide[3]

$2H_2O$ = water in the exhaust stream either in the form of water vapor, or, if cool enough, liquid water

$3.76\ (2)\ N_2$ = the nitrogen in the exhaust stream from the combustion air essentially passes through the combustion process unchanged

The equation is set up for the atomic balance; we now need to determine the mole flow rate, and subsequent mass flow and finally gallons of flow to get the value most people are interested in.

From the NFPA 54 handbook, we know we need 2.83 m^3 (100 ft^3) of natural gas combined with 28.3 m^3 (1000ft^3) of air for complete, or stoichiometric combustion. Then, using the on-line stoichiometry calculator at onlinesciencetools.com, we determine there are 119.75 moles[4] of CH_4 in 2.83 m^3, and this yields:

Balanced Molar Equation:

$119.75_{moles} CH_4 + 119.75\ moles\ 2O_2 + 119.75_{moles}\ 3.76\ (2)\ N_2 \dashrightarrow 119.75_{moles}\ CO_2 + 119.75_{moles}\ 2H_2O + 119.75_{moles}\ 3.76\ (2)\ N_2$

The only value we are interested in is the amount of H_2O on the right hand side of the equation, which simplifies to:

$239.5_{moles}\ H_2O$

Using this and the online calculator, this amount of moles of H_2O has a mass of 4.31 kg.

Converting this to gallons:

4.31 kg H_2O (2.2 lbm/kg) (1 gal/8.34lbm) = 1.1 gal H_2O/100ft^3 of natural gas burned.

The quantity of 100ft^3 of natural gas is commonly shown with Roman numerals, or 1 CCF, which is also real close to a therm (1.03 CCF/therm approximately). Therefore the amount of liquid byproducts of combustion can be assumed to be 1.1 gal/therm burned. The amount of water vapor in the combustion air has some effect on the amount of water in the exhaust,

[2] There are several intermediate steps during the actual combustion process, but this is the finished reaction [Air Pollution Control, 1986, Cooper, Alley]

[3] The CO_2 dissolves somewhat in the H_2O, forming H_2CO_3, or Carbonic Acid. This is why the liquid byproducts of combustion are acidic, similar to the carbonated water in soda. This is also why the vent material for Cat IV appliances are plastic, stainless steel, or other similar material. The treatment of this waste stream, where required by the water treatment authority, is addressed by manufacturer's installation instructions.

[4] At 60F (288K), and 1 Atm of pressure

but that quantity will vary by time of year, and will add slightly to the amounts from the chemical reaction of the combustion process.

So how much per hour? Per day? Per year? If the reader takes the rating of the unit in Btuh, and divides it by 100,000, that will be the equivalent of therms/hr capacity. For instance, a 100,000 Btu condensing furnace will burn 1 therm per hour, which will then produce approximately 1.1 gal per hour of condensate. On a design day and colder than a design day, it could be running continuously (depending on how it was sized, of course) so you would have 1.1 gal/hr 24 hr/day = 24 gallons/day. Obviously in non-design days it would produce considerably less. If the reader knows the therms or CCF/year the house uses for heating, they can convert this to therm equivalent, and get the gallons of condensate per year. That exercise is left to the reader.

Propane is a similar process. The formula for propane is C_3H_8, and the amount of liquid byproducts of combustion is 0.90 gal/therm (100,000 btu)[5]. This was calculated using Table 2, Chapter 15 of the 1993 ASHRAE Handbook of Fundamentals. This same table can be used for determining the water in a natural gas burning system also, or you can use the procedure outlined in this article.

Summary

In summary, the amount of condensate produced by a condensing furnace is not a random amount, it can be closely predicted based on the amount and type of fuel used, with values of approximately:

1.1 gal/therm burned of natural gas, and

0.90 gal/therm equivalent burned of propane

As always, refer to manufacturer's installation instructions for guidance on freeze protection, corrosion-resistant venting and drainage requirements, and neutralization kits.

[5] Using 4.2 lbm/gal, and 91,502 Btu/gal and rationing these up to 4.578 lbm propane and 100,000 Btu's, and 1.634 lbm H2O in exhaust stream per lbm propane yields 0.90 gal water after the proper conversion from lbm of water to gallons. Values based on 60F for propane. Refer to ASHRAE Handbook of Fundamentals, Combustion and Fuels Chapter. It is Chapter 15 in the 1993 edition.