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PUBLIC HEALTH BASIS FOR WAC 246-358, TEMPORARY WORKER HOUSING, WORKING DOCUMENT

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Division of Environmental Health Programs and
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Context

In order for the Department of Health to understand which portions of the temporary worker housing regulations are related to health and safety, the Office of Epidemiology convened a work group to determine which provisions of the Washington Administrative Code (WAC) 246-358 have a scientific basis, which seem to be developed from experience, which seem to rely on common sense, and which do not seem to be supported by science, experience or common sense. In order to make this determination, each provision in the WAC was examined separately. While this approach may be useful in determining the importance for health and safety of most of the provisions, there are several limitations.

First, the approach of examining each provision individually runs the danger of having the detail obscure the larger picture. Housing comes as a gestalt and while any one element may not be crucial, substandard housing across a number of elements combined with poor nutrition, poor access to preventive medical services, heavy physical labor involving exposure to potentially dangerous chemicals, lack of education regarding health practices, the sharing of living facilities by unrelated individuals, and the number of individuals served by the structure may change the picture. For example, while crowding in and of itself may not be too problematic, crowding combined with poor ventilation and altered host susceptibility, such as might occur with inadequate nutrition, can result in rapid spread of any number of communicable diseases.

Second, perception of housing adequacy may be related to health and this factor is not taken into account in the present analysis. One study on perception of housing adequacy found that dissatisfaction with housing was associated with poorer health (Fuller *et al.*, 1993), presumably mediated through a relationship between housing dissatisfaction and stress. Other studies have found that perception of crowding rather than the actual number of people per room is related to mental health. Although research on this topic is limited, it may speak to the need to involve workers in discussions of what they perceive to be the most important elements of housing so that satisfaction is maximized.

Third, when assessing the importance of housing and health for a specific group of people, it may be informative to look at causes of morbidity and mortality among that group. For example, in Washington state, farm workers constitute a large portion of workers occupying temporary housing. Between 1988 and 1991, proportionate mortality ratios for homicide and motor vehicle accidents were high among Washington's farm workers. Earlier data (1976-1989) indicate high proportionate mortality ratios for tuberculosis, pneumonia and several non-infectious diseases of the respiratory system, as well as motor vehicle accidents and homicide. Thus, housing conditions which may foster these causes of death may be particularly important for temporary housing provisions in Washington.

Fourth, the work group would like to note that while adequate housing is important for health and safety, it does not guarantee good health and safety, but rather sets the infrastructure to reduce risk of injury and communicable disease. Health and safety education is important so that facilities are used in a manner consistent with healthy practices.

Finally, while scientific documentation may make a strong case for the importance of a specific provision, the work group recommends that policy makers not under value the contribution that experience may play in this area. Public health experience related to temporary living conditions grows out of many years of field experience in diverse situations, such as refugee camps, military operations, and temporary worker housing. While much of this knowledge has not been formally tested using scientific methodology, the work group feels that both experience and common sense have much to offer in determining health and safety issues related to temporary worker housing.

The remainder of this document discusses the specific provisions in WAC 246-358. The title of each section of the WAC is in bold and the text of the WAC is underlined. Although there are many interrelated or repeated provisions, we have cross-referenced only in instances where text would be repeated (i.e., our response to both provisions is identical) or where we thought additional explanation was necessary. There are many instances where part of another response is relevant, but we did not cross-reference, since the explanation seemed clear without the cross-reference. For example, many provisions are to prevent rodents and insects from entering or breeding in the housing. A discussion of health and safety factors associated with rodents and insects occurs in subsection 246-358-155, but we do not refer the reader to that section every time we discuss rodents and insects.

We have provided references only where we have cited specific documents or studies. We do not provide references in cases where we believe information relating housing conditions to health and safety is well-established and available from a variety of sources either in the literature or in some cases, through expert testimony based on experience.

WAC 246-358 defines temporary worker as " a person employed intermittently and not residing year-round at the same site. Temporary worker housing is defined as "a place, area or piece of land where sleeping places or housing sites are provided by an employer for his or her employees or by another person, including a temporary-worker housing operator, who is providing such accommodations for employees for temporary seasonal occupancy, and includes "labor camps" under RCW 70.54.110.

WAC 246-358-045 Location and maintenance.

(1) An operator shall locate housing:

(a) To prevent a health or safety hazard:

Response: Housing which is not located to prevent health and safety hazards would, by definition, pose health and safety hazards to occupants.

(b) On well-drained sites to prevent standing water from becoming a nuisance:

Response: Standing water on a building site (under or near a building) could:

- compromise on-site sewage disposal and drinking and/or surface water quality depending on the location of such systems in relation to the standing water;
- serve as breeding sites for mosquitoes capable of carrying human pathogens;

- serve as a water source that attracts rodents and other mammals which could carry human pathogens; and
- create conditions for mold (fungal) growth in structures which could lead to human illness.

Sections 055 and 065 discuss the importance of clean water and proper sewage disposal, respectively. Section 155 discusses vectorborne human pathogens and Section 165 discusses the importance of rodent and insect control. Exposure to molds can produce allergic responses including asthma, rhinitis, hypersensitivity pneumonitis, and other respiratory effects. Direct dermal contact with molds can elicit skin rashes. Children appear to be more sensitive than adults to mold exposures. Molds produce mycotoxins which may be related to additional health effects from exposure to molds in indoor air including immunosuppressant effects. (Samson *et al.*, 1994)

(c) 500 feet or more from a livestock operation unless the department or contracted health officer determines that no health risk exists:

Response: Conditions at livestock operations (dairy farms, corrals, feedlots, slaughterhouses) including animals, feces, animal feed and water may attract rodents and insects (flies, mosquitoes) capable of carrying human pathogens. Additionally, odor is a nuisance problem associated with livestock operations in close proximity to housing, especially if prevailing winds are toward the housing. Distancing housing from livestock operations will reduce the likelihood of odors, rodents and flies reaching the housing units and residents. However, the 500 feet distance may or may not be outside the range of rodents and insects depending on the species and in the case of insects, weather conditions.

(d) More than 200 feet from swamps, pools, sink holes, or other surface collections of water unless provisions are taken to prevent the breeding of mosquitoes:

Response: Mosquitoes can carry human disease-causing organisms and transmit them via biting to humans. These bodies of water may also attract rodents and other animals capable of carrying human disease-causing organisms. It is unlikely that 200 feet is outside the range of most mosquitoes or small animals. While most residential zoning codes do not include a set-back distance of 200 feet from surface water, differences in the nature of permanent versus temporary housing may be relevant in considering safety issues, especially for children, associated with housing near water. Residents in permanent housing likely have greater ability to construct safe play areas away from the water (e.g., fenced in yards) helping to ensure that young children are not unsupervised when by the water. Without safe play areas and appropriate supervision, bodies of water pose a potential danger for children who do not know how to swim. However, it is not likely that this provision is based on this concern, because 200 feet is probably not sufficient to prevent young children from walking to the body of water.

(e) On sites sufficient in size to prevent overcrowding of necessary structures:

Response: This seems to refer to population density (crowding of structures) and not crowding within structures (see 246-358-075.5). Studies on the relation of population density to health are inconclusive, but do not suggest a strong relationship between

health and population density. However, overcrowding of structures can be problematic if their positioning inhibits access by emergency vehicles, or if there is insufficient space for septic system drainage fields and/or insufficient space for proper separation between drainage fields and water sources. Fire hazard may also be increased by the crowding of structures.

(2) An operator shall ensure that the housing site is maintained at all times in a sanitary condition free from garbage and other refuse:

Response: In the Centers for Disease Control and Prevention (CDC) Vectorborne Disease Control Training Manual, sanitation is described as "the control of insects and rodents of public health importance." One of the goals of maintaining "a sanitary condition free from garbage" is to discourage the presence of insects and rodents at the housing site. Garbage and other refuse can provide food, water, shelter, and a breeding environment for insects and rodents. Insects and rodents have been shown to carry infectious diseases which can be transmitted to humans. (See Section 246-358-155.) Increased human contact with insects and rodents at the housing site means an increased likelihood of exposure to an infectious disease, a physical injury from a rodent bite, and the nuisance factor resulting from insect bites. Rodents may also chew the plastic insulation on electric wiring which has been documented as a cause of fires.

We have concerns about the operator being required to maintain sanitary conditions at all times. Conditions which will attract insects and rodents could be the result of negligence by the operator or the residents in the housing unit. The flow of garbage is:

- 1) storage in adequate, leak-proof smaller container in the housing unit;
- 2) movement to a larger container outside when the smaller, inside container is full;
- 3) removal of the contents of the larger outside container on regular basis; and
- 4) appropriate disposal at a licensed disposal site.

Generally, tenants or residents are responsible for the first two steps listed above. For the operator to oversee these steps would require some type of routine inspection. However, given that the housing is temporary and the workers cannot reasonably be expected to provide the smaller and larger bins themselves, the operator should be required to provide adequate bins for the garbage storage. Generally, the landlord or operator would be responsible for step 3 or steps 3 and 4, if the operator did not contract step 3 to a licensed garbage collector. Based on experience, if proper facilities are not available, garbage will be allowed to accumulate until it is eventually burned.

While maintenance of sanitary conditions is essential for good health, assignment of responsibility for maintaining these conditions is a policy, not a scientific, decision. Proper storage of garbage both inside and outside of the housing unit would be a good health education topic.

WAC 246-358-055 Water supply. An operator shall

(1) Provide an adequate, convenient water supply from an approved source as described in chapter 246-290 WAC (Drinking Water Regulations):

(a) For housing existing prior to August 1, 1984, maintain and operate the water system in accordance with chapter 246-290 WAC:

(b) For housing constructed after August 1, 1984, design, construct, maintain, and operate the water system in accordance with chapter 246-290 WAC:

Response: The importance of potable water for health has been adequately documented. Lack of adequate potable water leads to dehydration which has been associated with illnesses such as kidney stones, and in the extreme, death. In addition to concerns related to dehydration, unregulated or improperly regulated drinking water can be an important source of exposure to disease-causing agents or toxins. The regulations are a governmental approach to maintaining separation between humans and waterborne disease-causing agents by assessment and, if needed, control of water quality. The regulations are not always based on scientific studies that have definable levels of certainty. Rather, they may be based on experience over many years (decades, if not centuries). Once scientific cause-effect relationships are discovered, scientific standards may be set to mitigate a potential disease risk (e.g., chlorine doses to effect bacteria kill), but standards may also be based on logic and reason. We suspect many standards come from the latter approach.

In the absence of a readily available source of drinking water, consumers have been known to seek and use whatever sources are most easily obtained. Sources available may not be approved in the sense that the water quality is subject to contamination by microbiological or chemical agents, and as such, pose a risk to the health of the consumers. Approved sources are those which have been determined to pose a minimal threat to health and are considered to reduce health risks to consumers, or have been sufficiently characterized to allow development of treatment methods which can render the water safe to drink.

The drinking water regulations constitute the basic foundations for public health protection for water supplies, including water quality requirements, system construction, system operation, and system maintenance. The availability of an adequate, convenient water supply from an approved source is important for health.

Although WAC 246-290 refers specifically to drinking water supplies, an adequate, convenient water supply is also important for hand washing and other aspects of personal hygiene, such as showering and clothes washing, all of which have been demonstrated to reduce transmission of infectious and/or toxic agents.

(2) Provide a water system:

(a) Capable of delivering 35 gallons per person per day to the housing site at a peak rate of two and 1/2 times the average hourly demand: and

Response: The provision of 35 gallons of water per person per day may be sufficient, although somewhat marginal. We were unable to find scientific evidence for specifying the number of gallon per day. Most likely, the specification of gallons per day has been developed through experience. For comparison, the Uniform Plumbing Code and/or the American Waterworks Association recommend 50 gallons per person per day for semi-permanent construction camps, 50 gallons per person per day for cottages with seasonal

occupancy, 35 gallons per person per day for tourist camps with central bath and toilet facilities and 60 gallons per person per day for multiple family dwellings.

If 35 gallons are to be delivered per person per day, average hourly demand is 1.46 gallons per person per hour (35 gallons/24 hours). Two and 1/2 times this rate gives a peak rate of 3.65 gallons per person per hour (1.46 gallons/hour x 2.5) which must be capable of being delivered at the appropriate pressure. (See subsection b below.) We question whether this would be sufficient to meet peak demand.

(b) With distribution lines capable of supplying water at normal operating pressures to all fixtures for simultaneous operation:

Response: "Normal operating pressure" needs to be defined in terms of a minimum pressure. Pressure fluctuations may put the water system at risk of contamination from back siphonage. WAC 246-290 requires a consistent residual pressure of at least 20 pounds per square inch (psi) be maintained in all portions of a public water system to prevent potential contamination from back siphonage. Additionally, consistent water pressure is convenient for showering and hand washing. A lack of consistent water pressure may dissuade or prevent residents from these activities.

(3) If water is not supplied solely by a community water system submit a water sample to a department-certified laboratory for bacteriological quality testing each year prior to opening housing in accordance with WAC 246-290-300:

Response: Microbiological quality of drinking water, based on the use of an indicator organism (coliforms), is important to ensure protection from waterborne pathogens. Documentation is available to show the relative safety associated with drinking water that has been tested and found to be negative for coliforms. Although this indicator bacterium is not 100% correlated with pathogen presence, it is the best available organism to test to ensure water that is relatively pathogen-free. The absence of coliforms has been widely accepted as an indicator of water that is bacteriologically safe to consume. Bacteriological testing is the only method of determining that water is free of coliforms.

NOTE: Chemical water quality is not discussed. By definition, temporary housing is housing which is not occupied year round and therefore, there may be relatively short exposure periods for workers in temporary living situations. Short term exposure to relatively low levels of organic and inorganic compounds would not pose an immediate health threat. The health importance of exposure to these elements and compounds derives from cumulative chronic exposure. Nonetheless, since people living in the housing may be exposed to organic and inorganic compounds in other living or work situations, it may be prudent to at least examine the water quality where we feel the sources of water are relatively vulnerable to contaminating influences, such as pesticides. For example, if the water sources are located in areas of known pesticide applications, we should look at whether the source is vulnerable to contamination to determine if testing may be warranted. For the inorganics, problems have been observed in fairly well-defined areas for elements or compounds such as arsenic or nitrate. If infants can be expected to be in residence at a housing site, we suggest that nitrates be examined so that the occupants can be informed of the risks. The same is true of arsenic in areas where we suspect it may be found.

(4) Delay the use of housing until bacteriological quality meets the requirements in WAC 246-290-310:

If the water quality does not meet the bacteriological requirements of the WAC, it is not safe to drink. However, alternatives, such as boiling the water before drinking or having the operator supply bottled water, may be preferable from a health viewpoint than delaying the use of the housing altogether. Whether health and safety are improved by delaying use of housing depends on what alternatives are available. However, non-potable tap water needs to be clearly labeled as such. (See subsection 8 below.)

5) Provide cold, potable, running water under pressure in, or within 100 feet of, each dwelling unit:

Response: The importance of the availability of potable water to health is well documented. We are not clear about the basis for "cold" or "running," although the absence of running water may introduce complications depending on how one obtains water from a non-running source (e.g., dipping into a water supply may lead to contamination of water). The majority of studies in developing countries looking at the relationship between disease and distance to water have shown decreases in infectious disease with decreased distance to water sources (Ersey *et al.*, 1991). However, some of the basis for this reduction was related to hygienic practices, such as hand washing, and so may not pertain to potable water, per se. Additionally, the basis for the 100 feet is unclear. The requirements seem to arise both from scientific evidence about the relationship of availability of potable water to health and from what would be a societal norm for such housing situations.

(6) Provide one or more drinking fountains for each 100 occupants or fraction thereof if water under pressure is available:

Response: We do not know the basis for this requirement. Most single-family and multi-unit dwellings do not include drinking fountains. They are more common in dormitory settings, where access to kitchen and bathroom facilities may be limited. Under those circumstances, access to drinking fountains may be more than a convenience, if their presence allows people to drink adequate amounts of water to keep from becoming dehydrated (although this may be a more important issue during working hours away from the residence) or discourages use of common or inadequately cleaned drinking cups or storage of water in containers with potential for contamination. (See subsection 7 below.) We found no basis for the provision of one drinking fountain for every 100 occupants or fraction thereof. It is not clear what the health implications would be if 120 occupants were served by one fountain.

(7) Prohibit the use of containers from which water is dipped or poured, and common drinking cups:

Response: There have been outbreaks of waterborne disease related to portable outdoor water supplies, and Hepatitis B has been shown to be transmitted through common usage of items, such as cups. There is a consistent premise in the literature that use of a common cup and containers from which water can be dipped or poured are possible sources of exposure to infectious agents, because of the possibility of

introducing contaminants into the water by hand or mouth. The main concern is to interrupt the opportunities for water contamination, which can logically be seen as a consequence of using common cups or containers from which water can be dipped. If containers are protectively sealed (like water containers used on work sites with spigots) and the water is not accessible by hand, then pouring water is likely to be safe. Pouring from open containers, however, is viewed as a risky practice.

(8) When water is unsafe for drinking purposes and accessible to occupants, post a sign by the source reading "DO NOT DRINK. DO NOT USE FOR WASHING. DO NOT USE FOR PREPARING FOOD." in English or marked with easily-understood pictures or symbols:

Response: See response to subsection 1. Drinking of water that is not safe for drinking is likely to cause acute illness. Since water which is unsafe for drinking often looks like water that is safe, marking the water as unsafe is the only way to assure that people know that the water is not safe. It is important to have the signs in a language that is understood by the population living in the housing. Therefore, we recommend that signs be in English and Spanish or other appropriate language. Since we do not know the literacy level of residents, we recommend that an easily recognizable icon be mandatory.

WAC 246-358-065 Sewage disposal. An operator shall:

(1) Connect sewer lines and floor drains from buildings to public sewers if public sewers are available;

(2) If public sewers are not available provide on-site sewage disposal systems designed, constructed, and maintained as required in chapter 246-272 WAC, chapter 173-240 WAC, and local ordinances;

(3) Ensure connection and drainage of sewage and waste water from all housing to a sewage disposal system approved by the jurisdictional agency.

Response to subsections 1-3: Improper sewage disposal has been connected with a variety of diseases including typhoid, paratyphoid, dysentery, poliomyelitis, cholera, hepatitis, and a variety of parasitic infections. The basis for the requirement for adequate sewage disposal is replete with studies and experience demonstrating adverse health outcomes associated with inadequate sewage disposal. Keeping sewage from contacting water, food, insects or people has a demonstrable benefit in terms of health protection. It is beyond the scope of this paper to review the basis for the specific sewage rules.

246-358-075: Construction and Maintenance. An operator shall:

1) Ensure construction provides protection against the elements and complies with applicable state and local ordinances, codes, regulations, and this chapter:

Response: Protection against the elements is a primary function of housing and allows people to continue with daily living functions important to health (e.g., cooking and sleeping) during inclement weather. In extreme conditions, lack of protection from the elements can result in direct adverse health events, such as frostbite.

While health and safety issues are related to the setting of many local and state ordinances, codes and regulations (e.g., fire hazards with improper electrical wiring, water contamination hazards with improper plumbing, potential of infectious disease spread with improper ventilation), it is beyond the scope of this document to review local and state building ordinances, codes and regulations to determine which are important to the health and safety of the occupants.

(2) Identify each dwelling unit and space for worker-supplied housing by posting a number at each site:

Response: Based on experience, housing addresses in temporary living situations have been shown to be important in finding individuals who may have been exposed to infectious disease or require some type of medical treatment. They are also important for locating of houses by emergency vehicles and identification when citing rules violations.

(3) Maintain buildings and shelters in good repair and sanitary condition:

Response: Buildings which are not maintained in good repair run the risk of becoming structurally unsound, allowing entrance by rodents or other small animals, and/or exposing occupants to the elements. Structurally unsound buildings pose a danger of unintentional injury to residents. Protection from the elements is discussed in subsection 1, above. Entry of rodents into buildings and health effects related to rodents are discussed in Sections 246-358-165 and 246-358-155, respectively.

Unsanitary conditions are linked to the spread of disease. For example, exposure to human and animal fecal material is associated with histoplasmosis, gastrointestinal disease, hepatitis and hantavirus. The presence of garbage in buildings may attract rodents and insects. (See Section 246-358-045.2.) While there are clear health and safety issues associated with maintaining sanitary conditions, based on experience, maintaining sanitary conditions requires activities on the part of both the operator and the residents.

4) Comply with chapter 51-20 WAC by providing two means of escape from sleeping rooms, foodhandling facilities, and rooms where fifty or more people congregate:

Response: Death and injury from fire occur when people trapped in burning buildings are burned, suffer smoke inhalation, or are trampled when many people are trying to escape. Provision of two means of escape (as opposed to one means of escape) increases the likelihood that people can exit a burning building, avoiding serious injury or death. It also allows two entrances for fire fighters to rescue people who have not yet escaped.

5) Provide at least seventy square feet of floor space for one occupant and fifty square feet for each additional occupant in each dwelling unit:

Response: Many infectious diseases with person-to-person transmission, as well as non-infectious conditions, such as homicide and psychological conditions, are known to be more prevalent when people live in crowded conditions. However, the vast majority of the studies documenting these associations do not control for other important

variables which are associated with crowding, including poverty, malnutrition, sanitation, and smoking. One recent review of the epidemiology of acute respiratory infections noted that "Because respiratory infections are contagious diseases, general conditions of crowding favor their propagation....[However,] given the extreme level of confounding between malnutrition and crowding as risk factors for acute respiratory infection, it will require some considerable effort and care to tease out the separate effects of these factors" (Graham, 1990, p.160-161).

Another author notes "One of the more widely held and cherished notions in medicine is that the spread of infectious disease is facilitated by crowding. This assumption underlies many of the research endeavors seeking to establish a relationship between housing and health, and has been accepted as a truism by policy makers. There is little question that under certain circumstances crowding may be linked to an increased incidence of communicable diseases, but in other circumstances no such relationship has been discovered" (Fuller *et al.*, 1993, p.1418).

A study by the same author found a relationship between perceived lack of privacy and subjective crowding and health outcomes, but found no relationship between objective measures of crowding and health.

The literature on psychological factors related to overcrowding is equally ambiguous. One study concluded that crowding decreased individuals' ability to cope with minor, daily stressors resulting in increased psychological distress symptoms (Lepore *et al.*, 1991). Other researchers have noted a relationship between crowding and mental health, but found that the relationship between the subjective experience of crowding and mental health is stronger than the relationship between persons per room and mental health (Gove and Hughes, 1984). This study also noted a relationship between crowding and both family discord and dissatisfaction with housing. The author cites two other studies which reported similar relationships. People from different cultures experience subjective crowding at different levels, and the experience of subjective crowding is also related to privacy needs which differ among cultures. One method of reducing subjective experience of crowding related to lack of privacy is to compartmentalize sleeping areas so that a large number of people are not sleeping and dressing in an open area.

Information on overcrowding from a safety perspective was not found in the scientific literature. However, overcrowding can make egress difficult in the event of a fire.

The literature on crowding generally defines crowding as persons per room and does not specify floor space. Studies in the U.S. and Canada generally have a smaller range of persons per room than do studies in the developing countries. For example, one study (Lepore *et al.*, 1991) looked at crowding in both the U.S. and India. In the U.S., residential density averaged 1 person per room with a range of 0.5 to 2. In India, investigators found an average of 3.5 person per room with a range of 0.5 to 11.

Even though the relationship between objective crowding and both mental and physical health is ambiguous, adequate living space for residents of temporary housing is important for a number of reasons.

- Under some circumstances spread of infectious disease is facilitated by people living in crowded conditions. Therefore, even though these circumstances have not been clearly delineated, it is prudent to avoid situations which may contribute to the spread of infectious disease. This may be particularly relevant for farm workers in Washington where the proportion of deaths due to tuberculosis and pneumonia are high compared to these causes of death in other workers.
- Interpersonal discord seems to be related to living in crowded conditions. Given the high proportion of deaths due to homicide among farm workers in Washington, it seems prudent to avoid conditions which may increase interpersonal discord.
- Both experience and common sense dictate that egress in the event of a fire is hindered in overcrowded conditions.

Unfortunately, we could not locate research or experiential guidance on what amount of space is sufficient space. The American Public Health Association (APHA)-CDC guidelines (Mood, 1986) require more space per person (150 square feet of floor space for the first occupant and 100 square feet of floor space for each additional occupant) than is required here, but the basis for these guidelines is unclear.

(6) Provide at least 7 foot ceilings and 50 square feet of floor space for each occupant in rooms used for sleeping purposes:

Response: See subsection 5 for a discussion of floor space. Relevant information about the relation of specific ceiling heights to health was not found. While ceiling heights may be a factor in the spread of airborne communicable disease in that lower ceiling heights reduce the cubic feet of air available per person, the issue is really proper ventilation, not ceiling height. (See subsection 9 for a discussion of the importance of proper ventilation.) There may be psychological factors associated with ceiling height. Several studies investigating this issue were recently identified and have been requested for review.

(7) Provide smooth and tightly constructed wood, asphalt, or concrete floors in good repair:

Response: The alternative to these types of floors seems to be earthen or rough floors, which may be more difficult to maintain in a sanitary condition. The floors need to be in good repair to prevent rodent entry and falls and to facilitate cleaning. It is not clear whether this provision is intended to prohibit the use of tile or sheet vinyl composition floor coverings. If so, the basis for a this prohibition is not clear.

(8) When wood floors are used, ensure floors are at least 12 inches above the ground at all points:

Response: This stipulation is most likely to prevent rodent access and to provide an air space for ventilation so that the wood stays dry. Keeping the wood dry prevents it from rotting and thus, is important for maintaining structural integrity. It may also prevent growth of mold. We do not know the basis for the precise specification of 12 inches. If the area between the ground and the floor is not properly screened, the area allows a living space for small animals.

(9) Provide a window area equal to 1/10 of the total floor area in each habitable room which opens 1/2 or more directly to the outside for ventilation:

Response: Fresh breathable air is a necessity for human life and health. Ventilation issues range from discomfort to disease transmission. The standards from the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) call for no less than 15 cubic feet per minute (CFM) of fresh outside air per person in dormitory style housing. This air is provided to dilute the by-products of human metabolism, such as CO₂, exhaled moisture, and biological aerosols. This dilution air is also provided to compensate for the use of cooking appliances which generate products of combustion like CO, NO₂, and SO₂, which when allowed to build up in a non-ventilated area will result in direct deleterious human health effects. Further justification is found in dilution of personal hygiene products, such as pressurized deodorant sprays and antifungal sprays, which may become toxic in non-ventilated areas and/or cause adverse reactions in sensitive individuals sharing the same living space.

It is important to dilute contagious human pathogens to a level that does not pose a disease risk to those in close proximity to someone who is ill. Several well documented cases exist with regard to overcrowding and under-ventilation resulting in the transmission of disease. While the spread of diseases like pneumonia and tuberculosis has been documented, there is also the likelihood that the common cold and flu may be spread at higher rates in overcrowded and under-ventilated situations. (While this may seem to contradict the information in subsection 5, the response to subsection 5 notes that under certain circumstances, spread of infectious disease is facilitated by people living in crowded conditions. Lack of adequate ventilation combined with the presence of disease carriers is undoubtedly one of those circumstances.)

Whether windows equal to one-tenth the floor area, which open half way, will also allow proper air movement to assure that the room is properly ventilated depends on a number of factors, such as size, number, and placement of windows, and wind direction. (From this perspective, opportunities for cross-ventilation should be taken.) The stipulation that the window open directly to the outside is to ensure that the air coming into the room is not contaminated by products affecting indoor air quality in adjacent rooms. Additionally, intake windows must not be by an exhaust vent from something else.

(10) Provide effective 16-mesh screens on all exterior openings, and screen doors equipped with self-closing devices:

Response: Screens reduce the likelihood of insects and animals, such as bats, rodents and snakes, which may carry disease or toxins, from entering the house. Flies can transmit enteric bacterial disease by physically transmitting bacteria from human feces to food items completing the fecal-oral route of transmission. Mosquitoes may also carry disease. Scratching of bites from insects may also result in skin infection when living conditions are not sanitary. (See Section 246-358-155.) Bats are known to carry rabies in Washington. Rodents carrying hantavirus have been identified in Washington and rattle snakes live in eastern Washington and the Cascade mountains. Sixteen mesh screens on exterior openings will prevent flies and most species of mosquitoes from entering housing units. They will also discourage entry by animals.

(11) Provide electrical service to include at least one electrical ceiling-type light fixture and at least one separate floor-type or wall-type convenience outlet in each habitable room.

Response: This section refers to provision of electric light, as well as provision of electricity through a wall outlet.

Electric lighting:

Most of the scientific literature on lighting relates to possible adverse health outcomes associated with over-illumination and/or fluorescent lighting, including damage to the eyes and skin and concerns about malignancies, such as malignant melanoma. However, concerns about fluorescent lighting seem to be limited to people who spend "much of their time" under such lighting, such as indoor workers (Abramov, 1985). Therefore, these concerns would probably not apply to housing for temporary workers and their dependents. Another aspect of light and health is the relationship of natural light to seasonal affective disorder. While seasonal affective disorder may be alleviated by exposure to specific spectra of artificial lighting, the type of lighting necessary is not considered residential lighting and so is not relevant to this discussion. One recent reviewer concluded that "the health and biologic effects of environmental lighting are not well understood and will likely remain so indefinitely" (Levin, 1995).

There are, however, common sense health and safety reasons for the provision of electric lighting in all rooms. The danger of injury from falls and encounters with insects and animals is reduced in areas with adequate lighting. The potential for unintentional injury related to using equipment, such as stoves, knives, scissors, etc., is be diminished with adequate lighting. Sanitation may be improved in foodhandling, bathing, toilet and laundry facilities with lights. People may be reluctant to use facilities without lighting and may seek less sanitary alternatives. Finally, the failure to provide adequate lighting may result in people using relatively less safe means of lighting, such as kerosene lamps or candles, resulting in increased risk of fire.

Provision of outlets for electricity:

Most of the scientific literature concerned with the provision of electricity concentrates on possible adverse health effects of electricity production, such as air pollution from oil-powered generators and exposure to ionizing radiation from nuclear power plants. Recently, much of the scientific literature has concentrated on potential adverse health effects of exposure to electromagnetic fields. We were unable to find studies which documented improvements in health associated with provision of electricity, per se. There may be some comfort and convenience issues associated with the provision of electric outlets.

Interestingly, the APHA-CDC recommended minimum housing standards (Mood, 1986) require provision of electricity only if there is usable electric service readily available from power lines which are not more than 300 feet away from the dwelling. If electric outlets are provided, based on experience, it may be important to assure there are a sufficient number of outlets to minimize use of potentially less safe alternatives. We do not know whether 1 per habitable room is sufficient. Michigan law requires 2 outlets per room. Other codes are based on the size of the room.

(12) Provide a minimum of 30 footcandles of light measured 30 inches from the floor in dwelling units:

Response: According to a recent reviewer, "research on task performance and accuracy ... led to new lighting standards (as published by the IES [Illuminating Engineers Society]), which raised recommended task illumination levels by 250-500% in the late 1950s and early 1960" (Levin, 1995, p.80). The same author notes that standards in industrialized Western European countries are 30-70% of the U.S. IES recommended levels. Additionally, data from the Illuminating Engineers Research Institute (IERI) show that "performance tasks are only marginally (3-7%) impaired at illumination levels only 10% of those recommended by IERI" (Levin, 1995, p.80).

A preliminary review of office lighting (ANSI/IESNA, 1993) and industrial standards (ANSI/IES, 1979) indicates that 30 footcandles may be enough light to perform most residential tasks, by most residents. For example, 20, 30 or 50 footcandles are recommended for reading newsprint and magazines in offices, depending on the age of the people and the importance of speed and accuracy.

For people over age 55 years, where speed and accuracy are important, 30 footcandles are recommended. If speed and accuracy are critical, 50 footcandles are recommended. However, for people ages 40 to 55 years, 30 footcandles are recommended for tasks where speed and accuracy are either important or critical. The same intensities are recommended for writing with a number 2 pencil or a ball-point pen.

Most daily living tasks can probably be accomplished at lighting intensities sufficient to read a newspaper or write with a ball-point pen. There may be some tasks, however, which require stronger lighting intensities. The 1993 ANSI/IESNA office lighting standards recommend 50, 75 or 100 footcandles for reading a telephone book, depending on the person's age and the importance of speed and accuracy. The 1979 ANSI standards for industrial settings recommend 70 footcandles for the first aid room.

The APHA-CDC (Mood, 1986) recommended minimum housing standards do not recommend lighting intensities except for public halls and stairways in multiple unit dwellings, where at least ten footcandles of light are recommended.

(13) Ensure wiring and fixtures are installed in accordance with department of labor and industries regulations, RCW 19.28.070 and local ordinances, and maintained in a safe condition:

Response: Reexamination of the RCW regulating the installation of wiring and fixtures is beyond the scope of this assignment. However, improperly installed and/or poorly maintained wiring and fixtures increase risk of fire and electric shock.

(14) Ensure heating, cooking, water heating, and other electrical equipment is installed in accordance with state and local ordinances, codes, and regulations governing such installation:

Response: See subsection 13.

(15) Provide adequate heating equipment if camp is used during cold weather:

Response: Although there are regulatory guidelines which address the issue of adequacy of heating equipment (for example, the federal Employee Housing Act), from a scientific perspective, there are health and safety factors related to fumes from improperly vented heating equipment and to potential for fire related to some types of heating equipment, such as some types of portable heaters.

The temperature to which the equipment can heat also reflects the adequacy of the heating equipment. Cold temperatures, per se, do not seem to be a risk factor for disease. Most of the scientific literature on home heating temperature concerns hypothermia and the elderly. An indoor air temperature of 70 degrees Fahrenheit seems sufficient to prevent hypothermia in the elderly (variously defined as over 65 or over 75 years old).

Hypothermia may be triggered by "mildly cool temperatures of 60 to 65 degrees Fahrenheit, particularly in those 75 years of age and older" (Macey, 1989). It is likely that people less than 65 years old with no chronic illnesses and adequate clothing are not at risk for adverse health outcomes at lower temperatures.

One article suggests that health factors seem to be unimportant in any decision to lower the temperature of [college] campus buildings to as low as 60 degrees Fahrenheit (College Health, 1974). The same author cites a study on manual performance as finding the lowest incidence of minor accidents among workers when the temperature in which they were working was between 65 and 68 degrees Fahrenheit.

From a comfort viewpoint, a recent review article on physical factors in the indoor environment states that temperatures between 68 and 78 degrees Fahrenheit are expected to satisfy 80-95% of building occupants, although the author questions the upper boundary and provides evidence that people find air quality less acceptable as temperatures increase above 68 degrees Fahrenheit (Levin, 1995).

A study of office workers in San Francisco cited in the same article found that 72.5 degrees Fahrenheit was the temperature at which fewest people were dissatisfied. Radiant temperature from surrounding surfaces, air movement and humidity interact with room temperature in affecting comfort level.

Based on experience, in the absence of adequate heating equipment, tenants find alternate methods of heating which often pose health and safety risks.

(16) Ensure that operator-supplied trailers and recreational vehicles manufactured after July 1968 display a Washington state department of labor and industries insignia as required in chapters 296-150A and 296-150B WAC:

Response: These WACs refer to regulations for factory-built structures and mobile homes. It is beyond the scope of this assignment to review whether these WACs are based on health and safety concerns.

(17) Follow the compliance schedule established with the department or contracted health officer when existing housing fails to meet the requirements in this chapter.

Response: It is reasonable that a compliance schedule needs to be followed to assure that structures which are not in compliance come into compliance. However, it is beyond the scope of this paper to review the compliance schedule to determine whether it is reasonable to assure health and safety. While many of the provisions in WAC 246-358 are related to health and safety, non-compliance with some of the provisions poses more immediate or greater health and safety risks than does non-compliance with other provisions. We have not investigated how different provisions are scheduled for compliance.

WAC 246-358-090 Laundry facilities.

An operator shall provide laundry facilities including:

(1) Hot and cold running water under pressure for laundry adequate to meet the needs of occupants as determined by the department or contracted health officer;

(2) One laundry tray or tub, or one mechanical washing machine, for each 30 occupants, or fraction thereof, specified on the operating license;

(3) At least one slop sink in each building used for laundry;

(4) Facilities for drying clothes;

Response to subsections 1-4: To reduce the opportunity for disease transmission, it is important to wash clothes that may have become contaminated with either chemicals or disease-causing organisms. There is documentation supporting the transmission of chemical contamination (e.g., lead) through clothing. Disease-causing organisms, such as infectious causes of diarrhea or hepatitis, have been documented to be transmitted through clothing and bedding. Laundering with hot water is effective in preventing disease transmission by these means. See Section 246-358-095.1a below, for further elaboration of the importance of hot water. While a slop sink (utility sink) is a convenience, it does not seem to be essential to health and safety as long as residents understand and use acceptable alternatives to disposing of waste water which is likely to clog normal sinks. Many residences do not contain slop sinks.

(5) Sloped, coved floors of nonslip impervious materials with floor drains;

Response: Sloped, coved floors and floor drains are to prevent water from accumulating in these areas and to ensure that laundry waste water is properly disposed of. Accumulation of water would allow for breeding of certain insects, and may attract rodents or other small mammals. Even without water accumulation, the floors in laundry facilities are likely to become wet, and possibly wet and soapy. Nonslip floor materials are important for reducing the likelihood of falls in the facilities. Impervious materials are important in areas that are likely to become wet to ensure the structural integrity of the flooring and allow for surfaces which could harbor bacteria, fungi, or molds using residual organic matter from human uses, to be readily cleaned, thus allowing greater protection from these organisms. These requirement may ensure more use of these facilities so that alternate, less sanitary, methods would not be as attractive.

(6) At least 1 electrical ceiling or wall-type convenience fixture:

Response: See Section 246-358-075.11.

(7) 30 footcandles of light measured 30 inches from the floor:

Response: See Section 246-358-075.12. In industrial settings, 30 footcandles are recommended for washing (ANSI/IES, 1979). However, higher intensities are recommended for other tasks (ironing, weighing, listing, marking, etc.), which may or may not be relevant to residential settings.

WAC 246-358-095 Bathing and handwashing facilities.

(1) An operator shall:

(a) Provide hot and cold running water under pressure for bathing and handwashing adequate to meet the needs of occupants as determined by the department or contracted health officer:

Response: Hot water is more effective in cleansing than cold water. The kinetics of soap's reaction with dirt (minerals, calcium, oils, etc.) is enhanced with hotter water and is, thus, made more effective for body/hand cleansing and clothes washing. (However, there is a documented risk of scalds and burns with water above 55 degrees Celsius.) Additionally, based on experience, when only cold water is provided people are less likely to wash their hands and bathe. See Section 246-358-055.2b for a discussion of the importance of having the water under pressure. (In some areas, both growers and farm workers have expressed the desire for a "rinse off" space outside of the living unit to hose off and remove clothing before entering the dwelling to shower. They are aware of the need to remove pesticides and dirt from their bodies and clothing before entering the dwelling to avoid contamination of the eating and sleeping areas.)

(b) Provide at least 1 electrical ceiling or wall-type convenience fixture.

Response: See Section 246-358-075.11.

(c) Provide 30 footcandles of light measured 30 inches from the floor.

Response: See Section 246-358-075.12. The ANSI/IES 1979 standard for locker rooms and showers in industrial settings is 10 footcandles. We have not looked into the reason for what appears to be a large discrepancy.

(2) An operator providing centralized bathing or handwashing facilities shall meet the requirements of subsection (1) of this section, and:

(a) Provide the number of handwashing sinks and shower heads as follows:

Handwashing sinks: 1 per each 6 persons or fraction thereof.

Shower heads: 1 per each 10 persons or fraction thereof.

The number of persons shall be calculated by subtracting the number of occupants sheltered in dwelling units that contain individual facilities from the maximum occupancies approved for both operator-supplied and worker-supplied housing.

Response: These are Occupational Safety and Health Administration's (OSHA) requirements ("Minimum Requirements for Sanitation in Temporary Labor Camps"). While they may come from studies in the workplace where factors such as productivity, convenience, reasonableness, etc. are taken into account, we did not locate those studies and so we do not know the basis for these requirements. Even if there are studies relating number of sinks and showers in the workplace to health and safety, it is not clear how they would translate to residential settings. Health may be at issue if the availability of these facilities is so limited that people forego or seek alternative means for washing and showering, rather than waiting. Thus, while there are health implications regarding the availability and accessibility of these facilities, we are not aware of the basis for these specific requirements. We are aware that others codes or laws have different specifications. For example, the federal Employee Housing Act requires 1 sink per 10 occupants.

(b) Provide a means to maintain a temperature of 70°F during cold weather.

Response: See Section 246-358-075.15. Based on the discussion in that subsection, maintenance of a temperature of 70°F may not be supportable, although that discussion does not specifically address temperatures in bathing facilities.

(c) Ensure bathing and handwashing facilities are maintained in a clean and sanitary condition

Response: The importance of maintaining clean sanitary conditions is discussed in Section 246-358-045.2. In addition to those considerations, an additional issue may be safety related to water on the floor in bathing and handwashing facilities. Even with nonslip surfaces, water on the floor may increase the potential for falls. Unsanitary conditions may also discourage use of the facilities. While the maintenance of clean and sanitary conditions is a health and safety issue, the assignment of responsibility for maintaining clean and sanitary conditions is policy decision.

(d) Provide one slop sink per building used for handwashing and bathing.

Response: While a slop sink (utility sink) is a convenience, it does not seem to be essential to health and safety as long as residents understand and use acceptable alternatives to disposing of waste water which is likely to clog normal sinks. Many residences do not contain slop sinks.

(e) Provide shower rooms with:

(i) Sloped, covered floors of nonslip impervious materials:

(ii) Floor drains: and

(iii) Smooth, water impervious walls and partitions to the height of splash.

Response: See Section 246-358-090.5.

(f) Provide cleanable, nonabsorbent waste containers.

Nonabsorbent waste containers are important in areas which are likely to become wet so that they remain intact and can be easily cleaned to prevent harboring of mold and bacteria. See discussion in Section 246-358-045.2.

(3) An operator providing bathing or handwashing facilities in dwelling units shall meet the requirements in subsection (1) of this section, and request occupants to maintain bathing, handwashing, and toilet facilities in a clean and sanitary condition.

Response: See subsections 1 and 2c. The latter part of this provision recognizes that maintaining these facilities in a clean and sanitary condition is the joint responsibility of the operator and the tenant.

WAC 246-358-100 Toilet facilities.

(1) The operator shall:

(a) Locate each toilet in a toilet room which is accessible without passing through a sleeping room:

Response: A "toilet room" indicates that each toilet is separated from other toilets and habitable areas. This is probably important for societal and cultural reasons. People may not use the toilets if they do not have privacy. Rather, they will look for alternate places for elimination and that may lead to the possibility of disease spread from human waste. We are not aware of the basis for the provision that the toilets be accessible without passing through a sleeping room. This may be to prevent disturbing others at sleep, to minimize accidents that could occur in the dark of the sleeping room (e.g., tripping over others or things), to maintain the privacy of those sleeping, or to ensure that the toilet is available at all times.

(b) Provide a window not less than 6 square feet in area opening directly to the outside, or other satisfactory ventilation.

Response: See discussion of ventilation under Section 246-358-075.9. In addition to the issues discussed in Section 246-358-075.9, proper ventilation in the toilet area is important so that people do not use less sanitary alternatives. As discussed in Section 246-358-075.9, adequate ventilation depends on a variety of factors, not just the size of the window. "Proper ventilation" is a vague term. A specific air flow rate needs to be indicated.

(c) Provide water flush toilets unless privies or other methods are specifically approved by the department or contracted health officer according to requirements in chapter 246-272 WAC:

Response: Provision of toilets is basic to reducing disease carried by human fecal matter. (See Section 246-358-065.) However, based on experience, there seems to be conflicting views of the desirability of prioritizing flush toilets compared to privies. The disposal system for flush toilets which are not connected to city sewage systems would need to be approved. While it is beyond the scope of this report to assess the health and safety issues related to WAC 246-272, this WAC regulates on-site sewage systems which is necessary to assure proper sewage disposal and integrity of the water supply (see Sections 246-358-055 and 246-358-065).

(d) Locate pit privies, when approved, at least 100 feet from any dwelling unit, space, or foodhandling facility:

Response: The separation from the point of the contamination potential to the inhabited area is at issue. We did not find the basis for the 100 foot distance. If properly maintained and located down wind from the prevailing winds, odor would not be problem at distances less than 100 feet, based on experience. Based on experience, it is unlikely that 100 feet separation is far enough to mitigate disease transmission from flying or crawling insects. Therefore, the privy needs to be properly constructed and maintained with screened ventilation. Given these constraints (down wind, properly maintained, screened ventilation), experience leads us to conclude that distances of less than 100 feet may be preferable to encourage use of the privy, especially during the night.

(e) When vault privies or chemical toilets are approved:

(i) Locate at least 50 feet from any dwelling unit, space, or foodhandling facility:

(ii) Maintain a service contract for sewage pumping with a licensed waste disposal company: and

(iii) Comply with local ordinances:

Response: Based on experience, certain waste receiving devices can be located nearer to the user groups if they are maintained and operated in an appropriate manner. The possibility of contamination from human wastes increases if these devices are not pumped appropriately. The health and safety issues related to the local ordinances are not known, but based on experience, some local ordinances may not reflect best current knowledge.

(f) If urinals are provided, cover the floor with a material impervious to moisture for a radius of not less than 15 inches from the outer edge of the urinal, and from the urinal to the wall:

Response: The 15 inch criteria most likely developed from a combination of experience and logic. The reason for the impervious materials is most likely to preclude problems with urine accumulation on floors which cannot be readily cleaned. This is seen mostly as an aesthetic consideration, since human urine is not considered an important risk factor for disease transmission in Washington. While human urine can play a role in the transmission of typhoid and paratyphoid fevers, this is not a large concern in Washington. Although it is not impossible that a carrier of typhoid or paratyphoid from an endemic region outside of the United States might be housed in temporary housing in Washington, spread of disease related to urinals is viewed as remote. Hand washing after elimination and before preparing food and/or eating, and maintaining the integrity of the water and sewage systems are viewed as more important to infectious disease control.

(g) Provide an adequate water flush in urinals if water under pressure is available.

Response: This is most likely for aesthetic purposes. See the discussion of the role of human urine in disease transmission in subsection 1f above.

(h) Connect sinks and bathing facilities through properly trapped floor drains to an approved disposal system.

Response: Wastes disposed through these facilities should be removed from the area to prevent flooding, or accumulation of water which could promote growth of mold or bacteria or provide breeding areas for insects. This provision also has aesthetic importance, and facilities are more likely to be used if waste water is properly drained. Proper traps are to prevent odors, insects and small animals from entering the facilities. Use of an approved disposal system is important to prevent potential contamination of soil, ground water and/or surface water by wastes from these facilities.

(i) Provide an adequate supply of toilet paper in each toilet room, privy, and chemical toilet compartment.

Response: The basis for this provision is most likely that the use of toilet paper is normative in this culture. It is reasonable to expect that the potential for disease transmission through the fecal-oral route will be decreased by the use of toilet paper combined with proper hand washing. (In this regard, supply of water and soap is important also.) Additionally, based on experience, when toilet paper is not available, people will use a wide variety of alternatives, such as newspaper, magazine paper, plastics, leaves, sticks and rocks. If thrown into a toilet, these items may compromise the integrity of the sewage disposal system. (See Section 246-358-065) If not thrown into the toilet, these items, which will contain fecal material, may become health hazards in their own right. Thus, based on experience, it appears that provision of toilet paper (as well as hand washing facilities) may be important in decreasing potential for disease spread through the fecal-oral route. While responsibility for provision of toilet paper is primarily a policy issue, given that residents of temporary housing are, by definition, relatively mobile, it may make sense for the landlord to provide toilet paper (and soap) under these circumstances, even though the tenant is usually responsible for provision of toilet paper in dwelling units occupied by families or small numbers of unrelated persons. Provision of toilet paper in central toilet facilities seems standard in this culture.

(j) Provide at least 1 electrical ceiling or wall-type convenience fixture.

Response: See Section 246-358-075.11.

(2) An operator providing centralized toilet facilities shall meet the requirements of subsection (1) of this section, and:

(a) Provide 1 toilet per 15 persons of each sex with a minimum of 2 toilets for any facility shared by men and women:

Response: Provision of toilets is essential so that people do not use less sanitary options. While people may use less sanitary options if waiting times to use toilets are too long, we found no evidence for one toilet per 15 people as an optimum ratio. Other codes specify different ratios. For example, the federal Employee Housing Act specifies one toilet per 10 people. A discussion of latrines in refugee situations suggests that one latrine per 10 to 15 people is suitable. (Simmonds *et al.*, 1983) To comply with subsection 2c below, at least two toilets would be necessary for a facility shared by men and women. (See subsection 2c below.)

(b) Locate toilets within 200 feet of the door or each sleeping unit:

Response: We are not aware of studies showing this distance to be critical with respect to health and safety. Based on experience, 200 feet may be too far away, and people may seek alternatives, especially at night.

(c) Separate toilet rooms for men and for women with solid walls or partitions extending from the floor to the roof or ceiling.

We found no scientific evidence relating to health and safety for the provision of separate facilities for men and women. There did not seem to be a consensus on the importance of this provision based on experience. However, to the extent that this provision recognizes a cultural standard for separate facilities for men and women, compliance with this norm will encourage use of these facilities as opposed to less sanitary alternatives, which could lead to spread of disease by the fecal-oral route.

(d) Clearly mark each room for "men" and for "women" by signs printed in English and in the native language of the persons occupying the camp, or marked with easily-understood pictures or symbols.

Response: This provision seems to be based in common sense. If the facilities are to be separate, there must be some means of distinguishing the men's from the women's facilities. Easily-understood picture or symbols are preferable to obviate concerns with literacy.

(e) Provide natural or artificial light 24 hours per day equal to 20 footcandles of light, measured 30 inches from the floor.

Response: The requirement for light 24 hours per day is important for both health and safety. This seems to be based on common sense. For safety, light is important to lessen the possibility of injury due to falls and lessen the possibility of bites from insects or small animals. From a health viewpoint, lighting is important to assure that the facility is properly used and cleaned, both of which are important in decreasing potential for disease transmission from fecal exposures. Provision of lighting may also increase the probability that the facility will be used on a 24-hour basis and that less protected waste disposal alternatives will be less attractive. Finally, the failure to provide adequate lighting may result in people using relatively less safe means of lighting, such as kerosene lamps or candles, resulting in increased risk of fire. For a discussion of lighting intensity, see Section 246-358-075.12. The ANSI/IESNA (1993) standard for rest rooms in an office setting is 10, 15 or 20 footcandles depending on the age of the people using the facility and how important one judges speed and accuracy to be in this setting.

(f) Provide a means to maintain a temperature of 70°F during cold weather.

Response: Adequate temperature is important to comfort. However, we found no scientific or experiential information indicating that 70°F is the appropriate temperature. See Section 246-358-075.15.

(g) Ensure that the toilet facilities are cleaned at least daily.

Response: The importance of maintaining clean sanitary conditions is discussed in Section 246-358-045.2. This is especially important in toilet facilities to decrease the potential for disease spread through fecal exposure and for aesthetic purposes so that people do not seek less sanitary alternatives. For shared facilities, the requirement to clean once per day may be reasonable (i.e., has some element of common sense), but we did not find documentation regarding the frequency of cleaning which is necessary to ensure sanitary conditions.

(3) An operator providing toilet facilities in dwelling units shall meet the requirements in subsection (1) of this section.

(a) Provide a handwashing sink in each dwelling unit that contains a toilet.

Response: The provision of the handwashing sinks with the toilets may increase the use of hand washing after use of toilets. There is good scientific documentation concerning the importance of hand washing to prevent disease transmission by fecal-oral routes of exposure. Additionally, studies have shown that if handwashing facilities are close by, persons are more likely to use them. (In fact, conveniently located hand washing facilities are so important in reducing spread of communicable disease, such as hepatitis, that we wonder why sinks are not required in close proximity to centralized toilet facilities covered in subsection 2 above.)

(b) Request occupants to maintain toilet facilities in a clean and sanitary condition.

Response: See subsection 2g above. While assignment of the responsibility for maintaining toilet facilities in a clean and sanitary manner is a policy question, it seems reasonable that occupants assume at least some of that responsibility when toilets are in dwelling units.

WAC 246-358-125 Cooking and foodhandling facilities.

An operator shall provide enclosed cooking and foodhandling facilities for all occupants.

(1) An operator furnishing cooking facilities in each dwelling unit shall provide:

(a) An operable cook stove or hot plate with a minimum of 1 cooking surface for every 2 adult occupants or 4 cooking surfaces for every 2 families:

(b) A sink with running water under pressure:

(c) Food storage areas and easily-cleanable food preparation counters situated off the floor:

(d) Mechanical refrigeration capable of maintaining temperature of 45 degrees Fahrenheit or below, with space for storing perishable food items for all occupants:

Response: The primary ways to prevent foodborne disease include:

- Frequent hand washing by food handlers to prevent transmission of infectious diseases which may be present in the food handlers or in the uncooked foods they touch,
- Adequate cooking and refrigeration of food, and
- Proper dish washing to prevent cross-contamination.

These preventive measures have been the standard of public health practice for many years. A study by Irwin, K, *et al.*, "Results of Routine Restaurant Inspections Can Predict Outbreaks of Foodborne Illness: The Seattle-King County Experience," (American Journal of Public Health, May 1989, p.586-590) found increases in foodborne diseases when these measures were violated in restaurants.

With regard to provision 1a, we did not find the basis for the optimal number of cooking surfaces per person.

Under provision 1b, hot water is preferable, since it is a better solvent than cold water and increases comfort that may be important in ensuring adequate hand and dish washing. Provision of hot water also decreases the potential for scalds and burns from heating hand and dish water on a stove. (Subsection 2c below stipulates hot and cold running water. It is not clear why this provision is not included in 1b, since 1a-d generally parallel 2b-e.)

Easily cleanable food preparation counters (1c) are important to minimize transmission of foodborne infectious agents which may be present in uncooked foods. Storage areas off the floor reduces potential contamination of food from mop water and floor cleaning chemicals, and may decrease access by rodents and insects. While the former concern seems to be based on common sense, we are not certain of the basis for the latter concern, since rodents and insects are able to access food stored in cabinets off the floor. Food preparation counters off the floor may make it easier to keep dirt and possible contaminants out of the food, and are probably viewed as an important convenience by most people in this culture. Depending on their height, the food preparation counters may have orthopedic value and may decrease potential for injury while cutting, but we did not investigate the ergonomic aspects of counter height.

While there is some debate about the ideal temperature for refrigeration, maintaining refrigeration temperatures at 45 degrees Fahrenheit or below (1d) is generally considered safe, since pathogens of concern either do not grow, or grow very slowly, at those temperatures. Above 45 degrees Fahrenheit, many common pathogens, such as salmonella and staphylococcus aureus, begin to multiply, resulting in both increased potential for disease related to foodborne pathogens and increased food spoilage and waste.

(e) Fire resistant, nonabsorbent, nonasbestos, and easily-cleanable wall coverings adjacent to cooking areas:

Response: These are intended to reduce the risk of fires in cooking areas, ensure the surface areas are cleanable to reduce the risk of cross contamination, and decrease exposure to asbestos which is known to cause lung disease.

(f) Nonabsorbent and easily-cleanable floors:

Response: Nonabsorbent floors are easier to clean than absorbent floors. Clean floors are important to decrease infestation by rodents and insects. In cooking areas, clean floors are also important to decrease the potential for injury due to falls and slips.

(g) At least 1 electrical ceiling or wall-type convenience fixture.

Response: See Section 246-358-075.11.

(h) 30 footcandles of light measured 30 inches from the floor.

Response: See Section 246-358-075.12. It is not clear how to translate standards for industrial foodhandling to residential settings. However, information on lighting requirements in small restaurants or cafeterias may be relevant. We are in the process of obtaining that information.

(2) An operator furnishing common foodhandling facilities shall provide:

(a) A room or building, adequate in size, separate from any sleeping quarters and without direct openings to living or sleeping quarters:

Response: Separation of the kitchen from the sleeping areas may have some health value in minimizing the potential for inadvertent contamination of food by contagious individuals who may be in the sleeping area. If the kitchen were in the sleeping area, noise from kitchen activities could interfere with sleep, and fatigue has been documented to be related to increases in unintentional injury. While this seems to be based in common sense for larger facilities, small residential units, such as studio apartments often contain cooking facilities which are not separated from the sleeping area.

We do not know the rationale for not having direct openings from the kitchen to the living or sleeping areas. This may be an attempt to reduce the number of people who have no need to be in cooking areas, such as children or people who have not washed their hands or have infectious disease. While the strategy of limiting the number of people in contact with food preparation most likely reduces the potential for inadvertent contamination of the food, as well as unintentional injury (e.g., burns in children), we have no evidence that this is an effective way to achieve that goal.

(b) An operable cook stove or hot plate with a minimum of 1 cooking surface for every 2 adult occupants or 4 cooking surfaces for every 2 families:

Response: See the general discussion under subsection 1 above and the comment for subsection 1a.

(c) Sinks with hot and cold running water under pressure:

Response: See the general discussion under subsection 1 above and the comment for subsection 1b.

(d) Food storage areas and easily-cleanable food preparation counters situated off the floor:

Response: See the general discussion under subsection 1 above and the comment for subsection 1c.

(e) Mechanical refrigeration capable of maintaining a temperature of 45 degrees Fahrenheit or below with space for storing perishable food items for all occupants:

Response: See the general discussion under subsection 1 above and the comment for subsection 1d.

(f) Fire-resistant, nonabsorbent, nonasbestos, and easily-cleanable wall coverings adjacent to cooking areas:

Response: See subsection 1e above.

(g) Nonabsorbent, easily-cleanable floors:

Response: See subsection 1f above.

(h) No direct openings to living or sleeping areas from the common foodhandling facility:

Response: See subsection 2a above.

(i) At least 1 ceiling or wall light fixture where electric service is available: and

Response: See Section 246-358-075.11.

(j) 30 footcandles of light measured 30 inches from the floor.

Response: See Sections 246-358-075.12 and 246-358-125.1h.

(3) An operator furnishing a dining hall shall:

(a) Comply with chapter 246-215 WAC, Food service:

Response: WAC 246-215 sets standards for central food handling and it is beyond the scope of this document to review that WAC. However, as noted in subsection 1 above, violations of measures required in central foodhandling facilities (restaurants) have been associated with increases in foodborne disease.

(b) Provide a room or building, adequate in size, separate from any sleeping quarters and without direct openings to living or sleeping quarters:

Response: See subsection 2a above.

(c) Provide fire-resistant, nonabsorbent, nonasbestos, and easily-cleanable wall coverings adjacent to cooking areas:

Response: See subsection 1e above.

(d) Provide at least 1 ceiling or wall light fixture where electric service is available: and

Response: See Section 246-358-075.11.

(e) Provide 30 footcandles of light measured 30 inches from the floor.

Response: See Sections 246-358-075.12 and 246-358-125.1h.

WAC 246-358-135 Beds and bedding and personal storage. An operator shall:

(1) Provide beds or bunks furnished with clean mattresses in good condition for the maximum occupancy approved by the department or contracted health officer for operator-supplied housing:

(2) Ensure bedding, if provided by the operator, is clean and maintained in a sanitary condition

Response to subsections 1 and 2: Sleep is a necessity for life and people in this culture are accustomed to a bed in which to do it. Clean bedding helps to prevent infection by parasites, such as scabies and lice, and exposure to harmful chemicals. Provision of beds for the maximum occupancy is to prevent overcrowding in beds which could result in spread of infectious diseases, as well as sleep deprivation.

(3) Provide a minimum of 12 inches between each bed or bunk and the floor:

Response: Based on experience, bedding off the floor has some advantages. However, the basis for the precise specification of 12 inches is unknown. Although some types of rats can climb, 18 inches seems to be considered a minimum height for deterring most rats and other vermin. Roof rats, which are common in rural Washington, tend to climb easily, but usually live in the upper timbers or attics. Keeping the beds off the floor protects bedding in the event of flooding, such as internal sewage backup, which may or may not be a possibility depending on the housing arrangement. Bedding off the floor also makes floor cleaning more convenient, decreases potential for contact with floor dirt which may contain contaminants, provides storage space for personal belongings, may increase warmth, and may prevent rodent harborage when the facility is not in use.

(4) When single beds are used separate beds laterally and end to end by at least 36 inches:

Response: The basis for spacing between beds is to 1) provide emergency escape lanes in case of fire, 2) decrease potential for spread of infectious disease, and 3) facilitate maintenance of the bed. However, we found no evidence documenting that 36 inches is the minimal spacing necessary to reduce health and safety concerns.

5) When bunk beds are used:

(a) Separate beds laterally and end to end by at least 48 inches:

Response: See subsection 4 above. Presumably, due to the need to climb in and out, greater separation is required.

(b) Maintain a minimum space of 27 inches between the upper and lower bunks:

Response: We do not know the basis for 27" as the minimum necessary separation. It may be to allow people to sit upright in bed.

(c) Prohibit triple bunks:

Response: The basis for this prohibition may be the potential for the bed tipping, the hardship of entering the top bunk and/or the increased potential of serious injury from falls from a relatively greater height than a double bunk. However, we do not know if stable triple bunks are available and whether there are studies or experience documenting increased injury with their use. Prohibiting triple bunks could also be to prevent conflict between requirements for minimum ceiling heights and vertical separation needs. Seven-foot ceilings are most likely not adequate for triple bunks.

(6) Provide storage facilities for clothing and personal articles in each room used for sleeping.

Response: Based on experience, without proper storage for clothing, clothing is often found in piles on the floor, providing harborage for insects and rodents.

WAC 246-358-140 Use of tents.

An operator may use tents that do not violate WISHA requirements.

While it is beyond the scope of this assignment to review the WISHA requirements, there is little in the scientific literature which addresses the potential for adverse health effects of living in tents. We found one study conducted during Desert Storm looking at health complaints of those living in air conditioned buildings compared to those living in tents. Complaints of sore throat and cough were associated with sleeping in the air conditioned buildings and chronic rhinorrhea was associated with exposure to blowing sand while living in tents. (Richards *et al.*, 1993) Based on experience and common sense, tents are preferable to no shelter.

WAC 246-358-145 Health and safety.

An operator shall:

(1) Comply with chapters 15.58 and 17.21 RCW, chapter 16-228 WAC, and pesticide label instructions when using pesticides in and around the housing:

Response: While it is beyond the scope of this assignment to review additional WACs and RCWs, improper use of pesticides may have adverse health effects.

(2) Prohibit, in the housing area, the use, storage, and mixing of flammable, volatile, or toxic substances other than those intended for household use:

Response: By definition toxic substances are those which have adverse health effects and flammable substances are those which pose a danger of fire, with subsequent injury and death. Volatile substances may be toxic and may pose a danger of explosion and fire, with subsequent injury or death. Therefore, there are health reasons to prohibit the use, storage and mixing of these substances in housing areas.

(3) Provide readily accessible first-aid equipment meeting the requirements of Part A-1 of chapter 296-24 WAC:

(4) Ensure that a person trained to administer first aid is readily accessible at all times:

Response to subsections 3 and 4: The availability of first aid equipment and the ability to use such equipment most likely can decrease adverse health effects in cases of injury. The assignment of responsibility for provision of equipment and its proper use in residential setting is a policy question.

(5) Comply with chapter 51-20 WAC by providing smoke detection devices:

Response: Smoke detection devices have been shown to reduce injury and death in residential fires.

(6) Store or remove unused refrigerator units to prevent access by children:

Response: Suffocation of children in unused older model refrigerators has been documented. Newer model refrigerators with magnetic closures may continue to be problematic for very young children, who could get into the refrigerator (e.g., in the course of playing with older children) and be unable to get out. Alternatively, removal of refrigerator doors would prevent suffocation of children in unused refrigerators. Other than suffocation, we do not know of injury associated with play in unused refrigerators, although this would be a possibility depending on the stability of the unused refrigerator and the nature of play.

(7) Fill abandoned privy pits with earth: and lock or otherwise secure unused privy buildings.

Response: Abandoned privy pits need to be filled so they do not become a site where insect breeding could occur. This is especially true for flies which could carry pathogens from the disposal pit to humans. It is also important to fill pits to prevent people, especially children, from falling into the pits. There are documented cases where people have fallen into unfilled, abandoned privy pits. Locking privy buildings is to prevent their further use without a proper pit.

WAC 246-358-155 Refuse disposal. An operator shall:

(1) Establish and maintain a refuse disposal system:

Response: This provides for routine removal of garbage and refuse from outside the housing site to prevent conditions which would attract insects and rodents. (See Sections 246-358-045.2 and subsection 2 below.)

(2) Protect against rodent harborage, insect breeding, and other health hazards while storing, collecting, transporting, and disposing of refuse:

Response: It is important to control rodents and insects which may carry disease.

Examples of diseases carried by arthropods which are transmitted to humans are:

Viral encephalitis - carried by mosquitoes and transmitted to humans via bites

Enteric bacterial disease - physically transmitted by flies from human feces to food completing fecal-oral route of transmission

Examples of diseases carried by rodents which are transmitted to humans:

Rat bite fever - bacteria transmitted by the bite of a rat

Leptospirosis - bacteria transmitted by direct or indirect human contact with urine of rodents and other animals

Salmonellosis - bacteria transmitted via food contaminated by rat and mouse feces.

Murine typhus fever - rickettsia transmitted to human via rat fleas

Trichinosis - rodents involved in the rodent-swine-human cycle

Rickettsial pox - transmitted from the house mouse to humans by the bite of the house mouse mite.

Lymphocytic choriomeningitis - viral disease transmitted to humans by contact with saliva, nasal secretions, urine and feces of mice.

Hantavirus pulmonary syndrome(HPS) - newly described viral strain shed in urine, feces and saliva of wild rodents and transmitted to humans via the inhalation of dust and aerosols (Zietz *et al.*, 1995)

In addition to the threat of infectious disease exposure from arthropods and rodents, other issues include the nuisance factor (mosquito, flea bites), the economic loss from food consumption and contamination by rodents, and the threat of fires caused by rats gnawing of electrical wire insulation. CDC Vectorborne Disease Control Training Manual states that 5-25% of fires of unknown origin on farms are caused by rats.

Other health hazards from improper storage, collection, transportation and disposal of garbage include exposures to toxic materials or dangerous (broken glass, metal) items which could result in physical injury.

The manner the garbage is collected, transported and disposed of depends on the collector (operator, trash collection company). Collection and transport could result in spilling garbage which would then attract insects and rodents or increase exposure to toxic or dangerous materials. If the garbage were collected in front of housing units, transported and disposed of improperly behind housing units the same problems could occur.

(3) Store refuse in fly-tight, rodent-tight, impervious, and cleanable or single-use containers:

Response: Between collection dates garbage should be stored in containers which adequately contain the garbage, do not allow access to insects or rodents, do not leak fluids (which would in turn attract insects and rodents), and which can be easily cleaned as to not attract insects and rodents.

(4) Keep refuse containers clean:

Response: See subsection 3 above.

(5) Provide a container on a wooden, metal, or concrete stand within 100 feet of each dwelling unit and space:

Response: The stand for the container provides a cleanable surface for spilled garbage. While we do not know the basis for the provision that the container be within 100 feet of the dwelling, if the container is too far away, residents may be more likely to let garbage accumulate in the housing areas.

(6) Empty refuse containers at least twice each week, and when full:

Response: Emptying the container when full will prevent conditions which will attract insects and rodents. CDC recommends twice-weekly garbage collection especially during the fly season (summer), unless the containers are fly-proof. From a health perspective, the important factor is not allowing rodents and insects access to the garbage, not frequency of garbage pick-up, as long as the containers are rodent and insect-tight. Typical residential garbage collection is once per week.

(7) Comply with local sanitation codes for removing refuse from housing areas and disposing of refuse:

Response: Any refuse which would provide shelter, nesting materials for rodents, or collection of rainwater (mosquito breeding grounds) should be removed from the housing areas and appropriately disposed. Examples include wood scraps, mattresses, irrigation pipes, appliances, vehicles, and paper. It is beyond the scope of this document to investigate the reasoning behind the local sanitation codes.

(8) Ensure the housing area is free of refuse when housing is closed for the season to prevent a nuisance.

Response: This provision is to prevent infestation of housing by rodents, which could pose a health hazard to the person opening the housing at the beginning of the next season.

246-358-165 Rodent And Insect Control. An operator shall take measures necessary to control rodents and insects in and around the housing.

Response:

The importance of insect and rodent control is discussed in Section 246-358-155.

Rodent control consists of three basic steps:

1) Do not provide an environment (food, water, shelter) which will attract rodents.

Rodents need food, water, shelter and nesting materials. A food source could be pet food left outside, accessible garbage, improperly stored foodstuffs inside the housing unit, livestock feed, poorly cleaned food preparation areas, etc. A water source could be any container that collects water or a leaky pipe. Shelter can consist of almost any place out of the weather (outbuildings, appliances, walls), and nesting materials can be found inside and outside of housing units (woodpiles, yard waste, vehicles, mattresses, clothing, drawers, closets, heating vents, paper) While the operator can control some of this step, some responsibility seems to rest with the residents.

2) *Do not provide rodent access to the inside of buildings.*

Some mice can enter a building through a 1/4 inch opening. Openings are commonly found in wall cracks, where pipes enter walls or floors, drains, heating systems, doors, etc. Openings can be filled with materials which will prevent rodent access. This appears to be the responsibility of the operator. This step requires substantial time, effort and expense for success.

3) *If a current rodent infestation exists in the housing, trapping and/or the appropriate use of rodenticides are needed to eliminate them.* This step must be carried out in combination with steps 1 and 2 for successful control. Again, substantial time, effort and expense may be required.

WAC 246-358-175 Disease prevention and control. An operator shall:

(1) Make reasonable efforts to know if disease is present among occupants:

(2) Report immediately to the local health officer:

(a) The name and address of any occupant suspected of having an infectious or communicable disease:

(b) Any case of suspected food poisoning; and

(c) Any unusual prevalence of any illness in which fever, diarrhea, sore throat, vomiting, jaundice, productive cough, or weight loss is a prominent symptom among occupants:

Item 2a should be modified as follows: The name and address of any occupant suspected of having a reportable infectious disease as determined in Chapter 246-100-076 WAC. A list of these reportable diseases can be obtained from local health departments.

Response to subsections 1, 2a (as modified), 2b, and 2c: General regulations exist (Chapter 246-100 WAC) requiring reporting of specified communicable diseases to prevent epidemics and further spread once epidemics occur. These regulations apply to schools and day care centers, as well as to health care providers, hospitals, clinics and local health departments. The regulations also allow any member of the general public to report cases or suspected cases. These provisions are an extension of this public health principle to another group at risk of infectious disease outbreaks, people in temporary worker housing. While the goal of this reporting is to prevent spread of disease, based on experience, there are a number of reasons why identification and reporting of illness may be difficult with residents of temporary housing, in general, and temporary farm worker housing, in particular. Residents may be reluctant to report any illness because they do not want to lose work and wages. Additionally, if people do not have health insurance, they may be reluctant to report disease which may require medical attention.

(3) Prohibit any individual with a communicable disease from preparing, cooking, serving, or handling food, foodstuffs, or materials in dining halls.

Response: Spread of communicable disease by infected food handlers has been well documented. Prohibition of individuals with communicable disease from involvement in food handling is a good strategy to limit the spread of these diseases.

(4) Establish rules and inform occupants of their responsibilities related to maintaining housing consistent with the requirements in this chapter.

Response: This seems to be a common sense step in having occupants understand and implement their responsibilities related to maintaining housing in a manner consistent with the requirements. However, people willingness to obey rules and implement responsibilities depends on many factors (e.g., sense of ownership or investment in the process; an understanding of the logic behind the rules; fear of consequences if rules are broken, etc.) Therefore, simply establishing and informing of rules independently of input by the occupant may not succeed in achieving the desired result.

(5) Post information regarding temporary-worker health and sanitation when provided by the department or contracted health officer.

Response: This may or may not be useful depending on residents' proficiency and literacy in the language of the posted information.

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