HEAT WAVE

Risks to Buildings, Occupant Safety & Environment

- Overheating beyond typical comfort conditions
- Electrical system overload due to increased energy usage associated with ventilation and air conditioning systems
- Potential utility service interruption due to increased energy usage
- Decreased lighting and communications connectivity
- Risk of heat exhaustion or loss of life due to overheating, dehydration or hyperthermia
- Decreased outdoor and indoor air quality due to smog and associated risk to human health

Site Strategies

Strategy	Cost	Impact	Alignment
Identify and incorporate opportunities for cross ventilation during floorplan development to increase air flow without dependence on mechanical systems	$$	***	
Reduce parking areas and/or add shading or vegetation to reduce the heat island effect	$$	**	

Design Strategies

Strategy	Cost	Impact	Alignment
Conduct simulations to explore the thermal performance of individual suites and the building as a whole, focusing on window to wall ratio, window to floor area ratio, window thermal performance and solar heat gain coefficient, wall thermal performance, airtightness, shading, natural ventilation, stack effect and solar orientation	$$	***	
Use the latest climatic data for the modelling of thermal performance of the building and individual units	$	*	
Increase thermal mass performance of horizontal and vertical surfaces through the inclusion of exposed concrete floor slabs, exposed brick walls, natural stone tile; avoid carpeting and suspended ceilings	$$$	***	
Take advantage of thermal masses to allow for night-purging of heat from passive gains	$$	***	
Identify facades with highest potention for solar heat gains and optimize glazing accordingly (e.g. reduce ratio of glazing).	$	***	
Design horizontal and vertical external shading and external operable screens to reduce incoming solar heat gains along south, east, and west façades	$$$	***	
Use high performance insulation and glazing, including higher solar heat gain coefficient fenestration, and low-e coatings to reduce the rate of heat transfer through building structures, and reduce heating and cooling loads	$$	***	
Include operable windows throughout floorplan layout and common corridors to assist cross ventilation and night-purging of internal heat	$	**	
Incorporate operable windows in common corridors wherever security concerns do not pose a risk	$	**	
Locate amenity spaces in a north-facing area with operable windows (and high ceilings) to act as a cooling refuge area. Design for additional cooling capacity, connect to back-up power, and finish floors with exposed concrete or natural tile	$$	***	
Place deciduous vegetation along south, east and west façades to reduce solar heat gains	$	**	
Install outdoor water fixtures connected to a gravity-fed source in a location easily accessible to building occupants	$	**	
Use high albedo or "cool" roofing materials or vegetated roof systems to reduce internal heat gains	$	**	
Use light-coloured building materials to reduce envelope surface temperatures	$	*	
Include passive and mixed-mode ventilation strategies to cool internal spaces without dependence on active cooling systems	$$$	***	
Investigate opportunities to use solar energy technologies to power cooling systems or chillers	$$$	**	

Heat waves are prolonged periods of abnormally hot weather that are often paired with high humidity in maritime climates such as the Pacific Northwest. What is considered a heat wave depends on the degree to which temperature exceed the normal temperature range for the area and season. Heat waves can be particularly intense in urban environments, as the number of heat-absorbing structures and buildings can act to increase overall temperature in what is known as the urban heat island effect. Heat waves are projected to increase in frequency and intensity as a result of climate change, and are projected to have adverse impacts on human health and well-being as risks of overheating increase. Building designers and operators should consider a range of strategies to reduce impacts to health and comfort of building occupants.

Design Strategies

Strategy	Cost	Impact	Alignment
Use high-efficiency lighting, equipment and appliances to reduce internal heat gains	$	*	
Place equipment and furniture with air circulation and temperature control in mind	$	**	

Operations Strategies

Strategy	Cost	Impact	Alignment
Ensure a minimum of 72 hours of fuel storage (natural gas) for power to refuge area and key services, including building pumps, fans, emergency lighting, and security systems	$$	***	
Establish operations and maintenance procedures and building management systems (BMS) to determine the level of cooling required in extreme heat events	$	**	
Ensure common areas' operable windows are opened at night to allow for circulation	$	*	
Educate occupants on practices to keep cool, including closing windows after noon and opening them at night	$	**	
Ensure building operators and occupants understand how to use thermal mass to mitigate temperature swings and optmize comfort	$	**	
Develop training programs to help staff to be able to identify symptoms of heat stress and associated health complications	$	**	

Power Outages · Air Quality · Fire at the Urban Interface · Severe Storms · Seismic Events

Relative Cost/ Cost Premium

Low	Medium	High
$	$$	$$$

Relative Impact

Low	Medium	High
*	**	***

Community Benefits

Consider the following strategies to help improve the resilience of the community overall:

- Provide a resilient potable water supply in site design to allow for universally accessible drinking water
- Design amenity rooms to act as cooling centres/refuge areas for at-risk community members (e.g. seniors) and a central location for emergency support and services
- Ensure refuge areas are designed to foster social connection, mental health, and overall cultural safety
- Increase tree canopies to help lower local temperatures and provide shading for community members
- Include public information in building common areas to educate on the common symptoms of health impacts from extreme heat
- Incorporate graywater recycling and rainwater cisterns for irrigation and plant drought tolerant species to conserve water during heat waves

Potential Design Conflicts

Take care and ensure resilient strategies do no exacerbate vulnerability and other risks

- Passive ventilation strategies that help cool buildings with fresh outdoor air can conflict with strategies used to reduce the impact of poor air air quality advisories. Ensure buildings have back-up cooling and ventilation systems that allow for mechanical ventilation when necessary.
- Increasing the thermal performance of vertical and horizontal surfaces through the use of concrete floor slabs may pose a risk to seismic resilience overall. Ensure concrete structures are appropriately designed to withstand seismic events.
- Ensure any vegetation used to shade building interiors are planted with fire risk in mind.

Additional Resources

- City of Vancouver. (2014) Extreme Heat Cool Buildings: A Review of Alternatives to Traditional Air Conditioning
- Government of British Columbia. Current Air Quality Data Map – Air Quality Health Index.
- Bureau de normalisation du Québec. Reducing the Urban Heat Island Effect

INTEGRAL GROUP

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