

Review of U.S. state-level laws in requiring carbon monoxide alarms in residential settings

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Carbon Monoxide Risk Assessment & Management
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CO Poisoning Epidemiology

❑ Mortality & morbidity

- >20,000 emergency department visits annually
- ~4000 hospitalizations
- ~450 deaths

❑ Populations affected

- Non-fatal: Children (<5 years), Females
- Fatal: Elderly (>65 years), Males

❑ **Estimated that accidental, non-fire related poisoning accounts for over \$1.3 billion annually in societal costs** (Hampson, 2016)

CO Poisoning

- ❑ **Most cases occur in residential setting**
- ❑ **Common sources**
 - Home heating and cooking appliances
 - Gas powered equipment
 - Motor vehicles
- ❑ **37% of U.S. households report having a CO alarm**
(2009 National Household Interview Survey)

Public Health Law

- ❑ Law can be an important tool to affect public health outcomes
- ❑ States have powers to enact legislation and promulgate regulations to protect the public health, welfare, and morals, and to promote the common good
- ❑ State laws include
 - Statutes that are adopted by legislature
 - Regulations that are promulgated by executive agencies

CO Alarm Laws

- ❑ **Sometimes adopted in response to CO poisoning events**
- ❑ **CO alarm provision can be adopted as part of**
 - Public health and safety laws
 - Landlord/tenant laws
- ❑ **Through state adoption of large national or international code(s):**
 - International Code Council (ICC) building, residential, and fire codes
 - National Fire Protection Agency (NFPA) codes and standards

International Code Council (ICC)

- ❑ Nonprofit organization that develops comprehensive, coordinated building safety and fire prevention model codes (I-Codes)
- ❑ I-Codes updated every 3 years
- ❑ CO alarm provisions first included in 2009 IRC
- ❑ I-Codes relevant to CO alarms:
 - International Residential Code (IRC)
 - International Building Code (IBC)
 - International Fire Code (IFC)
- ❑ I-Codes must be adopted by state or local governments through statute or regulation



2009 IRC

SECTION R315 – CARBON MONOXIDE ALARMS

**** IRC applies to detached one- and two-family dwellings and townhouses not more than three stories**

- ❑ **R315.1 Carbon monoxide alarms.** For new construction, an approved carbon monoxide alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which fuel-fired appliances are installed and in dwelling units that have attached garages.
- ❑ **R315.2 Where required in existing dwellings.** Where work requiring a permit occurs in existing dwellings that have attached garages or in existing dwellings within which fuel-fired appliances exist, carbon monoxide alarms shall be provided in accordance with Section R315.1.
- ❑ **R315.3 Alarm requirements.** Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance.

Objectives

- ❑ **Describe state-level laws that require CO alarms in residential dwellings**

- ❑ **Assess provisions of CO alarm laws pertaining to public health guidance for CO poisoning prevention**

- ❑ **Longer term objectives:**
 - Identify opportunities to incorporate aspects of public health guidance
 - Decrease variability among CO alarm laws
 - Examine effectiveness of state CO alarm laws in the reduction of CO exposures and poisonings

Methods

- ❑ **CDC attorneys conducted search to identify state laws**
 - WestlawNext database
 - International Code Council (ICC) website
 - Individual state legislative and building code websites

- ❑ **Inclusion criteria**
 - State-level statute or regulation
 - Adopted as of December 31, 2011
 - Address CO alarms in traditional residential dwellings

Methods

❑ Collected important provisions of laws

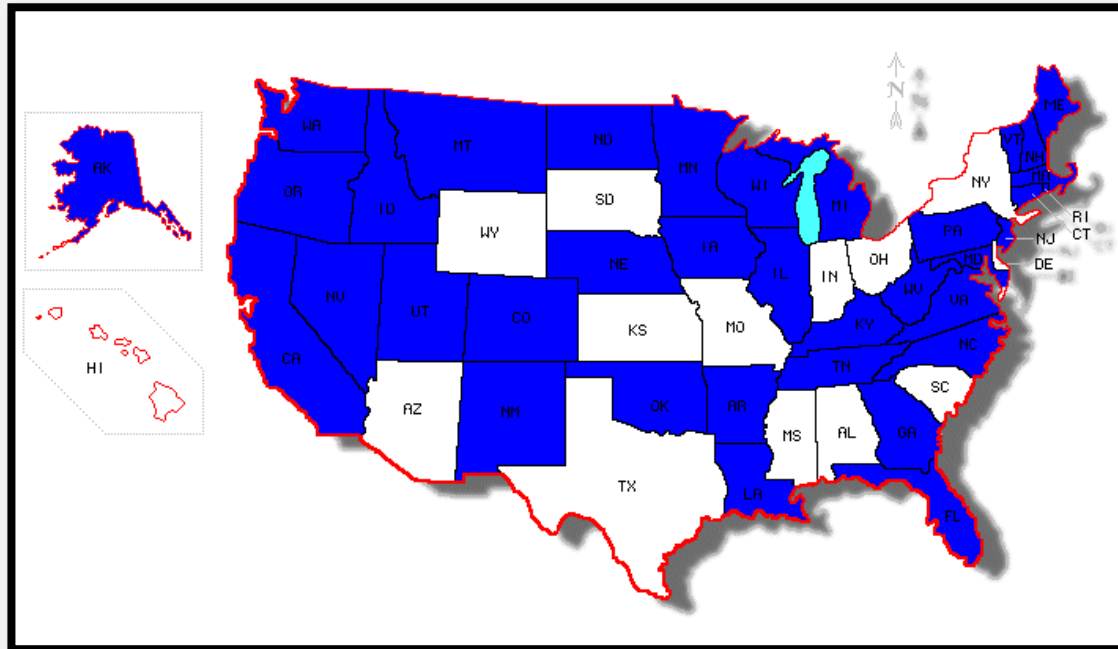
- Applicable building types
- Responsibility for installation and repair
- Alarm type, operation, and installation specifications
- Penalty and compliance issues

❑ Data abstraction

- Two researchers independently abstracted each law and resolved inconsistencies in coding
- Coding reviewed by an attorney for accuracy

Number of CO Alarm Laws

- 71 CO alarm laws identified as of Dec. 31, 2011
- 36 states (72%) have a CO alarm law; range 1-6 laws



Summary of CO Alarm Laws

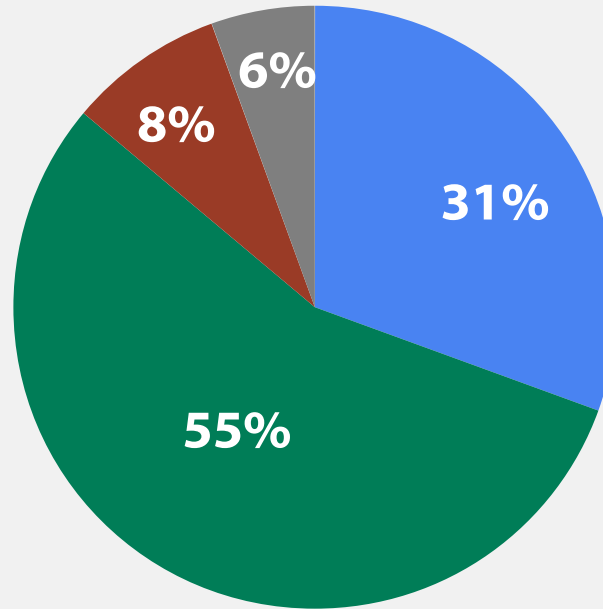
N=71	# of Laws	% of Laws
I-Codes, modified or verbatim	34	48%
Independent State Building Codes	8	11%
Landlord/Tenant laws	7	10%
Public Health or Safety laws	22	31%

N=36	# of States	% of States
I-Code only, verbatim or modified	12	33%
I-Code plus another law	15	42%
Independent State Building or Fire Code only	2	6%
Landlord/Tenant or Public Health or Safety laws only	7	19%

Alarm Requirements by Dwelling Characteristics

Construction Status

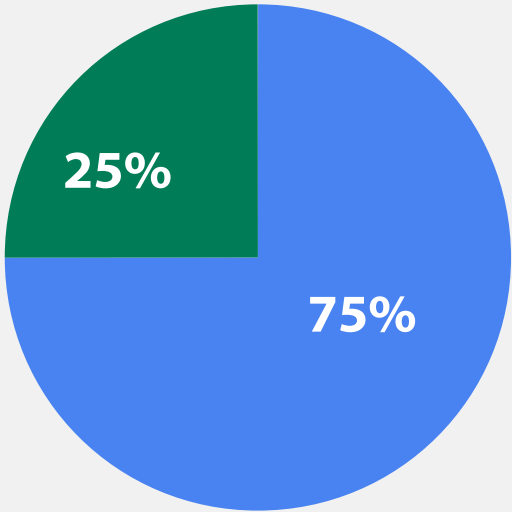
- New construction and existing dwellings
- New construction and renovations with permit
- New construction only
- Rental properties only, new and existing



Alarm Requirements by Dwelling Characteristics

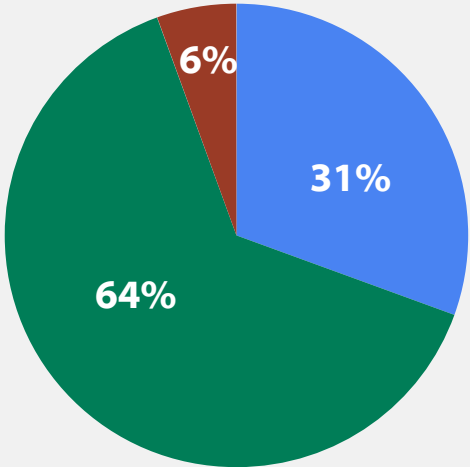
Residence Type

- All residential dwellings
- 1- and 2-family homes, townhomes



Occupancy Status

- Owner- and Renter-occupied
- Owner-occupied only
- Renter-occupied only



CO Alarm Guidance: Provisions

- ❑ **Provisions of public health CO alarm guidance**
 - 92% UL approved
 - 89% Installed outside of sleeping areas
 - 89% In homes with fossil fuel burning appliances
 - 86% In homes with attached garages/parking
 - 28% Operates on battery or has battery backup
- ❑ **7 states included all five provisions**
- ❑ **2 states included zero provisions**
- ❑ **Some state laws included provisions about installing CO alarms near fossil fuel-burning appliances, which is against manufacturer's instructions**

Compliance and Penalty Issues

Provision	# States (n)	%
Installation compliance check	29	80.6
Penalty for not installing	11	30.6
Prohibit tampering or disabling	12	33.3
Penalty for tampering or disabling	8	22.2

Limitations

- ❑ Only used legal resources available in the public domain
- ❑ Did not address how law interpreted and used
- ❑ Understanding content and provisions of law doesn't reflect how it is being used
- ❑ States without state-level CO alarm laws might have local laws

National Council of State Legislators 2016 review



ABOUT US LEGISLATORS & STAFF RESEARCH MEETINGS & TRAINING NCSL IN D.C. MAGAZINE

CARBON MONOXIDE DETECTOR REQUIREMENTS, LAWS AND REGULATIONS

10/27/2016

Note

The information on this page is for reference by state legislators and legislative staff. If you are a homeowner, landlord or tenant with questions about carbon monoxide detector requirements in your area, please contact your state or local housing department.

Carbon monoxide poisoning is a serious public health concern. Over 10,000 are poisoned by carbon monoxide needing medical treatment each year; over 500 people in the U.S. die annually from carbon monoxide poisoning.

With the number of illnesses and death cause by high levels of carbon monoxide in homes and buildings, state legislatures have begun adopting laws mandating the use of carbon monoxide detectors. The use varies, from every enclosed room being required to have detectors, to every room that has a smoke alarm to have a detector, to only day-care centers and group homes needing detectors.

<http://www.ncsl.org/research/environment-and-natural-resources/carbon-monoxide-detectors-state-statutes.aspx>

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[Additional Resources](#)

CONTACTS

[Doug Farquhar](#)

CARBON MONOXIDE DETECTOR STATUTES

STATE	STATUTE	SUMMARY
Alaska	<i>Alaska Stat. § 18.70.095 - Smoke and Carbon Monoxide Detection Devices</i>	Relates to the devices, including carbon monoxide detection devices, required in dwellings; provides that such devices must be installed and maintained in all qualifying dwelling units in the state; provides that smoke detection devices must be of a type and installed in a manner approved by the state fire occupancy. Requires marshal; provides that carbon monoxide detection devices must have an alarm and be installed and maintained according to manufacturers' recommendations; includes rentals.
California	<i>Cal. Health & Safety Code § 13260 to 13263 – Carbon Monoxide Poisoning Prevention Act of 2010</i>	Requires State Fire Marshal to developed approved carbon monoxide device list. Prohibits marketing, distribution or sale of devices not on the approved list.
California	<i>Cal. Health & Safety Code § 17926 to 17926.2 – Regulation of Buildings Used for Human Habitation</i>	Requires the owner of every single family dwelling, hotel and motel dwelling units and all other existing dwelling units intended for human occupancy to maintain a carbon monoxide devise in the unit. A tenant shall be responsible for notifying the owner or owner's agent if the tenant becomes aware of an inoperable or deficient carbon monoxide device within his or her unit.
Colorado	<i>Colo. Rev. Stat. § 38-45-101 to -106 – Carbon Monoxide Alarms</i>	Requires any existing single-family dwelling or dwelling unit of an existing multi-family dwelling offered for sale or transfer on or after a specified date, that has a fuel-burning heater or appliance, a fireplace, or an attached garage to have an operational carbon monoxide alarm installed within a specified distance of each room lawfully used for sleeping purposes; applies a similar requirement on new residential construction.

Next Steps

- ❑ **Update analysis**
- ❑ **More closely examine**
 - Breadth of the law
 - Funding
 - Implementation
 - Enforcement
- ❑ **There may be opportunity to strengthen existing laws and bring them into alignment with public health guidance**

CPSC

U.S. Consumer Product Safety Commission (CPSC)

- **November 2, 2016: voted to approve a notice of proposed rulemaking (NPR) to address the CO poisoning hazard associated with portable generators**
- **Proposed rule: Require portable generators powered by handheld spark-ignition (SI) engines and**
 - Class I SI engines must not exceed a weighted CO emission rate of 75 g/hr
 - Class II SI engines must not exceed weighted CO emission rate of 150 g/h
 - Class II SI engines with two cylinders must not exceed weighted emission rate of 300g/h

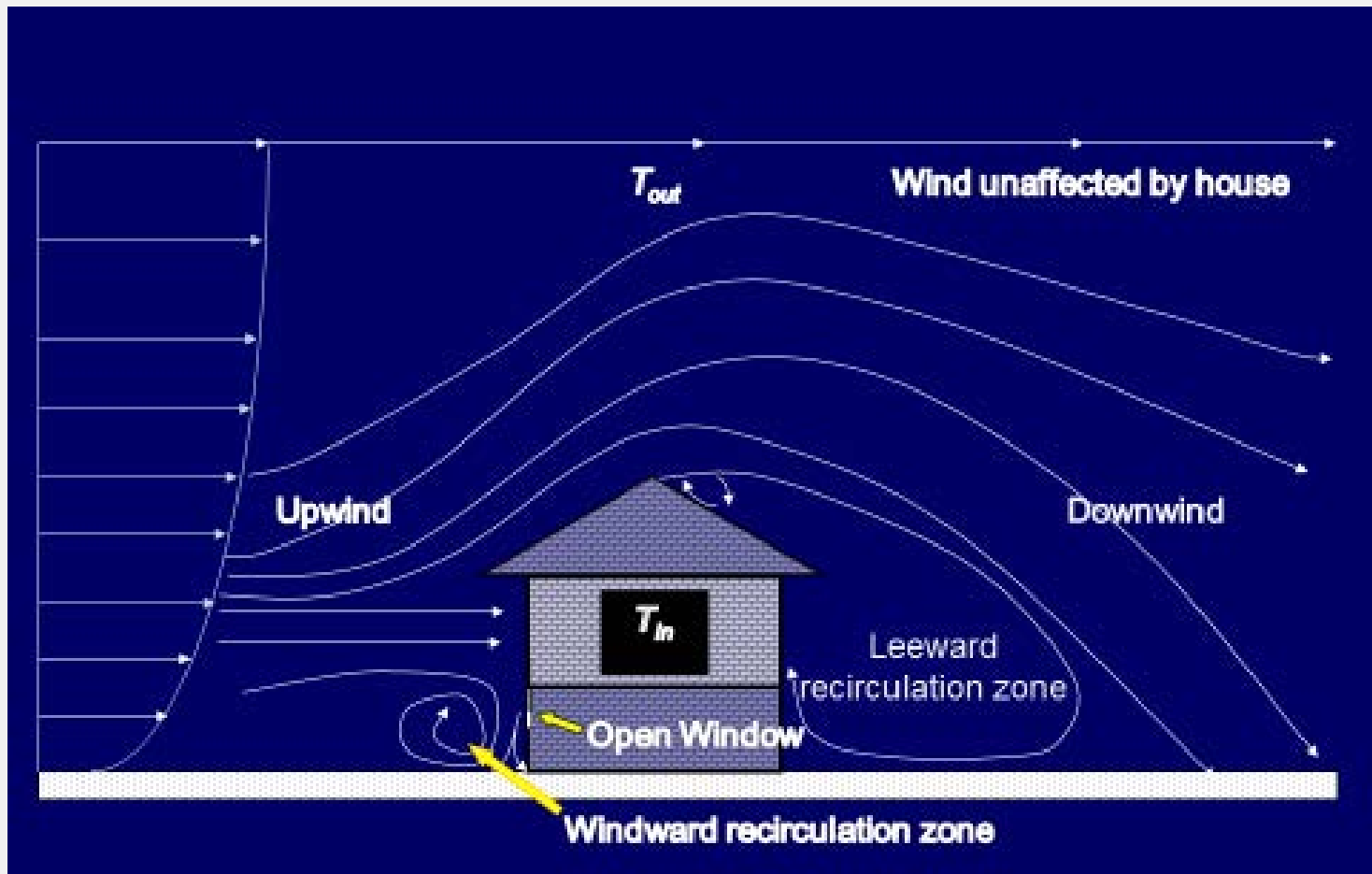
COLLABORATION WITH NIST

Existing Guidance on Generator Operation

- **3–4 ft of clear space on all sides and above generator to ensure adequate ventilation (OSHA 2005; FEMA 2006)**
- **Do not use a generator “within 10 feet of windows, doors or other air intakes” (EPA 2005)**
- **Manufacturers advise not to locate generators indoors or in an enclosed area, but do not provide specific guidance on a safe distance for operation**

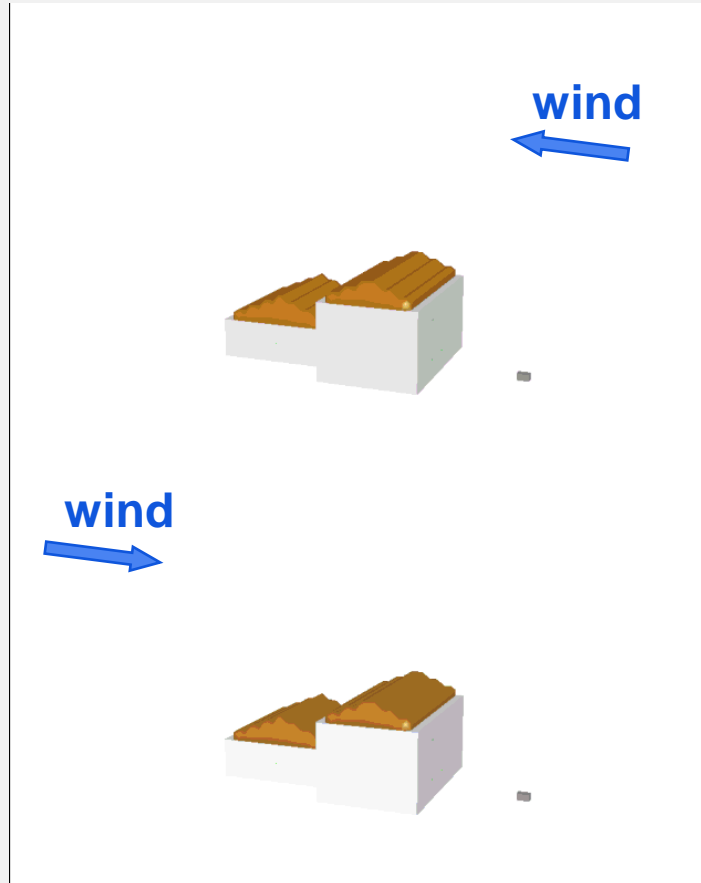
National Institutes of Standards and Technology (NIST)

- **Model indoor CO concentrations from operation of a portable generator outside the house under various conditions**
 - **Used computational fluid dynamics (CFD) to simulate airflow and CO movement outside of house**
 - **Used multizone indoor air quality model (CONTAM) to simulate CO inside house**



Sample CFD Results: Wind Direction

- Generator placed 15 ft away
- Exhaust towards house
- Wind speed 5 m/s

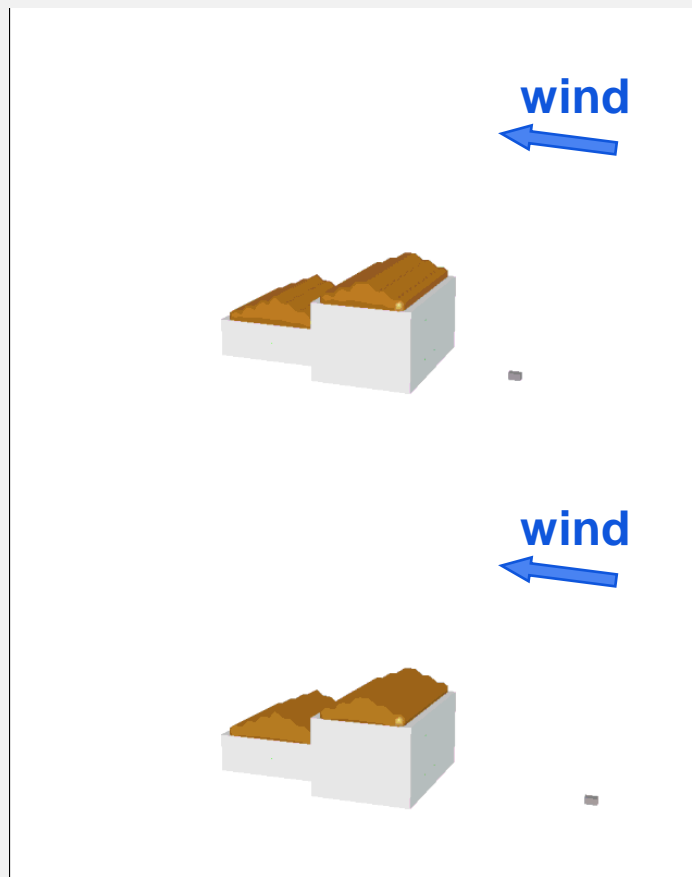


Generator
upwind

Generator
downwind

Sample CFD Results: Upwind Placement

- Exhaust away from house
- Wind speed 5 m/s



15 ft

30 ft



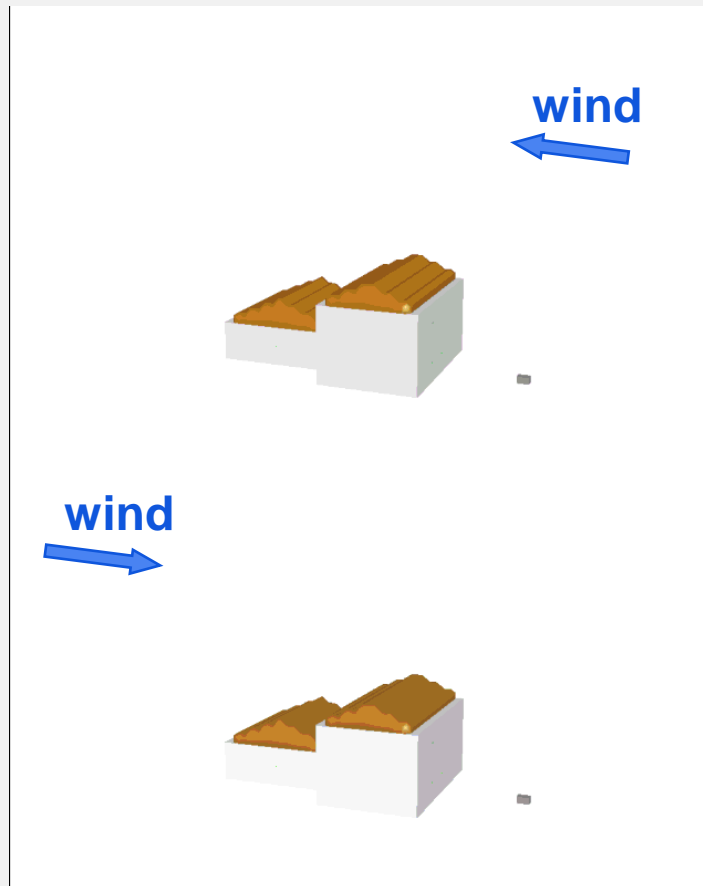
Sample CFD Results: Downwind Placement

- Exhaust away from house
- Wind speed 5 m/s



Sample CFD Results: Wind Direction

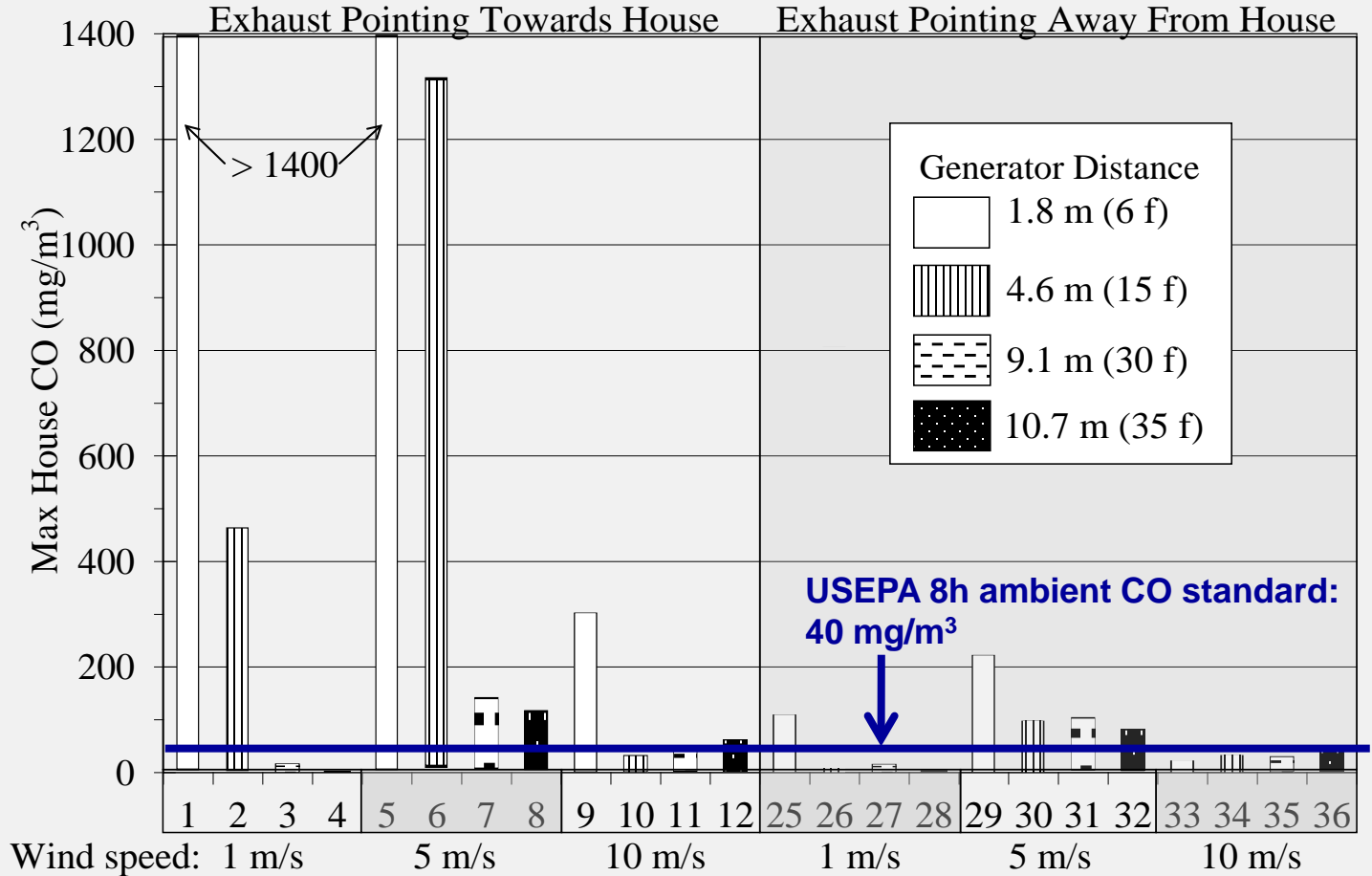
- Generator placed 15 ft away
- Exhaust towards house
- Wind speed 5 m/s



Generator
upwind

Generator
downwind

Indoor CO Concentrations



Summary

- **Generator positioned 15 feet away from open window may not be far enough to limit CO entry into the house**
- **Generator exhaust temperature and speed can significantly affect CO levels near house**
- **Generator placement downwind of the house reduced indoor CO levels in comparison to upwind placement**
- **Generator exhaust pointing away from the house always results in lower CO levels both outdoors and indoors**
- **Generator positioned >25–30 feet with exhaust pointing away from house significantly reduced CO levels indoors**

Thank you

www.cdc.gov/co



For more information, contact NCEH/ATSDR
1-800-CDC-INFO (232-4636)

TTY: 1-888-232-6348 www.atsdr.cdc.gov www.cdc.gov

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