



**ENERGY
SOLUTIONS
CENTER**

Energy Industry Fundamentals

Natural Gas Safety

Eric Burgis, Energy Solutions Center

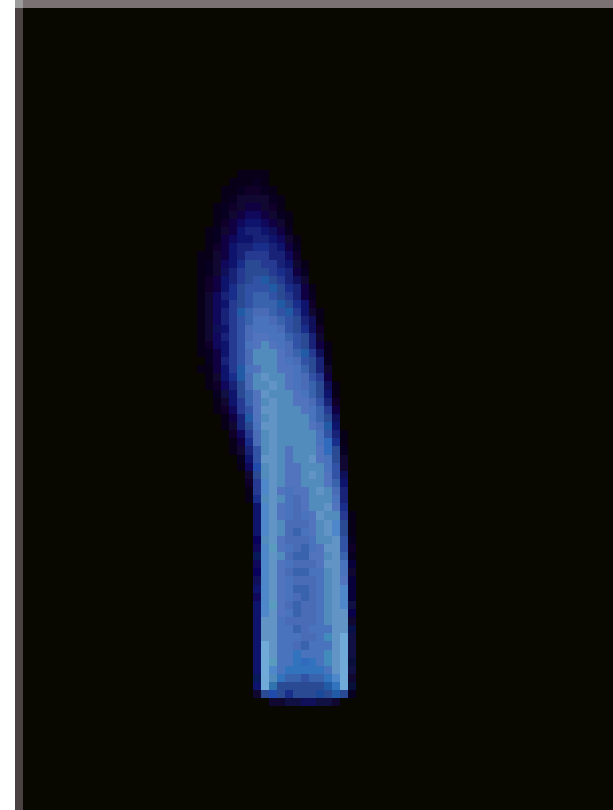
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Presentation Outline

- About Natural Gas
- Gas Leaks
- Digging Safety
- Pipe Safety
- Carbon Monoxide
- Hot Water Safety
- Emergency Preparedness
- General Safety



About Natural Gas

The background of the slide is composed of three main geometric regions. The top region is a solid dark blue. The bottom-left region is a light blue area that tapers towards the bottom-left corner. The bottom-right region is a red area that tapers towards the bottom-right corner. The boundaries between these regions are smooth, curved lines.

Natural Gas Safety

- Natural gas is used by 45% of U.S. and 55% of Canadian households as their main heating source
- Natural gas is clean, efficient and relatively safe
- However, there are potential dangers associated with natural gas usage
 - Combustible
 - Colorless
 - Tasteless
 - Odorless

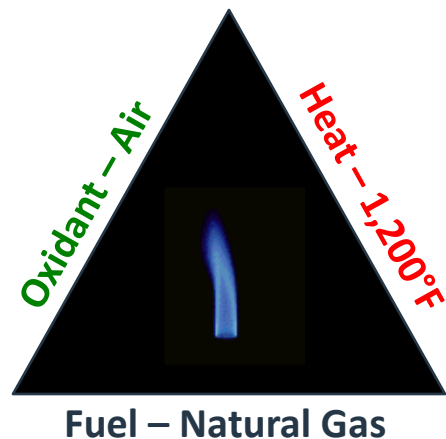


Source: 2020 Residential Energy Consumption Survey, Table Hc6.1
<https://www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%206.1.pdf>

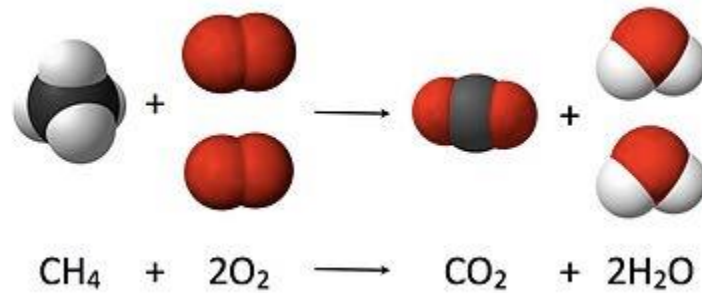
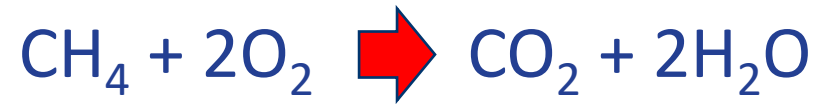
Source: Natural Resources Canada – Energy Fact Book 2022-2023
https://publications.gc.ca/collections/collection_2022/rncan-nrcan/M136-1-2022-eng.pdf

Natural Gas Combustion

- Natural gas is not flammable by itself
- Requires fuel, air, and ignition source
- All must be in an appropriate mixture shown simply by the Combustion Triangle

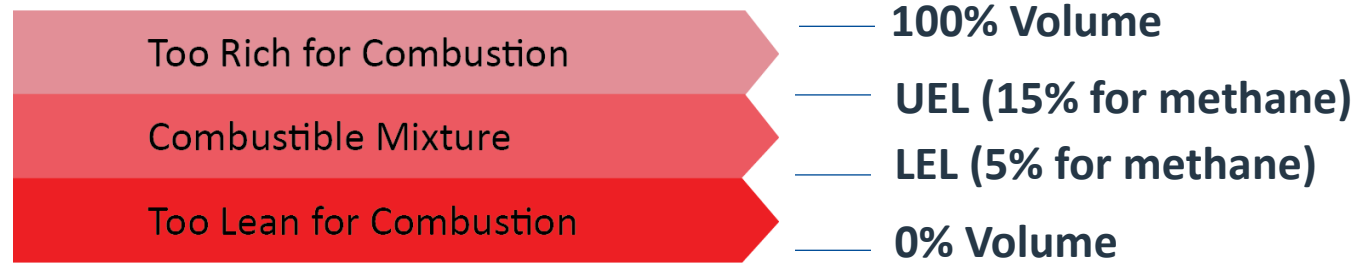


The Combustion Equation



- Must be in the proper ratios for the reaction to occur
- This is referred to as Stoichiometric combustion

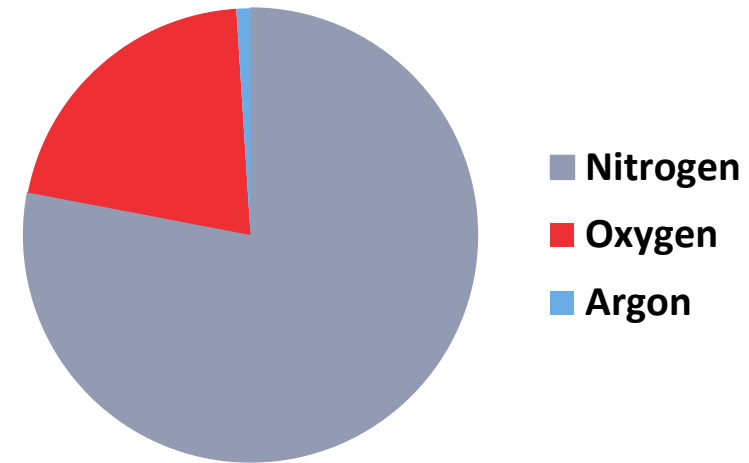
Combustion Zone



- Gas or vapor will ignite only within a specific range of fuel/Oxygen mixtures
- Too little or too much gas will not ignite
- These conditions are defined as the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL)
- Any amount of gas between the two limits is explosive

Issues in Combustion

- Most gas equipment uses “air” for the oxidant
- Air is composed of Oxygen, Nitrogen and Argon
- The chemical composition of the air in our atmosphere is:
 - Nitrogen (78%)
 - Oxygen (about 21%)
 - Argon (almost 1%)



Issues in Combustion

- When combusting with “air” the nitrogen and argon are not consumed but instead heated and pass through the process into the exhaust stream performing no work
- Any combustion at high temperatures in atmospheric air can create small amounts of several nitrogen oxides, commonly referred to as NO_x
 - NO_x is 300 times more potent than CO₂ and depletes our ozone layer

Gas Leaks

The background of the slide is composed of several overlapping geometric shapes. A large dark blue shape occupies the top half. Below it, a light blue shape curves across the middle. On the right side, a red shape is visible, partially overlapping the light blue one. The overall design is modern and minimalist.

Natural Gas Leaks

- While rare, natural gas line leaks can be extremely dangerous
- The most telling sign of a natural gas leak is the familiar rotten egg odor of natural gas
- This odorant called Mercaptan is added to the natural gas so it can be detected in the event of a leak



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How to Recognize a Leak

- Look for signs of a leak such as dead vegetation, bubbles in a flooded area or dirt blowing from the ground
- Listen for a hissing or roaring sound



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Gas Utility Responsibility

- Technicians have specialty equipment that can detect very small leaks
- Utility crew will check main lines, service line and meter location for leaks
- If a leak is detected in the gas service to the home or building, this service may be shut off to make repairs



<https://www.ueitest.com/ECommerce/product/cd100a/cd100a>

Know the 3 R's

- **R**ecognize



- **R**eact



- **R**eport



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What if you Suspect a Leak

- If you detect a strong gas odor, follow these tips:
 - Do not attempt to locate the leak
 - Do not turn any electrical appliances on or off
 - Do not smoke or use any open flames
 - Leave the house and, from a safe distance, call the utility company and 911
 - When digging outside, if a natural gas line is damaged, call the utility immediately

Digging Safety

Digging Safety

- Call 811 before you dig so that you know where gas lines are buried to prevent risk of injury
- If you hit a natural gas line while digging – leave the area and call 911 – do not attempt to make repairs yourself



**Know what's below.
Call before you dig.**

Digging Safety

- Be careful when excavation and respect markings from 811
 - Use trained operators and spotters when digging
 - Leave site safe at end of day – Protective fencing, warning barriers or covering plates
- Implement traffic control measures when digging in a street
 - Coordinate with city, state for traffic control
 - Use signs, cones, or flaggers as necessary

Call 811







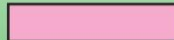
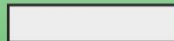
- It's the law – Call 811 before you dig
 - Applies to homeowners, landscapers, contractors
- Call at least 3 days prior to digging
- The local One Call Center will notify utilities
- Utilities will mark areas so you know what is below ground
- Service is free
- Line locators will mark the location of lines

Know the Colors

- Red Flag – Electric
- Orange Flag – Cable or Phone
- Blue Flag – Water
- Green Flag – Sewage
- Yellow Flag – Natural Gas



COLOR CODE FOR UTILITY MARKINGS

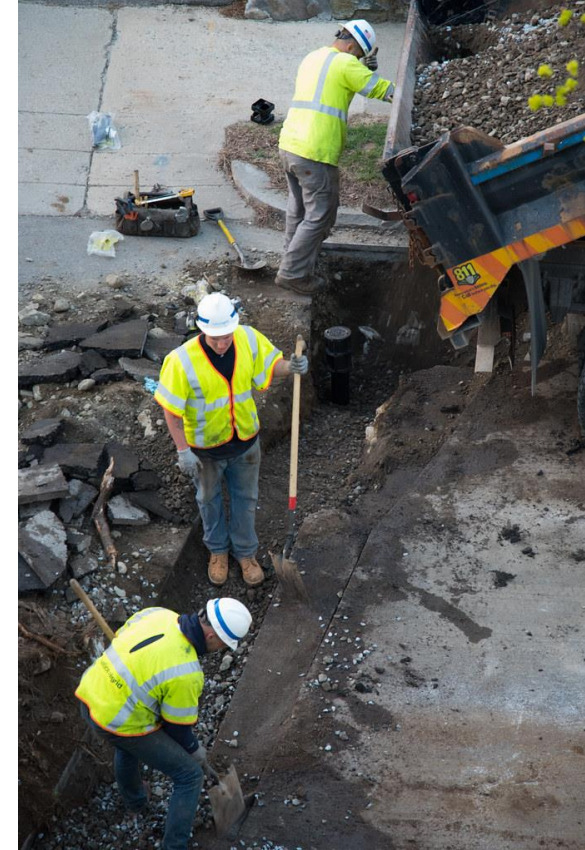
	ELECTRIC
	GAS-OIL-STEAM
	TELEPHONE & CABLE TV
	WATER
	SEWER
	RECLAIMED WATER
	TEMPORARY SURVEY MARKINGS
	PROPOSED CONSTRUCTION

When in Doubt – Check it Out

Pipe Safety

Utility Replacement Programs

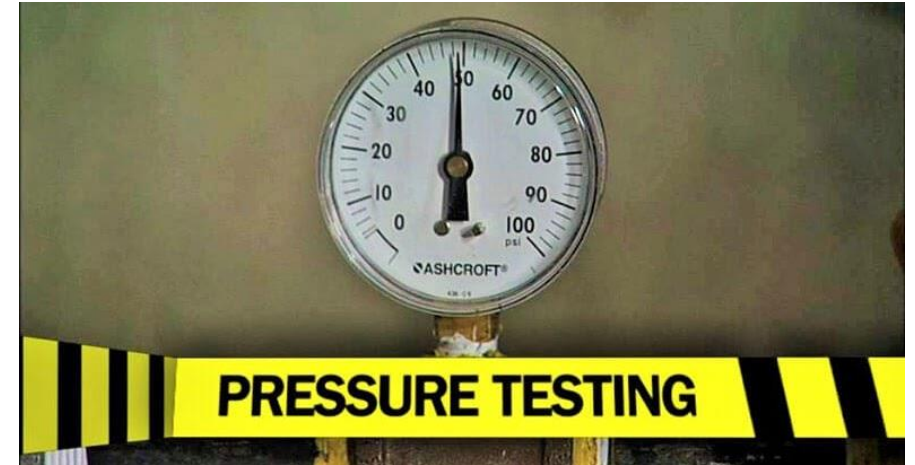
- Utilities routinely perform detailed safety inspections on their pipelines, fittings and connections
- Required system integrity programs to manage Transmission and Distribution systems
 - Elimination of cast iron piping
 - Replacement of all bare steel pipes
 - Maintenance of pressure regulators
 - Quality Assurance monitoring



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Internal Piping Safety

- Perform leak surveys
- Follow installation standards to insure consistency and quality of workmanship
- Use the correct materials and tools for the job
 - Black iron pipe
 - CSST
 - Copper tubing
- Test, Test and Retest of pressure for leaks on new piping.



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Carbon Monoxide

The background of the slide is composed of three distinct geometric regions. The top region is a solid dark blue rectangle. The bottom-left region is a light blue area that tapers towards the left edge. The bottom-right region is a red area that tapers towards the right edge. The boundaries between these regions are smooth, curved lines.

Carbon Monoxide (CO)

- The chemical properties of natural gas make it a clean fuel source
- However, it can be potentially dangerous for consumers if their natural gas appliances are not properly maintained
- One of the dangers of poorly maintained or improperly used appliances is carbon monoxide poisoning – if a faulty furnace does not burn natural gas properly (or is not vented properly) carbon monoxide can begin to build in the home

Carbon Monoxide

- Cannot see, hear, taste or smell CO
- Often called the invisible killer
- Created when fuels (such as gasoline, wood, coal, natural gas, propane, oil, and methane) burn incompletely
- In the home, heating and cooking equipment that burn fuel are potential sources of carbon monoxide
- Vehicles or generators running in an attached garage can also produce dangerous levels of carbon monoxide

Estimated Non-Fire Carbon Monoxide Poisoning Deaths by Associated Fuel-Burning Consumer Product

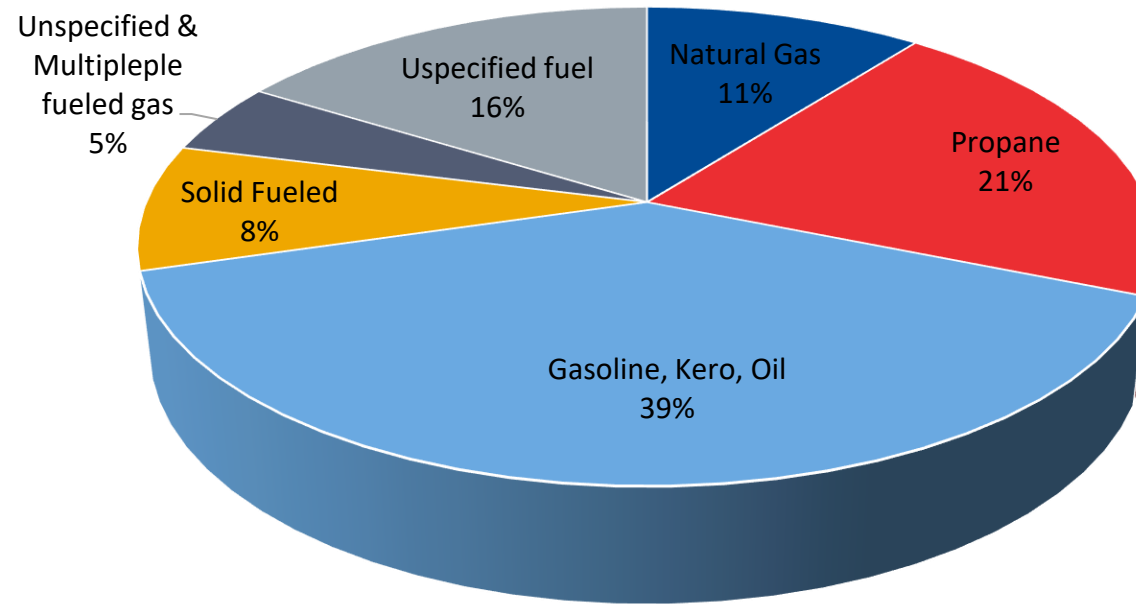
	2009	2010	2011	2012	2013	2014	2105	2016	2017	2018	2019
Total	148	159	163	137	146	164	172	178	188	210	250
All Heating	41	58	49	46	43	64	37	50	41	64	69
Gas Furnaces	10	15	6	15	5	6	6	15	6	21	13
Gas Water Heaters	1	2	4	*	*	*	*	1	4	1	7
Gas Range	2	2	3	*	2	*	3	6	*	2	3
Engine-Driven	76	56	73	64	68	62	92	80	104	100	118

*no data reported

Non-Fire CO Deaths with Consumer Products 2019 Annual Estimates | March 2023 | cpsc.gov
<https://www.cpsc.gov/s3fs-public/NonFireCarbonMonoxideDeathsAssociatedwiththeUseofConsumerProducts2019AnnualEstimates.pdf?VersionId=90WCZoH61aVUrTgDtOo16LLKZf1EeH3E>

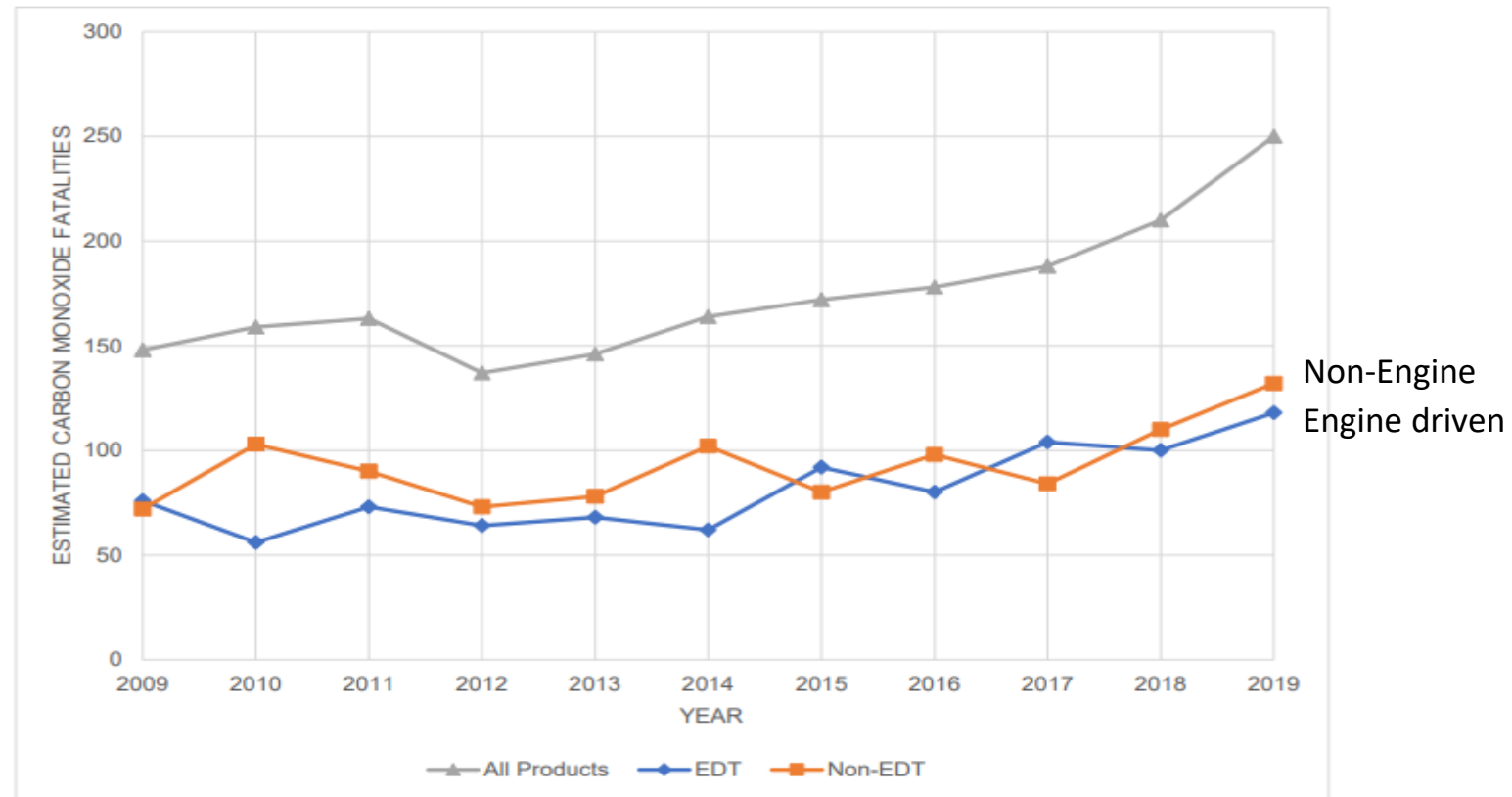
Estimated Non-Fire Carbon Monoxide Poisoning Deaths Associated with Consumer Products by Fuel Type

CO Deaths by Fuel Type



Non-Fire CO Deaths with Consumer Products 2019 Annual Estimates | March 2023 | cpsc.gov for 2019
<https://www.cpsc.gov/s3fs-public/NonFireCarbonMonoxideDeathsAssociatedwiththeUseofConsumerProducts2019AnnualEstimates.pdf?VersionId=90WCZoH61aVUrTgDtOo16LLKZf1EeH3E>

Comparison of Trends in Consumer Product-Related Carbon Monoxide Deaths, 2009 to 2019



Source: U.S. Consumer Product Safety Commission/EPHA.
CPSC Death Certificate File, CPSC Injury or Potential Injury Incident File, CPSC In-Depth Investigation File,
2009–2019.

Carbon Monoxide

- Signs of CO Poisoning (within 1-2 minutes)
 1. Dizziness
 2. Nausea
 3. Headaches
 4. Collapse
- Test your CO Detector monthly



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Carbon Monoxide Safety Tips

- CO alarms should be installed in a central location outside each sleeping area and on every level of the home
- Follow the manufacturer's instructions for placement and mounting height
- Choose a CO alarm that has the label of a recognized testing laboratory
- If the audible trouble signal sounds, check for low batteries.
- Test your CO Detector monthly
- If the CO alarm sounds, immediately move to a fresh air location outdoors or by an open window or door. Make sure everyone inside the home is accounted for. Call for help from a fresh air location and stay there until emergency personnel arrive

Hot Water Safety

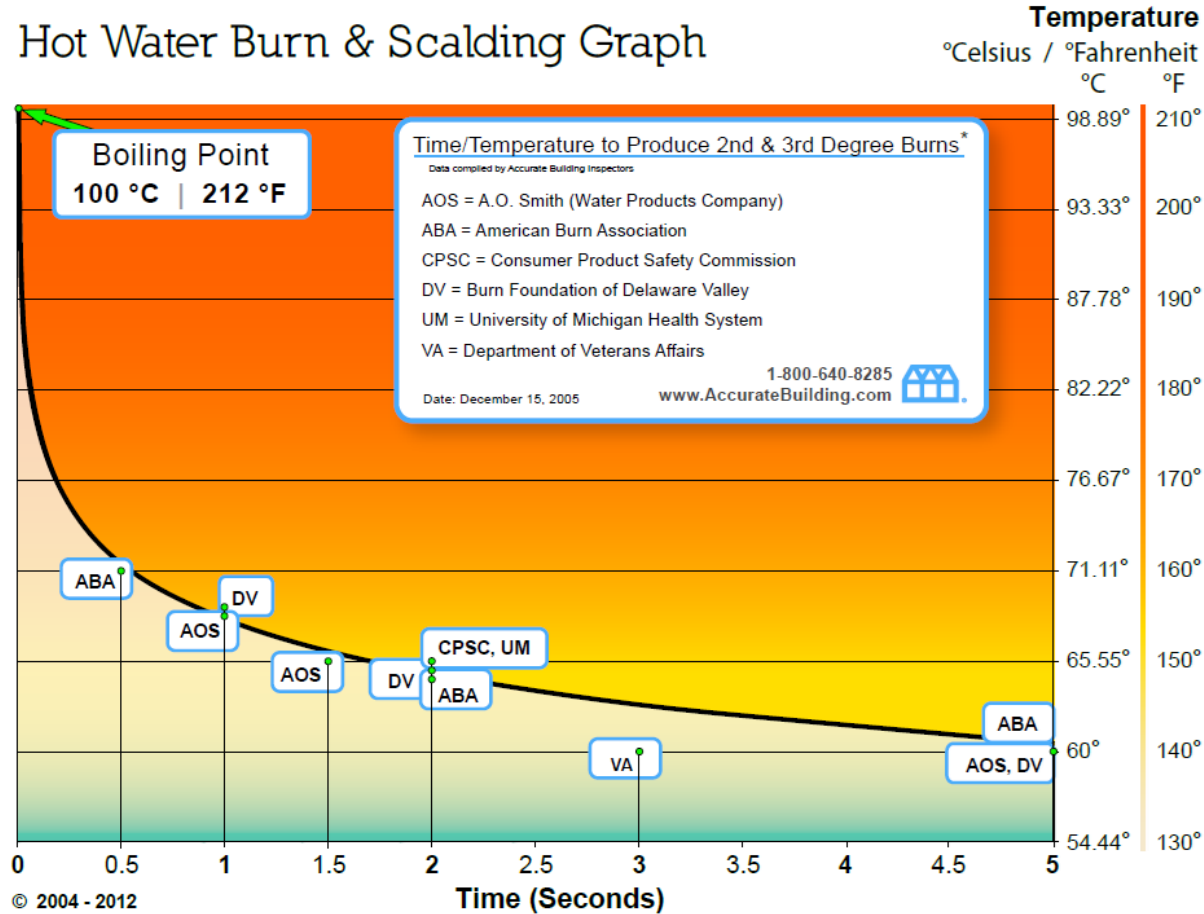
The background of the slide is composed of three main geometric areas. The top area is a solid dark blue rectangle. The bottom area is a large light blue shape that starts from the left edge and extends towards the right, meeting the dark blue area at a diagonal line. On the right side, a red triangular shape points upwards, partially overlapping the dark blue area and the light blue area.

Hot Water Safety

- Make sure your water heater is set to a safe temperature for home use
- Hot liquids can cause life-threatening burn injuries
- Scalds are the number-one cause of burn injury to children under age 4
- Hot tap water accounts for 17% of all childhood scald hospitalizations
- When tap water reaches 140°F, it can cause a third degree (full thickness) burn in just five seconds

<http://www.burnfoundation.org/programs/resource.cfm?c=1&a=3>

Time/Temp to Produce 2nd & 3rd Degree Burns



http://www.accuratebuilding.com/services/legal/charts/hot_water_burn_scalding_graph.html

Set Appropriate Temperatures

- Set per manufacturer recommendations



Remote
Tankless Water Heater
Controller

Emergency Preparedness

The background of the slide is composed of several overlapping geometric shapes. A dark blue shape occupies the top right portion. A large, light blue shape covers the bottom and left portions. A red shape is located on the right side, partially overlapping the dark blue and light blue areas. The text 'Emergency Preparedness' is centered in the dark blue area.

Lightning Safety Tips

- Plan in advance your evacuation and safety measures
- When you first see lightning or hear thunder, activate your emergency plan
- Now is the time to go to a building or a vehicle
- Lightning often precedes rain, so don't wait for the rain to begin before suspending activities

Indoor Safety Tips

- Even though your home is a safe shelter during a lightning storm, you may still be at risk
- About one-third of lightning-strike injuries occur indoors

Indoor Tips

- Here are some tips to keep safe & reduce your risk of being struck by lightning while indoors during a storm
 - **Avoid water** – Don't bathe, shower, wash dishes, or have any other contact with water
 - **Avoid electronic equipment** – Don't use your computers, laptops, game systems, washers, dryers, stoves, or anything connected to an electrical outlet
 - **Avoid windows, doors, porches and concrete** – Lightning can travel through any metal wires or bars in concrete walls or flooring

What to Do if the Lights Go Out

- Don't panic – check to see if neighbors have power
- If you're home is the only one without power, see whether a main fuse is blown or a circuit breaker is tripped – use a flashlight

Will the Gas Appliances Work

- A natural gas, propane or electric heating system will not operate while the power is out
 - Here are a couple tips to follow during an outage:
 - Never use a gas oven or range to heat your home
 - If inadequately ventilated, a kerosene heater or wood burner also can cause deadly carbon monoxide gas
 - Wear layers of clothing and use several layers of blankets

Will the Gas Appliances Work

- Gas ranges with a pilot light will work for cooking during an outage
- A conventional tank style gas water heater will continue to operate and provide hot water to your home
- High efficiency and tankless water heaters require electricity to operate fans and controls so these will not operate during an outage

Natural Gas Standby Generators

Natural Gas Generators

■ Standby Generator Advantages

- Fast, automatic delivery of emergency power, after power failure
- Units conduct self diagnosis every week and display alerts about its status
- Fuel autonomy to provide power for as long as you need it
- Allow you to normally operate your home or business including use of internet, heating and air conditioning, TV, etc.
- They can be sized to turn on your entire house or building or just the critical portion that is most important

Natural Gas Generators (Continued)

■ Standby Generator Advantages

- Automatically disconnects your house or building from the utility lines when power fails – protecting you and your electronic devices from violent power surges, spikes, and brownouts
- When power returns, generator does not transfer to the utility until the voltage has stabilized, protecting from dangerous voltage fluctuation when power is first turned on
- They are permanently installed – no need to run extension cords and set up your unit in the middle of a storm or other natural disaster

Natural Gas Generators (Continued)

■ Standby Generator Advantages

- Safe operation during storms or other disasters
- No need to improvise a backup energy solution during an actual emergency
- Afford you piece of mind by ensuring that your loved ones, and the things important to you are well protected during times of emergencies
- Allow you to remain at home and in familial surroundings during a storm or extended power outage, rather than fleeing to a hotel which may not be available as they too may be out of power, or full

General Safety

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General Safety Tips

- Have all natural gas lines located before making any home renovation
- Keep meter, regulators and exhaust vents clear
- Don't attempt to repair or replace appliances by yourself
- Make sure your appliances carry CSA & UL approvals



Fireplace Safety

- Hot glass and frame take up to 1 hour to cool
- Use a barrier (gate) or screen around stove or fireplace with children
- Put remote control out of reach



Dryer Safety

- Clean your lint trap after every use of the dryer



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Check the Color of the Flame on Your Stove

Wrong



Right



Install a CO Detector

- Follow the recommended installation specifications when installing a CO detector



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Have Chimneys Inspected Annually by a Trained Professional



www.ctsweep.com

Clear Clutter from Around Appliances



Thank You



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400 North Capitol Street, 4th Floor
Washington, DC 20001

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