18-554 DEPARTMENT OF ADMINISTRATIVE AND FINANCIAL SERVICES

BUREAU OF GENERAL SERVICES

CHAPTER 4 Standard 62-1981R "Ventilation for Acceptable Indoor Air Quality" Adoption in Public School Design & Construction

RULE

The design and construction of all new or substantial renovated public schools shall comply with the requirements of ANSI/ASHRAE Standard 62-1981R "Ventilation For Acceptable Indoor Air Quality", hereinafter referred to as the Standard.

EXISTING USE CONTINUED

Except as otherwise provided for in this rule, this rule shall not require the removal, alteration or abandonment of, nor prevent continued use of an existing mechanical ventilation system.

APPLICATION

Case 1. New Construction

New buildings and/or building additions shall be designed and constructed with ventilation systems in accordance with the Standard.

Case II. Substantial Renovations

Where buildings are being substantially renovated, ventilation shall be provided in accordance with the Standard.

Case III. Change of Use

Where buildings or spaces are altered for uses other than those for which they were originally designed, ventilation shall be provided in accordance with the Standard.

Case IV. Existing Ventilation Systems

Where existing ventilation system(s) must be altered or-replaced as a consequence of the building renovation or alteration design, the existing ventilation system(s) or replacements) shall be brought into compliance with the Standard. For the purposes of this case, only those ventilation system(s) affected within the scope of the renovation or alteration project need be considered.

Case V. Known Air Quality Problem

If an air quality problem exists as identified through technical analysis/evaluation, quantitative testing or qualitative assessment by owner/occupant in a building being altered or renovated, those area(s) of the building being altered or renovated shall be provided with a ventilation system compliant with the Standard.

DEFINITIONS

(continued on next page)

BUILDING - A building shall be defined as a structure used or intended for supporting or sheltering any use or occupancy. For application of this rule for renovations or alterations, each portion of a building separated from other portions by fire walls complying with section 908.0 of the BOCA Code shall be considered a separate building. Where a structure consists of multiple buildings attached contiguous to one another but not separated by a fire walls the appropriate building area for determining replacement value shall be as ruled by the Bureau of General Services.

Substantial renovation - Under this rule shall be defined as renovations the cost of which meet or exceed 50% of the replacement value of the building in which such renovations are to occur. The Standard - use of this term shall refer to ASHRAE Standard 62-1981R

STANDARD 62-1981R "Ventilation, for Acceptable Indoor Air Quality"

Adoption -in Public School Design & Construction

FACT SHEET

A. Statutory Authority for Rule-Making: Title 5 MRSA Sect. 1742 para. 6A

B. Principal Reasons for Rule:

(1) To insure the application of latest standards to provide acceptable and healthful indoor air quality in public schools.

(2) Unify codes by mandating the application of a common standard in both state owned public buildings and public schools.

C. Analysis of Rule:

The technical basis for the revised ventilation air quantities necessary for acceptable indoor air quality shall neither be further evaluated or disputed herein as the ASHRAE project committee responsible for the preparation of the standard is the recognized authority on the subject. This information is adequately treated within the text of the new ASHRAE Standard 62-1981R.

The revised outdoor air quantities. may be expected to have an impact on the following:

(1) Capital or first costs necessary to the construction of a public school addition or renovation.

(2) Annual operating costs of public schools.

(3) Estimated energy performance indexes and the maximum energy consumption goal compliance promulgated within the Life Cycle Analysis document authorized under Title 5, MRSA Section 1764.

In order to assess these impacts the following process has been employed:

(a) Review of existing technical analysis literature on the subject.

(b) Energy calculations using prescribed BPI estimating procedures to establish upper bounds on incremental energy and capital cost increases in going from a minimum of 5 CFM/person to 15 CFM/person

(c) Generalization of parametric analysis to arrive at an estimated total fiscal impact of the rule statewide at current levels of construction and energy costs.

EXISTING LITERATURE

An article prepared by Joseph H. Ito and Cecil Meyer published in the ASHRAE JOURNAL September 1988 entitled Analysis: The HVAC Costs of Fresh Air Ventilation" dealt specifically with the issue of changes in annual energy operating and first cost resulting from increased minimum outside air ventilation. Simulations performed were for typical office space. To summarize, percentage change in heating energy for climatic zones with degree days similar to Maine's may- be expected to increase by 3 to 5 percent in going from 5 CFM/person to 15 CFM/person. Added capital costs to provide additional ventilation air would range from 2.5¢/SF to 12¢/SF.

ENERGY CALCULATIONS (MAINE)

Employing the "BIN" methodology detailed in the state's Life Cycle Analysis document and recorded temperatures from the D.O.D.'s engineering and weather data manual, the incremental energy difference necessary to raise 5 cubic feet of air per minute (CFM) to 15 CFM from the outdoor temperature to a nominal indoor temperature of 70°F for the appropriate time duration of that temperature coincident with normally occupied school periods was calculated, for three discrete climatic zones in Maine. The results are summarized in the table below:

CLIMATE ZONE

Outdoor AN South Central Northern

(CFM/person) (BTU/person - year)

5 207000 226000 227000

15 622000 679000 801000

Increase 415000 453000 574000

4.3 gals/person/yr 4.7 gals/person/yr 5.9 gals/person/yr

Given that the Department of Education rules for construction dictate approx. 105 square feet per person (with a 10 percent plus or minus variation for type and size) these results translate into a 4000 to 5000 BTU/SF-YR increase for the added ventilation. Assuming nominal efficiencies of 70% and use of #2 oil an fuel source with current fuel prices at $0.90/gallon gives operating cost increases in the range of 4 to 5 cents per square foot per year.

Current energy standard require that the prototypical elementary school in Maine must be designed within an energy performance index of 40,000 BTU/ft²/yr. The resultant cost breakdown (on average) at given energy prices of 8¢/KWH and $0.90/gallon of #2 oil is:

Current Ventilation Rates

BTU/SF/YR Cost/SF

Fuel Oil 23,000 $.214

Electricity 17,000 $.397

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Total 40,000 $0.611

The 4,000-5,000 BTU/FT2 per year for the proposed additional ventilation air therefor represents a 17 to 22% increase in heating energy use and costs if a one to one relationship between percentage increase in minimum outside air ventilation and the increases in heating energy use and cost is assumed. These figures are therefor an "upper bound" estimate of the impact of the change. Standard ventilation systems are normally recirculant and when in economizer operation already provide greater amounts of outdoor air than the current minimum of 5 CFM . A "model" school was analyzed with the following results:

Assumptions: Area: 25,000 ft²

Occupants: 240

Lighting, Misc. power: 50 KW

Bldg. heating load: 4,000 BTU/hr°F

Operation: typical elementary school schedule

Solar gains: none

Heating Energy Usage

(MBTU per year)

Ventilation Rates Southern Central Northern

(CFM/person)

5 488,200 539,800 653,200

15 550,400 610,400 746,300

Increases percentage +12.8 + 13.1 +14.3

BTU/SF/YR 2490 2830 3730

Cost 2.3¢/SF 2.6¢/SF 3.5¢/SF

these increases fall within the range predicted for office buildings and the theoretical maximum. Future energy performance "budgets" and Life Cycle Analysis reviews under Title 5 MRSA Sect. 1762 should incorporate allowances within this range. The percent increase in total operating cost ranges from 4 to 6 percent.

D. Fiscal Impact

Current levels on construction costs are on the order of $60 million dollars per year for approx. 650,000 square feet. Using 3 cents per square foot increase in fuel oil cost gives an annual operating cost increase of $19,500 statewide for all new construction.

Capital cost increases to provide greater ventilation rates would encompass only incremental additional to already required systems costs, i.e. boiler and coil capacities, louver sizes, controls, etc. Using the estimate of $.35/Ft² results in an increase in budget of $250,000 statewide, less than a percent of the total annual construction budget.

Bringing all operating and first costs back to a net present worth, assuming construction levels are maintained at the current rate with no escalation rate in fuel costs, would suggest the full fiscal impact on new school budgets statewide would roughly be $500,000 per year.

EFFECTIVE DATE (ELECTRONIC CONVERSION): May 1, 1996

NON-SUBSTANTIVE CORRECTIONS: August 13, 1996 - minor spelling submitted by the agency.

WORD VERSION CONVERSION AND ACCESSIBILITY CHECK: July 8, 2025