

**STATE OF MINNESOTA
DEPARTMENT OF PUBLIC SERVICE**

**In the Matter of the Proposed Amendments
to Rules of the Minnesota Department of
Public Service amending the Minnesota
Energy Code (Minn. Rules ch. 7670).**

**STATEMENT OF NEED
AND REASONABLENESS**

August 1993

I. INTRODUCTION

The Commissioner of the Minnesota Department of Public Service (department) proposes to adopt amendments to Minn. Rules Chapter 7670, known as the Minnesota Energy Code. In addition to substantive changes, reorganization and grammatical changes are proposed to improve clarity and to conform with current style requirements.

The department began the present rule notification process on 23 March 1992 by publishing a note in the State Register (16 S.R. 2126) soliciting opinions and information from the public on the rules regarding the Minnesota Energy Code.

II. STATEMENT OF DEPARTMENT'S STATUTORY AUTHORITY

The Commissioner's authority to adopt the rule amendments is set forth in *Minn. Stat. § 216C.19, subd. 8* which provides:

In recognition of the compelling need for energy conservation in order to safeguard the public health, safety, and welfare, it is necessary to provide building design and construction standards consistent with the most efficient use of energy. Therefore, the commissioner shall, pursuant to chapter 14, adopt rules governing building design and construction standards regarding heat loss control, illumination and climate control. To the maximum extent practicable, the rules providing for the energy portions of the building code shall be based on and conform to model codes generally accepted throughout the United States. The rules shall apply to all new buildings and remodeling affecting heat loss control, illumination and climate control. The rules shall be economically feasible in that the resultant savings in energy procurement shall exceed the cost of the energy conserving requirements amortized over the life of the building. The rules adopted pursuant to this subdivision, shall be part of the state building code. Notwithstanding the provisions of this subdivision, all applications for approval of building specifications and plans may be submitted to the state building inspector as provided in section 16B.66.

Several other Minnesota Statutes set specific directions for the State energy code. These include Minn. Stat. 16B.165; 216C.195; and 216C.27, subdivision 8. For convenient reference by the reader of this document, copies of these statutes are included in this Statement of Need and Reasonableness (SONAR) as Attachment A.

III. STATEMENT OF NEED

Minnesota rules governing the Minnesota Energy Code were last modified effective September 7, 1992. The requirements set forth in Minn. Stat. §216C.195, subp. 2 and subp. 3 and §16B.165 (see attachment A) were completed with this last modification. The amendments proposed herein are needed at this time fulfill the department's additional statutory mandates and to reshape the Minnesota Energy Code to be a more "user friendly" document.

IV. STATEMENT OF REASONABLENESS

Minnesota Statutes Ch. 14 requires the department to make an affirmative presentation of facts establishing the reasonableness of the proposed rules. This means that the department must set forth the reasons for its proposal, and the reasons must not be arbitrary or capricious. However, to the extent that need and reasonableness are separate, need has come to mean that a problem exists which requires administrative attention, and reasonableness means that the solution proposed by the department is appropriate. Discussion of the need and reasonableness for the proposed rule amendments follows.

INCORPORATION OF LANGUAGE CURRENTLY ADOPTED BY REFERENCE

The department proposes to incorporate language into chapter 7670 that currently resides in other documents adopted by reference. This language includes:

from the Model Energy Code, 1989 edition:

- o scope and definitions;
- o building envelope requirements;
- o heating, ventilation and air-conditioning (HVAC) system requirements; and
- o service water heating requirements; and

from the Code of Federal Regulations, title 10, parts 430 and 435:

- o HVAC equipment efficiency requirements; and
- o lighting system performance standards.

This change is needed to clarify chapter 7670 for users of the chapter. The current code consists of two major adoptions by reference (the Model Energy Code and the Code of Federal Regulations) with numerous amendments. Building officials who enforce the energy code have expressed to the department that the need to refer to these other documents makes the code difficult to use. The proposed change to include most of the language of the code in chapter 7670 will remedy this difficulty.

The incorporation of this language into chapter 7670 is reasonable because it results in no changes to the scope or any requirement. The change will have little or no effect on the cost to purchase the State's energy code. Although chapter 7670 will be longer, the purchaser will save by not having to obtain the Code of Federal Regulations, and, perhaps, not even the Model Energy Code.

The department also proposes to replace all reference standards (currently denoted "RS-..") and the table of reference standards (part 7670.1000) with the *actual* references. This change is needed and reasonable for the convenience of users of chapter 7670. This format is consistent with all other parts of the State Building Code.

Part 7670.0100, subp. 5 APPLICATION TO EXISTING BUILDINGS

Item A, Additions, alterations and repairs.

The department proposes to add language to the paragraph (currently in the Model Energy Code titled "Additions") to clearly indicate that alterations or repairs to existing buildings must also conform to the requirements of chapter 7670.

This requirement is needed because language in the State Building Code leaves uncertain the question of whether or not portions of the State Building Code (including the Energy Code) apply alterations and repairs of existing buildings. The uncertainty arises because Uniform Building Code (UBC, adopted by reference in part 1305.0100), Sec. 104 (b) says "...alterations or repairs ... [must] conform to that required for a new building or structure." However, later this same section says "alterations or repairs to an existing structure which are non structural and do not adversely affect any structural member or any part of the building or structure having fire resistance may be made *with the same materials* of which the building or structure is constructed" (emphasis added). The department has received calls from building officials indicating that this later sentence is interpreted as meaning that chapter 7670 *does not* apply to alterations and repairs to existing buildings.

The proposed language is needed to assure that the State energy code is enforced consistent with the intent of existing Minnesota statute and rule. *Minnesota. Statute § 216C.19, subd. 8* specifically states that chapter 7670 *does apply* to alterations and repairs with the words: "... The rules shall apply to all new buildings and remodeling affecting heat loss control, illumination and climate control." Minnesota rules part 1300, stating the scope of the State Building Code (including the Energy Code), says: "The code applies to the construction, alteration, moving, demolition, repair, and use of any building or structure..."

The proposed amendment is reasonable because the application of chapter 7670 is not changed by the amendment (as illustrated by the statutory and rule citations above), but is merely clarified.

The amendment is reasonable because it only applies when alterations or repairs are done to a building, and requires that only those changes meet the minimum requirements of the energy code. The proposed amendment gives no authorization to mandate replacement of any existing building component. Furthermore, the amendment only applies to projects when a building permit is pulled. The proposed amendment does not authorize extending the energy code to cover minor repairs and building maintenance for which a building permit is not now required. The application of the energy code is specifically excluded from relocated residential buildings (part 7670.0100, subp. 4, C) and "historic buildings" (part 7670.0100, subp 5, B). In addition, the energy code is specifically excluded from abridging any safety, health or environmental requirements under other applicable codes or ordinances (part 7670.0100, subp. 3).

The application of the energy code is exempted for some repairs and remodeled elements by the existence of Uniform Building Code section 106 relating to practical difficulties. Section 106 states "whenever there are practical difficulties involved in carrying out the provisions of this code, the building official may grant modifications for individual cases ..." when justification is provided. The only exemptions to this exemption are fire-protection and structural integrity. This exemption is routinely applied when insulating walls of one- and two-family residential buildings and could be applied to other applications in existing buildings if compliance with the energy code would present difficulties due to space limitations or unreasonable costs. The application of the State energy code to remodeling and repair projects will cost effectively save substantial energy, benefiting individuals and the State as a whole (see Attachment B).

The reasonableness of the application of the proposed amendment to alterations and repairs for specific building components is given in the following discussion:

- **Exterior envelope:** For major renovations to walls and roofs, the minimum requirements of the energy code apply. The requirements would not apply to such partial renovation as window replacement, since no specific criteria exist in the energy code for windows. Insulating the cavity of an existing wall would easily be exempted from the energy code requirement by the "practical difficulties" provision of the UBC discussed above. Repairs to a small section of roof would also be easily exempted by the practical difficulties provision.
- **HVAC:** In adopting the HVAC equipment requirements from ASHRAE Standard 90.1-1989 in the spring of 1992, the department found the efficiency requirements were needed and reasonable. A detailed investigation indicated that the more efficient equipment would be readily available with no significant cost increase and with no detrimental effect on reliability or life expectancy. It will be reasonable to replace HVAC equipment (aside from maintenance items that would not require a building permit) with equipment meeting the standards of the energy code. Energy improvements to HVAC systems (pipes, ducts, pumps, controls, etc.) will improve the overall efficiency of the building even though other components do not meet the most recent energy standards.
- **Lighting:** An analysis of the application of lighting requirements to remodeled existing buildings is given in Attachment B. The analysis shows that, although lighting systems meeting the requirements of the energy code would cost more than less efficient systems, they will achieve a 2.7 to 6.5 year simple pay back in energy savings. The disadvantage of the additional cost is outweighed by the benefits to the occupant (who is paying the utility bill) and the State as a whole (by having to commit less generating capacity).

Part 7670.0130, INCORPORATIONS BY REFERENCE

Subp. 1, Incorporated items

The department proposes to delete and add several incorporations by reference.

These changes are needed and reasonable to make the incorporations consistent with changes proposed throughout the chapter.

Part 7670.0325, DEFINITIONS

The department proposes to add several definitions adopted from the Model Energy Code to clarify terms used throughout the chapter. Modifications are proposed in Subp. 45 to the definition of "Thermal transmittance, overall" by deleting the "Thermal bridges in sheet metal construction" method and adding the "Draped insulation effective assembly R-value" method. A definition of "Residential mechanical ventilation system" is added.

The addition of several definitions from the Model Energy Code that are currently incorporated by reference is a only an editorial change.

The addition of Subp. 30, "Mechanical ventilation system, Residential" definition is needed because it is used in the proposed revision to part 7670.0470, subp. 7. The definition is reasonable because it is consistent with the energy conservation standards of the Northwest Energy Code, to which this chapter must equal or exceed as required by Minn. Stat. §16B.165.

The proposed change in Subp. 48 to delete the "Thermal bridges in sheet metal construction" method is needed and reasonable because this method is so complex as to be unenforceable. There appears to be only one reference to this method in the scientific literature (written by an author residing in Denmark), and the department has been unable to find any illustrations or examples of its use in the

literature.

The proposed change in Subp. 48 at item D to add the "Draped insulation effective assembly R-value" method is needed and reasonable because it is proposed to be referenced in part 7060.0470. The technical reasons for the need and reasonableness of this item are addressed in the discussion of part 7060.0470, subp. 4 in this SONAR.

Part 7670.0450 VENTILATION

The department proposes to add two exceptions to amend ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality, as adopted by this part. One exception corrects an inference in the adopted standard that infiltration may provide adequate ventilation in residential buildings. The other changes the ventilation rates required for parking garages and auto repair rooms to be consistent with rules adopted by the Department of Administration.

The proposed exception regarding infiltration is needed because legislative mandate requires rules adopted under this Chapter to be compatible with public health and safety. Research has demonstrated that infiltration does not satisfy the requirement for ventilation in Minnesota residential buildings (Attachment C). The proposed amendment is reasonable because it does not by itself change any requirement of the chapter for residential construction. It merely corrects a misstatement of fact.

The proposed exception regarding parking garages and auto repair rooms is needed to make the ventilation requirements for these occupancies consistent with chapter 1346 adopted by the Department of Administration. In the past, Ch. 1346 has required 0.75 cfm/ft² (compared with ASHRAE's 1.5) for parking garages, and 1.0 cfm/ft² (compared with ASHRAE's 1.5) for auto repair rooms. This inconsistency has reportedly resulted in enforcement problems in some jurisdictions.

Part 7670.0470 ENVELOPE THERMAL TRANSMITTANCE FOR ALL BUILDINGS

Subp. 4, Thermal transmittance of opaque components

The department proposes to delete reference to the "Thermal bridges in sheet metal construction" method and add reference to the "Draped insulation effective assembly R-value" method. A definition of the added method is proposed in part 7670.0325, subp. 48, item D.

The deletion of the reference to the "Thermal bridges in sheet metal construction" method is needed because it is extremely complicated, lacking substantive documentation (such as worked-out examples), and therefore unenforceable. The deletion is reasonable because the thermal performance calculation of these assemblies can be performed by the zone method, which is an adequate calculation procedure for this type of assembly.

The addition of the "Draped insulation effective assembly R-value" method is needed to assure accurate calculation of thermal transmittance for the application described. Attachment D explains the importance of correctly calculating the effective R-value. The addition is reasonable because the effective assembly R-value method was developed and confirmed by national testing laboratories using tested performance.

Subp. 5, Thermal transmittance of window area and skylight elements

The department proposes to delete the reference to three standards for determining thermal transmittance of window area and skylight components.

This deletion of reference to these standards is needed because they are no longer considered uniform and valid measurements. The two prescribed methods in proposed Subp. 5 are currently the predominant methods (and will soon be the exclusive methods) of determining window performance in the United States. This change is reasonable because two the deleted standards are also referenced by the

National Fenestration Rating Council (NFRC) standard. The change is also reasonable because manufacturers may use the no cost and straightforward ASHRAE Handbook table to identify window U-factors in case a window has not been tested to the NFRC standard, or for the manufacturing of a small number of custom windows.

Subp. 6, Effectiveness of required thermal insulation

The department proposes to reorganize this chapter by moving the provisions of parts 7670.0480 and 7670.0550 into this subpart. The provisions of this subpart are proposed to be organized under three items with headings of "vapor retarder," "air leakage barrier," and "air intrusion barrier."

The change in organization is needed for clarity. The organization is reasonable because measures in the subpart as proposed all relate to prevention of water vapor migration (and subsequent condensation) in insulation and mitigation of wind wash, which are the subjects of this subpart. Air intrusion from outdoors directly affects the performance of installed insulation and therefore is appropriately included under the heading of this subpart.

Item A, Requirements for buildings

The department proposes a table of requirements (at subitem 1), and citing of requirements for two categories of buildings (at subitems 2 and 3). It is proposed that category 2 buildings (at subitem 3), where infiltration and natural ventilation are relied on to provide necessary year-round ventilation, must be constructed in accordance with only certain provisions of this subpart. Construction of all other buildings (at subitem 2) must be in accordance with all items listed in subitem 1.

This item is needed because performing all the requirements listed in subitem 1 may result in an inadequately ventilated residential building, unless a mechanical ventilation system is installed. The statutory authority for Chapter 7670 requires the Energy Code to be compatible with public health and safety. The department has received comment (Attachment C) that residential buildings would be under ventilated if air leakage is decreased and mechanical ventilation is not installed. The Builders Association of Minnesota (BAM) has adopted a "Strategic Plan" (Attachment E) calling for all residential construction to be air tight with mechanical ventilation. This item is in general agreement with the BAM Strategic Plan, and is needed to show the importance of building tightly to protect insulated cavities and installing mechanical ventilation. The department anticipates that in the near future mechanical ventilation will become more prevalent in residential construction. The proposed organization of this item is such that when mechanical ventilation is required by the building code for all construction, subitem 3 could be proposed to be deleted.

It is significant that this item does not mandate conformance to all measures of subitem 1 and installation of a mechanical ventilation system in all buildings. Such action is requested in the BAM "Strategic Plan." The department, in consultation with the department of administration, building codes division, has concluded that insufficient familiarity with standards for mechanical ventilation currently exists for proposing this for all buildings at the present time. The department of administration is under Statutory mandate (Laws of Minn. 1993, Chapter 327, section 11) to develop recommended ventilation standards for single family homes, including mechanical ventilation, by January 15, 1994.

Item B, Vapor retarder

The department proposes to add a requirement that the vapor retarder must be continuously sealed when it is also intended to serve as the air leakage barrier. It is also proposed to amend the exception regarding vapor retarder installation on the rim joist to allow its exclusion where the insulation is not susceptible to condensation from moisture diffusion.

The addition of the requirement to at subitem 1 is being proposed because some energy efficient construction strategies employ the vapor retarder as the air leakage barrier. Sealing the vapor retarder is needed and reasonable if it is to function as a barrier to air leakage.

Amending the exception for rim joists at subitem 2 is needed because this area may, under certain circumstances, be vulnerable to moisture condensation. Condensation problems have not been widely reported in typical rim joist construction with 2-inch thick soft wood band joists without a vapor retarder. However, a recent Minnesota case reported in Home Energy Magazine (letters, July/August 1993) indicated that if the band joist consists of only sheathing, condensation could be a major problem. While some may contend that the language proposed is ambiguous, the present state of understanding building science does not allow a more definitive requirement. The proposed language allows for an evolving understanding (such as the cited report) to govern when a vapor retarder should be installed at this location.

Item C, Air leakage barrier

At subitem 3, the department proposes an additional requirement to air seal all penetrations for electrical and telecommunications equipment.

The addition of this requirement is needed because it is a significant potential source of water vapor migration into insulation. Air leakage into insulated cavities through openings associated with electrical outlets resulted in condensation on sheathing in a 1982 study in Madison Wisconsin (Attachment F).

The requirement is reasonable because, although sealing may add to construction cost, the savings by preventing the problems caused by moisture are substantial. Specifically for recessed light fixtures, equipment and techniques are now widely available (see Attachment G) for sealing against air leakage.

Item D, Air intrusion barrier

The department proposes to amend this item to require that the air intrusion barrier be "air impermeable." At subitem 1, it is proposed to add requirements that the air intrusion barrier at the attic edge be of rigid material resistant to wind driven moisture. It is also proposed to add subitem 3 pertaining to exterior joints in the building envelope that may be sources of air intrusion.

The addition of the "air impermeable" phrase is needed to assure that the air intrusion barrier will perform its intended function. The addition is reasonable because air impermeable materials suited for these applications are widely available to the construction industry.

The addition of requirements that the air intrusion barrier at the attic edge be of rigid material resistant to wind driven moisture is consistent with the energy conservation standards of the Northwest Energy Code, to which this chapter must equal or exceed as required by Minn. Stat. §16B.165.

The addition of subitem 3 is needed and reasonable because air intrusion causes wind wash of thermal insulation, thereby reducing its effectiveness.

Subd 7, Air leakage

Item B, Building joints

The department proposes to modify the language for this requirement to conform with 1993 edition of the Model Energy Code.

This change is needed to clarify the intent of the requirement. The change is reasonable because it is identical to that approved for inclusion in the 1993 amendments to the national Model Energy Code. The department's statutory authority requires that this chapter "be based on and conform to model codes generally accepted throughout the United States."

Item C, Performance alternative

The department proposes to revise the measurement for the air tightness requirement in this item to be a value of cubic feet per minute (CFM) per square foot of conditioned space. It is also proposed that the ventilation requirement be changed to be a "residential mechanical ventilation system," as proposed to be defined in part 7670.0325, subpart 30.

This change of measure of air tightness is needed because since this alternative (referencing ASHRAE Standard 119) was added to the energy code in early 1991, the alternative has never (to the department's knowledge) been used because of the complexity of ASHRAE Standard 119. The change of the term to cubic feet per minute (CFM) per square foot of conditioned space is needed to simplify the method so that it can be used. The specific value of 0.24 CFM per square foot is reasonable because it is approximately equivalent to the air tightness requirement Northwest Energy Code (1.8 air changes per hour). Minn. Stat. 16B.165 (Attachment A) requires that the Minnesota Energy Code be no less stringent than the Northwest Energy Code.

The proposal to change the ventilation requirement to reference the "residential mechanical ventilation system" is needed to assure that residential buildings built to this stringent standard have adequate mechanical ventilation installed. The change is reasonable because it is consistent with the energy conservation standards of the Northwest Energy Code.

Subp. 8, Slab on grade floors

The department proposes to replace a chart of variable requirements (as a function of heating degree days) for this element with a simplified table of four values. The proposed change references part 1305.5400 that specifies foundation depths for two regions of the State.

This change is needed to simplify this requirement for convenience of users of this chapter. It is reasonable because the values are approximately equivalent, and in some cases slightly more stringent than the existing requirement for this element.

Subp. 9, Foundation walls

The department proposes to change this provision to require R-10 insulation on the entire foundation wall.

This change is needed because analysis has shown that additional foundation wall insulation is a cost effective energy conservation measure. The Building Foundation Design Handbook (Underground Space Center, University of Minnesota, 1988) includes engineering and life cycle economic analysis of foundation wall insulation alternatives. This report finds that for a heated basement in Minneapolis' climate, optimum basement wall insulation is at least R-10 over the entire foundation wall for all fuel price ranges. For unheated basements, this same insulation level is optimal for higher fuel cost ranges. Assuming a fuel cost of \$5.00 per million BTU, the annual energy savings in a typical (166 foot perimeter) house due to the proposed change in Minneapolis is \$21 for an unheated basement and \$85 for a fully heated basement.

The proposed change is reasonable because the Model Energy Code 1989 edition (MEC) requires the entire foundation wall to be insulated with from R-10 to R-15 in Minnesota's climate conditions. The department's statutory authority requires that this chapter "be based on and conform to model codes generally accepted throughout the United States."

The department also proposes to add item E to this subpart requiring that when foundation wall insulation is on the interior, a moisture barrier be located between the insulation and the foundation wall from the floor to grade level. The need for this change is indicated by the frequent reports of

condensation on the interior (insulation) side of vapor retarder on insulation installed on interior basement walls. The reports have been in the form of telephone calls and letters received by the department from home owners and building officials.

The change is reasonable because the cost of adding a moisture barrier (such as polyethylene) at this location is substantially less than repair or replacement of a moisture damaged interior wall that may result without it. The approach of adding a moisture barrier rather than removing the basement wall vapor retarder (which may also prevent accumulation of water in the insulated basement wall) is also reasonable. The latter alternative would unquestionably result in higher house interior moisture levels resulting in such problems as increased condensation on windows in the winter. The solution proposed is recommended by the Canadian Home Builders Association R-2000 program (Attachment H) and has reportedly been successfully used by many Minnesota home builders.

Subp. 10 Floors over heated spaces

The department proposes a requirement that floors over unheated spaces for all building types have a maximum U-factor of 0.04.

The requirement is needed to be consistent with ASHRAE 90.1, as required by statute (Attachment A). The requirement is reasonable because floor joists or trusses in most new construction are at least 2x8 and will accommodate an R-24 batt that will meet the U-factor of 0.04 requirement.

Subp. 11. Performance and identification of loose fill insulation

The department proposes to add a subpart requiring loose fill insulation to achieve performance at winter design temperatures (at item A), and requiring that insulation thickness markers and signed attic cards be installed (at items B & C) whenever loose fill insulation is installed in accessible attics.

The requirement that loose fill insulation to achieve not less than performance at winter design temperatures (adopted by the department in 1992) is now implemented, with affected insulation manufacturers providing "Minnesota" coverage charts. The proposed requirement to achieve performance at winter design temperatures simply requires that insulation be installed as proscribed on those coverage charts. The requirement is needed and reasonable because the department believes that building owners expect that installed thermal insulation will perform at its rated value at winter design conditions.

The identification requirements are needed because currently there is no practical means for inspecting a loose fill attic installation for compliance with the energy code. The proposed requirement would provide this means. The requirement is also needed because there is good reason to believe that insufficient insulation is being installed in many attics. A study in Georgia showed many attics had only 80 percent of the claimed loose fill insulation actually installed. Many insulation contractors have expressed support to the department for this measure as a way to assure that building purchasers get what they pay for.

The requirement is reasonable because inspectors and building owners should have a practical way of determining that the insulation required and being paid for has indeed been installed. The requirement is consistent with the Federal Trade Commission requirement that residential consumers receive a receipt stating the amount of insulation installed. The requirement is also reasonable because the estimated cost of the materials and work involved in complying is nominal (probably less than \$5).

Part 7670.0480 WALL AND ROOF CRITERIA FOR 1- & 2-FAMILY BUILDINGS

Subp. 2, Prescriptive criteria

Item A, Roof/ceilings

The department proposes to change the ceiling insulation requirement for this prescriptive approach when advanced ceiling framing is not used, and for roof/ceilings without attics.

The change is needed because analysis has shown (Attachment I) that the proposed prescriptive designs are equivalent to a roof/ceiling U-factor of 0.026. The change is reasonable because it represents no change in the thermal performance requirement of this element.

Item C, doors

The department proposes to add to the list of prescriptive criteria a requirement that doors have a maximum U-factor of 0.20 (minimum of R-5).

This addition is needed because no minimum requirement for doors currently exists for this alternative compliance option. The addition is reasonable because the development of the table appearing in item E assumed an R-5 door, and R-5 doors are commonly used in residential construction.

Item D, maximum window and door area as a percent of overall wall

The department proposes to amend the alternative compliance method (commonly referred to as the "cook-book approach") for one- and two-family dwellings. The amendment expands the choices for combinations of wall systems.

This change is needed because the added alternatives describe construction commonly practiced in Minnesota. The change is reasonable because it merely gives additional options for this building type that all achieve a wall U_o factor of 0.110. A builder can still use the component performance approach (Subp. 3) to use whatever combination of window, wall and roof that achieves the overall building thermal performance.

Part 7670.0490 WALL & ROOF CRITERIA FOR MULTIFAMILY RESIDENTIAL BUILDINGS 3 STORIES OR LESS.

Subp. 2, roof/ceilings

The department proposes an exception that alterations and repairs to insulated built-up roof systems must have a thermal transmittance no greater than 0.033 (R-30).

The exception is needed because of the great cost and impracticality of insulating an existing built-up roof to R-38. Statutory authority stipulates that requirements of this chapter be economically feasible in that the resultant savings in energy procurement shall exceed the cost of the energy conserving requirements amortized over the life of the building. While achieving R-30 is practical, in many cases an increase to R-38 would require the very expensive additional measure of raising the roof gutters. This exception is reasonable because substantial energy will be saved in existing buildings by installing R-30 in multifamily roofs. In addition, heat loss through an R-30 roof/ceiling of a multi-family buildings is small compared to energy used in the remainder of the building.

Subp. 3 & 4, walls

The department proposes to replace a graph of variable requirements (as a function of heating degree days) for this element with two values, depending upon the location of the building. The values are more stringent than the existing requirement for this element, and are the same as a change to be incorporated in the 1993 amendments to the Model Energy Code. The proposed change references part 1305.5400 that specifies foundation depths for two regions of the State.

The change is needed because engineering/economic analyses show the proposed requirement is both cost-effective for the building owner/occupant and has a desirable long-term cost-benefit ratio. This proposal is identical to a change that was approved for inclusion in the 1993 amendments to the Model Energy Code. An engineering/economic analysis is used to demonstrate the need for the proposed values.

The reasonableness of the proposed change is demonstrated in Attachment J. The proposed values are shown to have a simple pay back of 4.7 years and a benefit to cost ratio (assuming a 30-year mortgage) of 3.2.

Part 7670.0495 WALL & ROOF CRITERIA FOR ALL OTHER BUILDINGS.

Subp. 2, prescriptive criteria

The department proposes to replace two graphs of variable requirements for these elements (as functions of heating degree days) with two tables of values. The values are approximately equivalent to ASHRAE Standard 90.1-1989 requirements. The proposed change references part 1305.5400 that specifies foundation depths for two regions of the State.

This change is needed to assure that the minimum envelope criteria for these buildings is cost-effectively energy efficient, as has been demonstrated by ASHRAE and the US. Department of Energy. The change is also needed to bring exterior envelope criteria of this building type in conformance with ASHRAE Standard 90.1-1989 as required by *Minn. Stat. § 216C.195, Subd. 2* (Attachment A).

The reasonableness of the proposed change is demonstrated in the attached consultant report dated June 30, 1992 (Attachment K).

Subp. 3, performance criteria

The department proposes to adopt a performance criterion for this building type based on the ENVSTD computer program.

This adoption is needed to provide an alternative for the design of buildings that may not fit into the limitations of the prescriptive criteria of Subp. 2. It is reasonable because this computer program is equivalent to the criteria of ASHRAE Standard 90.1-1989.

Part 7670.0610 BUILDING MECHANICAL SYSTEMS

Subp. 15, Duct insulation

The department proposes to replace the existing language with a table specifying duct insulation requirements, depending on application.

This change is needed to bring HVAC standards of the energy code in conformance with ASHRAE Standard 90.1-1989 as required by *Minn. Stat. § 216C.195, Subd. 2*. The need for insulating underground ducts is demonstrated in a 1986 Minnesota research project (Attachment L). This research project found a significant increase of energy consumption for houses with (uninsulated) below slab warm air distribution systems.

The format change is reasonable because the table format is identical to the Uniform Mechanical Code, Table 10-D, incorporated by Chapter 1346, and familiar to users of the State Building Code. The requirement that below-grade ducts be insulated is reasonable because this is only slightly greater than currently required by Chapter 7670. The Model Energy Code section 503.9.1 requires a minimum insulation of $R = \Delta t/15$, where Δt is the design temperature differential between the air in the duct and the ambient temperature outside the duct. With a typical heating supply temperature of 100 °F and a typical ambient ground water temperature of 40 °F, a minimum R-value of 4.0 is required. Thus, the requirement for R-5 insulation on ducts within the ground is reasonable.

Subp. 16. Duct construction

The department proposes to delete existing requirements and to add a table specifying duct sealing requirements, depending on application. The proposed table is more stringent than the existing code because it applies to all ducts, not just to those operating at 0.25 water column pressure and above.

This change is needed to make the HVAC standards of Chapter 7670 to be at least as stringent as ASHRAE Standard 90.1-1989 as required by *Minn. Stat. § 216C.195, Subd. 2*. The application to ducts of all pressures is needed because of research indicating enormous heat loss and health dangers caused by unsealed ducts (Attachment M). The addition of the sentence requiring that all joints between dissimilar duct materials be sealed is needed because of the enormous leakage that is possible when dissimilar materials (such as a metal "pan under" at floor joists) are joined to construct a duct (Attachment M).

The change is reasonable because it will bring Chapter 7670 into conformance with the Uniform Mechanical Code, adopted by Chapter 1346, which requires all ducts to be "substantially air tight." The format change is reasonable because the table format is identical to the Uniform Mechanical Code, Table 10-D, incorporated by Chapter 1346, and familiar to users of the State Building Code.

Part 7670.0710 SERVICE WATER HEATING

Subpart 2, Efficiency requirements

The department proposes to differentiate requirements for certain service water heating equipment with volumes of less than 10 gallons and greater than or equal to 10 gallons.

The change is needed and reasonable to make the requirements consistent with the Code of Federal Regulations, title 10, part 430.33.

Subp. 5, Swimming pools and spas

The department proposes to differentiate the requirements for indoor and outdoor heated pools, and to add one or two optional means of meeting this requirement besides the installation of a pool cover.

The change is needed because the department understands that compliance with the present requirement is poor, and there are other reasonable options (those proposed) that would result in as much energy conservation as a pool cover. The options are additionally needed because in some cases, pools must be "super chlorinated" at the end of a period of use, and a pool cover cannot be used for a period following this process (and likely would not be used at all). These options are reasonable because they are estimated to be approximately equivalent to the energy savings due to a pool cover that is regularly used.

Part 7670.0800 ELECTRIC POWER AND LIGHTING

Subp. 1. Electrical energy determination

The department proposes to editorially change the subdivision.

The change is needed so that the language is consistent with *Minn. Stat. 216C.27, subd.8*. The change is reasonable because the requirement is not changed.

Subp. 2. Lighting power budget

The department proposes numerous editorial changes, including reorganization, to the lighting requirements from the Code of Federal Regulations, title 10, part 435.103 (currently incorporated by reference). These changes are needed and reasonable because they clarify the intent of the lighting requirements without substantially changing any requirement.

The department also proposes changes to in Subp. 2, item A (6) (c) to add three categories of

lighting that must be included in the calculation of connected lighting power. This change is needed to assure accurate computation of connected lighting power. This change is reasonable because the derivation of the unit power density standards included contributions by these three categories of lighting.

The department proposes to revise unit power density requirements for schools and classrooms from the values listed in the Code of Federal Regulations, title 10, part 435.103 ("CFR," currently incorporated by reference). This change is needed because the 1993 CFR numbers for classrooms were apparently in error. The US Department of Energy is soon expected to published an amendment changing the unit power density (UPD) requirement for classrooms to no greater than 2.0 watts. The proposed UPD requirement of 1.7 watts per square foot is reasonable because Minnesota lighting designers have advised the department that this value will provide adequate and efficient lighting in this application.

Subp. 4, Electric motor efficiencies

The department proposes to adopt a new table of minimum values for motor efficiencies. The department also proposes that these requirements apply only to motors expected to be used more than 500 hours per year.

The adoption of the new table is needed for improved efficiency and because the existing values follow a pattern not familiar to individuals who sell or install motors in the State. The department believes this feature renders the existing requirements meaningless to the industry, making compliance difficult. The proposed table is identical to the National Electrical Manufacturers Association (NEMA) Table 12-6B published in NEMA MG 1-1987 (September 1990 edition). Since NEMA handbooks are readily available to all industry members, the department believes that compliance will be substantially improved.

The change is reasonable because, although it does decrease minimum efficiency requirements for some sizes of motors, the energy savings due to increased compliance expected will more than compensate for the slightly decreased requirements. This change is permitted under the pre-emption clause of the National Energy Act of 1992, which allows a State to adopt a standard that is not more stringent than the amended version of ASHRAE Standard 90.1. The proposed values from NEMA Table 12-6B are not more stringent than the amended version of ASHRAE Standard 90.1.

The limitation of these requirements to motors used 500 hours per year and more is needed because Minn. Stat. section 216C.19, Subdivision 20 requires this chapter to consider appropriate efficiency requirements for motors used infrequently in agricultural and other applications. The 500 hours per year exemption value is reasonable because it is found in ASHRAE Standard 90.1-1989.

Part 7670.1115, EFFECTIVE DATES

The department proposes that the effective dates of changes to this chapter be January 1, 1994. The proposed timing is needed and reasonable to permit time to inform users of this chapter of the revised provisions, and to avoid requiring designers who may have a substantially designed building to redesign the building before submitting for code approval.

The department proposes that beginning January 1, 1998, the standard for residential buildings be the Canadian Home Builders Association "R-2000 Home Program." The proposed effective date for adoption of the Canadian Home Builders' Association "R-2000" standard is needed because Minn. Stat. §16B.165 requires the department to adopt amendments to the State Energy Code that are designed to equal or exceed the most energy-conserving codes adopted by any other state. The standards of the R-2000 program do equal or exceed the most stringent energy-conserving codes adopted by any other state. The adoption of the "R-2000" standard is reasonable because thousands of homes in Canada and many homes in the United States have been constructed to these standards.

REPEALER

The department proposes to repeal all existing parts of Minn. Rules chapter 7605. This chapter, adopted by the department in 1988, deals with standards for fluorescent lamp ballasts. The repeal is needed because revised standards for fluorescent lamp ballasts are proposed in part 7670.0800, subpart 2, item B, subitem 2. The repeal is reasonable because the standards in chapter 7605 are identical to federal requirements now mandatory for all fluorescent lamp ballasts sold in the United States since 1989.

V. SMALL BUSINESS CONSIDERATIONS IN RULE MAKING

Minnesota Statute § 14.115, subdivision 2 (1988) requires the department, when proposing rules which may affect small business, to consider the following methods for reducing the impact on small businesses:

- (a) the establishment of less stringent compliance or reporting requirements for small business;
- (b) the establishment of less stringent schedules or deadlines for compliance or reporting requirements for small business;
- (c) the consolidation or simplification of compliance or reporting requirements for small business;
- (d) the establishment of performance standards for small businesses to replace design or operational standards required in the rule;
- (e) the exemption of small businesses from any or all requirements of the rule.

The department has evaluated the effect of the proposed rules on small businesses and has considered each of the methods listed above for reducing the impact of the rules on small businesses. The adoption of these rule amendments will have some affect on small businesses in Minnesota.

Since Chapter 7670 contains no scheduling, deadline or reporting requirements, Minn. Stat. § 14.115, subd. 2 (a), (b) and (c) are not applicable.

Chapter 7670 includes several significant performance standards in conformance with Minn. Stat. § 14.115, subd. 2 (d). The proposed changes to part 7670.0550 regarding the air tightness alternative for one- and two-family buildings is significantly simplified.

In regard to item (e) above, no changes are proposed regarding the scope of application of the Chapter.

VI. ATTACHMENTS

The following attachments are incorporated by reference into this Statement of Need and Reasonableness.

- A) Selected Minnesota Statutes setting specific directions for the Minnesota Energy Code.
- B) Analysis of cost effectiveness of application of Ch. 7670 to an existing buildings.
- C) Letter dated 16th September 1992 from The Energy Conservatory concerning air-tightness and ventilation for residential buildings.
- D) Documentation regarding the draped insulation effective assembly R-value method.
- E) Builders Association of Minnesota "BAM Strategic Plan" dated January 8, 1993.

F) G.E. Sherwood, Condensation Potential in High Thermal Performance Walls -- Cold Winter Climate, USDA Forest Products Laboratory, 1982.

G) Minnesota Department of Public Service, Installing Airtight Recessed Light Fixtures, Home Builders' Energy Update, Fall 1992.

H) Interior basement wall insulation moisture barrier recommended by the Canadian Home Builders' Association in the R-2000 Builders' Manual.

I) Technical Support Document for Proposed Revision of the Model Energy Code Thermal Envelope Requirements, Batelle Pacific Northwest Laboratory, February 1993, Appendix B.

J) Model Energy Code multi-family roof/ceiling criteria & wall requirement documentation.

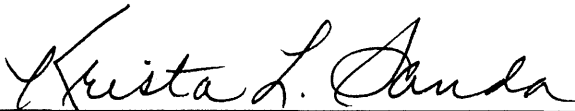
K) Prescriptive Envelope Option Development for the Minnesota Building Code, The Weight Group and The Deringer Group, June 30, 1992.

L) Energy Efficient House Research Project, prepared for Oak Ridge National Laboratory by the Minnesota Department of Public Service, Energy Division, St. Paul, MN, 1986, Pages 2, 30 and 31.

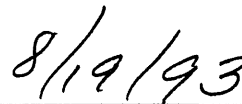
M) Nelson, Gary, et al, "Measured Duct Leakage, Mechanical System Induced Pressures and Infiltration in Eight Randomly Selected New Minnesota Homes," Energy Efficient Builders Association Conference Proceedings, March, 1993.

VII. CONCLUSION

On the basis of the foregoing, the proposed amendments to Minnesota Rules Chapter 7670 are both needed and reasonable.



Krista L. Sanda, Commissioner
Department of Public Service



Dated

DEPARTMENT: Public Service / Energy Division

SF-00006-05 (4/86)

STATE OF MINNESOTA

Office Memorandum

DATE: August 25, 1993

TO: ✓ Maryanne Hruby, Legislative Commission to Review Administrative Rules
Dennis Ahlers, Department of Public Service, Attorney General's Office

FROM: Bruce Nelson *BN*

PHONE: 7-2313

SUBJECT: Minnesota Energy Code Rulemaking (Minn. Rules Ch. 7670)

Enclosed for your file is a copy of the signed Statement of Need and Reasonableness prepared for a proposed rule to be published in the State Register on 30 August 1993. The end date for the comment period of this rulemaking is 1 October 1993.

**The Legislative Commission to
Review Administrative Rules**

AUG 26 1993



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**STATE OF MINNESOTA
DEPARTMENT OF PUBLIC SERVICE**

**In the Matter of the Proposed Amendments
to Rules of the Minnesota Department of
Public Service amending the Minnesota
Energy Code (Minn. Rules ch. 7670).**

**STATEMENT OF NEED
AND REASONABLENESS**

January, 1994

I. INTRODUCTION

The Commissioner of the Minnesota Department of Public Service (department) proposes to adopt amendments to Minn. Rules Chapter 7670, known as the Minnesota Energy Code. In addition to substantive changes, reorganization and grammatical changes are proposed to improve clarity and to conform with current style requirements.

The department began the present rule notification process on March 23, 1992, by publishing a note in the State Register (16 S.R. 2126) soliciting opinions and information from the public on the rules regarding the Minnesota Energy Code.

Proposed amendments to chapter 7670 were published in the August 30, 1993 State Register, however, the proposed amendments were withdrawn because of substantive errors in the Statement of Need and Reasonableness (SONAR) that accompanied those proposed changes. The amendments to chapter 7670 which this SONAR addresses are proposed in the February 7, 1994 State Register. The amendments to chapter 7670 proposed in the February 7, 1994 State Register refer at several items to the proposed amendments published in the State Register on August 30, 1993. Because the proposed amendments (for those items) are unchanged from the earlier (8/30/93) publication, reprinting them would be unnecessary and expensive. A complete copy of the amendments proposed to chapter 7670 may be obtained at no charge by contacting either the department's Energy Information Center at 612/296-5175 or Minnesota toll free 800-657-3710, or the department contact person for this rulemaking, Mr. Bruce Nelson at 612/297-2313 before the end of the comment period.

This SONAR is in support of the proposed amendments to the Minnesota Energy Code (Minnesota Rules Chapter 7670). When statements in this SONAR refer to "current requirements," they refer to chapter 7670 as currently in effect (unchanged by the August 30, 1993 proposed amendments).

II. STATEMENT OF DEPARTMENT'S STATUTORY AUTHORITY

The Commissioner's authority to adopt the rule amendments is set forth in Minn. Stat. § 216C.19, *subd. 8* which provides:

In recognition of the compelling need for energy conservation in order to safeguard the public health, safety, and welfare, it is necessary to provide building design and construction standards consistent with the most efficient use of energy. Therefore, the commissioner shall, pursuant to chapter 14, adopt rules governing building design and construction standards regarding heat loss control, illumination and climate control. To the maximum extent practicable, the rules providing for the energy portions of the building code shall be based on and conform to model codes generally accepted throughout the United States. The rules shall apply to all new buildings and remodeling

affecting heat loss control, illumination and climate control. The rules shall be economically feasible in that the resultant savings in energy procurement shall exceed the cost of the energy conserving requirements amortized over the life of the building. The rules adopted pursuant to this subdivision, shall be part of the state building code. Notwithstanding the provisions of this subdivision, all applications for approval of building specifications and plans may be submitted to the state building inspector as provided in section 16B.66.

Several other Minnesota Statutes set specific directions for the State energy code. These include Minn. Stat. §§ 16B.165; 216C.195; and 216C.27, subdivision 8. For convenient reference by the reader of this document, copies of these statutes are included in this Statement of Need and Reasonableness (SONAR) as Attachment A. The reference in Minn. Stat. § 216C.195 to "ASHRAE/IES 90.1" standard is alternatively referred to in this SONAR as "ASHRAE Standard 90.1" or "ASHRAE Standard 90.1-1989;" but all refer to the same document.

III. STATEMENT OF NEED

Minnesota rules governing the Minnesota Energy Code were last modified effective September 7, 1992. The requirements set forth in Minn. Stat. §§ 216C.195 and 16B.165 were substantially satisfied with that modification. The amendments proposed herein are needed at this time to assure completion of the department's statutory requirements, to reshape the Minnesota Energy Code to be a more "user friendly" document, and to assure that buildings built to these requirements will safeguard the public health.

Additional need for the proposed amendments is given by the federal Energy Policy Act of 1992 (Public Law 102-486). The Act strongly encourages states to upgrade their energy codes to meet or exceed the requirements of both the 1992 edition of the Model Energy Code and the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Standard 90.1-1989. The Act requires that by October 1994, the commissioner certify to the Secretary of Energy whether the Minnesota Energy Code is upgraded to these levels, or to explain in writing the decision not to upgrade. The proposed revisions to chapter 7670 are needed to make the Minnesota Energy Code largely consistent with the 1992 edition of the Model Energy Code and the ASHRAE Standard 90.1-1989.

IV. STATEMENT OF REASONABLENESS

Minnesota Statutes Chapter 14 requires the department to make an affirmative presentation of facts establishing the reasonableness of the proposed rules. This means that the department must set forth the reasons for its proposal, and the reasons must not be arbitrary or capricious. However, to the extent that need and reasonableness are separate, need has come to mean that a problem exists which requires administrative attention, and reasonableness means that the solution proposed by the department is appropriate. Discussion of the need and reasonableness for the proposed rule amendments follows.

INCORPORATION OF LANGUAGE CURRENTLY ADOPTED BY REFERENCE

The department proposes to incorporate language into chapter 7670 that currently resides in other documents currently adopted by reference. This language includes:

- from the Model Energy Code, 1989 edition:
 - o scope and definitions;
 - o building envelope requirements;

- o heating, ventilation and air-conditioning (HVAC) system requirements; and
 - o service water heating requirements; and
- from the Code of Federal Regulations, title 10, parts 430 and 435:
- o HVAC equipment efficiency requirements; and
 - o lighting system performance standards.

Notation is made throughout this SONAR where requirements that currently reside in other documents adopted by reference are incorporated into the chapter.

This change is needed to clarify chapter 7670 for users of the chapter. The current code consists of two major adoptions by reference (the Model Energy Code and the Code of Federal Regulations) with numerous amendments. Building officials who enforce the energy code have expressed to the department that the need to refer to these other documents makes the code difficult to use. The proposed change to include most of the language of the code in chapter 7670 will remedy this difficulty.

The incorporation of this language into chapter 7670 is reasonable because it results in no changes to the scope or any requirement (other than changes explained in this SONAR). The change will reduce the cost to purchase the Minnesota Energy Code. Although chapter 7670 will be longer, the purchaser will save by not having to obtain the Code of Federal Regulations, and, perhaps, not even the Model Energy Code. The incorporation is also reasonable because the department has secured written permission from the publisher of the Model Energy Code to copy certain portions of this copyrighted document. This written permission is contained in correspondence with the Council of Building Officials (see Attachment M).

The department also proposes to replace all reference standards (currently denoted "RS-..") and the table of reference standards (part 7670.1000) with the *actual* references. This change is needed and reasonable for the convenience of users of chapter 7670. This format is consistent with all other parts of the State Building Code.

PART 7670.0100, AUTHORITY; SCOPE; APPLICABILITY

This part replaces chapter 1 ("Administration and Enforcement") of the Model Energy Code (hereafter, "MEC"), currently adopted by reference. Amendments are proposed in this part because of the department's statutory requirements that this chapter be part of the State Building Code and apply to remodeled elements of buildings.

Subparts 2 & 3, Scope and applicability.

The department proposes in subpart 2 to delete reference to the statutory authority because the statutory authority is already cited in subpart 1.

Subparts 2 and 3 are proposed to replace §§ 101.1, 101.2 and 101.3 of the MEC (Title, Intent, and Scope). The State Building Code (of which chapter 7670 is a part) addresses the purpose, application and scope of the Minnesota Building Code at Minn. Rules parts 1300.2100 and 1300.2300. The department believes that related provisions in the State Building Code addressing this issue are adequate and familiar to users of this chapter, and there is no need for a separate provision in the energy code.

In subpart 3, reference to the Model Energy Code is proposed to be stricken. The need and reasonableness of this modification is demonstrated in the foregoing section of this SONAR titled "INCORPORATION OF LANGUAGE CURRENTLY ADOPTED BY REFERENCE."

Also in subpart 3, the sentence proposed to be added is taken verbatim from section 101.2 of the MEC. It is needed here because parts 1300.2100 and 1300.2300 do not address the issue that chapter 7670 (the Minn. Energy Code) is not meant to abridge the stated requirements.

Subpart 4, Exempt buildings.

This subpart is identical to the MEC section 101.3.1.1, currently incorporated by reference.

The MEC section 101.3.2 exempts buildings which are neither heated nor cooled, and this provision is not incorporated into chapter 7670. The deletion of the provision from the subpart is needed and reasonable because chapter 7670 includes requirements for lighting that may be installed in buildings that are neither heated or cooled, yet are covered by the State Building Code and use energy, and therefore must be covered by this chapter.

Subpart 5, Applicability to existing buildings.

Item A, Additions, alterations and repairs. The department proposes to amend the paragraph (currently in MEC section 101.3.2.1 titled "Additions to existing buildings") to require that alterations or repairs to existing buildings must also conform to the requirements of chapter 7670.

This amendment is needed because language in the State Building Code leaves uncertain the question of whether or not portions of the State Building Code (including the Energy Code) apply to alterations and repairs of existing buildings. The uncertainty arises because the Uniform Building Code (UBC, adopted by reference in part 1305.0100), Sec. 104 (b) states "...alterations or repairs ... [must] conform to that required for a new building or structure." However, later this same section states "alterations or repairs to an existing structure which are non structural and do not adversely affect any structural member or any part of the building or structure having fire resistance may be made *with the same materials* of which the building or structure is constructed." (Emphasis added.) The department has received calls from building officials indicating that this later sentence is interpreted as meaning that chapter 7670 *does not* apply to alterations and repairs to existing buildings.

The proposed language is needed to assure that the State energy code is enforced consistent with the intent of existing Minnesota Statute. Minnesota Statute § 216C.19, subd. 8 specifically states that chapter 7670 *does apply* to alterations and repairs with the words: "... The rules shall apply to all new buildings and remodeling affecting heat loss control, illumination and climate control." Minnesota rules part 1300, stating the scope of the State Building Code (including the Energy Code), states: "The code applies to the construction, alteration, moving, demolition, repair, and use of any building or structure..."

The proposed amendment is reasonable because the application of chapter 7670 is not changed by the amendment (as illustrated by the statutory and rule citations above), but is merely clarified.

The amendment is reasonable because it only applies when alterations or repairs are done to a building, and requires that only those changes meet the minimum requirements of the energy code. The proposed amendment gives no authorization to mandate replacement of any existing building component. Furthermore, the amendment only applies to projects to which the State Building Code applies. The proposed amendment does not authorize extending the energy code to cover minor repairs and building maintenance for which a building permit is not now required. The application of the energy code is specifically excluded from relocated residential buildings (part 7670.0100, subp. 4, C) and "historic buildings" (part 7670.0100, subp 5, B). In addition, the energy code is specifically excluded from abridging any safety, health or environmental requirements under other applicable codes or ordinances (part 7670.0100, subp. 3).

The application of the energy code is exempted for some repairs and remodeled elements by the existence of Uniform Building Code section 106 relating to practical difficulties. Section 106 states "whenever there are practical difficulties involved in carrying out the provisions of this code, the building official may grant modifications for individual cases ..." when justification is provided. The only exceptions to this exemption are fire-protection and structural integrity. This exemption is routinely

applied when insulating walls of one- and two-family residential buildings and could be applied to other applications in existing buildings if compliance with the energy code would present difficulties due to space limitations or unreasonable costs. The application of the State energy code to remodeling and repair projects will cost effectively save substantial energy, benefiting individuals and the State as a whole (see Attachment B).

The reasonableness of the application of the proposed amendment to alterations and repairs for specific building components is given in the following discussion:

- **Exterior envelope:** For major renovations to walls and roofs, the minimum requirements of the energy code apply. The requirements would not apply to such partial renovation as window replacement, since no specific criteria exist in the energy code for windows. Insulating the cavity of an existing wall would easily be exempted from the energy code requirement by the "practical difficulties" provision of the UBC discussed above. Repairs to a small section of roof would also be easily exempted by the practical difficulties provision.
- **HVAC:** In adopting the HVAC equipment requirements from ASHRAE Standard 90.1-1989 in the spring of 1992, the department found the efficiency requirements were needed and reasonable. A detailed investigation indicated that the more efficient equipment would be readily available with no significant cost increase and with no detrimental effect on reliability or life expectancy. It will be reasonable to replace HVAC equipment (aside from maintenance items that would not require a building permit) with equipment meeting the standards of the energy code. Energy improvements to HVAC systems (pipes, ducts, pumps, controls, etc.) will improve the overall efficiency of the building even though other components do not meet the most recent energy standards.
- **Lighting:** An analysis of the application of lighting requirements to remodeled existing buildings is given in Attachment B. The analysis shows that, although lighting systems meeting the requirements of the energy code would cost more than less efficient systems, they will achieve a 2.7 to 6.5 year simple pay back in energy savings. The disadvantage of the additional cost is outweighed by the benefits to the occupant (who is paying the utility bill) and the State as a whole (by having to commit less generating capacity).

Item B, Historic Buildings. This item is identical to section 101.3.2.2 of the MEC, currently incorporated by reference.

Item C, Mixed occupancy. This item is identical to section 101.3.3 of the MEC, currently incorporated by reference.

Item D, Change of occupancy. This item is identical to section 101.3.2.3 of the MEC ("Change of occupancy"), currently incorporated by reference.

Subpart 6, Alternate materials and methods.

The department proposes to add this new item, which is identical to section 103 of the MEC, ("alternate materials and methods of construction, design or insulating systems"), currently incorporated by reference.

Subpart 7, Plans and specifications.

The department proposes to add this new item, which is identical to section 104 of the MEC ("plans and specifications"), currently incorporated by reference.

Section 105 of the MEC ("inspections") is proposed to be not copied to this chapter, and is therefore deleted. The State Building Code (of which chapter 7670 is a part) addresses the inspections required in enforcement of the State Building Code in the Uniform Building Code section 305 (incorporated by part 1305.0100) and at part 1305.0900. The department believes that provision in the State Building Code addressing this issue is adequate and is familiar to users of this chapter, and there is no need for a separate provision in the energy code.

Section 106 of the MEC ("validity") is proposed to be not copied to this chapter, and is therefore deleted. ("Validity" means that if a portion of the code is found to be invalid, the invalidity does not affect any other provision of the code.) The State Building Code (of which chapter 7670 is a part) addresses the application of the code to validity at Minn. Rules part 1300.3100 (titled "severability"). The department believes that provision in the State Building Code addressing this issue is adequate and is familiar to users of this chapter, and there is no need for a separate provision in the energy code.

PART 7670.0130, INCORPORATIONS BY REFERENCE

Subpart 1, Incorporated items

The department proposes to delete and add several incorporations by reference. These changes are needed and reasonable to make the incorporations consistent with changes proposed throughout the chapter. The need and reasonableness of specific incorporations by reference are addressed in this SONAR when the reference is used.

PART 7670.0260, MATERIALS AND EQUIPMENT.

This part replaces section 102 "Materials and equipment" of the Model Energy Code. The current requirements of MEC section 102 are modified as discussed below.

Subpart 1, Identification.

This subpart is identical to subsection 102.1 of the MEC, currently incorporated by reference.

Subpart 2, Maintenance information.

This subpart is identical to subsection 102.2 of the MEC, currently incorporated by reference. There are no additional subsections in section 102 of the MEC.

Subpart 3, Thermal insulation.

This subpart is currently a part of Minnesota Rules, and is only changed to give it a subpart number in accordance with Revisor's style requirements.

PART 7670.0325, DEFINITIONS

The department proposes to add several definitions to chapter 7670 that are currently included in the Model Energy Code. Some definitions from the MEC are proposed to not be incorporated into the chapter because they are not used in the chapter, others are proposed to be not incorporated because the definitions are infrequently used and are located in other documents incorporated by reference, others are incorporated into this part verbatim from the MEC, and finally some are incorporated into this part with changes as they appear in the MEC.

The following list of definitions currently in the Model Energy Code as referenced by part 7670.0100 are proposed to be not incorporated into chapter 7670. The deletion of these terms is needed because the terms are not used in the current or proposed Minnesota Energy Code. All applications of these terms were deleted in the previous revision of chapter 7670 (effective September 7, 1992), but the department neglected in that rulemaking to make an amendment deleting them from the MEC. These deletions are also needed because the department's statutory requirement for lighting standards (216C.195, subd.3) does not include any of these terms:

- Coefficient of beam utilization
- Coefficient of utilization
- Color rendition
- Equivalent sphere illumination
- Equivalent sphere illumination
- Floodlighting
- Illumination
- Light loss factor
- Luminaire
- Reflectance
- Room cavity ratio
- Veiling reflections
- Work plane

The definition of "Overall thermal transfer area" that is currently in the MEC is proposed to be not incorporated into chapter 7670. The deletion of this term is needed because the term is not used in the current Minnesota Energy Code. All applications of this term were deleted in the previous revision of chapter 7670 (effective September 7, 1992), but the department neglected in that rulemaking to make an amendment deleting them from the MEC.

The department proposes that the following terms relating to heating, ventilating and air conditioning (HVAC) systems currently in the MEC not be incorporated into chapter 7670. Although the terms are used in this chapter, the department believes that these terms are commonly understood by users of this chapter. Furthermore, in the event that the precise definition of any of these terms are needed, the definitions for these terms are contained in the Code of Federal Regulations, as referenced in the proposed part 7670.0610, subpart 1.

- Service systems
- Sequence
- System
- Thermostat
- Terminal element
- Zone

The department proposes that the following terms relating to HVAC equipment currently in the MEC not be incorporated into chapter 7670. Although the terms are used in this chapter, the department believes that these terms are commonly understood by users of this chapter. Furthermore, in the event that the precise definition of any of these terms are needed, the definitions for these terms are contained in the Code of Federal Regulations, as referenced in the proposed part 7670.0610, subpart 1 and part 7670.0660, subpart 1.

- Coefficient of Performance

Package terminal air conditioner
Package terminal heat pump
Room air conditioner
Unitary cooling and heating equipment
Unitary heat pump
Water chilling package of absorption
Water-chilling package, centrifugal or rotary
Water-chilling package, reciprocating

The following terms, currently incorporated by reference in the MEC are not incorporated into chapter 7670 because their definition is unnecessary for the reasons given:

Public facility rest room -- this term is only used in MEC section 504.8 ("Conservation of hot water") that is proposed to be deleted for the reasons given on page 23 of this SONAR.

Service water heating demand -- this term is not used in chapter 7670.

Solar energy source -- The definition in the MEC is the same as the commonly understood definition and there is no need for a special definition. The term is a renewable energy source and is included in the definition of that term in subp. 41.

The deletion of the aforementioned definitions has no effect on the stringency of chapter 7670.

The department proposes to copy some definitions from the MEC, and to modify and add additional definitions. The definitions described below as "verbatim" are identical as they appear in the MEC, except that they are enumerated in accordance with Revisor's style requirements.

Subpart 1 replaces the MEC "Application of terms," and is a qualification statement giving the purpose of this part and scope of definitions listed herein.

Subpart 2 is a combination of the terms "accessible" and "readily accessible" taken verbatim from the MEC. These are proposed to be combined for the convenience of users of this chapter.

Subpart 3. Items A, B and C of this subpart currently exist in part 7670.0325 as subpart 5, and are moved to this location to maintain alphabetical consistency. The individual terms are given separate item numbers to improve clarity.

In Item A reference is made to the Uniform Building Code which is incorporated by reference into the State Building Code by Minnesota Rules part 1305.0100.

Item D of this subpart ("Improved ceiling framing") is a new term. The definition is needed because it is used in proposed part 7670.0480, subp. 2. The definition is reasonable because it succinctly describes a type of ceiling construction commonly used in Minnesota that provides improved energy efficiency. This type of ceiling construction is done with a prefabricated roof truss, sometimes called a "wedged heal" truss, that provides the 7-½ inch clearance as indicated in the definition.

Definitions of terms in **subparts 4 through 10** are incorporated into this part verbatim from the MEC.

Subpart 11 is identical to the definition of "conditioned space" in the MEC, except that the current (1991) edition of ASHRAE standard 55 is substituted for reference to the superseded (1981) edition. The reference to the current edition of the ASHRAE standard is needed and reasonable because

it is the edition that is being used by designers and other users of this chapter.

Definitions of terms in **subparts 12 through 15** are incorporated into this part verbatim from the MEC.

Subpart 16 is a new term needed because of its use in part 7670.0660. The definition is reasonable because it is identical to the definition of this term in both the Code of Federal Regulations, title 10, part 435 and ASHRAE Standard 90.1-1989.

Definitions of term in **subpart 17** is incorporated into this part verbatim from the MEC.

Subpart 18 is a new term needed because of its use in part 7670.0660. The reference to the Code of Federal Regulations for the definition is needed because the definition involves a lengthy description of a complicated test procedure that users of this chapter would have no need to have readily available. The reference is needed to maintain brevity and clarity of the chapter for the convenience of users of the chapter. The definition is reasonable because in the event that the precise definition of this term is needed, the definition is contained in the referenced citation.

Subpart 19 is incorporated into this part verbatim from the MEC, except that the title in the MEC is just "Energy." The addition of "kWh" and "Btu" to the title of this definition was recommended by the Revisor because these terms are also included in this definition.

Definitions of terms in **subparts 20 through 29** are incorporated into this part verbatim from the MEC.

Subpart 30. The addition of the definition of "Mechanical ventilation system, Residential" is needed because it is used in the proposed revision to part 7670.0470, subp. 7. The definition is reasonable because it is identical to the definition of this term in the energy conservation standards of the Northwest Energy Code, to which amendments to this chapter must equal or exceed as required by Minn. Stat. §16B.165 (see Attachment A).

Definitions of terms in **subparts 31 through 33** are incorporated into this part verbatim from the MEC.

Subpart 34. The definition of a "Once-through system" is added to this part because references to the term are added in part 7670.0660, subparts 4 and 7.

Subpart 35 is identical to the definition of "natural ventilation" in the MEC, except that the title of the definition is amended with the addition of the word "passive." This amendment is needed because "passive ventilation" is a more accurate term. (The word "natural" is retained to avoid confusion because other portions of the Minnesota Building Code use this term to refer to this definition.) The reason for this amendment is that the word "natural" connotes wholesome and good, while in fact the use of this term in part 7670.0470, subp. 6 means is that building occupants are expected to *open their windows in January* to provide ventilation necessary to provide adequate ventilation in the building. The addition of the word "passive" is reasonable because it is equally technically correct, yet a better descriptive term to use.

Definitions of terms in **subparts 36 through 44** are incorporated into this part verbatim from the MEC.

Subpart 45 is incorporated into this part verbatim from the MEC with the exception that reference to the current (1993) edition of ASHRAE Handbook of Fundamentals is substituted for reference to the superseded (1989) edition. The reference to the current edition of the ASHRAE handbook is needed and reasonable because it is the edition that is being used by designers and other users of this chapter.

Definitions of terms in **subparts 46 through 47** are incorporated into this part verbatim from the MEC.

Subpart 48. The department proposes to modify the definition of "Thermal transmittance, overall" by deleting the "Thermal bridges in sheet metal construction" method and adding the "Draped insulation effective assembly R-value" method. The compliance with Statutory requirements of these amendments is discussed when these terms are used (part 7670.0460, subp. 4).

The proposed change to delete the "Thermal bridges in sheet metal construction" method is needed because this method is so complex as to be unenforceable. There is only one reference to this method in the scientific literature (written by an author residing in Denmark), and the department has been unable to find any illustrations or examples of its use in the literature. The proposed change is reasonable because with the elimination of this method, users will be required to use one of the other methods specified in this part (most likely either the "Draped insulation effective assembly R-value" or "Zone" methods). The deletion of the "Thermal bridges in sheet metal construction" method will not compromise the stringency of chapter 7670 (in accordance with the requirements of Minn. Stat. § 216C.195, subd. 2, the standards for opaque envelope of this chapter be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989). The "thermal bridges in sheet metal construction" method might be more accurate than the "Draped insulation effective assembly R-value" or "Zone" methods, but since the method proposed to be deleted is unenforceable, it cannot be more stringent than the methods proposed to take its place that are readily enforceable.

The proposed change at item C to modify the title of this method to the "Metal stud framing equivalent R-value method." The change is needed because this method pertains only to metal stud framed assemblies. This change is also made when the method is referenced in part 7670.0460, subp. 4, item B, subitem 4.

The proposed change at item D to add the "Draped insulation effective assembly R-value" method is needed and reasonable because it is proposed to be referenced in part 7060.0470. The technical reasons for the need and reasonableness of this item are addressed in the discussion of part 7060.0470, subp. 4 in this SONAR.

Subpart 49 as proposed is identical to the definition of "Thermal transmittance, overall" in the MEC except that the proposed definition stipulates use of the parallel path heat flow method. Although the MEC does not stipulate this method, the parallel path heat flow method is the only method defined, therefore the proposed definition is in no way different from the MEC definition.

Subpart 50 is identical to the definition currently in part 7670.0325, subp. 2 except that two terms that are currently abbreviated are spelled out for clarity.

Subpart 51 is a combination of the terms "ventilation" and "ventilation air" taken verbatim from the MEC. These are proposed to be combined for the convenience of users of this chapter.

Subpart 52 is identical to the definition currently in part 7670.0325, subp. 3.

Subpart 53 is identical to the definition currently in part 7670.0325, subp. 4, except that the reference to "glazing area" is deleted because this term is not used in chapter 7670.

PART 7670.0400 DESIGN CONDITIONS.

The department proposes to repeat the language (with one modification) of the Model Energy Code Chapter 3. The existing amendment to this chapter of the MEC (a table of design condition temperatures) is retained. MEC section numbers are replaced with subpart and item numbers in accordance with Revisor's style requirements.

The one modification proposed is to delete the sentence at the end of MEC section 103.2 ("Heating and cooling") that states: "The design shall not create conditions of accelerated deterioration from moisture condensation." This deletion is needed because the requirement is unenforceable. The deletion is reasonable because part 7670.0470, subpart 6 "Effectiveness of required thermal insulation" sets up specific criteria to do what the deleted sentence apparently intends to accomplish.

PART 7670.0450 VENTILATION

This part is proposed to replace Model Energy Code section 303 "Mechanical ventilation criteria." The department proposes to amend ASHRAE Standard 62-1989 by adding two exceptions. One exception is to correct an inference in the adopted standard that infiltration may provide adequate ventilation in residential buildings. The other changes the ventilation rates required for parking garages and auto repair rooms to be consistent with rules adopted by the Department of Administration.

The proposed exception regarding infiltration is needed because legislative mandate requires rules adopted under this Chapter to be compatible with public health and safety. Research has demonstrated that infiltration does not satisfy the requirement for ventilation in Minnesota residential buildings (see Attachment C). The proposed amendment is reasonable because it does not by itself change any requirement of the chapter for residential construction. It merely corrects a misstatement of fact. Thus, in accordance with Minn. Stat. § 216C.195, subd. 2, the standards for heating, air conditioning and ventilation with this amendment will be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989.

The proposed exception regarding parking garages and auto repair rooms is needed to make the ventilation requirements for these occupancies consistent with chapter 1346 adopted by the Department of Administration. In the past, Chapter 1346 has required 0.75 cfm/ft² (compared with ASHRAE's 1.5) for parking garages, and 1.0 cfm/ft² (compared with ASHRAE's 1.5) for auto repair rooms. This inconsistency has reportedly resulted in enforcement problems in some jurisdictions. The effect of this amendment will be to reduce the required ventilation, and thus reduce energy consumption. Thus, in accordance with Minn. Stat. § 216C.195, subd. 2, the standards for heating, air conditioning and ventilation with this amendment will be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989.

PART 7670.0460 BUILDING DESIGN BY SYSTEMS ANALYSIS.

This part references and amends the Model Energy Code Chapter 4. This chapter of the MEC

(currently adopted by reference) is amended by changing references to chapters 5 and 6 of the MEC to the appropriate parts of Minnesota Rules.

The amendment is needed because the MEC contains references to other portions of the Model Energy Code that are inconsistent with current (and proposed) provisions of chapter 7670. The change is reasonable because the building design by systems analysis procedure references requirements for buildings which are identical to those contained in parts 7670.0260 through 7670.0800.

PART 7670.0470 ENVELOPE THERMAL TRANSMITTANCE FOR ALL BUILDINGS

Subpart 1 is incorporated into this part verbatim from MEC section 501.1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 2, Total heat gain or loss for entire building.

This subpart is incorporated into this part verbatim from MEC section 502.1.1 with one modification. The modification is that references in the MEC to other MEC sections are replaced with references to the appropriate parts of Minnesota Rules. The amendment is needed and reasonable because references in this subpart must be consistent with current (and proposed) provisions of chapter 7670.

Subp. 3, Thermal mass of opaque building components.

This subpart is incorporated from MEC section 502.1.2, with two modifications. The modifications are that the table in subpart 3 only applies to locations with heating degree days (HDD) in the range of 6,501 to 8,000, and a formula for calculating thermal mass that appears in the MEC is not included in subpart 3.

The deletion in the table of values for HDD of 6,500 and less is needed and reasonable because the minimum heating degree days of any location in Minnesota is greater than 6,500. The limitation of this procedure to locations with less than 8,000 HDD is needed and reasonable because MEC section 502.1.2 gives no credit for thermal mass for locations with 8,000 HDD and greater.

The deletion of the formula for calculating heat capacity is reasonable because the formula is merely instructions as to how to calculate heat capacity, which is generally already known by users of this chapter. The deletion is needed to maintain brevity of the chapter and to reduce the inclusion of unnecessary instructional material.

Subp. 4, Thermal transmittance of opaque components.

Item A is taken verbatim from the MEC section 502.1.3. It is needed and reasonable to include this item within this subpart because it pertains to thermal transmittance of opaque components.

Item B currently exists currently exists in chapter 7670 at this location as an amendment to the MEC with several modifications.

The need and reasonableness for incorporating this language into chapter 7670 that is currently an amendment to the MEC is demonstrated on page 2 of this SONAR. The deletion of reference to the various "RS" standards is needed and reasonable because complete definitions of these standards are proposed to be included in part 7670.0325, subp. 48.

In **subitem (3)**, the department proposes to delete reference to the "Thermal bridges in sheet metal construction" method and replace it with a reference to the "Draped insulation effective assembly R-value" method. A definition of the new method is proposed in part 7670.0325, subp. 48, item D.

The deletion of the reference to the "Thermal bridges in sheet metal construction" method is

needed because it is extremely complicated, lacking substantive documentation (such as worked-out examples), and therefore unenforceable. The deletion is reasonable because the thermal performance calculation of these assemblies can be performed by the proposed "Thermal bridges in sheet metal construction" or "zone" methods, which is an adequate calculation procedure for this type of assembly, as explained in this SONAR at the discussion of part 7670.0325, subp. 48.

The addition of the "Draped insulation effective assembly R-value" method is needed to assure accurate calculation of thermal transmittance for the application described. Attachment D explains the importance of correctly calculating the effective R-value. The addition is reasonable because the effective assembly R-value method was developed and confirmed by national testing laboratories using tested performance. The draped insulation effective assembly R-value method is more stringent than the standards for opaque envelopes in ASHRAE/IES Standard 90.1-1989 because this method does not appear in Standard 90.1. In accordance with Minn. Stat. § 216C.195, subd. 2, the standards for opaque envelope with this amendment will be at least as stringent as standards in ASHRAE Standard 90.1-1989.

At **subitem (4)**, the department proposes to replace the term "nonmetal surface with metal framing" for the two following units with "metal stud wall equivalent R-value method," and at **subitem (5)** to apply the "zone method" to all assemblies not defined in the foregoing four subitems. These modifications are needed and reasonable because the "zone method" applies to construction assemblies other than nonmetal surface with metal framing.

Item C is currently permitted in the Model Energy Code

Subp. 5, Thermal transmittance of window area and skylight elements.

Item A currently exists in chapter 7670 at this location as an amendment to the MEC, and is proposed to be put under a new heading with several modifications. It is needed and reasonable to include this item within this subpart because it pertains to thermal transmittance of windows and skylights. The replacement of the reference to the "RS" standard (currently the ASHRAE Handbook - 1989 edition) with a citation to the current edition of the ASHRAE Handbook is needed and reasonable because users of this chapter are using the current edition of the ASHRAE Handbook.

The department proposes to delete the reference to three standards for determining thermal transmittance of window area and skylight components. These deletions are needed because the deleted standards are no longer considered uniform and valid measurements. The two prescribed methods in proposed (items A and B) are currently the predominant methods (and will soon be the exclusive methods) of determining window performance in the United States. This change is reasonable because the two deleted standards are also referenced by the National Fenestration Rating Council (NFRC) standard. The change is also reasonable because manufacturers may use the no cost and straightforward ASHRAE Handbook table to identify window U-factors in case a window has not been tested to the NFRC standard, or for the manufacturing of a small number of custom windows.

Item B represents no change because "RS-20" in the current chapter (deleted in the line proceeding **Item B**) is defined in the current part 7670.1000 as NFRC 100-91.

These changes are also needed to assure compliance with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. The states of California and Washington have adopted requirements for window performance measurements requiring either NFRC 100-91 or the 1993 ASHRAE Handbook values.

Subp. 6, Effectiveness of required thermal insulation.

The department proposes to reorganize chapter 7670 by moving the provisions of parts 7670.0480 and 7670.0550 into this subpart. The provisions of this subpart are proposed to be organized under three items with headings of "vapor retarder," "air leakage barrier," and "air intrusion barrier."

The change in organization is needed for clarity. The organization is reasonable because measures in the subpart as proposed all relate to prevention of water vapor migration (and subsequent condensation) in insulation and mitigation of wind wash, which are the subjects of this subpart. Air intrusion from outdoors directly affects the performance of installed insulation and therefore is appropriately included under the heading of this subpart.

The current subject of subp. 3 (replaced by subp. 6) is proposed to be moved to part 7670.0480, subp. 2 and retitled "prescriptive criteria."

Item A, Requirements for buildings. The department proposes a new item to identify requirements for two categories of buildings (at subitems (1) and (2) and a table of requirements (at subitem (3))). It is proposed that category 2 buildings (at subitem (2)), where infiltration and natural ventilation are relied on to provide necessary year-round ventilation, must be constructed in accordance with only certain provisions of this subpart. Construction of all other buildings (at subitem (3)) must be in accordance with all items listed in subitem 3. The requirements of subitem (2) have been carefully selected to result in no tighter construction than is currently required by chapter 7670.

Item A is needed because performing all the requirements listed in subitem 3 may result in an inadequately ventilated residential building, unless a mechanical ventilation system is installed. In accordance with Minn. Stat. § 16B.165 (Attachment A), the amendments to chapter 7670 must be compatible with the interests of public health and safety. The department has received comment (Attachment C) that residential buildings would be under ventilated if air leakage is decreased and mechanical ventilation is not installed. For "category 2" buildings, subitem (2) requires construction that will result in no tighter construction than is currently required by chapter 7670. The Builders Association of Minnesota (BAM) has adopted a "Strategic Plan" (Attachment E) calling for all residential construction to be air tight with mechanical ventilation. For "Category 1" buildings, subitem (1) requires buildings to be tightly constructed with mechanical ventilation systems. This subitem is in agreement with the BAM Strategic Plan, and is needed to assure buildings to be constructed tightly to protect insulated cavities and installing mechanical ventilation.

The proposed language is further reasonable because the department anticipates that in the near future mechanical ventilation will become more prevalent in residential construction. The proposed organization of this item is such that when mechanical ventilation is required by the State building code for all construction, then subitem (2) could be proposed to be deleted. The department and Department of Administration, Building Codes Division are currently working with a task force organized by BAM to identify specific standards for mechanical ventilation appropriate for Minnesota.

Item B, Vapor retarder. Item B currently exists currently exists at part 7670.0480 as an amendment to the MEC, and is proposed to be moved to this location with two modifications. One proposed modification is to add a requirement that the vapor retarder must be continuously sealed when it is also intended to serve as the air leakage barrier. It is also proposed to amend the exception regarding vapor retarder installation on the rim joist to allow its exclusion where the insulation is not susceptible to condensation from moisture diffusion.

It is needed and reasonable to include this item within this subpart because it pertains to performance of required thermal insulation.

The addition of the requirement at **subitem (1)** is needed because some energy efficient construction strategies employ the vapor retarder as the air leakage barrier. Sealing the vapor retarder is needed and reasonable if it is to function as a barrier to air leakage.

Amending the exception for rim joists at **subitem (2)** is needed because the rim joist may, under certain circumstances, be vulnerable to moisture condensation. Condensation problems have not been widely reported in typical rim joist construction with 2-inch thick soft wood band joists without a vapor retarder. However, a recent Minnesota case reported in Home Energy Magazine (letters, July/August 1993) indicated that if the band joist consists of only sheathing, condensation could be a major problem.

The amendments at subitem (2) may not (when taken by itself) be consistent with the requirements for residential construction that these amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. However, the proposed requirement on part 7670.0115 that effective January 1, 1998, the requirements for residential construction will equal the requirements of the Canadian R-2000 program, does mean that the proposed amendments to this chapter will exceed the most stringent energy-conserving codes adopted by any other state.

Item C, Air leakage barrier. The department proposes to move elements of the existing chapter 7670 relating to air leakage barrier into this item and to amend several of the subitems as described below. The sentence following the title of this item is moved verbatim from part 7670.0480 (stated as an amendment to the MEC section 502.1.6.2). The following subitems are moved from their current locations:

subitem (1) is moved verbatim from its current location in part 7670.0480;

subitem (2) is moved with modifications from its current location in part 7670.0550, subp 2;

subitem (4) is moved with modifications from its current location in part 7670.0550, subp 3; and

subitem (5) is moved with modifications from its current location in part 7670.0550, subp 3.

Subitem (3) is proposed to be added as a new requirement under this item.

Subitem (2) is proposed with three modifications. The first modification is to the title, by adding the term "fire block." The term "fire stop" is currently defined in the Uniform Building Code, adopted by reference by Minn. Rules part 1305.0100. However, the department understands that the Department of Administration intends to soon propose amending the State Building Code that would have the effect of changing the term "fire stop" to "fire block" (both terms have the same meaning). The addition of the second term is needed to assure that in the event that the State Building Code is changed in the near future, this provision will still be using the correct term.

The second modification proposed is to require that an additional air leakage barrier be installed instead of having the fire stop being installed to block air movement. This modification is needed because it is not possible to pack fiber or glass minerals into a fire stop location and have it block air movement. The modification is reasonable because acceptable foam, caulk and gasketing materials are widely and inexpensively available that can be used in a fire stop application to block air movement.

The third modification proposed is to delete the exception that "a fire stop need not block air movement if its installation would conflict with any other part of the State Building Code." The removal of this section is reasonable because in discussion with the Department of Administration, Building Codes division (Mr. Scott McLellan) the department understands that this exception would never apply (that is, a fire stop installed to block air movement would never conflict with any other part of the State Building Code). The deletion is needed to clear the chapter of extraneous language.

Subitem (3) is proposed as an additional requirement to air seal all penetrations for electrical and telecommunications equipment. The addition of this requirement is needed because it is a significant potential source of water vapor migration into insulation. Air leakage into insulated cavities through openings associated with electrical outlets resulted in condensation on sheathing in a 1982 study in

Madison, Wisconsin (Attachment F). The amendment is needed for the chapter to be consistent with the requirement of Minn. Stat. § 16B.165, subd. 1 that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. This requirement is contained in the Northwest Energy Code. The requirement is reasonable because, although sealing may add to construction cost, the savings by preventing the problems caused by moisture are substantial. Specifically for recessed light fixtures, equipment and techniques are now widely available (see Attachment G) for sealing against air leakage. The amendment is also reasonable because the increased stringency beyond current practice in subitem (2) is limited to "category 1" buildings which are required to have mechanical ventilation in consideration of assuring public health and safety.

Subitem (4) is proposed to be modified by adding an exception for "category 2" buildings. The need to limit the requirement to air tighten "category 2" buildings is demonstrated at the discussion in this SONAR under the discussion of item A of this same subpart. This modification is needed for clarity. The amendment is reasonable because the requirement will be limited to "category 1" buildings which are required to have mechanical ventilation in consideration of assuring public health and safety.

Subitem (5) is proposed to be modified by adding an exception for "category 2" buildings. The need to limit the requirement to air tighten "category 2" buildings is demonstrated in this SONAR under the discussion of item A of this same subpart. This modification is needed for clarity. The amendment is reasonable because the requirement will be limited to "category 1" buildings which are required to have mechanical ventilation in consideration of assuring public health and safety.

Item D, Air intrusion barrier. The department proposes to move elements of the existing chapter 7670 relating to air intrusion barrier into this item and to amend several of the subitems as described below. The sentence following the title of this item is moved (and modified by adding the term "air impermeable") from part 7670.0480 (currently stated as an amendment to the MEC section 502.1.7). Subitem (1) is moved with modifications from its current location in part 7670.0480 (stated as an amendment to the MEC section 502.1.7). Subitem (2) is moved verbatim from its current location in part 7670.0480 (stated as an amendment to the MEC section 502.1.7). Subitem (3) is proposed to be added as a new requirement under this item.

The addition of the "air impermeable" phrase to the introductory sentence of this item is needed to assure that the air intrusion barrier will perform its intended function as an air intrusion barrier. Materials that are permeable to air will not function as an air intrusion barrier. The addition is reasonable because air impermeable materials suited for these applications are widely available to the construction industry.

At **subitem (1)** it is proposed to add requirements that the air intrusion barrier at the attic edge be of rigid material resistant to wind driven moisture. This amendment will make chapter 7670 consistent with the energy conservation standards of the Northwest Energy Code, which this chapter must equal or exceed as required by Minn. Stat. § 16B.165. The amendment is reasonable because materials resistant to wind driven moisture suited for this application are widely available to the construction industry.

Subitem (3) is proposed to be added (for "category 1" buildings only) requiring sealing exterior joints in the building envelope that may be sources of air intrusion. This addition is needed because air intrusion causes wind wash of thermal insulation, thereby reducing its effectiveness. The need to limit the requirement to air tighten "category 2" buildings is demonstrated in this SONAR under the discussion of item A of this same subpart. This modification is needed for clarity. The amendment is reasonable because the requirement will be limited to "category 1" buildings which are required to have mechanical ventilation in consideration of assuring public health and safety. In accordance with Minn. Stat. § 16B.165 (Attachment A), the amendments to chapter 7670 must be compatible with the interests of public health and safety.

Subd 7, Air leakage.

Item A, Windows and doors. The department proposes to incorporate this part verbatim from the MEC section 502.4.2 with one modification. That modification is that the current (1991) edition of ASTM standard 283 is substituted for reference to the superseded (1984) edition. The reference to the current edition of the ASTM standard is needed and reasonable because it is the edition that is being used by manufacturers and other users of this chapter.

Item B, Building joints. The department proposes to modify the language for this requirement to conform with the 1992 edition of the Model Energy Code section 502.4.3 with one modification. The modification is to not include "Weatherstripping" in the list of materials recommended for performing the required sealing. The item is separated into two subitems to separately identify the requirements for "category 1" and "category 2" buildings.

This amendment is needed for the chapter to be consistent with the requirement of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. The amendment is reasonable because the increased stringency in subitem (2) is limited to "category 1" buildings which are required to have mechanical ventilation in consideration of assuring public health and safety. In accordance with Minn. Stat. § 16B.165 (Attachment A), the amendments to chapter 7670 must be compatible with the interests of public health and safety. In accordance with Minn. Stat. § 16B.165 (Attachment A), the amendments to chapter 7670 must be compatible with the interests of public health and safety.

The deletion of "Weatherstripping" from the list of materials recommended for performing the required sealing is needed because this material is used to prevent air leakage at movable joints (such as windows and doors) and generally not at the immovable building joints addressed in this subpart. The deletion is reasonable because the inclusion of the phrase "or other materials" at the end of this list means that weatherstripping is not prohibited from being used in this application.

Item C, Performance alternative. The department proposes to move the requirement of the existing part 7670.0550, subp. 1 to this item with amendment. The sentence following the title of this item is moved verbatim from part 7670.0550, subp. 1 and amended by revising the citation of the prescriptive requirements currently in the MEC section 502.4.3 to the proposed location of item B of these same requirements. It is also proposed to revise the measurement for the air tightness requirement in this item to be a value of cubic feet per minute (cfm) per square foot of conditioned space. It is additionally proposed that the ventilation requirement be changed to be a "residential mechanical ventilation system," as proposed to be defined in part 7670.0325, subpart 30.

This change of measure of air tightness is needed because since this alternative (referencing ASHRAE Standard 119) was added to the energy code in early 1991, the alternative has never (to the department's knowledge) been used because of the complexity of ASHRAE Standard 119. The change of the term to cubic feet per minute (CFM) per square foot of conditioned space is needed to simplify the method so that it can be used. The specific value of 0.24 CFM per square foot is reasonable because it is equivalent to the air tightness requirement in the Northwest Energy Code (1.8 air changes per hour). Minnesota Statute § 16B.165 (Attachment A) requires that the Minnesota Energy Code be no less stringent than the Northwest Energy Code.

The proposal to change the ventilation requirement to reference the "residential mechanical ventilation system" is needed to assure that residential buildings built to this stringent standard have adequate mechanical ventilation installed. The change is reasonable because it is consistent with and no

less stringent than the energy conservation standards of the Northwest Energy Code as required by Minn. Stat. § 16B.165.

Subp. 8, Slab on grade floors.

The department proposes to move the requirement currently in parts 7670.0500 and 7670.0530 to this item with a modification. The modification is to replace the current chart of variable requirements (MEC Table 502.3.1) for heated and unheated slabs (as a function of heating degree days) with a single value (R-10) for all slab on grade floors.

This change is needed to simplify this requirement for convenience of users of this chapter. The proposal to require R-10 is needed because materials are not available that would give several of the R-values specified. They would prefer to use a higher R-value material for this application in all cases because of the susceptibility of the slab-on-grade wall to heat loss. It is reasonable because the values are slightly more stringent than the existing requirement for this element. For comparison, the requirement for vertical insulation to 24-inches for unheated slab-on-grade floors in ASHRAE Standard 90.1 is R-8, and to 48-inches is R-4. This amendment is needed for the chapter to be consistent with the requirement of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subp. 9. Foundation walls.

The department proposes to move the requirement currently in part 7670.0510 to this subpart with modifications. The modification is to add item numbers for clarity, to change this requirement to R-10 insulation on the entire foundation wall for residential buildings and R-15 for all other buildings in item B, and add item E to require a moisture barrier when insulation is installed on the interior.

At **item B, subitem (1)**, the change to R-10 over the entire wall for residential buildings is needed because analysis has shown that additional foundation wall insulation is a cost effective energy conservation measure. (The current requirement is for either R-10 to the design frost line or R-5 over the entire wall.) The Building Foundation Design Handbook (Underground Space Center, University of Minnesota, 1988) includes engineering and life cycle economic analysis of foundation wall insulation alternatives. This report finds that for a heated basement in Minneapolis' climate, optimum basement wall insulation is at least R-10 over the entire foundation wall for all fuel price ranges. For unheated basements, this same insulation level is optimal for higher fuel cost ranges. Assuming a fuel cost of \$5.00 per million BTU, the annual energy savings in a typical (166 foot perimeter) house due to the proposed change in Minneapolis is \$21 for an unheated basement and \$85 for a fully heated basement.

The proposed change is reasonable because the Model Energy Code 1989 edition (MEC) requires for residential buildings that the entire foundation wall to be insulated with from R-10 to R-15 in Minnesota's climate conditions. Thus, the proposed amendments at item B may not (when taken by itself) be consistent with the requirements for residential construction that these amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. However, the proposed requirement on part 7670.0115, that effective January 1, 1998, the requirements for residential construction will equal the requirements of the Canadian R-2000 program, does mean that the proposed amendments to this chapter will exceed the most stringent energy-conserving codes adopted by any other state. Thus, the amendment is in accordance with the requirements of Minn. Stat. § 16B.165, subd. 1 that the amendments to chapter 7670 must equal or exceed the most stringent energy-conserving codes adopted by any other state.

At **item B, subitem (2)**, the proposed change to R-13 over the entire wall for buildings other than residential buildings three stories and less is needed because the opaque envelope standards in

ASHRAE/IES Standard 90.1 is for R-12 in southern Minnesota and R-13 in northern Minnesota. (The current requirement for these buildings is the same as the current requirement for residential buildings. Thus, in accordance with Minn. Stat. § 216C.195, subd. 2, the standards for opaque envelope components with this amendment will be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989.

At **item E**, the proposed addition to this subpart is needed because of frequent reports of condensation on the interior (insulation) side of vapor retarder on insulation installed on interior basement walls. The reports have been in the form of telephone calls and letters received by the department from home owners and building officials. The change is reasonable because the cost of adding a moisture barrier (such as polyethylene) at this location is substantially less than repair or replacement of a moisture damaged interior wall that may result without it. The approach of adding a moisture barrier rather than removing the basement wall vapor retarder (which may also prevent accumulation of water in the insulated basement wall) is also reasonable. The latter alternative would unquestionably result in higher house interior moisture levels resulting in such problems as increased condensation on windows in the winter. The solution proposed is recommended by the Canadian Home Builders Association R-2000 program (Attachment H) and has reportedly been successfully used by many Minnesota home builders.

Subp. 10 Floors over heated spaces.

The department proposes to move the current requirement from MEC sections 502.2.1.3 and 502.3.1.3 with modification. The modification is to change to U-factor requirement from 0.05 to 0.04 for all buildings. The proposed requirement is more stringent than currently exists.

The requirement is needed to have chapter 7670 meet the requirement of with Minn. Stat. § 216C.195, subd. 2, the standards for opaque envelope components be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989. The standard in ASHRAE Standard 90.1 for floors over heated spaces in Minnesota's climate is a U-factor of 0.04 or less.

The requirement is reasonable because floor joists or trusses in most new construction are at least 2x8 and will accommodate an R-24 batt that will meet the U-factor of 0.04 requirement. This amendment is consistent with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subp. 11. Performance and identification of loose fill insulation.

The department proposes to add a new subpart requiring loose fill insulation to achieve performance at winter design temperatures (at item A), and requiring that insulation thickness markers and signed attic cards be installed (at items B & C) whenever loose fill insulation is installed in accessible attics.

At **item A**, the requirement that loose fill insulation achieve not less than stated performance at winter design temperatures (adopted by the department in 1992) is now implemented, with affected insulation manufacturers providing "Minnesota" coverage charts. The proposed requirement to achieve performance at winter design temperatures simply requires that insulation be installed as prescribed on those coverage charts. The requirement is needed and reasonable because the department believes that building owners expect that installed thermal insulation will perform at its rated value at winter design conditions.

At **items B** the identification requirements are needed because currently there is no practical means for inspecting a loose fill attic installation for compliance with the energy code. The proposed requirement would provide this means. The requirement is also needed because there is good reason to believe that insufficient insulation is being installed in many attics. A study in Georgia showed many

attics had only 80 percent of the claimed loose fill insulation actually installed. The proposed requirement is needed because inspectors and building owners should have a practical way of determining that the insulation required and being paid for has indeed been installed. The proposed requirement is reasonable because many insulation contractors have expressed support to the department for this measure as a way to assure that building purchasers get what they pay for.

At **items C and D**, the department proposes two alternative means of identifying attic insulation, and a requirement that an insulation receipt attic card be posted in the attic. These items are needed to specify acceptable methods conform to item B. These optional requirements are reasonable because many insulation contractors already do one of these alternatives in item C and post an attic card on a voluntary basis. The requirement is consistent with the Federal Trade Commission requirement that residential consumers receive a receipt stating the amount of insulation installed. The requirements are also reasonable because the estimated cost of the materials and work involved in complying is nominal (probably less than \$5).

The requirements of this subpart are not found in the energy code of any other state. Thus, these amendments are consistent with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

PART 7670.0475 CRITERIA FOR WALLS, ROOFS AND FLOORS OVER UNHEATED SPACES OF 1- & 2-FAMILY RESIDENTIAL BUILDINGS

The department proposes to add this new part to chapter 7670 and to move the current requirements relating to criteria for roofs, walls and floors over unheated spaces for 1 & 2 family residential buildings here. Some of the current criteria are also proposed to be modified, as indicated below.

The proposed amendments to this part may not (when taken by themselves) be consistent with the requirements for residential construction that these amendments equal or exceed the most stringent energy-conserving codes adopted by any other state. However, as proposed in part 7670.1115, these requirements will be superseded on January 1, 1998 by requirements of the Canadian Home Builders' Association R-2000 Home Program. Thus, the amendment is in accordance with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments to chapter 7670 must equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subpart 1, Scope.

This new subpart is proposed to identify the applicability of this part, and to indicate that buildings within the scope must comply with either the prescriptive (subp. 2) or performance (subp. 3) criteria. The requirement that these buildings demonstrate compliance with one of these two alternative procedures is the same as stated in the current requirement in part 7670.0470, subp. 3 (titled "Alternative compliance"). That subpart provides "alternative methods of compliance with (sections pertaining to wall, roof and floor thermal requirements) for one- and two-family residential buildings." The performance criteria (subp. 3) is identical (with one exception explained below) to requirements in the Model Energy Code currently incorporated by reference.

Subpart 2, Prescriptive criteria.

This proposed new subpart contains the requirements moved from the current part 7670.0470, subp. 3, and amended by changing the title, adding item numbers and modifying the content as indicated below. Item C (doors) is a new proposed requirement.

The current title for part 7670.0470, subp. 3 is "Alternative compliance." The change of title to

"Prescriptive criteria" is needed because it is a more accurate description of the method. This method is also commonly referred to as the "cook-book approach."

Item A, Roof/ceilings. This proposed item is to change the ceiling insulation requirement from the current "R-38" to different criteria when improved or advanced ceiling framing is used, and for roof/ceilings without attics. The proposed requirement is more stringent than currently exists.

The change is needed because analysis has shown (Attachment I) that the proposed prescriptive designs are equivalent to a roof/ceiling U-factor of 0.026. The change is reasonable because it represents no change in the thermal performance requirement of this element.

Item B, Rim joists. This requirement is moved verbatim from the current part 7670.0470, subp. 3.

Item C, Doors. The department proposes to add to the list of prescriptive criteria a requirement that entrance doors have a maximum U-factor of 0.30 (equivalent to a 1-1/2 inch solid-core wood door with storm).

This addition is needed because no minimum requirement for doors currently exists for this alternative compliance option, yet the table of maximum window and door area (item F) was calculated using an entrance door U-factor of 0.30. The addition is reasonable because this value would allow for entrance doors to be 1-1/2 inch solid-core wood door with storm, which is common in many homes. Such a door has a U-factor of not more than 0.30.

The addition of the exception for sliding and swinging glass patio doors is needed to clarify that the U-factor stated is for "entrance" doors only. Glass patio doors will likely have a U-factor greater than 0.30, and the exception is needed to assure that homes with glass patio doors are not excluded from using this prescriptive procedure. The addition of this exception is reasonable because, since the glass patio doors must have a U-factor less than or equal to the window U-factor for the building, the required thermal performance of any building using this procedure will be at least as stringent as if it used the performance procedure.

Item D, Floors over heated spaces. This item is proposed to be added to provide a prescriptive requirement that is equivalent to part 7670.0470, subp. 10. The addition is needed for the convenience of users of the prescriptive "cook-book" procedure. The item is reasonable because a floor with R-24 insulation between joists will have a U-factor of less than 0.04.

Item E, Foundation windows. This requirement is moved verbatim from the current part 7670.0470, subp. 3.

Item F, Maximum window and door area as a percent of overall wall. The department proposes to amend the table giving the maximum window and door area as a percent of overall exposed wall area that currently exists in part 7670.0470, subp. 3. The table is amended by deleting the portion of this table listed under the R-5 foundation wall insulation option, changing the percentages given to reflect revised input figures, and adding one more set of percentages for a new wall system.

The change deleting the figures under the R-5 foundation wall insulation is needed because an amendment is proposed in part 7670.0470, subp. 9 that would delete the R-5 foundation wall option from chapter 7670.

The changes to the percentages listed is needed because of the change in the assumed entrance

door U-factor (the current table assumed U-0.20). The percentages are calculated on a typical house to give a wall U-factor of 0.110, equal to the current requirement.

The addition of an option for an R-13 cavity insulation and at least R-7 sheathing is needed because this option is common design in Minnesota. The change is reasonable because it merely gives other options for this building type that all achieve a wall U_o factor of 0.110. A builder can still use the component performance approach (Subp. 3) to use whatever combination of window, wall and roof desired that achieves the overall building thermal performance.

Subp. 3, Performance criteria.

This new subpart contains the requirements for this building type currently in the MEC sections 502.2.1.1, 502.2.2.2, and 502.2.2.3, with the requirements of the last section listed modified.

This new subpart is needed to state the performance criteria for 1- and 2- family residential buildings. It is reasonable because the requirements of **item A** and **item B** are identical to the current MEC sections 502.2.1.1, and 502.2.2.2, respectively.

In **item C**, the requirement for floors over unheated spaces (to replace the current MEC section 502.2.2.3) is identical to that proposed in part 7670.0470, subp 10. That rule part is proposed to be amended to the value of 0.04 which is stated here.

PART 7670.0490 WALL & ROOF CRITERIA FOR MULTIFAMILY RESIDENTIAL BUILDINGS 3 STORIES OR LESS.

The department proposes to add this new part to chapter 7670 and to move all current requirements relating to roof and wall criteria for low rise multifamily residential buildings here. This new part contains the requirements for this building type currently in MEC sections 502.2.1.1, 502.2.2.2, and 502.2.2.3. Some of the current criteria are proposed to be modified, as indicated below.

For residential buildings, these requirements will be superseded on January 1, 1998 by the Canadian Home Builders' Association R-2000 Home Program standards as proposed in part 7670.1115. Thus, the amendment is in accordance with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments to chapter 7670 must equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subpart 1, Scope.

This new subpart is proposed to identify the applicability of this part, and to indicate that buildings within the scope must comply with roof criteria, and wall criteria as applicable (depending on location within the State).

Subp. 2, roof/ceilings.

This new subpart copies the current requirement for this building type from the MEC section 502.2.1.2 with one exception added. The exception pertains to alterations and repairs to insulated built-up or membrane roofing systems.

The exception is needed because of the great cost and impracticality of insulating an existing built-up roof to meet the U-factor requirement of 0.026 (equivalent to R-38). Statutory authority (page 1 of this SONAR) stipulates that requirements of this chapter be economically feasible in that the resultant savings in energy procurement shall exceed the cost of the energy conserving requirements amortized over the life of the building. While achieving R-30 is practical, in most cases an increase to R-38 would require the very expensive additional measure of raising the roof gutters. This exception is reasonable because substantial energy will be saved in existing buildings by installing R-30 in multifamily roofs. In

addition, heat loss through an R-30 roof/ceiling of a multi-family buildings is small compared to energy used in the remainder of the building.

To the department' knowledge, no other state has requirements that exceed R-30 as a minimum standard for alterations and repairs of built-up or membrane roofing systems. Additionally, the department is not aware of another state that applies the requirements of more than R-38 as a minimum standard for roofs of multifamily residential buildings three stories or less. These amendments are therefore consistent with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subp. 3 & 4, walls.

This new subpart is proposed to copy the current requirement for this building type from the MEC section 502.2.1.1, and to modify the requirement by replacing a graph of variable requirements (as a function of heating degree days) with two values, depending upon the location of the building within the State. The values proposed are more stringent than the existing requirement for this element. The proposed change references part 1305.5400 that specifies foundation depths for two regions of the State.

The change is needed because engineering/economic analyses show the proposed requirement is both cost-effective for the building owner/occupant and has a desirable long-term cost-benefit ratio. This proposal is identical to a change that was approved for inclusion in the 1993 amendments to the Model Energy Code. An engineering/economic analysis is used to demonstrate the need for the proposed values. The change is also needed because it is approximately the same (but no less stringent than) requirements for this building type in the 1993 edition of the Model Energy Code.

The reasonableness of the proposed change is demonstrated in Attachment J. The proposed values are shown to have a simple pay back of 4.7 years and a benefit to cost ratio (assuming a 30-year mortgage) of 3.2.

Although the department is not aware that any state has adopted the 1993 edition of the Model Energy Code, if any state has, then this chapter will be no less stringent. These amendments are consistent with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

PART 7670.0495 WALL & ROOF CRITERIA FOR ALL OTHER BUILDINGS.

The department proposes to add this new part to chapter 7670 and to move all current requirements relating to roof and wall criteria for buildings not regulated by part 7670.0480 or 7670.0490 (i.e., other than residential buildings three stories and less in height) to this location. These requirements are modified to be more stringent than the current requirements. The proposed requirements are at least as stringent as the ASHRAE/IES Standard 90.1-1989. Thus, the amendment is in accordance with the requirements of Minn. Stat. § 16B.165, subd. 1, that the amendments to chapter 7670 must equal or exceed the most stringent energy-conserving codes adopted by any other state.

Subpart 1, Scope.

This new subpart is proposed to identify the applicability of this part, and to indicate that buildings within the scope must comply with roof criteria, and wall criteria as applicable (depending on location within the State)

Subp. 2, Prescriptive criteria.

The department proposes to replace a graph of variable requirements for these elements (as functions of heating degree days) with two tables of values. The values are at least as stringent as

ASHRAE Standard 90.1 requirements. The proposed change references part 1305.5400 that specifies foundation depths for two regions of the State.

This change is needed to assure that the minimum envelope criteria for these buildings is cost-effectively energy efficient, as has been demonstrated by ASHRAE and the US. Department of Energy. The change is also needed to bring exterior envelope criteria of this building type in conformance with ASHRAE Standard 90.1-1989 as required by Minn. Stat. § 216C.195, Subd. 2 (Attachment A).

The reasonableness of the proposed change is demonstrated in the attached consultant report dated June 30, 1992 (Attachment K).

Subp. 3, Performance criteria.

The department proposes to adopt a performance criterion for this building type based on the ENVSTD computer program.

This adoption is needed to provide an alternative for the design of buildings that may not fit into the limitations of the prescriptive criteria of Subpart 2. It is reasonable because this computer program is equivalent to the criteria of ASHRAE Standard 90.1-1989.

PART 7670.0610 BUILDING MECHANICAL SYSTEMS

In accordance with Minn. Stat. § 216C.195, subd. 2, these standards for heating, ventilating, air conditioning (which are at least as stringent as standards in ASHRAE/IES Standard 90.1-1989) were substantially satisfied by the department prior to September 1, 1992.

Subpart 1, General.

At **item A, Scope**, the department proposes a statement to identify the applicability of this part, and to cite the location of standards for equipment and definitions for terms used in this part.

The proposal to include a cite to standards and definitions (rather than including them in chapter 7670) is needed to reduce the length and complexity of chapter 7670. The cite is needed in the unlikely event that the standards would need to be cited, or that a precise definition of any of these terms is needed. The proposal is reasonable because the department believes that these terms are commonly understood by users of this chapter, and are readily available in the cited documents.

At **item B, Exception**, the department proposes the language verbatim from the MEC section 503.1 "Exceptions" with one modification. The modification is to replace the words "requirements of section 503..." with "requirements of this part" to accommodate the placement of this paragraph into chapter 7670 in accordance with Revisor's style requirements.

Subp. 2, Heated commercial parking garages.

The department proposes to move the provision currently in part 7670.0125 to this location because of its relevance to building mechanical systems. This subpart is identical to existing part 7670.0125. The existing part 7670.0125 is proposed to be repealed.

Subp. 3, Calculation procedures.

The department proposes to strike the language amending the Model Energy Code, to add item numbers in accordance with Revisor's style requirements, to substitute "RS" abbreviations with citation to the actual standard, and to change the reference to the 1993 ASHRAE Handbook of Fundamentals.

The need and reasonableness of deleting amendments to the Model Energy Code and substituting "RS" abbreviations with citation to the actual standard are discussed on page 3 of this SONAR.

Standard "RS-1" in the current chapter 7670 refers to the 1989 edition of the ASHRAE Handbook of Fundamentals. The proposed change is to reference the 1993 edition of the ASHRAE Handbook. The change in reference to the current edition of the ASHRAE handbook is needed and reasonable because it is the edition that is being used by designers and other users of this chapter.

Subp. 4, System and Equipment sizing.

The department proposes to add this existing language as part of chapter 7670 instead of the current amendment to the Model Energy Code. No change in requirement is proposed. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 5, Simultaneous heating and cooling.

The department proposes to add language to Minn. Rules verbatim as it appears in the Model Energy Code section 503.3. These three subparts are the same as sections 503.3 except that they are given subpart numbers in accordance with Revisor's style requirements.

Subp. 6, Heat operated water chiller packages.

The department proposes to move the current requirement in part 7670.0660, subp. 1 (currently listed as an amendment to the MEC section 503.4.1) to this new subpart. This move is needed for clarity. In accordance with Minn. Stat. § 216C.195, subd. 2, these standards for heating, ventilating, air conditioning (which are at least as stringent as standards in ASHRAE/IES Standard 90.1-1989) were adopted by the department prior to September 1, 1992.

Subp. 7, Heat pumps.

The department proposes to add language to chapter 7670 as it appears in the Model Energy Code section 503.4.2 with modification. The subpart is given a number in accordance with Revisor's style requirements. The only modification from the language in the MEC is the deletion of the last sentence of section 503.4.2 that is simply an informational listing of possible sources of supplemental heating for heat pumps. The deletion of this one sentence is needed and reasonable because it is unenforceable.

Subp. 8, Mechanical ventilation.

The department proposes to add language to chapter 7670 as it appears in the Model Energy Code sections 503.4.4 with modifications. The subpart is also given numbers in accordance with Revisor's style requirements. The modifications proposed are to item B (1) (b) and item B (2). All other language is verbatim as it appears in the MEC.

The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

The modification proposed to item B (1) (b) is to change the listed fan system capacity in this exception from 5,000 cubic feet per minute (cfm) to 2,500 cfm. This change is needed because automatic dampers are needed on equipment with fan system capacity larger than 2,500 cfm to adequately control the system. The modification is reasonable because equipment with fan system capacity greater than 2,500 cfm is usually equipped with motorized (i.e., non-manual) dampers. For example, roof-top air conditioners larger than 5-ton (which have fan system capacity larger than 2,500 cfm) are always equipped by the manufacturer with motorized dampers. Equipment rated at 2,500 cfm and less is rarely equipped with motorized dampers because of the small energy savings that would result.

The modification proposed to item B (2) is to replace the exception of when dampers are not required from "when airflow is less than 100 cfm" to "when the system is designed for continuous operation." The deletion of the exception for systems smaller than 100 cfm is needed because significant energy loss would occur if these systems did not have a damper. An example of a nonresidential ventilating system less than 100 cfm is an exhaust fan for a service station rest room, which would result in a very cold rest room (indicating excessive energy loss) in the winter if did not have a damper. The deletion of the 100 cfm exception is reasonable because exhaust hoods with gravity dampers (similar to a dryer vent damper on the outside of a house) are inexpensive and widely used in small (100 cfm and less) ventilation applications. The addition of the exception for systems designed for continuous operation is needed and reasonable because a system operating continuously would have no chance of back drafting (the effect that the damper is intended to prevent).

Both of these modifications make this requirement more stringent than both the current requirement (in the Model Energy Code), and the ASHRAE Standard 90.1. The proposed subpart as modified is therefore at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989, in accordance with Minn. Stat. § 216C.195, subd. 2.

Subparts 9 through 12.

The department proposes to add this existing language as part of chapter 7670 instead of the current amendment to the Model Energy Code. No change in any requirement is proposed. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR. In accordance with Minn. Stat. § 216C.195, subd. 2, the requirements of these subparts are all at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989

Subpart 13, Economizer cycle.

The department proposes to add language to chapter 7670 verbatim as it appears in the Model Energy Code section 503.7. This subpart is the same as section 503.7 except that it is given subpart numbers in accordance with Revisor's style requirements. In accordance with Minn. Stat. § 216C.195, subd. 2, the proposed amendment is at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989.

Subp. 14, Controls.

The department proposes to add language to chapter 7670 related to HVAC verbatim as it appears in the Model Energy Code with two modifications. The modifications are to item C, subitem (4), unit (b) to mandate automatic controls (for other than residential buildings), and to add item E relating to isolation of zones. The modifications will make these requirements identical to the requirements of ASHRAE Standard 90.1.

Both of these modifications are needed for the proposed amendment to be at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989, as required by Minn. Stat. § 216C.195, subd. 2. The modifications are reasonable because designers of Minnesota non-residential buildings have for many years incorporated automatic controls and isolation of zones as proposed here.

In accordance with Minn. Stat. § 216C.195, subd. 2, the proposed amendment is at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989.

Subp. 15, Duct insulation.

The department proposes to replace the existing language with a table specifying duct insulation requirements, depending on application. The proposed requirements are more stringent than current requirements.

This change is needed to bring HVAC standards of the energy code in conformance with ASHRAE Standard 90.1-1989 as required by Minn. Stat. § 216C.195, subd. 2. The need for insulating underground ducts is demonstrated in a 1986 Minnesota research project (Attachment L). This research project found a significant increase of energy consumption for houses with (uninsulated) below slab warm air distribution systems.

The format change is reasonable because the table format is identical to the Uniform Mechanical Code, incorporated by Chapter 1346, and familiar to users of the State Building Code. The Model Energy Code section 503.9.1 requires a minimum insulation of $R = \Delta t/15$, where Δt is the design temperature differential between the air in the duct and the ambient temperature outside the duct. With a typical heating supply temperature of 100 °F and a typical ambient ground water temperature of 40 °F, a minimum R-value of 4.0 is required. Since the insulation product commonly used in this application (extruded polystyrene) is R-5 per inch, and the two thinnest products available are ¼-inch and 1-inch thicknesses, contractors usually install R-5 in this application even though the current requirement is only R-4. Thus, the requirement for R-5 insulation on ducts within the ground is reasonable.

The requirements of this subpart are more stringent than the minimum requirements for duct insulation (Table 9-2) in ASHRAE/IES Standard 90.1-1989. Thus, in accordance with Minn. Stat. § 216C.195, subd. 2, the proposed amendment is at least as stringent as the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989.

Subp. 16, Duct construction.

The department proposes to modify the existing language in format, maintaining the existing requirements and adding citation to certain related elements of the State Building Code.

The format change is reasonable because the table format is identical to the Uniform Mechanical Code, Table 10-D, incorporated by Chapter 1346, and familiar to users of the State Building Code.

The addition of a citation to the Uniform Mechanical Code section 706 (e) (currently incorporated into the State Building Code) is needed to assure that users of chapter 7670 are aware of the need to seal return air ducts in spaces containing furnaces. Research has demonstrated that leakage of return air ducts can cause excessive energy waste in Minnesota residential buildings (see Attachment C) because air circulated to provide summer air conditioning can simply be circulated within the basement. The addition is reasonable because the cited requirement is already part of the State Building Code.

These requirements are identical to the standards for heating, ventilating, air conditioning in ASHRAE/IES Standard 90.1-1989.

Subp. 17, Pipe insulation.

The department proposes to amend the current requirement (currently existing as MEC section 503.11) to be identical to the requirements for pipe insulation in ASHRAE/IES Standard 90.1-1989, with one exception. The exception is in item C of this subpart, to clarify when a vapor retarder is required.

The adoption of the more stringent standard of ASHRAE/IES Standard 90.1-1989 is needed to bring HVAC standards of the energy code in conformance with ASHRAE Standard 90.1-1989 as required by Minn. Stat. § 216C.195, subd. 2. It is also needed because this standard is currently being used by designers and other users of this chapter.

The proposed modification in item C regarding when a vapor retarder is required is needed

because the ASHRAE standard is unclear on this matter in several respects. The ASHRAE standard calls for an unspecified amount of "additional insulation," and does not specify under what specific conditions a vapor retarder must be considered by the designer. For these reasons, the language in the ASHRAE standard is unenforceable. The proposed language makes this requirement specifically applicable to very cold refrigerant applications below 32 °F (such as to maintain a frozen surface at an ice arena). This modification is reasonable because condensation problems would be likely under the specified conditions unless a vapor retarder were installed.

Subp. 18, Operation and maintenance manual.

The department proposes to add this existing language (which is identical to ASHRAE Standard 90.1-1989 section 9.4.10.1) as part of chapter 7670 instead of the current amendment to the Model Energy Code. No change in requirement is proposed. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

This requirement is in accordance with Minn. Stat. § 216C.195, subd. 2, that the standards for heating, air conditioning and ventilation be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989.

PART 7670.0660, EQUIPMENT EFFICIENCY

The current requirements in this part are incorporated from the Code of Federal Regulations, title 10, part 435.108 (CFR). This part of the CFR is identical to ASHRAE/IES Standard 90.1-1989. (The reason the department incorporated the CFR by reference and not the ASHRAE standard is the CFR is not copyrighted, permitting the department to more easily reproduce the requirements for distribution.) Thus, in accordance with Minn. Stat. § 216C.195, subd. 2, these standards for heating, ventilating, air conditioning are at least as stringent as standards in ASHRAE/IES Standard 90.1-1989.

Subpart 1, HVAC equipment performance requirements.

The department proposes to add this existing language as part of chapter 7670 instead of the current amendment to the Model Energy Code. The current three exceptions to the CFR are deleted and those current requirements are moved to the appropriate section in the proposed amended chapter 7670 (Table 8.3-6 is proposed as subp. 8 of this part, Table 8.3-7 is proposed as subp. 11 of this part, and MEC section 503.4.1 is proposed as part 7670.0610, subp. 6). No change in any requirement is proposed. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 2, Electrically operated, air-cooled equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-1 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 3, Electrically operated, evaporatively cooled equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108

(CFR). This subpart incorporates Table 8.3-2 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

The proposal to include a cite to standards and definitions (rather than including them in chapter 7670) is needed to reduce the length and complexity of chapter 7670. The cite is needed in the unlikely event that the standards would need to be cited, or that a precise definition of any of these terms is needed. The proposal is reasonable because the department believes that these terms are commonly understood by users of this chapter, and are readily available in the cited documents.

Subp. 4. Water-cooled equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-3 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 5. Packaged terminal equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-4a from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 6. Room equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-4b from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 7. Water-source equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-5 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subd. 8. Large unitary equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108

(CFR). This subpart incorporates Table 8.3-6 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 9. Gas-fired and oil-fired equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 435.108 (CFR). This subpart incorporates Table 8.3-8 and 8.3-9 from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 10. Mobile home equipment.

The department proposes to incorporate language into chapter 7670 that currently is incorporated by reference by part 7670.0660, subp. 1 from the Code of Federal Regulations, title 10, part 430.32 (CFR). This subpart incorporates item (i) "direct heating equipment" from the CFR. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 11. Water chiller packages.

The department proposes to incorporate language into chapter 7670 that currently exists as part 7670.0660, subpart 1. The reference standards listed in the CFR table are not added to this subpart, but rather are incorporated by reference as discussed in subp. 1.

PART 7670.0710, SERVICE WATER HEATING

In accordance with Minn. Stat. § 216C.195, subd. 2, these standards for service water heating (which are at least as stringent as standards in ASHRAE/IES Standard 90.1-1989) were substantially satisfied by the department prior to September 1, 1992.

Subpart 1, Ice making water supply.

The department proposes to add this subpart, which is section 504.1 of the Model Energy Code, currently incorporated by reference.

The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

Subp. 2, Efficiency requirements.

The department proposes to differentiate requirements for certain service water heating equipment with volumes of less than 10 gallons and greater than or equal to 10 gallons.

The change is needed and reasonable to make the requirements consistent with ASHRAE Standard 90.1. Subpart. 2 is at least as stringent as the most energy-conserving code adopted by any other state, in accordance with Minn. Stat. § 16B.165, subd. 1.

Subp. 3, Automatic controls.

The department proposes to add this subpart, which is identical to subsection 504.3 of the Model Energy Code, currently incorporated by reference. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR. Subpart 3 is at least as stringent as the most energy-conserving code adopted by any other state, in accordance with Minn. Stat. § 16B.165, subd. 1.

Subp. 4, Shutdown.

The department proposes to add this subpart, which is identical to subsection 504.4 of the Model Energy Code, currently incorporated by reference. The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR. Subpart 4 is at least as stringent as the most energy-conserving code adopted by any other state, in accordance with Minn. Stat. § 16B.165, subd. 1.

Subp. 5, Swimming pools and spas.

The department proposes to differentiate the requirements for indoor and outdoor heated pools, and to add one or two optional means of meeting this requirement besides the installation of a pool cover.

The change is needed because the department is aware that compliance with the present requirement is poor, and there are other reasonable options (those proposed) that would result in as much energy conservation as a pool cover. The options are additionally needed because in some cases, pools must be "super chlorinated" at the end of a period of use, and a pool cover cannot be used for a period following this process (and likely would not be used at all). These options are reasonable because they are estimated to be approximately equivalent to the energy savings resulting from a pool cover that is regularly used.

Subpart 5 is at least as stringent as the most energy-conserving code adopted by any other state, in accordance with Minn. Stat. § 16B.165, subd. 1; and is at least as stringent as standards in ASHRAE Standard 90.1-1989, in accordance with Minn. Stat. § 216C.195, subd. 2.

Subp. 6, Pump operation.

The department proposes to add this subpart, which is similar to section 504.6 of the Model Energy Code, currently incorporated by reference. The MEC language is modified to conform to more stringent requirements of ASHRAE Standard 90.1. The modification is to replace the words "automatically or manually" with the words "with automatic time switches or other means" when describing the required controls. This modification will make this amendment at least as stringent as standards in ASHRAE/IES Standard 90.1-1989, in accordance with Minn. Stat. § 216C.195, subd. 2.

Subp. 7, Pipe insulation.

The department proposes to amend the current requirement (currently existing as MEC section 504.7) to be identical to the requirements for pipe insulation in ASHRAE/IES Standard 90.1-1989 (Table 9-1).

This modification is needed for chapter 7670 to be in accordance with Minn. Stat. § 216C.195, subd. 2. The standards for heating, air conditioning and ventilation with this amendment will be at least as stringent as standards in ASHRAE/IES Standard 90.1-1989. The modification is reasonable because most designers and other users of this chapter are currently using ASHRAE Standard 90.1, and this will not be a change from current practice for most.

Section 504.8 of the Model Energy Code ("Conservation of hot water") is proposed to be not incorporated into this chapter. This section specifies maximum flow rates of shower heads, kitchen faucets and lavatory faucets. Minnesota Statutes § 216C.19, subd.19 sets maximum flow rates for all shower heads, kitchen faucets and lavatory faucets sold or installed in the State after July 1, 1993. Thus, the requirement of MEC section 504.8 is sufficiently covered by statute, and there is no need to include it in the State Energy Code.

PART 7670.0800 ELECTRIC POWER AND LIGHTING

Subp. 1. Electrical energy determination.

The department proposes to change this subpart to be consistent with the requirements of Minn. Stat. § 216C.27, subd.8, and to change the provision from an amendment of the MEC to a subpart of chapter 7670.

One change is to insert the word "new" to assure that this standard only apply to buildings constructed after the effective date of the amended standard, in accordance with Minn. Stat. § 216C.27, subd. 8. The other change to this subpart is that the individual metering is readily accessible to the individual occupants.

The proposed changes are needed to be consistent with the requirements of Minn. Stat. § 216C.27, subd. 8. The proposed changes are reasonable because from communication with building officials, the department understands that separate metering is currently done only in new multifamily buildings. The department also understands that meters are usually located either outside the building or in unsecured areas within buildings, both readily accessible to individual occupants. Thus, the proposed change is reasonable because it would not require a change to current common practice.

Subp. 2. Lighting power budget.

In accordance with Minn. Stat. § 216C.195, subd. 2, these standards for lighting are at least as stringent as lighting standards for new federal buildings (for 1993) in Code of Federal Regulations, title 10, § 435.103, and were adopted by the department prior to September 1, 1992.

The department proposes to incorporate language into this part that is currently incorporated by reference from the Code of Federal Regulations, title 10, part 435.103 (CFR), to reorganize the language as it appears in the CFR, and to add requirements that are more stringent than the CFR.

The addition of language described below as "verbatim" are identical as they appear in the MEC, except that they are enumerated in accordance with Revisor's style requirements.

The need and reasonableness for adding this language to chapter 7670 that is currently incorporated by reference is demonstrated on page 2 of this SONAR.

The reorganization is needed and reasonable because it add clarity for users of the chapter and does not change the requirements.

Item A (General) is proposed to be incorporated into this subpart verbatim from the CFR with two modifications. The first modification at subitem 6 unit (c), to add three subunits making specific reference to three categories of lighting, and to set criteria for each of these categories that must be included in the calculation of connected lighting power. Except for the addition of the three subunits, subitem 6 unit (c) is verbatim from CFR part 435.103 (3.1.6.3). This change is needed to assure accurate computation of connected lighting power. Without the specific references, the chapter would be unclear whether or how plug-in loads, incandescent sockets and track lighting should be handled. The modifications specifically include plug-in luminaries (subunit i), proscribe wattage values to be assigned to screw-in sockets (subunit ii), and proscribe wattage values to be assigned to track lighting (subunit iii)

are reasonable because they are equivalent to the Washington State Energy Code (which itself is modeled after the Northwest Energy Code).

The other modification is at item A, subitem 9, where the department proposes to add a list of acronyms used more than once in this subpart. Acronyms that are only used once in this subpart are defined at that use. This list is needed to provide a convenient reference to users. This list is needed and reasonable because the department expects that the users of this subpart will be frequent users (lighting designers and persons within building code offices specializing in the electrical requirements of this chapter). For the frequent user, a listing of acronyms in one place is more convenient than having the acronym defined at its first use; a copy of the list could be easily made for quick reference.

The proposed changes to item A comply with Minn. Stat. § 216C.195, subd. 3 because as amended, the lighting standards will be at least as stringent as the CFR lighting standards.

Item B (Minimum requirements) is proposed to be incorporated into this subpart verbatim from the CFR section 3.3 with one modification. The modification is at subitem (2), unit (c) to establish a requirement for ballasts of compact fluorescent lamps and high intensity discharge lamps under 100 watts to each have a power factor of not less than 80 percent. This inclusion is done by removing compact fluorescent lamps and high intensity discharge lamps under 100 watts from the list of exceptions to the requirement that fluorescent lamp ballasts have a power factor of not less than 80 percent.

This modification is needed because ballasts with power factor of less than 80 percent put an excess load on electric utility power systems. In addition, medium to large commercial and industrial customers must pay when the power factor of their electrical load is low; low power factor ballasts would contribute to lowering the power factor of such customers. The inclusion of compact fluorescent lamps and high intensity discharge lamps under 100 watts in this power factor requirement is reasonable because, while higher power factor ballasts (80% and above) were not widely available for these lamps when the ASHRAE Standard 90.1 and CFR standards were written, such ballasts are now widely available for these lamps.

The proposed change to item B complies with Minn. Stat. § 216C.195, subd. 3 because as amended, the lighting standards will be at least as stringent as the CFR lighting standards. In addition, to the department's knowledge, no other state has a requirement for fluorescent lamp ballasts or ballasts for high intensity discharge lamp under 100 watts exceeding 80 percent, thus, these amendments are consistent with the requirements of Minn. Stat. § 16B.165, subd. 1 that the amendments equal or exceed the most stringent energy-conserving codes adopted by any other state.

Item C (Exterior power allowance) is proposed to be incorporated into this subpart verbatim from the CFR. Since this reference is incorporated by reference by the current part 7670.0800, subp. 2, there are no changes proposed in these requirements.

Item D (Interior lighting, prescriptive procedure) is proposed to be incorporated into this subpart verbatim from the CFR with one modification. The modification is to change the unit power density (UPD) requirements for school buildings. While the CFR lists more stringent requirements for pre-elementary, Jr. high and high schools, the department proposes that the UPD values for all schools be the higher values for technical & vocational schools.

The proposed change is needed and reasonable to be consistent with the proposed change to item E as discussed below. The US Department of Energy has informed the department that it intends to soon publish a change to the CFR classroom UPD numbers.

The proposed changes to item D comply with Minn. Stat. § 216C.195, subd. 3 because as

amended, the lighting standards will be at least as stringent as the CFR lighting standards.

Item E (Interior lighting, system performance procedure) is proposed to be incorporated into this subpart verbatim from the CFR with one modification. The modification is to revise the unit power density requirements for schools and classrooms from the values currently listed in the Code of Federal Regulations, title 10, part 435.103 ("CFR," currently incorporated by reference).

Since the CFR will soon be changed so that the unit power density (UPD) requirement for classrooms is 2.0 watts/ft². The proposed UPD requirement of 1.7 watts per square foot is reasonable because Minnesota lighting designers have advised the department that this value will provide adequate and efficient lighting in this application.

The proposed changes to item A comply with Minn. Stat. § 216C.195, subd. 3 because as amended, the lighting standards will be at least as stringent as the CFR lighting standards (for 1993).

Subp. 4, Electric motor efficiencies.

The department proposes to adopt a new table of minimum values for motor efficiencies. The department also proposes that these requirements apply only to motors expected to be used more than 500 hours per year.

The adoption of the new table is needed for improved efficiency and because the existing values follow a pattern not familiar to individuals who sell or install motors in Minnesota. The department believes this feature renders the existing requirements meaningless to the industry, making compliance difficult. The proposed table is identical to the National Electrical Manufacturers Association (NEMA) Table 12-6B published in NEMA MG 1-1987 (September 1990 edition). Since NEMA handbooks are readily available to all industry members, the department believes that compliance will be substantially improved.

The change is reasonable because, although it does decrease minimum efficiency requirements for some sizes of motors, the energy savings due to increased compliance expected will more than compensate for the slightly decreased requirements. This change is permitted under the pre-emption clause of the National Energy Act of 1992, which allows a State to adopt a standard that is not more stringent than the amended version of ASHRAE Standard 90.1. The proposed values are not more stringent than the amended version of ASHRAE Standard 90.1.

While several states have adopted ASHRAE Standard 90.1-1989, to the department's knowledge, no state has adopted the amended version of ASHRAE Standard 90.1. The proposed values for electric motor efficiency are more stringent than ASHRAE Standard 90.1-1989. To the department's knowledge, no other state has adopted the motor efficiency requirements of the amended version of ASHRAE Standard 90.1. Thus, as required by Minn. Stat. § 16B.165, subd. 1, this amendment equals or exceeds the most stringent energy-conserving codes adopted by any other state.

The limitation of these requirements to motors used 500 hours per year and more is needed because Minn. Stat. § 216C.19, subd. 20, requires this chapter to consider appropriate efficiency requirements for motors used infrequently in agricultural and other applications. The 500 hours per year exemption value is reasonable because it is identical to the requirement of ASHRAE Standard 90.1-1989.

PART 7670.1115, EFFECTIVE DATES

The department proposes that the effective dates of changes to this chapter be 45 days after publication of the notice of adoption of the amendments in the State Register. The proposed timing is needed and reasonable to permit time for the department to inform users of this chapter of the revised provisions, and to avoid requiring designers who may have a substantially designed building to redesign

the building before submitting for code approval.

The department proposes that beginning January 1, 1998, the standard for residential buildings be the Canadian Home Builders Association "R-2000 Home Program." The proposed effective date for adoption of the Canadian Home Builders' Association "R-2000" standard is needed because Minn. Stat. §16B.165 requires the department to adopt amendments to the State Energy Code that are designed to equal or exceed the most energy-conserving codes adopted by any other state. The standards of the R-2000 program do equal or exceed the most stringent energy-conserving codes adopted by any other state. The adoption of the "R-2000" standard is reasonable because thousands of homes in Canada and many homes in the United States have been constructed to these standards.

REPEALER

The department proposes to repeal all existing parts of Minn. Rules chapter 7605. This chapter, adopted by the department in 1988, deals with standards for fluorescent lamp ballasts. The repeal is needed because revised standards for fluorescent lamp ballasts are proposed in part 7670.0800, subpart 2, item B, subitem 2. The repeal is reasonable because the standards in chapter 7605 are identical to federal requirements now mandatory for all fluorescent lamp ballasts sold in the United States since 1989.

COMPLIANCE WITH STATUTORY REQUIREMENTS -- SUMMARY

The proposed amendments to chapter 7670 fulfill all the requirements of Minn. Stat. §§ 16B.165; 216C.195; and 216C.27, subd. 8 (Attachment A) and all other statutory requirements.

Minnesota Statutes § 16B.165, subp. 1 requires that by February 1, 1993, the department begin rulemaking to adopt amendments which would equal or exceed the most stringent energy-conserving codes adopted by any other state. Reference is made to the energy conservation standards of the Northwest Power Planning Council for climate zones having 8,000 to 10,000 heating degree days. The proposed revisions to chapter 7670 for residential buildings three stories and less will become effective in two phases. The requirements for these buildings that would become effective 45 days after notice of the adoption of these amendments are published in the State Register will (in accordance with proposed part 7670.1115) be superseded on January 1, 1998 by the Canadian Home Builders Association R-2000 Home Project standards. The Canadian Home Builders Association R-2000 Home Project standards are more stringent than the Northwest Power Planning Council for climate zones having 8,000 to 10,000 heating degree days. They are also more stringent than energy-conserving codes for this building type adopted by any other state. Thus, the proposed amendments for residential buildings three stories and less will equal or exceed the most stringent energy-conserving codes adopted by any other state, satisfying the requirements of this statute for residential buildings.

The requirements of chapter 7670 currently proposed for all buildings other than residential buildings three stories and less are at least as stringent as standards in ASHRAE/IES Standard 90.1-1989. To the department's knowledge, no state has energy codes for buildings other than residential buildings three stories and less that exceed ASHRAE/IES Standard 90.1-1989. Thus, the proposed amendments for residential buildings other than three stories and less will equal or exceed the most stringent energy-conserving codes adopted by any other state, satisfying the requirements of this statute for all buildings other than residential buildings.

Minnesota Statutes § 16B.165, subp. 2 requires that by February 1, 1993, the department begin rulemaking to adopt amendments to assure that standards for commercial HVAC systems and installations are as energy efficient as practical. The department's proposal to adopt the most stringent energy code for HVAC systems and installations in the nation is demonstration that the proposed amendments are as energy efficient as practical. Thus, the proposed amendments to chapter 7670 satisfy

the requirements of this statute

Minnesota Statutes § 216C.195, subd. 1 requires the commissioner of public service to adopt amendments to chapter 7670 to implement energy efficient standards for new commercial buildings. Subdivisions 2 and 3 of the statute define particular requirements of these standards. "New commercial buildings" are included within the scope of chapter 7670. The department substantially satisfied this statute with modifications to chapter 7670 that became effective September 7, 1992. The proposed amendments to chapter 7670 will completely satisfy the requirements of this statute.

Minnesota Statutes § 216C.27, subd. 8 requires separate metering of electrical service in multi-family buildings. The department substantially satisfied this statute in 1984 when it adopted amendments to the Minnesota Energy Code requiring separate metering of electrical service in multi-family buildings. The proposed amendment to part 7670.0800, subp. 1, item A modifies to language of this requirement to conform with the statute, and thus completely satisfies the statute.

Minnesota Statutes § 216C.19, subd. 20, requires this chapter to consider appropriate efficiency requirements for motors used infrequently in agricultural and other applications. The requirements of this statute are satisfied in the proposed modification to part 7670.0800, subp. 4.

V. SMALL BUSINESS CONSIDERATIONS IN RULE MAKING

Minnesota Statutes § 14.115, subdivision 2 (1988) requires the department, when proposing rules which may affect small business, to consider the following methods for reducing the impact on small businesses:

- (a) the establishment of less stringent compliance or reporting requirements for small business;
- (b) the establishment of less stringent schedules or deadlines for compliance or reporting requirements for small business;
- (c) the consolidation or simplification of compliance or reporting requirements for small business;
- (d) the establishment of performance standards for small businesses to replace design or operational standards required in the rule;
- (e) the exemption of small businesses from any or all requirements of the rule.

The department has evaluated the effect of the proposed rules on small businesses and has considered each of the methods listed above for reducing the impact of the rules on small businesses. The adoption of these rule amendments will have some affect on small businesses in Minnesota.

Since Chapter 7670 contains no scheduling, deadline or reporting requirements, Minn. Stat. § 14.115, subd. 2 (a), (b) and (c) are not applicable.

Chapter 7670 includes several significant performance standards in conformance with Minn. Stat. § 14.115, subd. 2 (d). The proposed changes to part 7670.0550 regarding the air tightness alternative for one- and two-family buildings is significantly simplified.

In regard to item (e) above, no changes are proposed regarding the scope of application of the Chapter.

VI. ESTIMATED COST TO LOCAL PUBLIC BODIES

Minnesota Statutes § 14.11, subd. 1 requires the department to estimate the total cost to public bodies of implementing the rule change for the two years following adoption. Potential costs to public bodies as a result of adopting this rule could include:

- o procuring a copy of the revised Minnesota Energy Code,
- o training building officials and inspection on provisions of the revised code, and
- o reviewing plans and inspecting for additional items required by the revised code.

The issue of procuring a copy of the revised Minnesota Energy Code is discussed on page 2 of

this SONAR. The change will have little or no effect on the cost to purchase the State's energy code. Although chapter 7670 will be longer, the purchaser will save by not having to obtain the Code of Federal Regulations, and, perhaps, not even the Model Energy Code. There are currently approximately 620 jurisdictions in the State that enforce the State Building Code. An estimate obtained from the Department of Administration, Building Codes Division (Mr. Scott McLellan) is that each of these jurisdictions would need one copy, although the larger jurisdictions would need more than one copy, bringing the total estimated number of copies needed to 750. At an estimated cost of \$15 per copy for the revised Minnesota Energy Code, Minnesota jurisdictions would incur a total estimated cost for purchasing copies of \$11,250.

The training of building officials and inspection on provisions of the revised code is expected to be accomplished at no cost to public bodies. The department is planning two actions, following the adoption of the revised code, to provide the necessary training. The first will be to publish a newsletter about the revisions and distribute it at no charge to all building inspection departments. The second is to send a representative to discuss the revisions to the regular meetings attended by building inspectors and officials throughout the State.

All costs of reviewing plans and inspecting for additional items required by the revised code is expected to be recovered by each public body by permit fees charged to permit applicants. The principal additional items required by the proposed revisions to the Energy Code are contained in part 7670.0470, subpart 6 relating to "category 1" and "category 2" buildings. As pointed out in this SONAR at the discussion of part 7670.0470, subp. 6, the criteria for "category 2" buildings is not changed from the existing Energy Code. A "category 1" building would have additional measures (air tightening, and if a residential building, a residential mechanical ventilation system) installed and need to be inspected. The additional costs of a "category 1" building would increase the valuation of the building permit, thereby increasing the plan review and inspection fee paid to the building inspection department. Other additional items required by the proposed revisions to the Energy Code will similarly be covered by increased fees recovered by inspection departments. Thus, no added costs of reviewing plans and inspecting for additional items required by the revised code is expected to be incurred by public bodies as a result of the additional items required by the proposed revisions to the Energy Code.

In conclusion, the department estimates the total cost to Minnesota public bodies of implementing the rule change to total \$11,250. The amount spent in each of the two years following adoption would sum to this total amount.

VI. ATTACHMENTS

The following attachments are incorporated by reference into this Statement of Need and Reasonableness.

- A) Selected Minnesota Statutes setting specific directions for the Minnesota Energy Code.
- B) Analysis of cost effectiveness of application of Chapter 7670 to existing buildings.
- C) Letter, dated September 16, 1992, from The Energy Conservatory concerning air-tightness and ventilation for residential buildings.
- D) Documentation regarding the draped insulation effective assembly R-value method.

- E) Builders Association of Minnesota, "BAM Strategic Plan," dated January 8, 1993.
- F) G.E. Sherwood, Condensation Potential in High Thermal Performance Walls -- Cold Winter Climate, USDA Forest Products Laboratory, 1982.
- G) Minnesota Department of Public Service, Installing Airtight Recessed Light Fixtures, Home Builders' Energy Update, Fall 1992.
- H) Interior basement wall insulation moisture barrier recommended by the Canadian Home Builders' Association in the R-2000 Builders' Manual.
- I) Technical Support Document for Proposed Revision of the Model Energy Code Thermal Envelope Requirements, Batelle Pacific Northwest Laboratory, February 1993, Appendix B.
- J) Model Energy Code multi-family roof/ceiling criteria & wall requirement documentation.
- K) Prescriptive Envelope Option Development for the Minnesota Building Code, The Weight Group and The Deringer Group, June 30, 1992.
- L) Energy Efficient House Research Project, prepared for Oak Ridge National Laboratory by the Minnesota Department of Public Service, Energy Division, St. Paul, MN, 1986, Pages 2, 30 and 31.
- M) Nelson, Gary, et al, "Measured Duct Leakage, Mechanical System Induced Pressures and Infiltration in Eight Randomly Selected New Minnesota Homes," Energy Efficient Builders Association Conference Proceedings, March, 1993.
- N) Correspondence between the department and the Council of American Building Officials.

VII. CONCLUSION

On the basis of the foregoing, the proposed amendments to Minnesota Rules Chapter 7670 are both needed and reasonable.

1-21-94
Dated

Krista L. Sanda
Krista L. Sanda, Commissioner
Department of Public Service