10/1/90

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 State Building Code regarding Heat Loss, Illumination, and Climate Control (Minn. Rules ch. 7670).

STATEMENT OF NEED AND REASONABLENESS

September, 1990

I. INTRODUCTION

The Commissioner of the Minnesota Department of Public Service (department) proposes to adopt amendments to Minn. Rules Chapter 7670, rules known as the Minnesota Energy Code.

The principal rule changes proposed include adoption of the new edition (1989) of the Model Energy Code, provisions to maintain the effectiveness of thermal insulation in residential buildings, and new lighting standards. Reorganization and grammatical changes also are proposed to improve clarity and to conform with current style requirements.

The department began the present rule notification process on June 19, 1989, by publishing a note in the State Register (13 S.R. 2991) soliciting opinions and information from the public on the rules regarding the Minnesota Energy Code. The deadline for receiving comments was subsequently extended to June 30, 1990.

II. STATEMENT OF DEPARTMENT'S STATUTORY AUTHORITY

The Commissioner's authority to adopt the rule amendments is set forth in Minnesota Statute § 216C.19 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.

III. STATEMENT OF NEED

Minnesota rules governing the Minnesota Energy Code were last modified in January, 1984. Since then, major changes have occurred in the understanding of both residential and commercial building energy performance and the factors affecting it. These changes are reflected in new national standards regarding building design and construction. To bring Minnesota into agreement with current understanding of building energy conservation and with updated national standards, changes in the current energy code are needed.

First, the department proposes to adopt the latest (1989) edition of the Model Energy Code to replace the 1983 edition currently in place.

Second, the U. S. Department of Energy (DOE) sponsored several major studies of energy performance in new buildings. The DOE studies revealed major opportunities for energy conservation, particularly in lighting standards. Based on the results of these studies, DOE adopted in July, 1989, new energy conservation standards for new commercial and high-rise multi-family residential buildings (10 CFR Part 435). These standards also have been published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) as ASHRAE Standard 90.1-1989. The department proposes that these new standards, as they apply to determination of thermal transmittance, design conditions, equipment sizing, and lighting, be made a part of the Minnesota Energy Code.

Third, the department also proposes additional changes to requirements for low-rise residential buildings. It proposes changes to requirements covering effectiveness of required thermal insulation and air leakage.

IV. STATEMENT OF REASONABLENESS

The department is required by Minnesota Statutes Ch. 14 to make an affirmative presentation of facts establishing the reasonableness of the proposed rules. In general terms, 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. The need and reasonableness for the proposed rule

amendments are discussed below.

Part 7670.0100 Authority; Scope; Conflicts.

The department proposes adding the word "conflicts" to the title to recognize the three subparts into which this part would be reorganized. Subpart 2 is added to make clear that chapter 7670 is a part of the State Building Code and cites the Minnesota statutes that make it part of the State Building Code. In addition, the State Building Code is defined by the Minnesota statutes that authorize it. In subpart 3, the words "other parts of" are added to be consistent and clear in acknowledging that this chapter is part of the State Building Code. The last sentence in subpart 3 is deleted to minimize duplication of statutory language in accordance with Minnesota Statute § 14.07, subdivision 3(1).

Part 7670.0120 Effective Date

The department proposes to change the effective date for the proposed amendments to Chapter 7670 from January 1, 1984, to February 1, 1991. January 1, 1984, was the effective date for the previous revisions to this chapter and is no longer relevant. Selection of an effective date is permitted by Minnesota Statute § 14.18. The choice of February 1, 1991, is based on providing a reasonable amount of time for informing code users of the changes (if they are adopted) and how to implement the new requirements after the expected completion of the present rule-making process. Explanation of how to apply the new rules would be particularly important in the case of designers and building officials who would be applying and enforcing the new rules. In anticipation of proposing that new requirements be incorporated into the Minnesota Energy Code, the department conducted

educational needs assessments for architects and building officials. From these assessments, the department concludes that one to two months would be required to prepare lighting designers, engineers, and building officials to implement these changes. If the proposed requirements are adopted, the department intends to implement the appropriate education and training projects described in the needs assessments. Scheduling the effective date as February 1 also gives the department an opportunity to announce upcoming rule changes and distribute information at the Annual School for Minnesota Building Officials conducted by the University of Minnesota in January.

Part 7670.0125 Legislative Mandates Concerning the Minnesota Energy Code

The department proposes adding a part that lists a legislative mandate concerning the Minnesota Energy Code. This mandate currently is covered in two different parts of the Energy Code -- 7670.0310, subpart 1 and 7670.0600, subpart 1. Including it in a single, separate part would improve organizational clarity. The old parts are included in the repealer at the end of the proposed rule amendments.

Part 7670.0130 Incorporations by Reference

A complete explanation or citation is required for each of the standards and references referred to in the Minnesota Energy Code. Subpart 1, items B. through H., incorporates into Chapter 7670 the citations referred to in the proposed amendments to Chapter 7670. Item A. of subpart 1 changes the date of the Model Energy Code reference to the most recent edition, 1989. It also deletes the clause incorporating the Model Code by reference and making it a part of the State Building Code because this is already stated in 7670.0100,

subpart 2. The phrase "subject to the amendments in this chapter" is replaced with the specific parts of Chapter 7670 that amend the Model Energy Code.

Subpart 2 states where these standards and documents incorporated by reference are available for public inspection. This statement of availability is required by Minnesota Statute § 14.07, Subdivision 4. Items A through D list additional sources for these standards and documents for the convenience of users of this chapter.

Part 7670.0250 Applicability

A new subpart is added to make clear which buildings are covered by the Model Energy Code as amended. The Model Energy Code applies to remodeled buildings in the same way as the State Building Code applies to these buildings. It also makes clear that in cases of conflict with the Model Energy Code, Minnesota Rules Chapter 7670 governs. An exception to the scope of the Minnesota Energy Code is provided for relocated residential buildings. This exception is mandated by Minnesota Statute § 16B.61, subdivision 3 (1) (1989 Supp). It is proposed as an amendment to this chapter to inform users of the energy code of that exemption.

Part 7670.0325 Amendments to Section 201: Definitions

Subparts 1, 2, 3, and 4 are added to provide definitions of thermal transmittance, vapor retarder, wind wash, and window area.

Subpart 1 - Thermal transmittance. The department proposes to add definitions of thermal transmittance and how it must be calculated for opaque wall components (U_w), roof/ceiling

components (U_r), and windows (U_g). A definition of these terms is needed to ensure that they will be used correctly so that buildings will achieve the expected energy performance. Because these terms are not defined in the Model Energy Code, they need to be defined here.

In item A, the department proposes that, depending on the material of the framing and surface components, one of four methods be used to calculate thermal resistance. Which methods to use for which materials are illustrated in Chapter 22 of the ASHRAE Handbook of Fundamentals, 1989 Edition (Attachment 1). The reasons why different methods must be used for different materials also are set out in the ASHRAE Handbook, chapter 22 (Attachment 1). The methods and the material configurations to which they apply are set forth in subitems 1 - 4.

In subitem 1 the department proposes to require that the "parallel heat flow" method be used for wood frame construction and masonry with surface-applied insulation. According to the ASHRAE Handbook (Attachment 1, page 22.3), this method is valid for these materials. This is the simplest of the four methods and has always been used for the designated applications.

The department proposes in subitem 2 that the "series-parallel" method be required for masonry blocks with insulation inserts or filled cores and for nonmetal surfaces with metal framing. The need to use this method for masonry blocks with insulation fillings is established in the ASHRAE Handbook (Attachment 1, page 22.4). The Handbook points

out that calculations by this method agree with measured values. The need for using this method is further supported by the National Concrete Masonry Association (NCMA) Standard Series Parallel Procedure for calculating the overall coefficient of heat transfer. In response to the department's solicitation for outside facts and opinions, the Minnesota Masonry Institute (MMI) provided a table (Attachment 2) that gives further evidence of the need for application of a uniform standard. The MMI table compares masonry block R-values (based on U-values calculated by the series parallel method) with R-values listed by manufacturers and obtained by other methods. In some cases manufacturers' R-values are as much as 224 percent higher than the calculations based on the recommended series-parallel method.

Continuing the discussion of subitem 2, the need for requiring the "series-parallel" method for nonmetal surfaces with metal framing is indicated by example 3 in the ASHRAE Handbook (Attachment 1, page 22.5) which shows that the closest correlation with measured values is obtained with the series-parallel method. The ASHRAE Standard 90.1 and 10 CFR Part 435 (Attachment 3) also require use of the series-parallel method for nonmetal surfaces with metal framing.

The department proposes in subitem 3 that for assemblies with metal framing and a metal skin or covering on one or both sides, the U-value be computed using the "sheet metal construction" method. This requirement accords with ASHRAE Standard 90.1 and 10 CFR Part 435 (Attachment 3).

The department proposes in subitem 4 that for metal surfaces with non-metal framing, the "zone method" be employed to calculate the U-value. The ASHRAE Handbook (Attachment 1, pages 22.10 and 22.11) recommends this method for this type of construction. ASHRAE Standard 90.1 and 10 CFR Part 435 (Attachment 3) also require use of the zone method for metal surfaces with nonmetal framing.

The four methods listed in the proposed rule amendment (identified as 1 through 4) are reasonable because they coincide with the recommendations of the ASHRAE Handbook and NCMA and requirements of 10 CFR Part 435 and ASHRAE Standard 90.1 These requirements should not be a burden for small businesses such as home builders who can use the simple parallel heat flow method (which they have used all along) for all assemblies except insulation-filled blocks. In the case of insulation-filled blocks, the supplier of the insulation system will likely provide the analysis.

In item B a definition of window U-value (U_g) is proposed to assure accurate window U-value calculations. (See Attachment 4.) The department proposes that any one of four methods, listed in subitems 1 - 4, be acceptable for calculating U_g. Most manufacturers already use one of these alternatives, and stipulating that any one of the four is acceptable lessens the burden of these rules. Support for the acceptability of these four methods is given below.

Subitem 1 states that one acceptable method be the method prescribed in the ASHRAE 1989 Handbook, Chapter 27, pages 27.16-27.18 (Attachment 1) as discussed in the

ASHRAE Journal - June, 1989 article. (Attachment 5.) Window U-values in the 1989 Handbook consist of calculated data for a variety of glazing systems and framing materials based on computer simulations verified by laboratory measurements.

The department proposes in subitem 2 that a second acceptable method be the American Architectural Manufacturers Association (AAMA) Standard 1503.1. This method is widely used. The AAMA is a respected organization that publishes a Certified Products Directory that lists window U-values based on this method of calculation.

The department proposes in subitem 3 that a third acceptable method be the use of either American Society for Testing and Materials (ASTM) Standard C 236 or C 976 using specified design conditions. This is identical to one of the options of the Seattle Department of Construction and Land Use for demonstrating compliance with its energy code. This method is also used by several window manufacturers to determine thermal performance.

A fourth acceptable method is proposed in subitem 4: use of computer program WINDOW, developed by the Windows and Daylighting Group at Lawrence Berkeley Laboratory. WINDOW was developed in response to a lack of a widely accepted, accurate, and easy-to-use procedure to analyze window thermal performance.

All of these methods are reasonably accurate; there is no national consensus that any one of them is superior to the others. All of them are used throughout the country and

requiring them is in accordance with Minnesota Statute § 216C.19, subd. 8, that calls for energy code rules to conform to codes generally accepted throughout the United States. Providing alternatives minimizes any burden for compliance with the rule.

Subpart 2 - vapor retarder. The definition of vapor retarder, previously in part 7670.0340, is included here with the other proposed definitions; 7670.0340 is included in the repealer at the end of the proposed rule amendments. Two substantial changes are made in the proposed definition of vapor retarder. The first change adopts the term "vapor retarder" in place of the term "vapor barrier." This change is consistent with the ASHRAE Handbook of Fundamentals which uses this new term in its 1989 edition, a change from the 1985 edition. The change is also consistent with ASTM C 755-84, "Standard Practice for Selection of Vapor Retarders for Thermal Insulations." (Attachment 7) The new term more accurately describes the function of the material described; the material does not completely prevent water vapor movement, but retards it. Although the term vapor barrier is still widely used by the building industry, the terminology is changing to vapor retarder.

The second change alters the maximum perm rating from 0.1 to 1.0. The 0.1 perm rating is too stringent. Four mil polyethylene (found to work satisfactorily in this application) is, in fact, greater than 0.1 perm, as indicated by laboratory tests (Attachment 6). Measurements of permeability and thickness were made on 23 specimens of polyethylene, taken in 1989 from recently constructed Minneapolis-St. Paul area houses, and on two large rolls of polyethylene sheeting from Minnesota retail outlets. Although many of the thicknesses were less than 4 mils, even those over 4 mils (underlined on table) had average

permeability measures of 0.17 to 0.31 perms. This change in the maximum perm rate is needed for builders to continue to use 4-mil polyethylene without violating these rules. The change will not significantly affect the amount of water moving into the insulated cavity, since only a very small amount of water vapor moves into the wall by diffusion through the vapor retarder, as indicated by the ASHRAE Handbook, pages 21.4 and 21.5 (Attachment 1). The 1.0 perm rating also conforms to the national standard ASTM C 755-84, Table 1 (Attachment 7) for residential buildings. In addition, this change is consistent with the Council of American Building Officials 1990 amendments to the 1989 Model Energy Code requiring a vapor retarder of 1.0 perm or less.

In a previous rulemaking for this chapter, a perm rating of 0.1 was specified to help ensure thickness or durability of polyethylene. This thickness is ensured, however, by the rule requiring the polyethylene to be not less than 4 mils (i.e., four thousandths of an inch) thick. It is anticipated that the change in perm rating will not, in fact, alter current construction practices.

Subpart 3 -- Wind wash. Wind wash is a new term referred to in proposed amendment to 7670.0480, subdivision. 3. Home Builders' Energy Update (Attachment 8) illustrates the use of this term. The term is also used in Cold Climate Housing News, Volume 2 issue 3. (Attachment 9). A definition is needed because the term is just now coming into use and is not widely understood.

Subpart 4 -- Window area. The department proposes to add a new term, "window area," to

the Model Energy Code. It defines the term as including the glazing and sash or the area used to determine window thermal transmittance.

The Model Energy Code uses the term "glazing area" to refer to windows. This term is not defined in the Model Energy Code, and since "glazing" is often understood to mean only the glass area, the term is misleading. The term "window area" more accurately conveys the meaning of the term as it is used in determining the thermal performance of windows.

Part 7670.0400 Amendment to Section 302: Design Conditions

The proposed changes make the Model Energy Code consistent with 10 CFR Part 435 and ASHRAE/IES Standard 90.1 - 1989, which are nationally accepted standards. Although the cooling design condition may appear more restrictive (Minneapolis-St. Paul summer design condition of 89° instead of 92°F.), when combined with the proposed amendment to Part 7670.0610 (calculation procedures and equipment sizing), it is not.

Part 7670.0450 Amendment to Section 303: Ventilation

An amendment is proposed to incorporate the latest ASHRAE standard for ventilation. Because the Model Energy Code was published before ASHRAE came out with the new standard, an older version of the standard is referenced in the Model Energy Code.

Chapter 7670.0470 Amendment to Section 502: Envelope Thermal Transmittance

This amendment is moved from 7670.0940 with two slight modifications. (Part 7670.0940

is included in the repealer at the end of these proposed rule amendments.) The purpose of these modifications is to make this alternative approach equivalent to the revised requirements of the 1989 Model Energy Code and to simplify the language.

Footnote 1 is proposed to clarify that the R-values required in the alternate approach are for insulation only, and not the entire cross-section of walls or floors. Because the R-values apply to insulation only, the values are lowered from R-20 to R-19.

In footnote 2, the department proposes to change the specification for windows from "double-glazed" to U-0.49. As discussed in Part 7670.0330, subpart 1, item B, window performance measurements have improved. Change is needed because "double-glazed" is an inadequate description of how a window will perform. A double-glazed window with aluminum or metal frames and without thermal breaks performs poorly. The value of U-0.49 is reasonable because most manufacturers of residential windows offer a window meeting this standard in their moderately-priced product line. Furthermore, the value can be achieved without using more expensive "low-e" glass, argon-gas filling, or other special window construction methods. Finally, meeting this requirement is optional; the builder can still use the component performance approach which allows more glass area if higher performance windows are used.

Part 7670.0480 Amendment to Section 502: Effectiveness of Required Thermal Insulation

Subpart 1. Thermal insulation. The rule cited here is established in Minnesota Rules

Chapter 7640 and is enforced by the department. The department proposes to restate this requirement here (with a cross reference to 7640) because of its relevance and importance in meeting the Energy Code.

Subpart 2, item A. For organizational clarity, this item is moved from Part 7670.0520 and that part is included in the repealer at the end of these proposed rule amendments. There are three proposed modifications -- deletion of "continuous and uninterrupted," deletion of "rips in vapor barrier must be patched," and addition of a new sentence: "Joints in the vapor retarder must be sealed between solid blocking." Meeting the requirement in the added sentence would more effectively accomplish the objectives sought by the deleted phrases.

Subpart 2, item B. This item is added to give attention to air movement as a factor in transporting moisture into insulated cavities. The importance of air movement is reflected by the ASHRAE Handbook of Fundamentals, 1989 edition, on page 21.4 and 21.5. (Attachment 1). The Handbook points out that movement of air carrying water vapor is far more influential than vapor diffusion in transporting water vapor within the building envelope. The Handbook also notes that although a good quality vapor retarder eliminates condensation by vapor diffusion, it is of little use if it can be bypassed by air. Additional explanation of the importance of preventing air movement into insulated cavities and description of simple techniques for preventing this movement are in Home Builders Energy Update, Summer, 1988 (Attachment 10).

Subpart 3. The department proposes to add this amendment requiring that a barrier be provided to mitigate wind wash. Recent investigations using infrared scans reveal that wind can penetrate insulation, resulting in heat loss and possible moisture damage. (See Home

Builders Energy Update, Winter 1989, Attachment 8). The energy savings potential of this requirement has not been quantified, but the proposed methods are easy and inexpensive to apply.

Part 7670.0510 Foundation Walls

This part is divided into subparts to improve clarity; there are no word changes in subparts 1 and 2. Subpart 3 is added, requiring that exterior foundation wall insulation be protected from deterioration due to sunlight and physical abuse.

A study of exterior foundation wall insulation conducted in Minnesota by the department found insulation damage caused by failure to apply an adequate protective coating. (See Attachment 11.) Similar findings of inadequate protection also were reported in a study by the Wisconsin Energy Conservation Corporation*. The Minnesota study concluded that not only is the damage unsightly, but insulation exposed to the elements will soon lose at least some of its effectiveness. An additional requirement for adequate protection is needed to ensure that the exterior insulation functions as intended.

The proposed addition is not new; it is already required by Minnesota Rules part 7640.0140, subpart 3, (Minnesota Residential Thermal Insulation Standards). Adding it to this rule reinforces its importance and increases awareness of the need to comply with it. Furthermore, builders have the choice of installing either exterior or interior foundation insulation; if they choose exterior insulation, it is reasonable to require that they take steps to ensure that the insulation performs as intended.

* Schlegel, J.A., O'Leary, L.A., Post, L.K., Foundation Insulation Field Survey - Final Report, Wisconsin Energy Conservation Corporation,

1045 East Division St., #117, Madison, WI 53703. December, 1986, unpublished.

Part 7670.0550 Air Leakage

Subpart 1 is reorganized, for greater clarity, into two sentences rather than one. The prescriptive measures for sealing air leaks are included in the first sentence, and examples of where these measures are to be applied are listed in the second sentence.

Subpart 2. An alternative to meeting the requirements specified in Subpart 1 is provided for detached single-family residential buildings. These buildings can meet the requirements specified in Subpart 1, or they can meet air leakage classifications A, B, C, or D of the ANSI/ASHRAE Standard 119. If this alternative is selected, the building ventilation system must provide for a minimum of 0.35 air changes per hour, or 15 cfm per person, whichever is greater. This rate must be verified by measurement.

This change is needed for the following reason: A wide variety of construction methods can be used to achieve the same level of airtightness as the methods specified in subpart 1. The department feels that builders would like greater flexibility in selecting methods of achieving airtightness. Providing the option of meeting the ASHRAE Standard 119 gives builders this greater flexibility. It also provides home buyers and builders with an objective measure of air tightness and an accurate basis on which to calculate the home's ventilation needs. The proposed amendment also includes a minimum, verified air change rate, thereby assuring a minimum level of ventilation is installed. This latter is important, since very tight construction may result in indoor air quality problems if adequate ventilation is not provided. Studies in the United States and Canada show that actual performance rates

of ventilation systems are often much lower than the systems' rated capacity; therefore, verification of ventilation rates by measurement is needed.

The proposed change is reasonable because it simply adds an option that allows builders to replace design specifications with a performance standard. This change complies with Minnesota Statute § 14.115, subd. 2 (d), that requires the department to consider establishing performance standards to replace design or operational standards. Also, the proposed performance standard is nationally recognized, and including it as an option complies with Minnesota Statute § 216C.19, subd. 8, requiring energy code rules, "to the maximum extent practicable," to conform to model codes generally accepted throughout the United States. In practice, the standard is already in effect in Minnesota, since homes meeting the specifications set out in subpart 1 above would meet Standard 119-1988 classifications A-D, according to a consultant's report to the department (see attachment 12). The standard also conforms to ASHRAE Standard 62.

Subpart 3. Fire stops are required by the State Building Code. The department proposes that for those fire stops made of mineral or fiber glass that separate conditioned and unconditioned spaces, steps be taken to prevent air leakage. In case of possible conflict between these two requirements, the State Building Code should take precedence.

Fire stops made of mineral fiber or fiber glass are sources of air leakage that can cause many problems, including energy loss, ice buildup on roofs, and possible contribution to back drafting of combustion appliances (see attachment 13). A separate provision is needed

to call attention to the need to air seal these fires stops.

Weatherization agencies routinely seal "attic bypasses" on existing low-income residences. Attic bypasses (open paths through which warm air flows out of the heated house and into the attic) are acknowledged as a major source of heat loss. Most, if not all attic bypasses are, in fact, simply fire stops that are not air sealed. Since these fire stops are routinely air sealed during weatherization of older houses, it is reasonable -- and certainly efficient -- to require them to be air-sealed during new home construction.

Finally, the provision simply calls attention to the need for sealing air leaks in these fire stops; the methods for sealing these leaks are relatively simple (see attachment 13), and the choice of methods is left to the builder. To resolve any possible conflict with the State Building Code, a provision is added clearly establishing the State Building Code as taking precedence.

Part 7670.0610 Building Mechanical Systems

The department proposes to change the calculation procedures for sizing heating and cooling systems and equipment. The limitation of equipment sizing to 115 percent for heating and 100 percent for cooling is too restrictive and does not allow engineering judgement to be used in this calculation. The procedures described in subparts 1 and 2 will accomplish the goal of not wasting energy and also will allow engineering judgement concerning safety factors, pick-up loads, and other sizing considerations. These procedures are identical with those in 10 CFR Part 435 and ASHRAE Standard 90.1 and are therefore

consistent with other proposed changes which bring the Minnesota Energy Code into agreement with national standards.

Part 7670.0660 Amendment to Section 503: Equipment Efficiency

Subpart 1 is moved from 7670.0540, which is repealed. The subpart proposes to replace the entire table, previously included in 7670.0540, with a single sentence. Including the Table is not necessary since it is in the 1989 Model Energy Code, which is incorporated by reference.

In proposed subpart 2, the numbers from Table No. 503.4.8. are largely deleted since they are part of the 1989 Model Energy Code, which is incorporated by reference. The numbers not deleted are retained because they do not appear in the 1989 Model Energy Code. Neither of the two proposed subparts would substantively change the rule.

Part 7670.0670 Amendment to Section 503.10: Duct Construction

Minor changes are proposed to improve clarity; they would make no substantive change in the rule.

Part 7670.0710 Amendments to Section 504: Service Water Heating

The proposed changes merge parts 7670.0710, .0720, and .0730, all relating to water heating, into a single part for greater clarity. Parts 7670.0720 and .0730 are included in the repealer.

Part 7670.0800 Amendments to Section 505: Electric Power and Lighting

Subpart 1. The department proposes to delete the first paragraph of the rule since it is already in the 1989 edition of the Model Energy Code and is therefore not needed. The amended exception, proscribed by Minnesota Statute § 216C.19 subd. 8, differs from the language in the Model Energy Code and therefore is needed.

Subpart 2. The department proposes to amend the lighting requirements of the Model Energy Code to bring them into agreement with U.S. Department of Energy performance standards, 10 CFR, Part 435.103 (excluding section 3.2) and ASHRAE/IES Standard 90.1 - 1989.

The proposed lighting requirements are a change from the Model Energy Code requirements in at least two respects. First, lighting criteria are dramatically simplified. Lighting requirements in the Model Energy Code are difficult to understand without extensive knowledge of the field. They also are highly subjective -- for example, "where good color rendition is important" and "where visual comfort is important" are among the criteria for determining lighting requirements. These are virtually unenforceable. In contrast, proposed criteria specify maximum watts per square foot. (Attachment 14) They are simple and enforceable. The second significant change, and one that well may raise comment, is the rather strict limitations of allowed lighting power. The new requirements will mandate the use of more efficient (and probably more costly) fixtures and control technologies that may be unfamiliar to today's lighting engineers. The department believes, however, that technology and techniques are available to achieve the stricter standards

readily and cost effectively. One example is a lighting analysis of the First Bank/IBM Tower under construction in downtown Minneapolis. Attachment 15 indicates that if more efficient lighting design were implemented in this building, capacity demand could be reduced by 690 kilowatts for lighting and 41 kilowatts for air conditioning.

Other states have adopted lighting specifications from either the U.S. Department of Energy Performance Standard 10 CFR Part 435 or ASHRAE/IES 90.1. New York state's commercial building code's Lamp and Fixture Efficiency section is very similar to 10CFR Part 435. According to the New York State Energy Division, the standard was not overly stringent and its format aided enforcement. Massachusetts adopted an early draft of ASHRAE/IES Standard 90.1, effective October 1, 1988. The Massachusetts Safety Division reports that the standard has been both manageable and achievable. Since July 1978, California has had mandatory lighting requirements for all nonresidential buildings. The requirements are, in fact, more stringent than the changes proposed here.

Further evidence that the proposed lighting requirements are reasonable is reported in *Lighting Design and Application* magazine. (Attachment 16) A study conducted by the New England Power Company and an independent consulting firm found that "standards such as (ASHRAE/IES) 90.1 are not unduly strict and will save significant amounts of energy." The authors of the report also note that "those buildings in our study that exceeded the requirements of 90.1 indicate that additional energy savings is possible in many cases. As standards such as 90.1 are incorporated into building codes, designers will find that incorporating simple energy saving measures into their designs will be enough to ensure

compliance in most cases. Adoption of 90.1 will be a significant step toward improving lighting energy efficiency without causing undue hardship on the practice of lighting design."

The exemption for one- and two-family detached buildings and the dwelling portions of multifamily buildings from these requirements is identical to an exemption for lighting requirements in the Model Energy Code.

Part 7670.0850 Design by Acceptable Practice

A sentence is proposed to replace parts 7670.0900 through 7670.0970 which are included in the repealer. This sentence is needed because buildings designed in accordance with this method should conform to the same amendments made to the Model Energy Code, Chapter 5, "Building Design by Component Performance Approach."

Part 7670.1000 Amendments to Section 701: References

Amendments of standards and references are included in this part instead of in five parts; 7670.1010, 7670.1020, 7670.1030, 7670.1100, and 7670.1110 are included in the repealer. Two new items are included in the list of standards and references -- the updated versions of ASHRAE Handbook 1989 edition and ASHRAE Standard 62-89.

The department proposes to replace two reference standards (RS-17 and RS-18) with the single document, "SMACNA HVAC Duct Construction Standards: Metal and Flexible, First Edition, 1985." The two SMACNA reference standards being replaced (1975 and 1976 documents) have been superseded by the Sheet Metal and Air Conditioning Contractors

National Association (SMACNA) with the single document cited above.

V. SMALL BUSINESS CONSIDERATIONS IN RULEMAKING

Minnesota Statue § 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 adoption of these rule amendments will affect small businesses in Minnesota. 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.

In conformance with item (a) above, small businesses would benefit from the proposed amendments to Minn. Rules Part 7670.0325, subpart 1, item B, relating to definition of window thermal performance. Some of the subitems (2 and 3) require costly physical

testing to implement, but others do not. Since Chapter 7670 includes no reporting requirements, Minnesota Statute § 14.115, subd. 2, (b) and (c) are not applicable.

The proposed rules include several significant performance standards in conformance with Minn. Statute § 14.115, subd. 2(d). Part 7670.0325, subpart 1, item B, includes four performance options for determining the thermal performance of windows. In the Model Energy Code, Chapter 4 (Building Design Systems Analysis) is entirely performance based. The Model Energy Code Chapter 5 (Building Design by Component Performance Approach) is also performance based. The lighting criteria proposed in Part 7670.0800 subpart 2 are also performance based.

In regard to item (e) above, Minnesota Statute § 16B.62 establishes the scope of application of the State Building Code. It would be inappropriate for the department to usurp statutory requirements by changing the applicability to exempt small business. In Part 7670.0250, the applicability is changed to exempt relocated residential buildings in conformance with Minn. Statute § 16B.61, subd. 3(i).

VI. ATTACHMENTS

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

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Handbook of Fundamentals, 1989 edition, pages 21.4, 21.5, 22.3, 22.4, 22.5, 22.10, 22.11, 27.16, 27.17, and 27.18.

2. Minnesota Masonry Institute table, "R-value Comparison -- 8-inch Insulated Concrete Masonry Systems."

3. 10CFR Part 435, Table 5.3-1, "Calculation Procedures for Thermal Transmittance Through Opaque Envelope Assemblies."

4. "Window R-Values Substantially Overstated," Energy Efficient Building Association (EEBA) Alert, 1990.

5. "Window U-Values: Revisions for the 1989 ASHRAE Handbook -- Fundamentals," ASHRAE Journal, June, 1989,

6. Twin City Testing report on polyethylene vapor retarder thickness, June 29, 1989.

7. "Standard Practice for Selection of Vapor Retarders for Thermal Insulation," American Society for Testing and Materials (ASTM) C 755-85, Table 1.

8. "Cold Ceiling Corner Mystery Examined," Home Builders' Energy Update, Winter 1989.

9. "Windwashing and Its Effects on Wood Frame Buildings," Cold Climate Housing News, Volume 2, Issue 3.

10. "Moisture Problems in Bathroom Exterior Walls," Home Builders' Energy Update, Summer, 1988.

11. "Exterior Foundation Wall Insulation," Home Builders' Energy Update, Winter, 1990.

12. "Report on the Suitability of Incorporating ASHRAE 119-1988 -- Air Leakage Performance for Detached Single Family Residential Buildings -- into the Minnesota Energy Code," April, 1990.

13. "Preventing Air Leaks at Fire Stops," Home Builders' Energy Update, Summer 1990.

14. 10CFR Part 435, Table 3.4-1 "Prescriptive unit lighting power allowance," and Table 3.5-1 "Base unit power density for area/activity."

15. Sylvania Information Analysis for the First Bank/IBM Tower, downtown Minneapolis.

16. "Is ASHRAE/IES Standard 90.1P Being Followed?," *Lighting Design and Application*, Match, 1990.

VII. CONCLUSION

Based on the foregoing, the proposed amendments to Minnesota Rules Chapter 7670 are both needed and reasonable.

Dated: Sept 12, 1990

TONY PERPICH
Commissioner