The History


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Insurance Services Office Grading Schedules

The Insurance Services Office, (ISO) is a national corporation providing advisory services to property and casualty insurance carriers. The ISO functions as an insurance rating organization, as an actuarial advisory organization, and as a statistical agent. In 1996, the ISO employed approximately 2,000 people and served nearly 1,300 affiliated insurance companies[1].

Approximately every ten years, or as requested, employees of the ISO apply the requirements of their Municipal Grading Schedule, (MGS) to municipalities, communities, and their fire departments for the purpose of classifying their fire defenses and physical conditions. This schedule provided a standardized, nationally accepted method for classifying municipal public fire protection defenses, and to establish base insurance rates for fire insurance purposes. With improved ratings, fire insurance companies that subscribe to the ISO rating system typically lowered residential and commercial insurance rates for their customers. Political officials proudly announced Class 1 ratings as a way to repay their citizens for the investments expended on municipal fire protection. The fire defenses in many areas of the country, including most large cities, were developed around the ISO-MGS requirements for obvious reasons. For many years, a favorable ISO class rating was the premier method to determine adequate or sub-standard fire department preparedness.

The 1974 edition of the MGS was specification based and designed to identify deficiencies from a published standard, with very little flexibility in the schedule. Therefore, communities that did not have traditional underground water mains supplied from a municipal system were unable to achieve other than a Class 9 rural rating in that evaluation. Montgomery County was last rated (see page 14) using this Municipal Rating Schedule.

In 1980, the MGS was updated and replaced with the ISO Fire Suppression Rating Schedule, (FSRS). Several significant changes occurred with this update that had a direct impact on areas similar to Montgomery County. For the first time, credits were extended to rural areas that did not have conventional underground water lines and hydrants. Therefore, areas like Montgomery County that are a mixture of urban, suburban, and rural communities now have the ability to lower ISO ratings in non-urban areas.

The 1980 FSRS is a performance based document designed to increase the flexibility of the schedule while crediting changing conditions and technologies exceeding the traditional MGS. The current FSRS is based on delivery performance only, without regard to the delivery method used. This schedule is

[1] Source: NFPA Fire Protection Handbook, 18th edition.

adaptable to crediting the delivery of water by other means (e.g. tankers). These credits can now be extended to areas without municipal water systems[2].

A second important change between the MGS and the FSRS is identified in the formula for needed fire flow. The 1974 schedule and its predecessors did not provide significant recognition of the decreased need for public fire suppression in large buildings and properties that are protected by automatic sprinkler systems. The FSRS recognizes this contribution by excluding all properties fully protected with standard automatic sprinkler systems from the development of needed fire flow calculations. This change speaks directly to the importance placed upon automatic sprinkler protection.

Finally, the 1980 revision increases the relative weight assigned to both water supply and the fire department. The relative weight for water supply is 40%, and the relative weight for fire department is 50%. Those numbers were 39% and 39% respectively for previous editions.

ISO Major Rating Items Comparison (percent)

Feature	**MGS (Pre 1980)**	**FSGS (Post 1980)**
Water Supply	39 %	40 %
Fire Department	39 %	50 %
Fire Service Communications	9 %	10 %
Fire Safety Control	13 %	0%
	100 %	100 %

In either evaluation, water supply delivery is critical to any Fire Department preparedness plan. It is important to understand that ISO classifications developed using the fire suppression rating schedule are only one of several elements used in the development of fire insurance rates. Individual insurance underwriters who choose to, may utilize this class rating as a primary method of determining rates for insurance premiums. However, each underwriter determines their own rates considering other factors, as well.

The ISO model is considered to be helpful to local officials when viewed in conjunction with more specific local needs. Any improvement in the ISO rating should translate into savings for individual property owners through reduced insurance rates. The WSWG acknowledges this reality and considers the FSRS requirements fundamental.

[2] Currently there are nine jurisdictions in the United States who have been able to earn a ISO Class-4 rural rating coupled with a Class 1 urban rating. DuBoise, Pa., and Fallon, Nevada serve as representative examples.

The following cities currently have ISO Inc., Class 1 fire department ratings. The date indicates when the fire department received its Class 1 rating.

1. St. Louis, MO	Pre-1964
2. Baton Rouge, LA	May 1, 1979
3. Santa Ana, CA	January 1, 1984
4. Stockton, CA	January 1, 1984
5. Macon/Bibb County, GA	June 1, 1984
6. Hialeh, FL	May 1, 1986
7. Springfield, IL	September 1, 1988
8. Anaheim, CA	November 1, 1988
9. Beverly Hills, CA	May 1, 1989
10. Las Vegas, NV	May 1, 1990
11. Vernon, CA	November 1, 1990
12. Greensboro, NC	February 1, 1992
13. Coral Gables, FL	November 1, 1992
14. Glendale, CA	November 1, 1992
15. Oak Lawn, IL	March 1, 1993
16. Arcadia, CA	August 1, 1993
17. Lisle-Woodbridge FD, IL	December 1, 1993
18. Clark County, NV	February 1, 1994
19. Hartford, CT	July 1, 1994
20. Culver City, CA	February 1, 1995
21. Skokie, IL	September 1, 1995
22. E. Bank Consol. FD, LA	September 5, 1995
23. Torrance, CA	May 1, 1996
24. Hoboken, NJ	July 1, 1996
25. Fallon, NV	August 1, 1996
26. Arlington Heights, IL	September 1, 1997
27. Syracuse, NY	January 1, 1998
28. Pembroke Pines, FL	February 1, 1998
29. Charleston, SC	June 1, 1998
30. Shreveport, LA	July 6, 1998
31. Dubois, PA	October 1, 1998
32. Plano, TX	October 1, 1998
33. Cambridge, MA	July 1, 1999

Montgomery County ISO Ratings

WSWG member William “Scotty” Cameron had copies of several Insurance Services Office (ISO) publications and reports dating back to the early 1970s pertaining to the history of the county’s ISO ratings. These, and later documents made available by local ISO representative Fred Brower, helped the

Work Group understand Montgomery County's ISO ratings over the past 20+ years. A list of ISO references reviewed by the WSWG appears below:

- "Public Fire Protection Report on Montgomery County, Maryland," October 1976.
- Letter (with attachments) to County Executive James Gleason from John Beilein, Manager, ISO, containing county's Metropolitan District ISO rating, November 1, 1976
- "Grading Schedule for Municipal Fire Protection," ISO, 1974.
- "Guide for Determination of Required Fire Flow," ISO, 1972.
- "Fire Suppression Rating Schedule," ISO, 1980.

The ISO municipal grading schedule was last applied to Montgomery County in October 1976. At that time, the City of Rockville, and rural portions of the up-county including the Town of Damascus were excluded from the study. The total deficiency points determined that Montgomery County earned a **Class 4** municipal rating and a **Class 9** rural rating.[3]

As part of their survey, the ISO calculates the needed fire flow for structures within a given community and compares those demands to the fire department's ability to deliver water within that community. A public protection classification is then assigned that is used by insurance companies to determine insurance rates for property owners.[4] Historically, municipal fire defenses have been structured and deployed to maximize the public protection classification, thereby lowering insurance rates for all property owners. However, the method used to determine this public protection classification has changed since the last Montgomery County evaluation. Suburban areas like Montgomery County with population greater than 250,000, are now statistically rated based upon previous fire loss. The ISO believes that this method better reflects a community's risk in that actual fire loss can be attributed to the components that drive fire loss such as water supply, communications, staffing, fire prevention, etc. Applying the traditional model to areas as large as Montgomery County is simply too labor intensive.

The following paragraph is taken from the 1976 report and is specific to the water supply section of the final report[5].

[3] Any area greater than 5 miles from a fire station is automatically rated as ISO Class 10.
[4] Other factors beyond the scope of this report such as staffing, communications, and others are considered as well.
[5] The WSWG focused on this section of the report only. No consideration was given to the impacts of fire department, communications or fire safety control ratings since they are not included in the scope of this study.

"An adequate supply is available but there are several features of moderate unreliability even when considering storage and emergency supply. The arterial system is generally adequate and well arranged, except looping is incomplete in outlying areas and single mains supplying Montgomery Village, Germantown, the booster zones and several pressure-regulated zones. The gridiron of smaller mains is mainly good in the Bethesda, Chevy Chase, Wheaton, and Silver Spring areas except at service limits, but is irregular and incomplete in outlying areas. Most pressures are good to fair and well maintained fire flow tests, indicate that the quantities available are good in business, shopping center, and apartment districts and good to fair in industrial, institutional, and residential districts. Hydrant spacing is only fair to excessively wide in commercial districts and fairly good in residential districts. A moderate number of hydrants lack a valve in the branch connection; hydrants are in only fair to poor conditions"[6]**.**

Current findings of the WSWG are largely consistent with the 1976 summary. Specifically, the implied problems regarding stored water capacity, hydrant maintenance, and looping of expanding water mains remain a concern. In the twenty-three years since this was written, many of the problems remain the same, but the problems have moved geographically. Instead of looping problems in the Gaithersburg-Germantown corridor, the concern is now in the Germantown-Clarksburg corridor. The WSWG is not aware of any cooperative efforts between the WSSC and MCFRS to address these on-going concerns. More importantly, the ISO ratings for Montgomery County remain the same as twenty-three years ago.

Needed Fire Flow

The amount of water in gallons per minute (GPM) required to suppress a fire in a given structure is most often referred to as needed fire flow, or required fire flow. Water requirements for fire fighting include the rate of flow, the residual pressure required at that flow, and the total quantity required.

The American Water Works Association, (AWWA) defines required fire flow as **: *"the rate of water flow, at a residual pressure of 20 PSI for a specified duration, that is necessary to control a major fire in a specific structure***[7]**.**

Several different methods may be used to calculate needed fire flow for ***non-sprinklered structures*****.** The Iowa State University Method is the easiest to

[6] Source: ISO Public Fire Protection Rating for Montgomery County, Maryland; October 1976
[7] Source: AWWA M31 Distribution System Requirements For Fire Protection, AWWA, Denver, Co. 1958

apply and is most frequently used by Command Officers for a convenient method to estimate fire flow needs. Although not as complex as other formulas, the Iowa State formula is considered to be very reliable. This simple formula is:

$$GPM_{\text{Required}} = \text{Length} \times \text{Width} \times \text{Height}_{\text{Of Structure}} / 100$$

The Illinois Institute of Technology publishes a formula based upon a survey of 134 fires in the Chicago Area. This formula is not suitable for local needs.

The most widely recognized and utilized formula is contained in the Insurance Services Office Fire Suppression Rating Schedule. The flows calculated using this method are considered a good estimate. The ISO Method considers building construction, occupancy, adjacent exposed buildings and communication paths for fire spread between buildings.

The basic formula for needed fire flow is:

$$NFF_i = (C)_i(O)_i(X+P)_i$$

Where:

NFF_i = Needed Fire Flow in (GPM)
C_i = Construction Factor
O_i = Occupancy Factor
$(X+P)_i$ = Exposure Factor

Calculations are typically rounded to the nearest 250 GPM for flows under 2500 GPM and the nearest 500 GPM for larger flows. Additional adjustments are made for buildings with wood shingle roofs.

As a general rule both the American Water Works Association (AWWA) and the ISO recommend 3500 GPM as the upper limit for needed fire flow for normal public protection. These organizations have further established 500 GPM as the minimum needed fire flow. This is not to say that larger structures or facilities with severe hazards do not require additional fire flows. Calculated fire flows up to 12,000 GPM are not unusual for many buildings in older cities. However, data provided to the WSWG by the ISO shows that most non-sprinklered residential high-rise buildings within Montgomery County have a calculated required fire flow of between ***5,000 and 8,000*** GPM. Water supplies of 50,000 GPM are not unheard of, but designing public systems capable of flows that high is not cost effective or practical. Regardless, the needed fire flow should be available simultaneously with domestic consumption at the maximum daily rate.

Needed fire flow should be available for up to 10 hours. Many municipal water authorities place an upper limit of 2 to 4 hours on fire fighting water supply duration due to the economics of pumping and storing large quantities of water.

Of special interest to the MCFRS is the following table that summarizes NFF for groups of dwellings based upon separation distances of similar exposures.

The ISO recommends the following minimum fire flows for groups of structures.

Required Fire Flows for Groups of Dwellings

Exposure Distances (Ft.)	Required Fire Flow (GPM)
Over 100	500
31-100	750
11-30	1000
10 or less	1500

Due to the large number of garden apartments, townhouses, and other clusters of homes, ***the WSWG recommends a minimum quantity of fire fighting water in the 3000-3500 GPM range for townhouses, garden apartments and other groups of dwellings.*** This can be accomplished in areas with municipal fire hydrants utilizing the resources currently deployed on a structure fire response, providing sufficient supply lines are deployed above ground.

The ISO current required duration for needed fire flows are 2 hours for flows of 2500 GPM and less, 3 hours for flows of 2501-3500 GPM, and 4 hours for flows greater than 3500 GPM.

In contrast, water supply requirements for structures equipped with automatic sprinklers are required by code to meet the anticipated flow (design flow) of the sprinklers, plus an allowance for hose streams for manual fire fighting. Therefore, structures protected by automatic sprinklers are excluded from needed fire flow calculations[8]. The long-standing success of automatic sprinklers is well documented in the fire protection community.

A joint report of committees from the American Society of Civil Engineers, the American Water Works Association, and others suggested that the maximum general service demand on a waterworks system be taken as the peak hourly demand during a test year[9].

The occurrence of a fire or multiple fires should not affect domestic demands or vice versa. These assessments are important because as more and

[8] The specific requirements for structures containing sprinklers may be found in the NFPA 13 series of codes/standards that govern good practice in buildings containing automatic sprinklers.

[9] ASCE Bulletin #2, American Society of Civil Engineers, New York, 1951

more water is used in a given system for domestic needs, less water will be available for fire fighting.

NFPA 1231

NFPA 1231 The Standard on Water Supplies for Suburban and Rural Fire Fighting identifies minimum requirements for fire fighting water supplies in rural and suburban areas where reliable water supply systems do not exist. Every day adequacy and reliability is the primary focus of the standard.

The method used to determine the minimum water supply necessary in this standard deviates from the ISO Needed Fire Flow formula. Rather than determining a rate of flow in GPM, the NFPA guidelines are used to calculate a minimum water supply in gallons. This information is then used to recommend a minimum water delivery rate in GPM for fire department use. In many cases, this minimum water supply is intended to protect exposures only, and therefore not designed to extinguish a fire in the original building.

The basic formula for minimum water supply is:

$$\text{Minimum Water Supply} = \frac{\text{Total Volume of Structure}}{\text{Occupancy Class Number}} \text{ (Construction Classification \#)}$$

Where:

Occupancy Classification Number =

3 for Severe Hazard Occupancies
4 for High Hazard Occupancies
5 for Moderate Hazard Occupancies
6 for Low Hazard Occupancies
7 for Low Hazard Occupancies

And:

Construction Classification Number =

0.5 for Type I Fire Resistive Construction
0.8 for Type II and IV Noncombustible and Heavy Timber Construction
1.0 for Type III Ordinary Construction
1.5 for Type V Wood Frame Construction

Assignment of the various occupancies are pre-determined in NFPA 1231, although the Authority Having Jurisdiction can exercise professional judgement when applying the requirements of the standard based on other factors.

Calculation of the total water supply required in gallons is then used in the following table to determine the minimum rate of delivery by the fire department:

Total Water Supply Required (GALS)	**Rate of Delivery (GPM)**
Up to 2499	250
2500 – 9999	500
10,000 – 19,999	750
20,000 or more	1000

Source: Table 5-9(b), NFPA 1231

The reader should be careful not to confuse the requirements of the previous ISO recommendations with the NFPA recommendations. The ISO guidelines were originally developed for use in cities and municipalities where hydrants and water is readily available. The NFPA standard referenced here focuses on rural and suburban areas where water may not be as readily available. In either case, the recommendations in this report for Needed Fire Flow are supported by either of these methods.

Historical Fire Loss

The United States has a serious and substantial fire problem. Roughly once every two seconds an unreported fire occurs. Nearly once every minute, there is a home fire serious enough to warrant calling the fire department[10].

The rate of death from fire in the United States is significantly higher than in other industrialized nations. Fire in the United States kills more people than all natural disasters, such as floods, hurricanes, tornadoes, earthquakes and blizzards, combined.

Nationwide in 1998, an estimated $6.7 billion in structure fire property damage occurred as a result of fire. Sixty-five percent of that loss, or $4.4 billion occurred in residential occupancies[11].

The economic implications of fire loss extend beyond the direct losses associated with the physical losses of a structure and its contents. Other indirect costs that include loss of use of the property, loss of employment, loss of tax revenues, insurance costs, medical costs associated with death, injuries, and disabilities would inflate the direct losses considerably.

[10] Source: U.S. Fire Administration. “Protecting Your Family From Fire.”
[11] Source: NFPA Journal, September/October 1999.

The National Fire Protection Association's "Survey of Fire Departments for 1994 through 1998 U.S. Fire Experience" identifies a number of statistics worth noting in this report. The average fire experience nationwide in similar communities with a population of 500,000-999,999 lists the following data:

National Fire Loss Statistics for Communities of Similar Size

Year	All Fires	Structure Fires	Civilian Deaths	Civilian Injuries	Dollar Loss
1994	5,157	1,703	9.50	73.94	$19,033,200
1995	4,537	1,498	10.39	71.94	$21,319,200
1996	4,306	1,462	9.82	67.64	$19,437,300
1997	4,058	1,417	8.73	75.69	$27,843,000
1998	3,634	1,133	8.76	68.55	$16,942,100

Source: National Fire Protection Association –Annual Fire Loss Statistics

In addition, the NFPA has determined that the number of fires per thousand population nationwide is 6.2 for communities this size. More importantly, in 1998, 74% of all structure fires occurred in residential structures. This ratio of residential fires to all structure fires is long standing in the U.S.

Montgomery County is home to approximately 850,500 people spread over 496 square miles of land area. Since Montgomery County is predominantly residential in composition, the ratio between residential structure fires and other structure fires has the potential to be even higher than the national average. Fire loss data for Montgomery County for calendar years 1994 through 1998 is shown below[12].

Fire Loss Statistics For Montgomery County, MD

Year	All Fires	Structure Fires	Civilian Deaths	Civilian Injuries	Dollar Loss
1994	3302	1089	11	91	$14,523,853
1995	2892	1016	10	50	$19,017,740
1996	3533	832	14	72	$18,671,387
1997	3147	1536	8	76	$19,926,100
1998	2613	641	3	71	$10,974,379

Source: Montgomery County, Maryland, DFRS Bureau of Life Safety Services, Division of Fire Investigations

[12] The Work Group believes that the number of structure fires and the resultant dollar loss is grossly under-estimated, particularly for 1998 in Montgomery County for two reasons: 1) there exists a significant non-compliance problem concerning personnel not using or misusing the Fire Incident Reporting Executive System (FIRES); and 2) historically, incident command and unit officers have under estimated actual fire loss by using codes that indicate "good intent fire, smoke scare, hazardous condition-other, etc." rather than "inside structure fire." This expedites the reporting process, however, under reports the actual fire loss statistics.

This loss experience is similar to the nationwide statistics in all areas except dollar loss. ***The WSWG recommends that the Fire Rescue Commission initiate immediate action to correct the problems with F-I-R-E-s compliance and fire loss estimation.***

The ISO now rates large municipal areas like Montgomery County using previous fire loss data, rather than a periodic survey of available resources. Therefore it is essential that data be as accurate as possible.

Since almost 80% of all fire deaths occur in the home, the key to reducing fire loss and subsequent fire deaths is to develop fire safety initiatives targeted at the home.