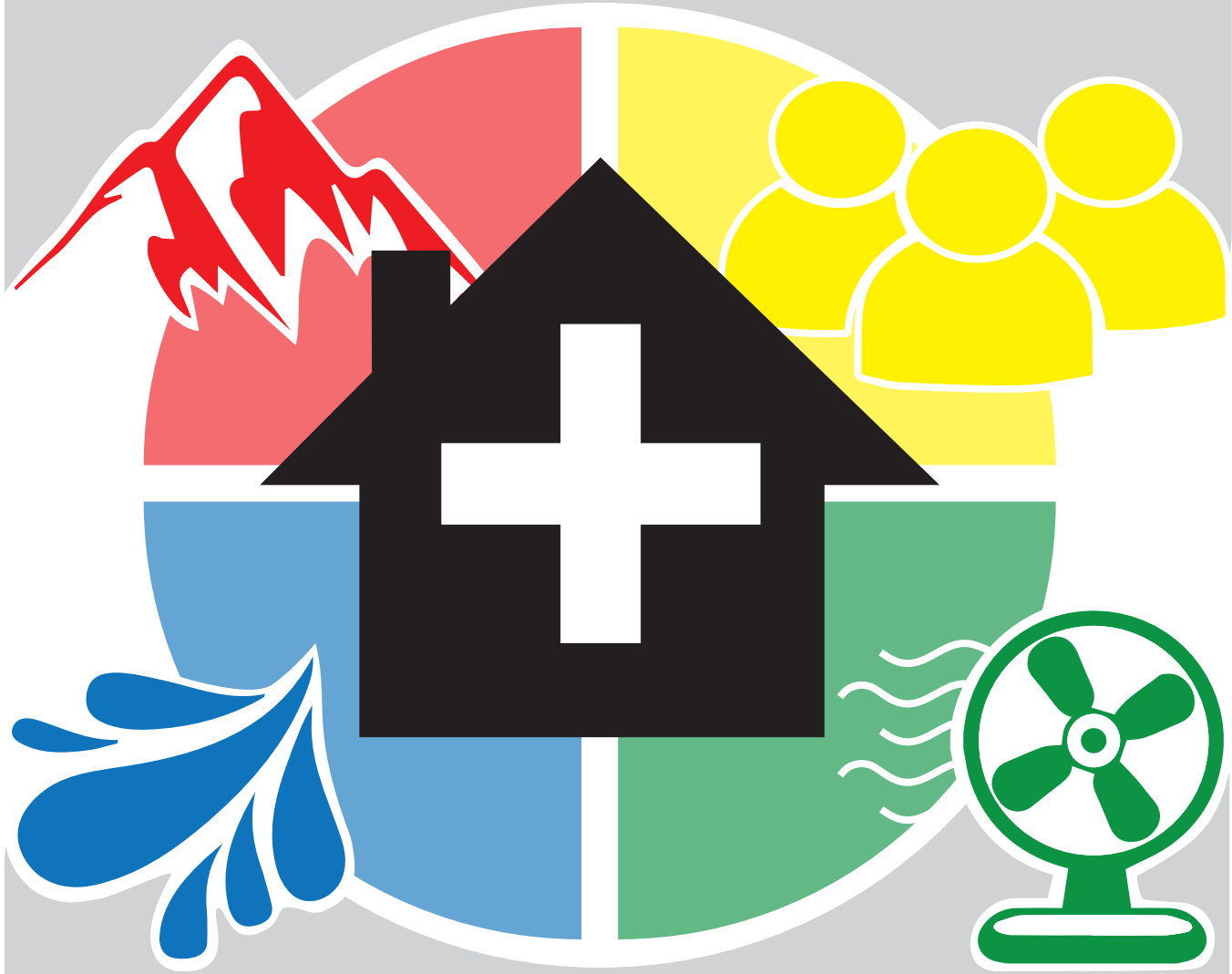
HEALTH & SAFETY CONSIDERATIONS



IN NEW CONSTRUCTION

Prepared March 2022 by:

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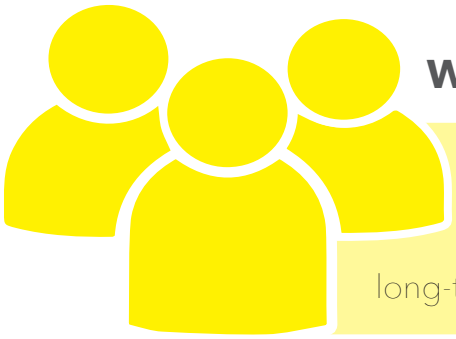
HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

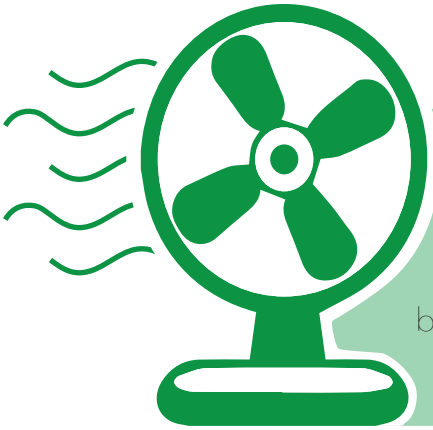
SITE AND MATERIAL SPECIFICS

The harsh environmental conditions of Alaska can make it extremely difficult to build safe and healthy homes. Alaska's environment can thrash otherwise durable structures, create hazardous living conditions, and introduce harmful substances into the living environment. It is important to integrate the many environmental factors, limitations, and assets of the site into the design and construction of the home to ensure that it will be safe and healthy over its lifetime. As climate change continues to progress, it is especially critical to consider the impacts that rapidly changing site conditions will have on indoor environments.



WORKING WITH COMMUNITIES

Over its history, rural Alaska communities have been subjected to housing designs that do not adequately support unique local cultures and lifestyles. Collaborating with communities and homeowners during the design and construction processes improves the likelihood that resulting homes can support the long-term health, safety, comfort, and contentment of occupants.



INDOOR AIR QUALITY

Respiratory illness is arguably the leading health challenge for Alaska Native children. Illnesses such as pneumonia and respiratory syncytial virus account for approximately two-thirds of child hospitalizations in rural Alaska. In one region about 1 in 4 infants are hospitalized ever year for these illnesses. Early results from an ANTHC study of eight participating communities in southwest Alaska suggest that these illnesses can be prevented through simple home designs and/or modifications. Climate change is also expected to be a driver of poor indoor air quality in many communities, as it is projected to increase ambient moisture levels, increase summer temperatures, and increase the frequency of smoke and wildfire events.

WATER & SEWER SYSTEMS

Infants in locations with limited water service have five times more hospitalizations for respiratory infection and 11 times more hospitalizations for pneumonia than the overall U.S. population. Access to clean and abundant water and safe sanitation improves health as a preventative measure to reduce hospitalizations related to respiratory and skin infections, especially amongst youth and Elders. Having in-home water and sewer makes hand washing and healthy hygiene practices easier, which have been shown to reduce illness overall.

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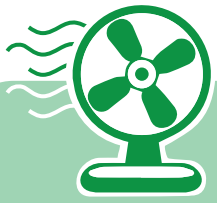
SITE AND MATERIAL SPECIFICS

WORKING WITH COMMUNITIES



INDOOR AIR QUALITY

WATER & SEWER SYSTEMS

WHO TO ENGAGE IN THE DESIGN PROCESS

SITE AND MATERIAL SPECIFICS

- Community Representatives
- Structural Engineer
- Specification Writer

WORKING WITH COMMUNITIES

- Community Representatives
- Certified Aging In Place Specialist (CAPS)
- Regional Tribal Health Organization

INDOOR AIR QUALITY

- Community Representatives
- Mechanical Engineer
- Specification Writer

WATER & SEWER SYSTEMS

- Community Representatives
- Plumbing Specialist
- Alaska Native Tribal Health Consortium
- Alaska DEC; Division of Water; Village Safe Water

TESTS / INSPECTIONS / REPORTS TO REQUEST

SITE AND MATERIAL SPECIFICS

- Climate Change & Environmental Projections
- Radon Testing
- Geotechnical Survey

WORKING WITH COMMUNITIES

- Inventory of Community & Elder Design Preferences and Needs

INDOOR AIR QUALITY

- Combustion Safety Test
- AHFC PUR-101 & AHFC PUR-102
- Ventilation System Balancing

WATER & SEWER SYSTEMS

- Inventory of Community Water/Sewer Infrastructure

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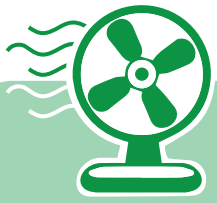
SITE AND MATERIAL SPECIFICS

WORKING WITH COMMUNITIES



INDOOR AIR QUALITY

WATER & SEWER SYSTEMS

HEALTH & SAFETY TOPICS

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

RADON GAS

RELEVANCE TO ALASKAN CONSTRUCTION

Radon is a cancer-causing radioactive gas that occurs naturally in certain types of soils and rock formations. Because it is tasteless, colorless, and odorless, it is virtually impossible to detect without testing for it directly.

HEALTH & SAFETY IMPACTS

Occupants living in homes built over radon-containing soils are at risk of prolonged radon exposure, which poses serious risks to occupant health. After smoking, radon is #2 cause of lung cancer in US, and the #1 cause of lung cancer among non-smokers.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

RADON GAS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Conduct pre-emptive radon testing on proposed sites, and provide reports to designers and contractors.
- If radon is detected, require specific mitigation inverventions be implemented into new housing design and during construction.

DESIGNERS

- Incorporate radon-mitigation interventions into foundation design. This may include choosing a raised foundation design, air-sealing of crawlspaces and basements, active radon-specific ventilation designed for crawlspaces, slabs, and basements.

CONTRACTORS

- Pay close attention to air sealing details in crawlspaces and basements.
- Work with ventilation professionals if necessary to ensure the radon mitigation system can be installed to function effectively.

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HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

PERMAFROST AND UNSTABLE GROUND MOVEMENT

RELEVANCE TO ALASKAN CONSTRUCTION

Permafrost is defined as ground that has been continuously frozen for 2 or more years. Permafrost can occur in any type of soil: gravel, sand, clay, silt, etc. Clay- and silt-rich permafrost types hold the highest amounts of water, and are most at risk of collapsing if the permafrost thaws and the stored water drains away. Water released from thawing permafrost can also pool underground, which can lead to frost heaves at the surface as the pooling water freezes seasonally (this process is referred to as ice lensing). If the soils remain frozen, ice-rich permafrost is generally considered stable enough to build upon. However, if ice-rich permafrost thaws or heaves, it can cause significant damage to structures built upon it.

Permafrost thaw, frost heaves, coastal erosion, and soil saturation/flooding all can create unstable ground conditions, and cause significant ground movement. The frequency and intensity of these events are projected to increase as climate change progresses, which will create worsening unstable ground conditions in affected areas.

HEALTH & SAFETY IMPACTS

Differential settling caused by permafrost thaw, frost heaves, coastal erosion, and other ground-destabilizing conditions can cause structural separations within the house, or cause plumbing and electrical connections to shift, sever, or otherwise fail. Home damage caused by permafrost may lead to lost access to water/wastewater, electrical hazards, gas leaks, heating system combustion safety problems, or dangerous structural failures.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

PERMAFROST AND UNSTABLE GROUND MOVEMENT

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Conduct geotechnical surveys and/or core drilling samples of proposed sites, and provide reports to designers and contractors.
- If permafrost exists on site and/or where substantial ground movement is expected over the lifetime of the building, request that adjustable and/or relocate-able foundations, ground stabilization techniques, flexible service connections, water diversion and management techniques, and appropriate site grading be explored and incorporated.
- Require that a structural engineer with a license to practice in Alaska be contracted during the design process to develop a stamped set of structural foundation plans.

DESIGNERS

- Consult geotechnical reports for the proposed site during the pre-design process.
- Work with a structural engineer to develop an appropriate foundation design.
- Specify that entry stairways be fastened to the structure using a hinged connection to accommodate differential settling.
- Specify that flexible service connections be used to connect interior systems to exterior systems (water and sewer service connections, electrical conduit, fuel lines, etc.).
- Where substantial ground movement is expected over the lifetime of the building, choose a foundation type that can accommodate differential settling over the lifetime of the structure. This may include adjustable leveling features, or the ability to move the structure entirely (or both).
- In the foundation design, minimize the number of load-bearing pads and carrying beams (2 is ideal for homes) to minimizes stresses imparted on the structure should differential settling occur.
- Design floor assemblies to be as rigid as possible to resist damage due to differential settling. Incorporate methods for homeowners to monitor any differential settling that may occur with their foundation. Incorporate water management strategies to divert water away from the structure, such as gutters, downspouts and kickouts, and site grading.

CONTRACTORS

- Consult geotechnical reports for the proposed site during the construction process.
- Ensure that flexible service connections are used to connect interior systems to exterior systems (water and sewer service connections, electrical conduit, fuel lines, etc.).
- Observe how water moves on site, and re-grade as necessary to divert water away from structure.
- If included, ensure that gutters, downspouts, and kickouts are installed correctly and are able to discharge water as far away from the structure as possible.

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HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

MATERIAL CHOICE

RELEVANCE TO ALASKAN CONSTRUCTION

Choosing the right materials for the project can be one of the most important considerations when building in Alaska. Often times, material "appropriateness" differs dramatically depending on where the home will be built. Climate, shipping logistics, affordability, material availability, indoor air quality, and local interest should all be factored into material choice.

HEALTH & SAFETY IMPACTS

Climate-inappropriate material choices most often affect the durability of a structure, but in severe cases can lead to structural failures, mold growth, and introduce Volatile Organic Compounds (VOCs) into the living environment.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

MATERIAL CHOICE

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a specification writer be contracted with during the design process.
- Provide the specification writers and designers with a description of the health and safety material considerations to be included. Examples of health and safety-related material specifications include: "mold-resistant", "VOC-free", plywood instead of Oriented Strand Board (OSB) for long-term moisture durability, etc.

DESIGNERS

- Select materials that are commonly used and readily available within the community, particularly for items that require periodic replacement. Also consider the high costs of living that many rural Alaska residents experience, and incorporate materials and systems that are economical to operate and maintain.
- Work with a specification writer to develop material specifications that support occupant health, long-term operation and maintenance affordability, and building durability.
- Consult manufacturer data sheets, UL, Greenguard, Living Building Challenge (LBC), Living Future Institute (LFI) Red List, etc. during the design process to ensure that desired materials do not include material additives or properties that may be harmful to human health.

CONTRACTORS

- If submitting a material substitution during procurement, ensure that substituted options offer equivalent or better health and safety-related specifications.
- During construction, ensure that materials are stored properly to avoid water damage or weather exposure.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

INCLEMENT WEATHER AND NATURAL DISASTERS

RELEVANCE TO ALASKAN CONSTRUCTION

Floods, earthquakes, erosion, fires, storms, and other extreme events occur frequently within Alaska, and have the potential to severely damage or destroy housing.

HEALTH & SAFETY IMPACTS

Increased snow and wind loading during storm events can cause severe damage to a homes exterior and possibly lead to structural failures. Floods and wind driven rain can cause bulk water intrusion, creating ideal conditions for mold growth. Earthquakes and erosion can cause severe structural damage to homes. Wildfire smoke negatively impacts indoor air quality. In extreme cases, any of these events can result in total housing losses.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

INCLEMENT WEATHER AND NATURAL DISASTERS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Work with community liaisons to collect natural disaster information for the local area.
- Provide designers and contractors with any and all relevant natural disaster data for the proposed site. This may include historic flood lines, wildfire maps, earthquake history, annual precipitation projections, design wind speeds, climate change projections for the area (ie: increased landslides, erosion, wildfire susceptibility, etc.).

DESIGNERS

- Consult relevant natural disaster data and climate change projections (changes in snow load, wind load, flooding events, etc.) for the proposed site.
- Follow relevant code requirements outlined by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).
- Work with members of the community to design homes for local climate conditions, both present and projected. Most communities can provide design best practice information regarding home orientation, raised vs. pad foundation options, snow load and precipitation, etc.

  Example design interventions include: snow stops for roofs, entryways that do not face the prevailing wind direction, raised and adjustable foundations (or foundations that can be moved), increasing exterior wall fire ratings, water management features (such as gutters, downspouts, and kickouts), and increasing safety factors on structural connections and indoor air filtration and cooling systems (e.g. fans).

CONTRACTORS

- Consult relevant natural disaster data and climate change projections (changes in snow load, wind load, flooding events, etc.) for the proposed site.
- Follow relevant code requirements outlined by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

RURAL CONDITIONS AWARENESS

RELEVANCE TO ALASKAN CONSTRUCTION

A majority of Alaska communities are unconnected to the contiguous road system, and have populations less than 2,500 people. Economic opportunities available in such communites are considerably different and typically more limited compared to more urban areas. Generally, the availability of advanced technologies and associated specialists is limited.

HEALTH & SAFETY IMPACTS

In smaller rural communities, it can be uncommon to find specialized tradesworkers that are employed year-round. Furthermore, it can be prohibitively expensive and logistically challenging to hire a specialist temporarily. This often means that any specialized technologies introduced into these communities will be difficult to maintain, repair, or replace if issues arise. If these technologies are designed to support occupant health and safety, their loss can have severe consequences if failures occur.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

RURAL CONDITIONS AWARENESS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Provide designers and contractors with any and all relevant logistical data for the proposed site.
- Advocate for the use of local labor when possible. If direct project funding is unavailable for this purpose, assist contractors and designers in identifying alternative funding streams that can provide compensation for local labor.
- Work with community consultants to catalogue any and all relevant site logistical data.

  This may include cataloging all available heavy construction equipment, developing a list of local contacts and resources, gathering renewable energy resource data, recording seasonal subsistence schedules, evaluating local labor capacity (availability of specialists, tradesments, technicians, installers, laborers, etc.), cataloguing freight, cargo, and transportation service providers, identifying all local governing bodies, etc.

DESIGNERS

- To the extent possible, seek to employ and work with members of the community to ensure that designed homes can be constructed economically and effectively under the local logistical parameters.
- Consult relevant site logistical data.
- Most communities can provide best practice information regarding ideal construction schedules, shipping methods to and from site, appliance brands that are well-known to community members and easy to source parts for, local labor capacities, etc.

CONTRACTORS

- To the extent possible, seek to employ local laborers, technicians, specialists, consultants, and tradesmen during construction.
- Work with community consultants to ensure that the construction of the home is conducted with a consciousness of local logistical constraints.
- Look for partnership opportunities with communites to provide labor force on-the-job trainings.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

CULTURAL CONDITIONS AWARENESS

RELEVANCE TO ALASKAN CONSTRUCTION

Alaska is home to 11 distinct Alaska Native indigenous cultures. Inupiaq and St. Lawrence Island Yupik groups live in North and Northwest Alaska. Athabascan peoples live in Interior Alaska. Yup'ik and Cup'ik groups live in Southwest Alaska. Alutiiq and Unangax groups live on the Aleutian Chain and in Southcentral Alaska. Eyak, Tlingit, Haida, and Tsimshian groups live in Southeast Alaska. Languages, histories, subsistence activities, artwork, lifestyles, and cultures between these groups are diverse and distinct.

HEALTH & SAFETY IMPACTS

It is critical that the unique community cultures be meaningfully integrated during all stages of housing design and construction. Not doing so can impact the effectiveness of the home in supporting occupant quality of life, health, and safety.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

CULTURAL CONDITIONS AWARENESS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Include a community engagement process during the design phase, and require that community consultants be hired to participate in the design process. If direct project funding is unavailable for this purpose, assist contractors and designers in identifying alternative funding streams that can provide compensation for community consultants.
- Work with community consultants to identify the variety of cultural conditions and lifestyles within the community, and how such information intersects with housing design and construction.

DESIGNERS

- Conduct a design charrette with members of the community to determine the locally specific set of housing needs, desires, preferences, and dislikes.
- Collaborate and consult with community consultants consistently throughout the design development process.
- Consult local cultural and lifestyle information early and often during the design process.
- Consider subdivision layouts, housing orientations, and designs that compliment the local environment, take advantage of limited daylight, and are properly oriented for protection from wind and drifting snow.

CONTRACTORS

- Work with community consultants to ensure that the construction of the home is conducted with a consciousness of local cultural and lifestyle constraints. Emphasis on local hires wherever possible.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

AGING IN PLACE

RELEVANCE TO ALASKAN CONSTRUCTION

Alaska's population of Elders is set to double by 2030, at which time Elders are expected to comprise 17% of the total population. There currently exists a major shortage in Alaska of affordable housing facilities that can accommodate Elder needs. This housing need is especially felt in rural Alaskan communities, where Elders are frequently required to either live in unsafe and unhealthy environments, or else relocate to an urban hub away from their communities and families in order to access specialized care and appropriate facilities.

HEALTH & SAFETY IMPACTS

Inadequate santitation, fall hazards, difficult-to-control indoor climate conditions, and otherwise antagonistic features of a home make it difficult to impossible for elders to "Age in Place" safely. Moving Elders away from their families and homes and into assisted living facilities can be culturally and emotionally damaging, which can negatively impact mental health.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

AGING IN PLACE

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Request that designs be developed under Universal Design Guidelines. Universal Design refers to the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. It is considered to be a highly equitable design framework that can adequately accommodates Aging in Place.
- Consider requiring that a Certified Aging in Place Specialist (CAPs) be consulted with during the design process.
- Depending on the funding source and project type, it may also be necessary to require compliance with accessibility requirements as outlined by the Americans with Disabilities Act (ADA) Standards for Accessible Design (SAD), International Code Council (ICC) / American National Standards Institute (ANSI) (Section A117.1: "Accessible and Usable"), and/or the Fair Housing Accessibility Guidelines (FHAG).

DESIGNERS

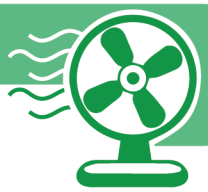
- In many cases it may be beneficial to all parties to bring the client, the designer, and builder to the table during the design stage to ensure the best possible project outcome. Both the client and the builder may be able to provide valuable design and construction information that will help make the project a success and within budget.
- Integrate principles of Universal Design at all stages of the design development process.
- Work with a Certified Aging in Place Specialist (CAPs) and community liaisons during the design process to ensure that designs can accommodate Elder needs.
- Where applicable, consult and comply with the Uniform Federal Accessibility Standards (UFAS), the Americans with Disabilities Act (ADA) Standards for Accessible Design (SAD), International Code Council (ICC) / American National Standards Institute (ANSI) (Section A117.1: "Accessible and Usable"), and/or the Fair Housing Accessibility Guidelines (FHAG).

CONTRACTORS

- Consult with a Certified Aging in Place Specialist (CAPs) to ensure that Universal Design features are properly detailed, prepared for, installed correctly, and inspected.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

VENTILATION



RELEVANCE TO ALASKAN CONSTRUCTION

Proper ventilation is a critical component of a healthy home, especially in Alaska, where many homes face overcrowding, extreme cold temperatures (and in some cases, extreme heat), lack of adequate air filtration and conditioning systems, and generally poor ambient air quality.

Ventilation systems may be categorized as mechanical or passive, and balanced or unbalanced. MECHANICAL forms of ventilation are those that consume energy during operation. Common forms of mechanical ventilation include HRVs/ERVs, range hood exhaust fans, bathroom exhaust fans, and fresh air supply fans. PASSIVE forms of ventilation are those that do not require energy input to function. In Alaska, common forms of passive ventilation include Fresh 80s/100s, makeup air vents, or the simple opening of doors and windows. A BALANCED ventilation system is designed to intake fresh air at the same rate that stale air is being exhausted. HRVs/ERVs and Fresh 80s/100s are examples of balanced systems. An UNBALANCED ventilation system either intakes more air than it exhausts, or exhausts more air than it intakes. A home witih a bathroom exhaust fan only is an example of an unbalanced system.

Heat Recovery Ventilators (HRVs) are balanced mechanical ventilation appliances that deliver fresh air to the indoors while exhausting stale air to the outdoors. Before stale air is exhausted, the HRV extracts some of its heat and applies it to the incoming fresh air stream. In addition to transfering heat energy between air streams, an Energy Recovery Ventilator (ERV) also removes some moisture from exhaust air and applies it to the incoming fresh air stream.HRVs and ERVs are currently considered to be one of the most effective methods of ensuring healthy indoor air, but can be rendered ineffective if not properly designed, installed, or maintained.

HEALTH & SAFETY IMPACTS

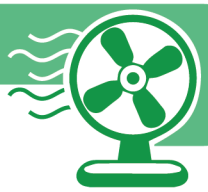
Proper ventilation is a critical component of a healthy home. Without proper ventilation, moisture and pollutants can accumulate in the indoor air, and create health and safety hazards for occupants. Alaska's high rates of respiratory illness, especially in rural areas, can be attributed to poor indoor air quality due to a lack of adequate ventilation in homes in buildings.

Severe winter temperatures, power outages, high energy costs, and lack of technical specialists in rural communities can all contribute to the loss or disabling of ventilation systems (especially mechanical ventilation systems such as HRVs and ERVs). When ventilation systems break or are intentionally disabled, indoor air quality suffers and can negatively affect occupant health. Occupant education is important to acceptance and proper use of ventilation equipment.

Unbalanced ventilation systems can create undesirable positive or negative indoor pressure conditions. Under positive pressure conditions, indoor air (which carries moisture) can be forced into floor, wall, and roof cavities, where it may condense and cause mold growth. Under negative pressure conditions, outdoor air can be forced inside via heating appliance exhaust flues, which can bring harmful pollutants and deadly carbon monoxide into the living environment. Indoor air quality and occupant safety can suffer as a result of either positive or negative pressure conditions.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

VENTILATION



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a mechanical engineer with a license to practice in Alaska be contracted with during the design process to develop a stamped set of mechanical plans.
- Require that a specification writer be contracted with during the design process.
- Require that woodstoves chosen for design include a dedicated outdoor air duct (sometimes referred to as an outdoor air kit).
- Require a combustion safety test to ensure that the heating systems will operate safely.
- Require pass/fail testing of the systems at commissioning to help ensure that the systems are installed correctly during construction.
- Consider ways to increase occupant awareness, education, and 'buy in' into the operation and maintenance of the mechanical systems.
- Advocate for the inclusion of a community-appropriate HRV/ERV-based ventilation system that is balanced with an appropriately sized passive make-up air system (to accommodate the bathroom exhaust fan, range hood, and dryer).
- Consider requiring that the home be designed to meet or exceed a 5-Star rating, as outlined by the AHFC Building Energy Efficiency Standard (BEES). This would include the commissioning of PUR-101 and PUR-102 inspections of the home.

DESIGNERS

- Work with a mechanical engineer and the community to design mechanical ventilation, cooling, and/or filtration systems that can be maintained by the community, with spare parts and filters available locally, resulting in an appropriately sized balanced system that allows for passive make-up air to dryers, kitchen and toilet exhausts while ensuring the home meets ASHRAE standards for space comfort.
- Provide permanently mounted monitor displaying temperature, humidity, VOCs and CO2 with recommended ranges so the homeowner can make informed decisions on ventilation.
- Avoid designing ventilation system designs that are exhaust-only, or otherwise unbalanced.
- Work with a specification writer to ensure that woodstoves chosen include a dedicated outdoor air duct (sometimes referred to as an outdoor air kit).
- Design homes to meet or exceed a 5-Star rating, as outlined by the AHFC Building Energy Efficiency Standard (BEES).
- Follow relevant code provided by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

CONTRACTORS

- Work with a mechanical engineer during the construction process to ensure that systems are properly prepared for, installed correctly, and inspected.
- Pay close attention to air-sealing details in the mechanical room, kitchen, bathroom, or other areas of the home that contain an appliance with high volume air flow.
- Work with a ventilation installer to ensure that the chosen ventilation appliances are sized and balanced appropriately.
- Label all main components, including the fan, controls, and ducts, and ensure that homeowners receive operation and maintenance training on any mechanical equipment that is installed.
- Provide building owner an operation and maintenance manual with a brief description of the system that explains the principles of operation, control strategy, and maintenance. This manual should include the installer's name and phone number, product literature for all components, ventilation system model and serial number, ventilation airflows, and the operation and maintenance schedule. If possible, show the occupants the location of each component and how to operate the system.
- Follow relevant code provided by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

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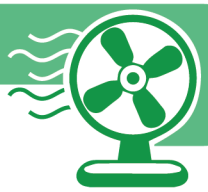
HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

BACK-DRAFTING



RELEVANCE TO ALASKAN CONSTRUCTION

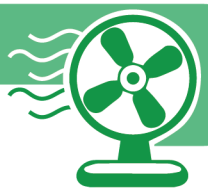
Combustion/burning heating appliances of any type produce harmful byproducts during use. Under optimal conditions, these heating appliances will exhaust their combustion byproducts directly to the outdoors. If indoor air pressures are highly negative, however, the heating appliance may "back-draft". When back-drafting occurs, the dangerous combustion byproducts are pulled into the living environment.

HEALTH & SAFETY IMPACTS

Homes that are more air-tight can be at significant risk for back-drafting, especially those with mechanical forms of ventilation (bathroom exhaust fans, range hood fans, etc.). Under high negative pressure conditions, back-drafting can occur and introduce dangerous combustion byproducts such as carbon monoxide, PM2.5, and nitrogen dioxide into the living environment. These byproducts are harmful to human health, and can be fatal in extreme cases.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

BACK-DRAFTING



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a mechanical engineer with a license to practice in Alaska be contracted with during the design process to develop a stamped set of mechanical plans.
- Require that a Combustion Safety Test be conducted prior to Certificate of Occupancy issuance. This test should specifically detect the presence of carbon monoxide (if any), spillage for combustion appliances, and the worst-case depressurization pressure.
- Require that sealed combustion appliances be specified where applicable and feasible.

DESIGNERS

- Work with a mechanical engineer and the community to design the heating system.
- Require that sealed combustion appliances be chosen for heating system design, and work with a specification writer to develop associated specifications.
- Ensure that a carbon monoxide and smoke detectors are included in the design and material specification list.

CONTRACTORS

- Work with a mechanical engineer and heating installer during the construction process to ensure that systems are properly prepared for, installed correctly, and inspected.
- Pay close attention to air-sealing details in the mechanical room, kitchen, bathroom, or other areas of the home that contain an appliance with high volume air flow.
- Work with a ventilation installer to ensure that the chosen ventilation appliances are sized and balanced appropriately.
- Label all main components, including the flues, controls, and delivery systems.
- Provide building owner an operation and maintenance manual with a brief description of the system that explains the principles of operation, control strategy, and maintenance. This manual should include the installer's name and phone number, product literature for all components, heating system model and serial number and the operation and maintenance schedule. If possible, show the occupants the location of each component and how to operate the system.
- Follow relevant code provided by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

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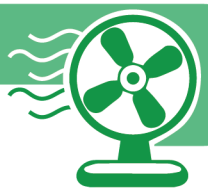
HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

CARBON MONOXIDE



RELEVANCE TO ALASKAN CONSTRUCTION

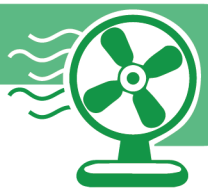
Carbon monoxide is a colorless, odorless gas that is hazardous to human health. Carbon monoxide is produced as a byproduct of combustion. Heating appliances, stoves, cars, and other engines all produce carbon monoxide during use.

HEALTH & SAFETY IMPACTS

Carbon monoxide can cause a range of health issues, and is fatal in high enough concentrations. In low and medium dose exposures, carbon monoxide can cause flu-like symptoms. Higher doses can result in a loss of consciousness or fatalities. Alaska ranks #2 in the nation for number of fatal carbon monoxide poisonings.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

CARBON MONOXIDE



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a mechanical engineer with a license to practice in Alaska be contracted with during the design process to develop a stamped set of mechanical plans.
- Require that a Combustion Safety Test be conducted prior to Certificate of Occupancy issuance. Require that sealed combustion heating appliances be specified.

DESIGNERS

- Work with a mechanical engineer and the community to design the heating system.
- Require that sealed combustion appliances be chosen for heating system design, and work with a specification writer to develop associated specifications.
- Ensure that a carbon monoxide detector is included in the design and material specification list.

CONTRACTORS

- Work with a mechanical engineer and heating installer during the construction process to ensure that systems are properly prepared for, installed correctly, and inspected.
- Pay close attention to air-sealing details throughout the home. Work with a ventilation installer to ensure that the chosen ventilation appliances are sized and balanced appropriately.
- Ensure that a smoke detector and CO monitor is installed in multiple locations in the house and has both grid and battery power.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

MOLD

RELEVANCE TO ALASKAN CONSTRUCTION

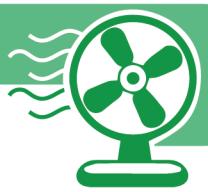
Mold is a type of fungi that grows and thrives on warm, moist surfaces. Some types of mold are harmless, while others can cause mild to severe health reactions. In homes with high humidity levels, or in areas where water leaks persist for long periods of time, mold can flourish.

HEALTH & SAFETY IMPACTS

Mold can be harmful to human health, especially to those with pre-existing respiratory issues. Infants and children, elders, immunocompromised people, and those with respiratory illnesses are all at increased risk of reacting to mold spores. In Alaska, mold is one of the most common culprits responsible for poor indoor air quality.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

MOLD



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a mechanical engineer with a license to practice in Alaska be contracted with during the design process to develop a stamped set of mechanical plans.
- In addition to an active mechanical ventilation system, advocate for the inclusion of a redundant passive ventilation systems in the design. Also advocate for the inclusion of a redundant, non-electric heating system.
- Require that a specification writer be contracted with during the design process. Request that mold-resistant materials be specified where applicable and feasible.
- For homes with mechanical ventilation, require that a blower door test be conducted post-construction to ensure that air leakage is reduced to a desired minimum rate (2.0 ACH or lower, for example).

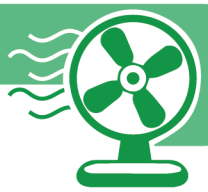
DESIGNERS

- Work with a mechanical engineer to design the ventilation system.
- Preference mold-resistant materials, and work with a specification writer to develop associated specifications.
- Avoid specifying materials that foster mold growth (gypsum drywall, OSB, etc.).
- Rural Alaskan homes tend to have much higher occupancy than urban homes, so it is important to ensure that the ventilation system is designed to accommodate higher occupancy.

CONTRACTORS

- During construction, ensure that materials are stored properly to avoid water saturation.
- Pay close attention to vapor and air sealing details of the building vapor retarder, especially in the bathroom, kitchen, and other high moisture environments.
- Ensure homeowners are educated in how to operate the ventilation system.
- Work with a mechanical engineer and HVAC installer during the construction process to ensure that systems are properly prepared for, installed correctly, and inspected.
- If submitting a material substitution during procurement, ensure that substituted options offer equivalent or better mold-resistant properties.
- Work with a ventilation installer to ensure that the chosen ventilation appliances are sized and balanced appropriately.

VOLATILE ORGANIC COMPOUNDS (VOCs)



RELEVANCE TO ALASKAN CONSTRUCTION

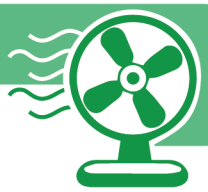
Volatile Organic Compounds (VOCs) are harmful chemicals that are produced from off-gassing of materials. VOCs are commonly found in paints, solvents, wood preservatives, aerosols, pesticides, houshold cleaners, furniture, and various building materials. VOCs are also produced as a byproduct of cooking.

HEALTH & SAFETY IMPACTS

Both acute and prolonged exposure to VOCs can cause a range of health effects, including minor irritations, temporary but severe reactions, or in extreme cases exposure can lead to organ failure, and cancer. The type and intensity of health impacts depend on the specific chemical and the duration

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

VOLATILE ORGANIC COMPOUNDS (VOCs)



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Require that a specification writer be contracted with during the design process.
- Request that VOC-free materials be preferred.
- Require a range hood that is ducted to the outside.

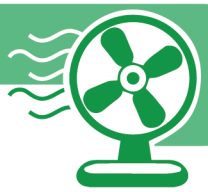
DESIGNERS

- Consult manufacturer data sheets, UL Greenguard, Living Building Challenge (LBC), Living Future Institute (LFI) Red List, etc. during the design process to ensure that desired materials do not include VOCs.
- Preference VOC-free materials in design, and work with a specification writer to develop associated specifications.

CONTRACTORS

- If submitting a material substitution request during procurement, ensure that substituted options do not contain VOCs.

OVERCROWDING



RELEVANCE TO ALASKAN CONSTRUCTION

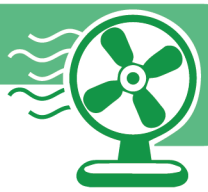
When the amount of people living in a home exceeds its design capacity, the home is considered to be "overcrowded." Overcrowding is especially common in rural Alaska, where housing is often in short supply. The amount of people living in a home influences indoor moisture production. Common moisture-producing activities include bathing/showering, dish washing, clothes washing, cooking, hand washing, and breathing. Carbon dioxide, a byproduct of breathing, also increases in overcrowded environments.

HEALTH & SAFETY IMPACTS

Increased moisture production in overcrowded environments can aggravate certain respiratory and physical conditions and lead to mold growth, which can negatively impact indoor air quality.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

OVERCROWDING



BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Advocate for moderately oversized mechanical and plumbing systems in designs in order to accommodate higher occupant loads during the lifespan of the building.
- Require that a mechanical engineer with a license to practice in Alaska be contracted with during the design process to develop a stamped set of mechanical plans.
- Advocate for a plumber, with a license to practice in Alaska, to be consulted during the design and construction processes.
- Request formally that overcrowding be considered in the design of all Mechanical, Electrical, and Plumbing (MEP) systems.

DESIGNERS

- Work with a mechanical engineer and plumber to design Mechanical, Electrical, and Plumbing (MEP) systems that are sized appropriately to handle overcrowded conditions.
- Choose ventilation and plumbing appliances and fixtures that are extra durable in order to accommodate high intensity usage.
- Choose materials for the bathroom and kitchen that can withstand high humidity conditions and occasional bulk water intrusion.

CONTRACTORS

- Pay close attention to air sealing details in the bathroom, kitchen, and other high moisture environments.
- Work with a ventilation installer to ensure that the chosen ventilation appliances are sized and balanced appropriately for overcrowded conditions.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

WATER - SEWER SYSTEMS

RELEVANCE TO ALASKAN CONSTRUCTION

No Alaska community is the same when it comes to their water and wastewater infrastructure. Commonly available potable water options may include piped public utility water treatment plants, washeteria facilities, packaged imported water, hauled water from a treated public source, and hauled water from an untreated natural source. Available wastewater options may include, in order of least to most hazardous: piped community sewer systems, individual residential sewage treatment plants (STPs), individual residential septic systems and leech fields, Portable Alternative Sanitation Systems (PASS), flush-and-haul sewage tank systems, outhouses, and honeybuckets.

HEALTH & SAFETY IMPACTS

Better quality sanitation in homes leads to healthier occupants. Choosing water and wastewater options that are both high-quality and community-compatible is necessary. Some water/wastewater options are simply not viable in some communities, either logistically or economically.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

WATER - SEWER SYSTEMS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- Work with ANTHC and/or Village Safe Water and the community of the proposed site to provide designers and contractors with a list of both existing and preferred water/wastewater options. If one option is desired over the rest, advocate for its inclusion in the design, and submit relevant background information to designers.

DESIGNERS

- Work with members of the community, plumbing specialists, ANTHC Alaska Rural Utility Collaboritive (ARUC), Tribal Utility Support (TUS) representatives, and/or with a Tribal Health Organization/Environmental Health Services representative to design the water/wasterwater systems, and work to accommodate the option that optimizes for health, safety, and preference.
- Follow relevant code requirements outlined by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

CONTRACTORS

- Use flexible service line connections when connecting interior to exterior water and wastewater lines to avoid any potential damage due to differential settling of the structure. Work with plumbing specialists to ensure that water and wastewater systems are properly prepared for and installed correctly.
- Follow relevant code requirements outlined by the Alaska Housing Finance Corporation (AHFC) New Construction Guidelines, the International Residential Code, and the International Building Code (IBC).

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

HONEYBUCKETS

RELEVANCE TO ALASKAN CONSTRUCTION

A honeybucket is a common toilet subsitute in rural locations without access to public water utilities or other forms of running water. Honeybuckets usually consists of a toilet seat situated on top of a 5-gallon bucket, and may or may not be lined with a plastic bag for collecting human waste. Honeybuckets are used to collect solid and liquid human waste.

HEALTH & SAFETY IMPACTS

Over 3,300 homes in rural Alaska lack access to running water, and instead rely on honeybuckets. To mask the smell produced by honeybuckets, it is common for occupants to pour bleach or PineSol into the honeybucket intermittently. The introduction or mixing of smell-covering chemicals can produce noxious gases (chlorine gas), and introduce harmful chemicals such as tuolene into the indoor air. Emptying honeybuckets into local sewage lagoons or dump sites can be considered a biologically hazardous activity to the transferer. Sewage-related diseases, such as Hepatitis A, bronchitis, and viral meningitis, are spread through contact with fecal matter.

HEALTH & SAFETY CONSIDERATIONS IN NEW CONSTRUCTION

HONEYBUCKETS

BEST PRACTICES FOR...

HOUSING AUTHORITIES

- If honeybucket usage is predominant in a community, and other forms of sewer systems do not seem feasible for new construction, consider advocating for the implementation of PASS systems.
- Work with ANTHC and/or Village Safe Water to collect and submit relevant community water/wastewater system information to designers.
- If PASS or ventilated toilet systems are to be included, require that ANTHC be consulted during design and construction for quality assurance.

DESIGNERS

- Work with ANTHC to incorporate ventilated toilet systems into new home designs.
- Make sure your mechancial engineer is aware of the exhaust fan that is used in the PASS system.

CONTRACTORS

- If PASS systems are to be included, work with ANTHC during construction to ensure that the PASS system is properly prepared for and installed correctly.

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