

**NC Department of Insurance
Office of the State Fire Marshal - Engineering Division
1202 Mail Service Center, Raleigh, NC 27699-1202
919-647-0000**

Carbon Monoxide Alarms in One-and-Two-Family Dwellings and Townhouses

Code: 2018 Fuel Gas

Date: August 26, 2019

Section: 311.1 - 311.3

Code: Residential – See Specific R315 interpretation

Section: R315

Code: Mechanical

Section: 313.1-313.3

Code: Plumbing

Section: 317.1-317.3

The following list of questions and answers pertaining to carbon monoxide alarms. References to code sections all refer to the code excerpt shown in Error! Reference source not found..

311.1 Carbon monoxide alarms. In new construction, one-and two-family dwellings and townhouses within which fuel-fired appliances or fireplaces are installed or that have attached garages shall be provided with an approved carbon monoxide alarm installed outside of each separate sleeping area in the immediate vicinity of the bedroom(s) as directed by the alarm manufacturer.

311.2 Where required-existing dwellings. In existing dwellings, where interior alterations, repairs, or additions requiring a building permit occurs, or where one or more sleeping rooms are added or created, or where fuel-fired appliances or fireplaces are added or replaced, carbon monoxide alarms shall be provided in accordance with Section 311.1.

Exception:

Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, or the installation of a fuel-fire appliance that cannot introduce carbon monoxide to the interior of the dwelling, are exempt from the requirements of this section.

R311.3 Alarm requirements. The required carbon monoxide alarms shall be audible in all bedrooms over background noise levels with all intervening doors closed. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions. Battery powered, plug-in, or hard-wired alarms are acceptable for use.

Figure 1: Current Effective Code – NC Fuel Gas Code 2018

New Buildings

Question 1:

When is a Carbon Monoxide alarm required in a **new** one-and-two-family dwelling and townhouse?

Answer:

A carbon monoxide alarm requirement is triggered by any of the following--**all** new one-and-two-family dwellings and townhouses that have **any** of the following present:

- A fuel-fired appliance,
- A fireplace
- An attached garage

Question 2:

Do the requirements for carbon monoxide alarms include homes without any fuel-fired appliances, fireplaces or an attached garage?

Answer:

No.

The code requirement was changed to align with the NC statute that requires there to be at least one of the following before a carbon monoxide alarm is required: **a fuel fired appliance, fireplace, attached garage** (per 311.1).

Question 3:

Does the **Exception** apply to both Section 311.1 and 311.2?

Answer:

Only 311.2.

In new construction, the R311.1 language reads "...within which fuel-fired appliances or fireplaces are installed..." Therefore, if you have a new house with an exterior fuel-fired appliance, R311.1 would not require the installation of a carbon monoxide alarm for said exterior appliance.

Question 4:

Are the carbon monoxide alarms required to be hard-wired units?

Answer:

Yes, in new construction.

With the advent of the 2018 code, Section **R315.5 Power Source** in the Residential Code **does** require the primary source of power to be the building power wiring. **This is a change from the 2012 code cycle.**

If the carbon monoxide alarms are triggered by an alteration, repair, or addition, then they can be battery powered only. See Exception 2 to R315.2.

Existing Buildings

Most questions have been “when are carbon monoxide alarms required in an existing one-and two-family dwelling?”. After issuance of the first interpretation on this topic in 2012, it became apparent that the term “permit” requires additional clarification in order to clarify the intent of the amended section, as some departments offer “blanket permits” with subcategories for the trades, whereas others write out individual permits for general contracting and the trades.

General Code Language Interpretations of 311.2

Question 5:

Would a permit issued for a trade such as mechanical, electrical, or plumbing be considered a “building permit” as described in 311.2 above?

Answer:

No.

The “building permit” referenced in 311.2 is meant to apply to general contracting work, such as wall additions and removals.

Please note you must continue reading the entire paragraph, and the Exception following, and, if necessary, 311.1 to determine if a carbon monoxide alarm is required by 311.2.

311.2 Where required-existing dwellings. In existing dwellings, where interior alterations, repairs, or additions requiring a building permit occurs, or where one or more sleeping rooms are added or created, or where fuel-fired appliances or fireplaces are added or replaced, carbon monoxide alarms shall be provided in accordance with Section 311.1.

Exception:

Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, or the installation of a fuel-fire appliance that cannot introduce carbon monoxide to the interior of the dwelling, are exempt from the requirements of this section.

Figure 2: 311.2 Existing dwelling carbon monoxide alarms

Question 6:

In general, what work and/or permit issuance triggers the installation of carbon monoxide alarms in an existing residence?

Answer:

The installation of a carbon monoxide alarm is triggered by any of the following:

- The issuance of a building¹ permit, requiring compliance with the NC Residential Code, for interior alterations or repairs, where the building has any of the following (per 311.1)²: **a fuel-fired appliance, fireplace, attached garage.** Or-
- The issuance of a permit, requiring compliance with the NC Residential Code, for a building addition, where the building has any of the following (per 311.1): **a fuel-fired appliance, fireplace, attached garage.** Or-
- The issuance of any permit (building or trades) for the installation and/or replacement of a fuel-fired appliance or fireplace, (since the work involved the installation of a fuel-fired appliance or fireplace, obviously the conditions of 311.1 were met), Or-
- The addition or creation of one or more sleeping rooms where the building has any of the following (per 311.1): **a fuel-fired appliance, fireplace, attached garage.**

Question 7:

Relative to the addition or creation of one or more sleeping rooms--Does this mean that if a homeowner converts an existing room from a study or some other use into a bedroom, which does not require a building permit, and the bldg. has any of the following (per 311.1): **a fuel fired appliance, fireplace, attached garage;** that the installation of a carbon monoxide alarm is required?

Answer: Technically all work must comply with the requirements of the codes and the installation of the alarms would be required. However, since a permit was not issued, there is no way that the local inspections department can verify compliance.

Follow-up to Question 7:

Does this mean that if a homeowner finishes off a previously unfinished space in the homeowner's dwelling for a bedroom, doing the work himself without getting a permit (the HVAC and electrical may have been installed earlier), and the bldg. has any of the following (per 311.1): **a fuel fired appliance, fireplace, attached garage;** that the installation of a carbon monoxide detector is required?

Answer: Technically all work must comply with the requirements of the codes and the installation of the alarms would be required. However, since a permit was not issued, there is no way that the local inspections department can verify compliance.

¹ See Question #5 under Existing Building Section for "building permit" clarification.

² The revised code language in this section is not trying to make the requirements for existing buildings any stricter than that for new buildings, although a strict reading of the code language may not communicate this to the reader. However, based on our opinion of NC GS 143-138 paragraph (b2), the rationale for sending the reader back to 311.1 is to only require a carbon monoxide alarm in an existing building if there is at least a fuel fired appliance, fireplace, or attached garage, and to install it to the manufacturer's requirements.

Trade Permit Interpretations of 311.2

Question 8:

When the permit is issued for the installation of appliances, equipment, fixtures or devices covered by the trade codes (such as the renovation of a bathroom that encompasses only plumbing fixtures with no building related issues, or the change out of an electrical panel) would the requirements of 311.2 apply?

Answer:

Yes.

However, after evaluating the requirements of 311.2, there may not be a trigger for the installation of a carbon monoxide alarm. If there are no building related issues and a building permit is not issued, and no fuel-fired appliance is being installed or replaced, and the bldg. does not have any of the following (per 311.1): **a fuel fired appliance, fireplace, attached garage**, then the requirement for carbon monoxide alarms is not triggered.

Question 9:

I have an inspection for the replacement of an electric water heater, of equal capacity and wattage, and per the General Statute for permits this replacement does not require the issuance of a permit. (the permit was requested by the plumber for his protection). Would this installation evoke the requirement for carbon monoxide alarms given that it is not “required by the Residential Code?”

Answer:

No.

If there are no building related issues and a building permit (requiring compliance with the NCRC) is not issued and a fuel-fired appliance is not being installed, the requirement for carbon monoxide alarm installation is not triggered.

Question 10:

The work involves the installation or replacement of a heat pump, (or other all-electric appliance); and there is an existing fuel-fired appliance, fireplace, or attached garage present in the one-and-two-family dwelling. Is a carbon monoxide alarm required as part of this work?

Answer:

No.

The replacement or installation of the electric appliances did not require a “building permit” (as opposed to a “trade permit”) as discussed in this interpretation, and the appliance(s) installed or replaced is not fuel-fired, therefore, even though there are existing conditions in the dwelling that would require a carbon monoxide alarm on a new house, the replacement or installation of a heat pump (or other all-electric appliance) would not require a carbon monoxide alarm on an existing dwelling.

Question 11:

The work involves the installation of a non-fuel-fired appliance to replace an existing fuel-fired appliance, such as the installation of an electric range to replace an existing gas range or a heat pump to replace an existing gas furnace. Does this replacement require the installation of a carbon monoxide alarm if there is: **a fuel fired appliance, fireplace, attached garage** (per 311.1) somewhere else in the bldg. after the replacement occurs?

Answer:

No.

The replacement or installation of the electric appliances did not require a “building permit” as discussed in this interpretation, and the appliance(s) installed or replaced is not fuel-fired, therefore, even though there are existing conditions in the dwelling that would require a carbon monoxide alarm on a new house, the replacement or installation of an electric appliance to replace a fuel-fired appliance would not require a carbon monoxide alarm on an existing dwelling.

Question 12:

If I am an electrical contractor installing an electric fence in the yard of an existing dwelling, would I be required to install carbon monoxide alarms in the dwelling?

Answer:

No.

In this case, there are no building related issues and a building permit (requiring compliance with the NCRC) is not being issued; therefore, the requirement for carbon monoxide alarms is not triggered.

Question 13:

How does a code official (or contractor) determine whether or not an **exterior fuel-fired** appliance can introduce carbon monoxide to the interior of the building?

Answer:

The code is silent on this matter. In general, if it is an outdoor fuel-fired appliance installed in accordance with its manufacturer’s installation instructions, and the code with regards to venting and clearances to building openings, overhangs, etc., and **there is no interconnecting ductwork**, it would not be required to have a carbon monoxide alarm. Here is a partial list of items that are typically encountered, and our interpretation:

- Water heaters - No
- Package units with fuel-fired heat – Yes. Although the design of modern package units makes it unlikely to introduce carbon monoxide into the bldg., there are cases where it has happened.
- Direct-vent appliance installed in living space, attic, basement, or crawl – yes.
- Outdoor boiler connected via only piping – No.
- Outdoor furnace connected via ductwork – Yes. Similar logic as a fuel-fired package unit.
- Permanently installed generators – No, not by this code section. **However**, check manufacturer’s installation requirements, many manufacturer’s instructions have mandatory language (shall, must, etc.) requiring one as part of the installation, so the code would require it be installed under section NCFGC 305.1.

- Portable generators³. – These are not regulated by the Code. Although the misuse of these has proven to be a major percentage of carbon monoxide poisonings, Code Section 311.1 or 311.2 would not require a carbon monoxide detector.
- Outdoor permanently installed fuel-fired cooking appliances with no attached roof or horizontal projection of the dwelling over the appliance – No
- Outdoor fire pits or decorative appliances⁴ on attached decks with no attached roof or horizontal projection of the dwelling over the equipment - No
- Portable grilles – No, they are not subject to these code sections.

Miscellaneous Scenario Interpretations

Question 14:

Do the provisions of 311.1 and 311.2 apply to one-and two-family dwellings that are rented out?

Answer:

Yes.

There may be additional requirements placed on the structure by landlord ordinances⁵ that are beyond the review and enforcement of the building code, but may be enforced by minimum housing standards.

Question 15:

Does the existence of stubbed out, but capped off gas lines for future appliances not installed or required at time of final inspection require a carbon monoxide alarm? (There are no fuel burning appliances presently installed at certificate of occupancy stage). An example would be a stub out for a gas range, but the actual installed range is all-electric.

Answer:

No.

If and when the appliance is installed, the requirements would be triggered. Of course, this assumes no other items in 311.1: **a fuel fired appliance, fireplace, or attached garage** are present.

Question 16:

A fire damages part of a dwelling requiring the entire space to be refinished and some prior walls, ceiling, roof trusses and roofing to be replaced. The scope of work does not add any new space or any new rooms, and there is at least one item present under 311.1: **a fuel fired appliance, fireplace, attached garage**.

Answer:

Yes.

Per 311.2, the work required a building permit, and the scope of work was beyond the Exception, and the dwelling had at least one of the items referred to in 311.1.

³ <http://www.cpsc.gov//Global/Research-and-Statistics/Technical-Reports/Home/Portable-Generators/GeneratorsandOEDTFatalities-2014-FINAL.pdf>

⁴ Every code-compliant installation we have seen to date does not allow any roof or horizontal projection over the equipment, but the industry is in constant motion, and we may not be aware of all products.

⁵ http://www.ncga.state.nc.us/EnactedLegislation/Statutes/HTML/BySection/Chapter_42/GS_42-42.html § 42-42. Landlord to provide fit premises.[Item 7]

Question 17:

A fire damages part of a dwelling requires the entire space to be refinished and some prior walls, ceiling, roof trusses and roofing to be replaced. The scope of work does not add any new space or any new rooms, and there is **NOT** at least one item present under 311.1: **a fuel fired appliance, fireplace, attached garage.**

Answer:

No.

Per 311.2, the work required a building⁶ permit, and the scope of work was beyond the Exception, **BUT** the dwelling **does not** have at least one of the items referred to in 311.1: **a fuel fired appliance, fireplace, attached garage.**

Question 18:

A kitchen is renovated (building permit) with countertops, updated electric, lighting, possibly sinks, dishwashers, but existing gas range is not replaced. Is a carbon monoxide detector required for this scope of work?

Answer:

Yes.

Per 311.2, there was a building⁷ permit required for the scope of work, and there is existing fuel fired appliance(s) present, therefore a carbon monoxide alarm is required.

Question 19:

A kitchen renovation is performed, but no building permit is required, but a permit was pulled for trades of electrical and plumbing for electrical lighting work and sink replacement. There is an existing gas range. Is a carbon monoxide alarm required as part of this scope of work?

Answer:

No.

A building⁸ permit was not required, and no fuel-fired appliance was repaired or replaced per 311.2.

⁶ See Question #5 under Existing Building Section for “building permit” clarification.

⁷ See Question #5 under Existing Building Section for “building permit” clarification.

⁸ See Question #5 under Existing Building Section for “building permit” clarification.

Code Official Certificate Requirement Interpretations

Question 20:

Since this is a requirement in NC Residential Code, can a mechanical or plumbing inspector do the inspection on the carbon monoxide installation or does it require a certified building inspector?

Answer:

For either plug-in or battery-powered units there is little in the Code to inspect other than the location “in the vicinity of the bedrooms” and compliance with UL 2034. The manufacturer’s instructions will be onsite with the device. The mechanical or plumbing inspector should be able to inspect those items, but that is the local jurisdiction’s decision as referenced in Question 8 above. If it is a hard-wired device, then an electrical permit is appropriate, and the code official would have to hold a minimum of Level I electrical certificate.

Question 21:

If the installation of a carbon monoxide alarm is triggered by an item in 311.2, is there a special permit for the carbon monoxide alarm or is it lumped with any permit that initially triggered the installation as stipulated in 311.2?

Answer:

There are no requirements to issue a special permit for compliance with the code amendment. Each jurisdiction should decide individually how to best handle enforcement. The DOI feels that most of the devices will be either plug-in or battery-powered units, for retrofits, that could be inspected without a separate permit. If it is a hard-wired device, then an electrical permit is appropriate.

Question 22:

Question deleted – no longer applicable.

Contractual Question Interpretations

Question 23:

When multiple trades are involved in a project scope and more than one trade or general contracting scope of work could have triggered the carbon monoxide installation requirement, which contractor is responsible for providing and installing the carbon monoxide alarm?

Answer:

The code does not address contractual responsibility. This would be handled on a case-by-case basis by the permitting department and permit holder(s).

Question 24:

Are the carbon monoxide alarms allowed to be installed by the homeowner?

Answer:

Yes.

When the work requires a carbon monoxide alarm to be installed, the code official has to verify its (their) existence and proper installation, but the homeowner can provide and install it (them⁹). The permit would not be closed out until verification of proper installation. The detectors must be labeled as compliant with the requirements of UL 2034 and must be installed in accordance with the device manufacturer's installation instructions. As discussed in an earlier question, it can be battery operated, plug-in, or hard-wired. Of course, the hard-wired alarm would require an electrical permit.

Question 25:

Is more than one carbon monoxide alarm required?

Answer:

Many times, yes.

Section 311.1, requires "...carbon monoxide alarm outside each separate sleeping area in the immediate vicinity of the bedroom(s) as directed by the alarm manufacturer." Obviously, this means, in the case where there are more than one sleeping area, more than one alarm is required.

Question 26:

What if there is a fuel burning appliance inside a bedroom, would another alarm be required inside the bedroom in addition to the area outside each sleeping area?

Answer:

Yes.

Refer to Residential Code Section R315.3 Location. This section has more descriptive language concerning this, and that language shall be followed.

R315.3 Location. Carbon Monoxide alarms in dwelling units shall be installed outside each separate sleeping area in the immediate vicinity of the bedrooms. **Where a fuel-burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.**

Where there is an appliance within the bedroom or its attached bathroom, a carbon monoxide alarm is required in the bedroom also. If this appliance scenario is present in a house, this installation within the bedroom does not negate the requirement for carbon monoxide alarms outside each separate sleeping area.

⁹ In some situations, more than one alarm is required if the manufacturers installation instructions are followed.

Question 27:

Do code sections 311.4 – 311.4.6 apply to one and two-family dwellings?

Answer:

No. These sections are for commercial occupancies.

Section 311.4.1.1 Reads:

311.4.1.1 Where required. Carbon Monoxide detection shall be provided in Group I-1, I-2, I-4, and R occupancies (except R-3) and in classrooms in Group E occupancies in the location specified in Section 311.4.2 where any of the conditions in Sections 311.4.1.2 through 311.4.1.6 exist.

Please note that although R-occupancies are included, R-3 occupancies are an exception to the requirements, which is what one and two-family dwellings are classified as.

End of interpretation