An Assessment of Scio Township's Fire Protection.

by:

Wilmer R. Dane, Fire Chief
Scio Township Fire Department
Ann Arbor, Michigan
November 11, 1996

Table of Contents

PART III

FORWARD

The purpose of this report is to provide information to the Township Board for evaluation of the current and future fire service needs of Scio Township. The information contained in this report was prepared by reviewing the National Fire Protection Association's Standard for Developing Fire Protection Services for the Public, Standard Number NFPA 1201, and then contrasting Scio Township's current level of service with the standard. NFPA Standard 1201 contains requirements and recommendations on the structure and operation of public fire protection services, and is intended for the use and guidance of those charged with providing fire protection and safety services to protect lives, property, and the environment from the effects of fire and other perils.

INTRODUCTION

Based on NFPA 1201, the first part of this document contains a discussion of the structure and operation of organizations providing public fire protection services including: fire suppression; fire prevention; and, fire safety education. It includes recommendations that are intended to provide effective and efficient protective services to prevent fires and reduce risks to lives and property; to deal with actual incidents; and to be prepared for situations that may be anticipated to occur.

There is a fundamental fire risk that is associated with modern society. Public fire service organizations are intended to reduce the risk within the area of their jurisdiction by taking measures to prevent the outbreak of fire; to limit the extent and severity of a fire; to provide for the removal or rescue of endangered person[s]; and to control and extinguish fires that occur within their jurisdiction. The cumulative effects of preventive efforts, risk reduction and control, and fire suppression capabilities result in a variable level of risk to the jurisdiction and its residents. The level of service provided and the degrees of risk accepted by the jurisdiction are subject to local determination. The risk remaining after deducting the cumulative effect of the public fire service organization's activities is the responsibility of the individual, whether renter, homeowner, or business person. Fire risk cannot be completely avoided or eliminated.

Many fire departments have evaluated and redefined their fire protection needs through the master planning process. This can result in proposing methods other than suppression that contribute to an acceptable level of fire protection.

Based on part I of this document and NFPA 1201, the second part of this document contains a discussion of the structure and operation of the Scio Township Fire Department. It will include recommendations that are intended to provide effective and efficient protective services to deal with fire and other emergencies that may occur in Scio Township and reduce the risk to life of its citizenship. These recommendations are established on the analysis of perceivable situations that may occur in Scio Township and the ability of its fire department to deal with and be prepared for the incidents.

PART I

PURPOSE OF A FIRE DEPARTMENT

The mission of a fire department is to attempt to prevent the outbreak of fires in the community and to limit the danger to persons and the damage to property caused by those fires that do occur. In a modern society that is surrounded by combustibles, this aspect of the fire department's activities should encompass a variety of approaches, including: inspections; enforcement of fire codes; review of plans for new construction projects; consultation with builders, developers, and those responsible for the management of individual properties; and, public education efforts. Every fire department should have a program under which its personnel regularly examine every part of the community where a significant fire problem may develop. Personnel should inspect all property in the community with emphasis on identified high life and property hazard occupancies, according to a schedule based on risk. A service of the fire department should be to consult with local individuals and organizations who have fire problems and assist in their solution. The availability of a fire protection engineer and other fire safety specialists would greatly assist in consultations with developers, architects, contractors, and other engineers. In addition, such expertise would enhance the on-going program of continued improvement of the fire defense system within the community.

Fire suppression is a fundamental responsibility of the fire service, and the fire department should be organized to effectively combat fires that occur in the area it serves. The commitment to providing other emergency and non-emergency services and performing other functions should not interfere with the ability to effectively combat fires. The priorities involved in fire suppression are to save lives, to control the fire and limit its spread, and to protect property from fire and related hazards. The delivery of services that are directed toward saving lives from a variety of perils are generally included in the mission of the fire service, although the nature and extent of these services varies from one jurisdiction to another. Fire departments are usually staffed and deployed in a manner that readily supports the delivery of such additional emergency services when the necessary resources are provided. Preservation of human life is the primary responsibility of the fire department at fires and other emergencies. Departments also should be prepared to perform rescue work and provide emergency care for those injured in connection with such incidents as traffic accidents, train wrecks, aircraft crashes, floods, windstorms, and earthquakes. In many areas the fire department is designated as the primary provider of emergency medical services [EMS]. This may involve the delivery of basic or advanced life support services and may include ambulance service. These services may be performed by fire fighters or by members of the fire department specializing in EMS. The impact on fire department resources and the department's continued ability to perform its fire control responsibilities must be considered when undertaking the EMS activity.

Recent studies indicate that the majority of building fires are caused by carelessness and ignorance and are preventable primarily through educational and motivational efforts. Reducing the number of life and dollar losses, casualties, and fire incidents in this category is dependent on the fire department developing ongoing, comprehensive fire safety programs, with emphasis on "high risk" populations. Thus, fire safety education is becoming an increasingly important and cost effective element in the community fire protection system. It must be a planned program including needs assessment, determination of objectives, evaluation, and allocation of sufficient resources. An important aspect of public education is controlling the combustibles within which we surrounds ourselves. One way to do this is to review the plans for new proposed structures or plans for renovations. Special consideration must be given to life safety, elimination of undesirable building features, providing fire protection systems and equipment, and ensuring access for fire suppression operations by the fire department.

In many communities the fire department is assigned the primary responsibility for the management of hazardous materials emergencies. In some cases this includes regulatory responsibilities to identify and limit risks to the community resulting from the storage, use, transportation, and disposal of hazardous materials. Hazardous materials present a tremendous disaster risk to the community. Disaster planning should be coordinated on all levels of government in anticipation of large scale emergencies. Comprehensive response plans should be in writing and provide for management and coordination of all public and private services called into action in disasters.

GOVERNMENTAL RESPONSIBILITIES

Fire protection is considered to be a local government responsibility in most areas in North America. The governmental agency responsible for the establishment and operation of the fire department should formally adopt a statement of purpose and policies for the fire department that includes the types and levels of service that are to be provided and the delegation of authority to the fire chief and other officers to manage and operate the fire department. Where fire services are provided by a governmental agency, the resources of other related governmental units, such as personnel systems, finance departments, planning agencies, purchasing systems, and similar components should be used cooperatively to achieve the most effective service delivery system. The fire department must rely on a close working relationship with the agencies responsible for law enforcement and water supply, among others, to operate in an effective and cooperative manner.

FIRE RISK ANALYSIS AND PLANNING

Communities must recognize the need for the creation and implementation of a master plan for a community-wide fire control strategy, dedicated to the reduction of life and property loss from fire. The fire department must plan its internal operations as well as being involved with community planning for anticipated community growth. When the fire department must choose between economic efficiency or program effectiveness to determine which program is more appropriate, cost benefit analysis can be used to provide the basis for department planning.

Program effectiveness is an important part of cost benefit analysis. A higher costing program may be more effective, even though it is not the most efficient. In emergency services, value criteria should be considered; such as life being of higher value then property. Cost benefit analysis typically consists of five steps that draw heavily on system analysis: determining need; developing objectives; developing the criteria for measuring effective accomplishment; generating alternatives; and, analyzing and selecting alternatives.

Fire Service Master planning is a process designed to evaluate the level of fire risk in a community and to establish future objectives for limiting or reducing that risk. The overall approach is comprehensive, examining the resources available for fire prevention and suppression in light of the level of risk created by the environment. The need for public protection can be modified by changing the required level of protection that must be provided by the private sector, in the form of fire alarm and detection systems, automatic sprinklers, and limiting the size and type of construction that is permitted. A desirable approach provides a low level of fire risk at low overall cost, although the specific cost and risk levels are determined by local option. A master planning process will identify what kind of community the fire department will have to protect ten or twenty years in the future. The costs of the fire department can be kept reasonable by limiting both potential life hazards and the combustible features of the community. If excessive area buildings or noteworthy life risks without appropriate private fire protection are tolerated, the taxpayers must also accept either a high level of fire department expense or inadequate protection. The same is true of tolerance of other defects that set up a high fire hazard or present unreasonably difficult fire control problems. Master planning should lead to a series of rational decisions that determine the levels of fire risk that will prevail in the community. The planning procedures enable the fire chief to recommend amounts of money to be allocated annually for the fire department operations after cost benefit and program effectiveness studies have been completed. Expenditure standards involve both technical questions and value judgments. There is usually no question as to whether fire department protection is to be provided. The annual operating cost of the fire department is largely established when the number of engine and ladder companies it will maintain and the personnel required for these companies has been determined by an analysis of the degree of desired protection and ability to provide financial support. The money that must be annually appropriated for the fire department is closely related to how well property owners accept responsibility for better protection of their individual properties from fire.

Possible reduction of the ability of local government to provide public fire protection must be considered in any planning process. These reductions may be temporary, as in the case of apparatus being out of service for repair, or permanent because of a reduction in the tax base. The result of such events may range from slight inconvenience to total elimination of usual services. The fire department, unlike many community departments, provides an emergency service upon which may depend the saving of lives and control of major property destruction. The fire chief, in concert with community administration, should be prepared with practical contingency plans that may be implemented depending on the nature and degree of service curtailment. Local, state, and federal regulations and agreements should be guiding factors when planning for the contingency of any work curtailment. Fire code enforcement, fire safety education, and community cleanup programs are a general approach to the reduction of fire suppression workload. On a short-term basis, they offer limited chance to affect fire department operation costs but they can be productive when undertaken on a long-term basis. Computer software packages can be utilized to help determine optimum station locations, number of companies required, and best response routes. In addition they can assist in development of inter-jurisdictional fire response plans including mutual and automatic aid plans. Research reports and analyses of fire loss, structural and occupancy trends, and demographic information should form the basis for all long-range planning.

A statement should be prepared describing what the fire department hopes to accomplish during a minimum future period of five years. It should indicate budget requests planned for personnel, equipment, and facilities based on established objectives. Over a period of several years, capital items may be spread out by use of reserve funds or borrowing, if necessary. A five-year plan enables major changes to be carried out on an extended and rational basis. A statement should be prepared describing potential master plan accomplishments during a future period of ten years. It should indicate how long-range programs of the department and the community may begin to reduce losses. It should show how capital cost items for equipment and fire stations will be provided when needed.

ORGANIZATIONAL STRUCTURE OF THE FIRE DEPARTMENT

The management organization of a fire department should be similar to a well-run private business. The governing body corresponding to the board of directors as in any enterprise. A qualified fire chief should be appointed.

The fire chief is expected to manage the operations on a day-to-day basis and provide input to the governing body. The governing body has three primary responsibilities: [1] establishing the scope and level of service provided by the fire department, [2] providing the necessary funding, and [3] providing for the necessary personnel and facilities. In order to provide service, the governing body must have the power to levy taxes or solicit funding, to own property and equipment, and to cover personnel costs. The governing body should also monitor the achievement of the management goals of the department, such as fire prevention, fire suppression, employee training, communications, maintenance, public fire-safety education, and department administration. The governing body should establish the primary policies of the fire department and should not act as an administrative agency nor direct day-to-day management of the department.

The fire chief should be appointed on a basis of merit and ability for an indefinite term, removable only for cause. The National Fire Protection Association [NFPA] 1021, *Fire Officer Professional Qualifications*, should be used as the basis of determining qualifications. The fire chief should be selected and appointed by the designated governing body, and should communicate closely with the manager and/or governing body. This is essential for long rang planning, goal setting, and program and budget development. The manager and/or governing body should be kept abreast of department performance and needs through regular reports submitted by the fire chief. The governing body of the fire department, by its authorization of activates and appropriations, determines the total required amount of equipment and personnel. The fire chief should determine how operating units of the department should be organized into bureaus, divisions, fire companies, or response teams together with the number and distribution of such units.

The term "fire companies" means the principal response unit of the department. Practice followed in the United States traditionally establishes the basic sub-unit of a fire department as the fire company. It is provided with at least one fire truck and consists of the personnel necessary to safely and efficiently place the apparatus into service and operation when needed. Fire companies whose primary function is to pump water are called engine companies. One company can perform basic fire fighting, but even in a jurisdiction of detached dwellings, a minimum of two engine companies should be provided.

A ladder company performs ladder work, forcible entry, ventilation, rescue, salvage and illumination at night fires. Ladder company operations must be executed at all fires even though a department does not have a ladder truck.

Other types of companies equipped with specialized apparatus and equipment should be available to assist engine and ladder companies. Some departments provide companies for special purposes such as salvage, rescue, lighting, refilling self-contained breathing apparatus, and handling hazardous materials.

Fire departments in America staff fire companies with personnel that respond from a fire station; personnel that respond from home or work [paid-on-call]; or other variations of these staffing methods. The mode of staffing tends to be determined by the level of fire frequency and severity; the ability of the community to afford paid personnel; and the availability of suitable paid-on-call personnel. In order to meet a minimum staffing level, some suburban communities have had to utilize a paid force for response by day because paid-on-call personnel are principally available only at night, weekends, and national holidays.

Response personnel refers to the number of physically able, competent, and well-trained personnel available to respond and includes both officers and fire fighters. The response personnel of a fire company should be comprised of the number necessary for safe fire fighting performance related to the expected life hazard, the potential property loss, the characteristics of the service area [including but not limited to, water supplies, built-in fire protection, building size, occupancy, condition, construction, and accessibility, etc.], the type of fire ground tactics employed as standard procedure, the type of apparatus in use, and the expected results to be obtained at the fire scene. Each company should have an officer to provide leadership whenever the company is involved in any activity. Company officers should be included in the total personnel of companies.

The fire chief is responsible for managerial functions in addition to command of fire suppression. These functions are referred to as staff functions and include financial management, personnel management, fire protection engineering, fire prevention, fire safety education, fire investigation, research and planning, maintenance, training, community relations, communications, safety and health, and other activities. The fire officer designated to assist with staff functions is referred to as Staff Chief. The fire officer designated to assist with fire companies and with response to and command at fires is referred to as Operations Chief. In small departments, line officers may also have additional staff functions or assignments and vise versa.

Fire departments, like other organizations, are comprised of a group of people working together in a coordinated effort to achieve a common set of objectives. In order for a department to function effectively, it should have an organizational plan that shows the relationship between the operating divisions and the total organization. An organizational plan does not preclude the necessity for active leadership; it simply provides the means by which the organization can be managed effectively. The manner in which fire departments are organized is dependent not only upon the size of the department but the scope of its operations as well. Organizational plans are designed to illustrate or show the relationship of each operating division to the total organization. It is essential that each fire department have an organizational plan that reflects the current status of the department. Some departments find projected plans useful for budgetary and planning purposes. A good plan is essentially a blueprint of the organization. Accompanying the organizational plan should be a list of responsibilities or a position description for each job.

Every fire department should have an effective mutual aid arrangement with neighboring jurisdictions. Where appropriate, this should include automatic response on first alarms. The concept contemplates joint response of designated apparatus and personnel on a predetermined running assignment basis. Mutual aid concepts should be considered on a regional basis. In an effective mutual aid arrangement, each fire department should retain reserves of personnel and apparatus. Participating fire departments that have no reserves can only receive aid. Mutual aid agreements should be in writing. They should address such issues as liability for injuries, cost of service, authorization to respond, staffing, and equipment including the resources to be made available and the designation of the incident commander. Traditionally and legally, overall command of the incident is vested with the senior officer of the jurisdiction having the emergency. Some areas use consolidated dispatching to coordinate the response of fire companies to assist an outside fire department. The management of responses can be made easier by utilizing computerization and other advanced planning. Training of the personnel of all fire departments should be comprehensive and standardized to produce an effective fire force for mutual aid to be effective. All personnel should have received sufficient training to assure uniform operations. Operational methods should be as uniform as practicable. Apparatus responding to mutual aid incidents should be equipped with mobile radios and company officers should be equipped with portable radios that allow communication with the incident commander and/or division/group leaders. Separate frequencies should be provided that allow this to happen without disruption to the dispatch frequency.

To save money or to provide the necessary personnel and equipment to do an adequate job, some local government jurisdictions have combined compatible functions, such as communications, maintenance, and other services that can be shared with an overall increase in efficiency. In combining such functions, the fire chief should ensure that the ability of the fire department to effectively deliver emergency services is not impaired. There is a direct relationship between the functions and objectives of a building department and a fire department, as both departments are involved in the enforcement of safety codes to properties within the jurisdiction. In several jurisdictions these functions have been successfully combined by making the building code enforcement program a part of the fire department organization structure.

FINANCIAL MANAGEMENT

The fire department should have a system of accounts for financial administration. The system should keep a record of funds received by the department and funds expended. Furthermore, the system should enable the fire chief to analyze how the money is spent and should provide analytical information to support the continuing challenge of finding more cost effective ways of operating.

PERSONNEL MANAGEMENT

The personnel standards of a fire department should establish and maintain a competent and well-trained force by attracting qualified personnel and providing an interesting and useful career from recruitment to retirement. The fire chief should regularly review, revise and execute the personnel standards of the department and issue the orders necessary for administering personnel procedures. The fire chief should determine station and work group assignments for each company and/or member of the department by [1] placing a member in a position that will make the greatest use of that individual's skill and knowledge, [2] training a member in different kinds of work by assigning them to a variety of positions so that they may later be advanced to more responsible work, [3] bringing about maximum productivity of the work force by moving members about to take care of peak loads as they occur in various parts of the organization, and [4] alleviating situations where there is a personality clash between members.

HEALTH AND SAFETY

All fire department members should be physically fit for the duties they are expected to perform. The fire department should adopt a mandatory physical fitness program that addresses the particular demands of fire department activities. The program should be under the direction of qualified medical personnel. In addition, the fire department should adopt a mandatory health maintenance program that includes medical standards by age and department activity. Personnel should be assisted in meeting the standards of each program. All members of the department should be furnished with an annual medical and physical examination. This should be performed by the fire department physician or the same medical facility that gives pre-employment examinations to candidates for the department. The confidentiality of personal health records must be maintained. The medical reports should establish the ability of each member of the department to perform emergency duties. When members are found to be unfit for emergency duties, to perform the functions of their position, the fire department should attempt to assist the member in correcting the problem.

The fire department should adopt an occupational health and safety program that complies with NFPA 1500, *Fire Department Occupational Safety and Health Program*, and other applicable laws, standards, and regulations. Safe work procedures should be stressed and emphasized throughout a person's career. Accidents and injuries should be investigated and the findings should be included in the member's personnel record and appropriate action taken. Every supervisor should be responsible for ensuring that their employees use and maintain safety equipment in accordance with department regulations as well as state and federal legislation. The fire department should appoint a safety officer who has the duties and responsibilities as defined in NFPA 1501, *Standard on Fire Department Safety Officer.*

RECRUITMENT

The fire department should establish a recruitment program in accordance with federal and state requirements. The recruitment program should consist of, at the minimum, the following:

1. conducting an active search for the best qualified person[s] available for membership in the department and encouraging them to apply;

2. rejecting without examination candidates who show, on their application form, that they clearly fail to meet department standards for entrance;
3. testing to measure aptitudes and physical ability;
4. subjecting candidates to a thorough physical and medical examination, which they should pass in order to fully perform fire department work;
5. investigating the character of candidates by talking to former employers, personal references, neighbors, others familiar with their past; and
6. reviewing the driving record and requiring the appropriate driving license before completion of their recruit training.

A minimum age limit should be specified to assure that members are physically and mentally mature to perform fire fighting duties. A high school education or state recognized equivalent should be required as a minimum. For a period of at least 12 months before permanent appointment to the department, applicants should be assigned to a probationary training program and supervision. The fire fighter should meet the requirements for Fire Fighter I and Fire Fighter II of NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, before permanent appointment.

TRAINING

The fire chief is responsible for the training program of the department and should designate a training officer to act in administering the program. The fire chief should budget for training facilities, expendable supplies, training aids, and training staff, including both in-house and guest instructors. The training officer should recommend the subjects in which training is to be given. The program should be related to the personnel needs of the department and should utilize all available resources within the community.

The training officer should be responsible for the work of department personnel assigned as instructors. This should include periodic evaluations of each instructor, reviewing such aspects as lesson preparation and instructional techniques.

New personnel should be given comprehensive training before engaging in emergency duties to ensure that the trainee can work safely and effectively at fires and other emergencies. The course of probationary training should be consistent with the performance objectives as stated for the designated fire fighter level within NFPA 1001, *Fire Fighter Professional Qualifications.*

Probationary training should be under the direction of the training officer. Special and advanced training is desirable. Courses should be developed for individuals including special instruction and advanced training for all members to the extent that facilities, instructional personnel, and time permits. Safety should be a primary consideration in all training exercises and drills. Live structural training exercises should conform to the requirements of NFPA 1403, *Live Fire Training Evaluations in Structures*. The fire chief is ultimately responsible for the safety of all fire department members.

OPERATING PROCEDURES

Department regulations and standard operating procedures [SOP's] should be developed for the purpose of assuring uniformity in department actions and operations. The fire chief should establish the organizational and operational procedures by the issuance of written administrative regulations and SOP's. These should be published and circulated to all members, and training should be provided whenever major changes or additions are made.

A system should be established that requires each member to read and to be aware of existing and changed regulations and procedures. Standard response assignments should regulate the dispatch of companies and command officers to fires and other emergency incidents. Response assignments should be predetermined.

Company officers should prepare a standard report giving specified information for each response made by the company. These reports should include the location and nature of the fire or emergency and describe the operation[s] performed. This report should identify the members responding to the incident. The record of arrival time of units at incidents is particularly important for planning and analysis. Companies should report their arrival at the scene by radio transmission.

INCIDENT COMMAND SYSTEM

Emergency incidents may involve operations that vary considerably in their complexity and scale. The control of these emergency incidents depends on the implementation of a very effective fireground management organization.

The extent of this management organization is to accomplish identified objectives. Every fire department, regardless of size, needs a sound system to regulate and direct emergency forces and equipment at both routine and major incidents. The system should form the basic structure of operations, regardless of scale. An effective incident command system should be designed to manage incidents of different types, including structure fires, wildland fires, hazardous materials incidents, medical operations, and other types or emergencies. A model incident command system has been developed to manage all types of emergencies and all sizes of operations. The Federal Emergency Management Agency [FEMA] assisted in the development of this model incident command system.

EMERGENCY MEDICAL SYSTEMS

Many fire departments are involved in the delivery of emergency medical services [EMS] in addition to their other responsibilities. In many cases the EMS activity level exceeds the workload from fires and other types of emergencies by a considerable margin. The resources needed to provide an EMS may include combinations of both public agencies and private organizations cooperating to respond to medical incidents. The local fire department is a natural source of medical aid capability having a sizable body of reliable, trained personnel operating in an existing command structure [ICS], with a communications system and emergency vehicles geographically deployed throughout the community. All fire department members should be trained in the delivery of emergency medical care, preferably to the Emergency Medical Technician [EMT] level, as a minimum.

In many cases the fire department operates as part of a system that includes a combination of public and private sector resources, such as private ambulances transporting patients after initial response and treatment has been provided by fire department personnel. The benefits of an effective ICS are readily transferable to a medical incident. The fire department is often the first to arrive at the scene and the first to establish command.

COMMUNITY RELATIONS

The fire chief should establish and maintain a community relation program.

Due to the nature of public education of the community, the fire chief should personally monitor the program. The overall effectiveness of any community relations program is generally a direct reflection of the administrator's participation in the program. Whenever possible, a staff specialist should be assigned the responsibility for developing and implementing an organized program identifying objectives. The fire department should analyze the community and its subgroups in order to design a plan to develop public awareness and cooperation to manage the fire risk. The inclusion of the general public and the various community subgroups will assist in the solution to the fire protection problem. The fire department should apply special effort to earn the community's attention through a positive community relations program. Such a program should be a continuing effort and should be a persistent, well-planned, and well-organized activity to promote community understanding and appreciation of fire department services.

CODE ENFORCEMENT

Code enforcement is one of the major areas of responsibility for a fire department. The fire chief and building official are given the legal authority and responsibility to establish and maintain fire and life safety throughout the community. Ultimately, the citizens depend on the fire department to ensure that they are protected against the dangers of fire, panic, explosion, and other hazardous conditions and the resulting effects that may occur. Most fire departments adopt one of the model codes that has been developed by private code and standard development organizations. Model codes may be amended to adjust for local concerns and needs. Many communities have determined that certain types of occupancies, or buildings exceeding specific heights or floor areas, should be required to install automatic fire sprinkler systems. Some local governments require automatic sprinklers in all buildings including residential occupancies.

The rationale is to build in the fire protection rather than completely relying on fire suppression services. New advances in automatic sprinkler technology have made systems cost effective in residential properties. Such provisions have a direct impact on the overall life and property losses within the community as well as on the size and cost of providing manual suppression forces. Requirements for the installation of smoke detectors are intended to increase life safety for residents living in apartments, hotels, motels, dormitories, condominiums, dwellings, and other residential property, through early warning.

Smoke detector ordinances should be retroactive for existing occupancies and apply to all new occupancies. Most model building codes currently require detectors in new residential occupancies, but local laws can make smoke detector requirements retroactive in order to protect the health and safety of the community. Properly installed and maintained smoke detectors have been proven to reduce loss of life due to fire. This is cost-effective fire protection, and fire departments should be active in ensuring detector protection is provided in all residential type occupancies. Fire lanes should be required to provide access to structures for fire department vehicles during emergency incidents. Fire lane parking violation ordinances should be developed to keep these access roadways clear. Other fire protection measures such as weed abatement ordinances and dilapidated building removal ordinances should be enacted and enforced as necessary to remove potential fire problems before they become a public danger.

Due to the limited number of full-time fire prevention positions and the responsibility for fire safety, each community must decide what level of service the fire department should provide. Many departments have prioritized inspections based on life safety considerations in order to utilize their inspection staff in the critical areas. Once the priorities have been established, each inspector can work in the priority areas. This allows a community to receive a high level of service for the investment. The fire department should establish an inspection schedule for all properties in the community. Inspectors should have sufficient authority granted by the Township to enforce the provisions of the fire prevention regulations. Inspectors should also be trained to the requirements of Fire Inspector I, II, and III of NFPA 1031, *Professional Qualifications for Fire Inspectors*. The code enforcement staff receives numerous inquiries concerning advanced planning for buildings and subdivisions, technical subjects, and code interpretation. The fire department should provide prompt and complete staff work in these technical areas. The code enforcement staff should also assist fire suppression forces in developing pre-fire plans. Building construction and site plans should not be approved without the consent of the fire department except upon successful appeal to the board of appeals.

Zoning regulations should include provisions for evaluating how buildings and occupancies will affect the fire service demands of the community. Representatives from the fire department should be consulted by the local zoning authority on new proposals, revisions, or exceptions to the zoning regulations. Major use classifications should be established to categorize fire service demands. There should be a local determination based upon size, environmental effects, height limitations, hazardous industrial processes, water supply requirements, and similar contingencies.

Allowances should be considered for the provision of built-in fire protection such as fire sprinkler systems, smoke and fire detection systems, fire standpipes, and compartmentation. Water supply for fire suppression should be established in relation to the fire service demands and should be a part of the zoning requirement. The regulations should provide for a periodic review of zoning regulations to assess changing conditions, and adjust zoning requirements accordingly. The responsibility for enforcement should be clearly established in the zoning regulations. It is desirable for fire officials to have the power to approve or disapprove plans and applications. Penalties with sufficient force to be effective should be established in the zoning regulations.

Building regulations should be adopted that are at least comparable to recognized model codes. There should be an organized building regulations revision process with an established frequency or revision. The regulations should set appropriate requirements or restrictions so that local fire suppression capabilities can meet the community's fire service demand. The fire department should insure that fire protection and safety be part of the building permit application, plans check, approval and certificate of occupancy process. A procedure should be established to obtain the approval of the fire department on all requests for variances and equivalencies that affect fire safety.

The investigation of fires identifies the factors that can be used to lessen the number and severity of fires in the future. Data from fire investigations should be a part of the department's management information system. Fire investigation information is a valuable tool to use in: developing an effective fire prevention program; determining necessary code revisions or additions; identifying public education programs; describing a community's fire problem; and, planning future fire protection needs. All fires should be investigated to determine the origin and cause of the fire. If the fire is determined to be accidental, the investigation should consider methods of eliminating or reducing this type of fire. If the fire is determined to be incendiary or suspicious, then a full investigation must be initiated. A thorough investigation of all incendiary or suspicious fires is a powerful deterrent to the crime of arson.

COMMUNICATIONS

The provision and operation of a reliable emergency communication system is an essential requirement to facilitate the delivery of public fire service.

The nature and extent of the system provided will vary with: the size and nature of the jurisdiction served; the services provided; and, other local conditions and preferences. All communication facilities and equipment should comply with NFPA 1221, *Standard for the Installation, Maintenance, and Use of Public Fire Service Communication Systems.* A fire communication system may serve an individual jurisdiction or multiple jurisdictions. In many cases a regional system, operating under a valid intergovernmental agreement, will provide operational advantages and reduced overall costs as compared with a number of smaller systems serving individual jurisdictions.

EQUIPMENT AND BUILDINGS

The department should maintain a current inventory of all apparatus, vehicles, and equipment owned, leased, utilized, or maintained by the department. A list should be maintained of all requirements for new apparatus and equipment. As a minimum, the listing should indicate specific acquisition requirements for one year ahead and should be projected for a minimum of 5 years in the future. Such projections should be consistent with the department's long-range plan. Adequate reserve vehicles should also be included in all equipment lists.

Following any response, maintenance should be immediately performed to restore the apparatus and equipment to ready status in anticipation of another response. This should include: replenishment of supplies used; restoration of ladders, tools, and respiratory equipment after use; inspection of apparatus and equipment for damage; and, verification that all personal safety equipment is fully operational. Any unsatisfactory condition found should be properly recorded and corrective action initiated. Pumps, aerial ladders, and ground ladders should be tested on a periodic basis and after major repairs. Apparatus testing should include a road performance test and operation of all functions. Ladders should also be tested after any suspected destructive impact, overloading, or destructive exposure to fire. NFPA 1911 *Acceptance and Service Tests of Fire Department Pumping Apparatus*, NFPA 1914 *Testing Fire Department Aerial Devices*, and NFPA 1932 *Use, Maintenance, and Service Testing of Fire Department Ground Ladders*, should be the basis of the test procedures. All fire department hose should be tested in accordance with NFPA 1962, *Standard for the Care, Use, and Maintenance of Fire Hose Including Connections and Nozzles.* In addition, hose should be tested after exposure to freezing and after the repair/replacement of any coupling.

Members of the department should be provided with personal protective clothing and equipment [helmet, protective hood, coat, gloves, self contained breathing apparatus with mask, personal alert safety system, pants and boots] prior to engagement in any fire department response or hands-on training. All equipment necessary to meet NFPA 1500, *Fire Department Occupational Safety and Health Program*, requirements as well as federal, state, or local law should be provided. These standards include: NFPA 1971, *Protective Clothing for Structural Fire Fighting*; NFPA 1972, *Helmets for Structural Fire Fighting*; NFPA 1973, *Gloves for Structural Fire Fighting*; NFPA 1974, *Protective Footwear for Structural Fire Fighting*, NFPA 1975, *Station/ Work Uniforms for Fire Fighters*; NFPA 1981, *Open-Circuit Self-contained Breathing Apparatus for Fire Fighters*; NFPA 1982, *Personal Alert Safety Systems [PASS] for Fire Fighters*; and, NFPA 1983, *Fire Service Life Safety Rope, Harnesses, and Hardware.*

Each fire department should prepare a five, and possibly a ten year plan for future station locations in accordance with the projected growth or service demands of the area protected by the department. In addition, a program should be prepared for any new building needed, including location and land requirements. The fire chief should seek general approval of the program by the governing authority of the fire department. The program should be updated annually and recognized changes in the operation of the department that will affect the building[s] and land required. The general development plan of a community should be reviewed, and future station locations should be identified. Fire stations should be designed to conform with the surrounding neighborhood and meet the service demand in terms of space for apparatus and personnel. When planning sites for new fire stations, adequate land should be provided for parking and other needs. Floor space requirements should be determined recognizing current and projected future needs. The requirements for floor space of apparatus can quickly exceed those originally provided as additional responsibilities are assumed by the fire department such as EMS or hazardous material control services. Apparatus and equipment storage space may become a significant requirement. Nonslip flooring should be provided on apparatus floors to permit the cleaning of vehicles and equipment inside under safe conditions. Fire department buildings should be fully protected by smoke detectors and an automatic sprinkler system. Fire departments frequently have to recommend protection for other important privately and publicly owned buildings in the community. Installing such a systems in a fire department facility not only sets a good example, but provides reliable protection for an important community facility. In addition, a system in a fire department building can be used for the training of fire fighters.

In evaluating buildings, due consideration should be given to the requirements for training. Requirements for: classroom space; telecommunications capabilities; utilization and storage of audiovisuals and written materials; and, personal study space within the fire station, should be specified. Training facilities should include: adequate classrooms; lecture halls; conference rooms; library and study rooms; assembly areas; and, audiovisual facilities for the needs of the fire department. A classroom or similar lecture facility for in-service or continuing education training should be available within every fire department. In addition, the department should have access to training facilities for: ground ladder training; live smoke and fire training; flammable liquid fires; pumping and drafting operations; and, apparatus driver training. [The training facility discussed here is for training members of the fire department separate from the training and drill work done at fire stations.] NFPA 1402 *Building Fire Service Training Centers*, should be used to design a proper training facility. The facility should include: one or more drill towers; buildings in which actual fires can be set and rescue operations performed; classrooms; laboratories; and, administrative and storage space. A training center should include an appropriate selection of built-in fire protection equipment including: smoke detectors; automatic sprinklers; standpipe systems; fire pumps; tanks; and, other equipment with which fire department personnel should be familiar. Paved areas should be provided for apparatus driving instruction.

The fire department requirements for vehicle maintenance facilities should be determined. In a department with a few of vehicles, a small maintenance area in the apparatus area of the fire station may be appropriate. Larger departments may require a fully equipped and staffed facility for apparatus and equipment maintenance and repair. Departments with a few vehicles may find it advantageous to have vehicle maintenance work performed by qualified contractors or in a consolidated municipal vehicle repair facility.

Routine maintenance procedures should be established for all fire department facilities including land and buildings. The procedures should cover paving, grass, and other areas, including proper drainage. They should cover the building structure's exterior and interior finish. They should be appropriate for each major item of building equipment, including plumbing, heating, and air conditioning. Maintenance expense should be identified for the fire department budget. Smaller departments may find it advantageous to have qualified contractors perform some maintenance procedures. If fire department personnel are used on maintenance, such personnel will have less time for important fire department activities, such as training, pre-fire planning, and fire prevention.

MANAGEMENT OF WATER FOR FIRE PROTECTION

The fire department should establish minimum fire flow requirements for representative structures and locations in the municipality as a part of fire risk evaluation and pre-fire planning. The fire flow requirements are based on estimates of the number of hose streams required at a given location for unprotected structures and the water flow allowance for sprinkler protected properties. The fire department should pre-determine fire flow requirements for proposed construction projects. Through coordination with the building inspection department, satisfactory plans for provision of such flows should be a condition of authorization to issue a building permit. Significant reductions in required fire flow can often be achieved by the installation of an approved sprinkler system throughout the building.

The fire department should have standard operating procedures outlining utilization of available water supply, taking into account any weaknesses or deficiencies. Where deficiencies are identified, the fire department should plan to supplement the weak supply through the use of large diameter hose and/or response of mobile water supply apparatus.

In general, the fire department does not have any responsibility for the design, installation, maintenance, or operation of the water systems from which it must obtain water for fire fighting operations. The fire chief or his representative should determine water supply demands in new residential and commercial districts. For operations outside the water service area, the fire department should provide portable pumps and mobile water supply apparatus with water tanks. It should also develop the necessary operating practices to effectively utilize water supplied by such equipment.

The fire department should be familiar with franchise and contract provisions of utilities that affect its operations. The fire department should act through appropriate administrative channels to see that any needed revisions of franchise or contracts are made whenever such franchises or contracts are renewed.

The fire department should have authority for the approval of hydrant design and installations. This should include the size and type of hydrants, number and size of outlets, and the threads used; as well as approval of each specific hydrant location and installation. Hydrant placement should reflect the hazards of the locality and the needs of the fire department in dealing with those hazards.

Fire hydrant locations should be clearly marked and maintained so that each hydrant location is visible and accessible at all times. Hydrant barrels may be painted with reflective paint for nighttime location. Reflective markers can be placed in the middle of the street opposite hydrants to assist in nighttime location or in daytime location if hidden behind parked vehicles or other obstacles.

Each hydrant should be marked to provide engine operators with an idea as to available flow. NFPA 291, *Fire Flow Testing and Marking of Hydrants*, explains a method of conducting flow tests and a marking scheme using colors for tops and caps to indicate flow. Flow data on individual hydrants is principally of value in weak areas of a distribution system and on dead-end mains to alert officers and engine operators to very limited flows.

All hydrants should be inspected and tested at least once per year, preferably twice per year, and after use at fires if problem related to hydrant performance were experienced. If not inspected and tested by the water utility, the hydrants should be inspected and tested by the fire department. Where problems or deficiencies are identified, the fire department should file a report with the water utility asking for specific relocation, repairs, or other adjustments to correct the problem. American Water Works Association Manual M-17, *Installation, Field Testing, and Maintenance of Fire Hydrants*, can be helpful in this process. The fire department should be notified by the water utility whenever any fire hydrant is placed out of service or returned to service. The fire department should post the information so that all members are aware of this important information.

Private fire connections are the connections from public utility street mains that are made to individual properties to furnish water for fighting fires. The simplest connections serve sprinkler or standpipe systems. More complicated situations feed private underground yard systems and hydrants or storage tanks providing a private fire pump supply. The fire department should know how water systems in individual properties supplied by private fire connections may be employed most effectively in fighting fires and should have the authority for approval and general supervision of private fire connections. The water utility should inform the fire department whenever a connection is made to supply fire protection systems in a specific property and to furnish detailed plans of the connection to the fire department. The fire department should approve any fire department connections provided in private systems.

The fire department should maintain a file of records or plans of the piping and valves in all connections to water utility systems for fire protection of specific properties. It should inspect such connections at the time of installation , when changes are made, when pre-fire plans are being made, and at other times as necessary or at least annually. Particular attention should be given to pumps supplying sprinkler and standpipe systems. The fire department should require managers of properties with private fire protection systems to notify it when any of the valves controlling private water supplies have to be closed for repairs, extensions, or other reasons. Mangers of industrial and other properties with extensive yard systems of private piping for fire protection usually require employees to notify the officer in charge of loss prevention in such cases. In such plants, notification of the fire department should provide a valuable supporting service to plant protection as the fire department can develop contingency plans to support the fire protection in the impaired areas in case of a fire. Plants without an official assigned to fire loss prevention should be asked to require maintenance personnel to notify both plant management and the fire department of system impairments.

The fire department should continually emphasize the need for the installation of sprinkler systems and other forms of private fire protection through education programs, press releases, and liaisons with special interest groups within the municipality. Some large occupancies present uncontrollable fire potential if they are not protected by automatic sprinklers. Some occupancies are serious life hazards without sprinkler protection. Fires in tall buildings are extremely difficult to fight if the buildings are not fully sprinklered. Reductions in insurance premiums for fully sprinklered buildings are often sufficient to recover the expense of the sprinkler system over a period of several years. Automatic alarm signals from built-in detection and suppression systems provide early warning and enable earlier fire department response. The installation of such systems should be encouraged where alarm receiving facilities are available or can be provided.

The fire department should study alternate sources of water supply, in the event of a major disruption in public water supply capabilities. Water is available from natural lakes and ponds, streams, and rivers. To make them available for fire engine intake, these sources may require that dry hydrants and piping be installed or that driveways, ramps, or platforms be provided. It may also be possible to obtain water from swimming polls, decorative pools, stock tanks, private ponds, or storm drainage systems.

Written agreements should be signed with the parties concerned where the auxiliary water sources are privately owned or under the control of a separate public authority.

HAZARDOUS MATERIALS

The storage, use, transportation and disposal of hazardous materials and hazardous wastes have been recognized as significant risks in most communities. To effectively manage these risks requires expertise and specialized capabilities. In many cases the fire department has been assigned as the primary or lead agency in protecting the community from these risks. The responsibility for managing the community hazardous materials program requires extensive interaction with other agencies on the local, regional, state, and federal levels, organized planning groups, and private sector organizations. The fire department should be directly involved, as either a lead or participating agency, in the process of gathering and organizing information, identifying risks, planning for hazardous materials emergencies, and regulating the storage, use, transportation, and disposal of hazardous materials and hazardous wastes.

All fire department members should be trained to recognize and deal with emergencies involving hazardous materials. The level of training for individual members should depend on the role they are expected to perform in dealing with a hazardous materials incident. The training level should be derived from established and recognized levels as described in NFPA 472, *Professional Competence of Responders to Hazardous Materials Incidents*. To safely and effectively manage hazardous materials incidents, fire service personnel must be properly trained and equipped and have access to resources beyond those used for fire suppression. These considerations include specialized protective clothing and breathing apparatus, disposal containers, neutralizing agents, monitoring equipment, reference materials, and communications with other agencies and sources of information that may be needed in the event of a leak or spill. The fire department should have an inventory of and specific information on the hazardous materials that are stored or used at each fixed location in the community. This information should include MSDS, plans, and diagrams, information on potential sources of leaks or spills, and appropriate intervention strategies to be employed in predictable situations. The fire department should adopt SOP's for these incidents that integrate with ICS and other types of incidents.

Pre-incident plans should be prepared for specific occupancies. The planning process should be coordinated with community and private sector planning processes that are implemented to meet legal requirements. These plans should include evacuation plans, intervention strategies, sources of expertise, and specialized assistance and disposal plans. The planning process should clearly identify the fire department as having incident command responsibility during hazardous materials incidents. Hazardous Materials response teams should be established in jurisdictions with significant haz-mat risks. The establishment of a hazardous materials response team requires a significant commitment in terms of training, equipment, and medical support. Where the fire department lacks the necessary resources to fully support and operate a hazardous materials response team, alternatives such as regional teams and private sector support should be evaluated.

EMERGENCY MANAGEMENT

The fire department should be involved in planning for emergencies that go beyond the scale of major fires and have the potential to exceed the resource capabilities of a particular jurisdiction. Emergency management is a complex subject that goes beyond the scope of this document. The information provided in this section is intended only to describe the basic components of emergency management. Emergency management is usually considered in four phases: mitigation, preparedness [including planning], response, and recovery. These phases are commonly known as comprehensive emergency management. The fire department is involved primarily in preparedness and response.

MANAGEMENT REPORTS AND RECORDS

Records must be maintained to satisfy legal requirements as well as providing the data base from which management reports are generated. Information should be collected that satisfies requirements and provides useful data for decision making. A records system should support the management of the department by providing the chief and other officers with data that indicates the department's effectiveness in preventing, suppressing, and investigating fires. The system should provide data for reports on department activities, accomplishments, and future planning.

The fire chief should base reports to the township officials and to the public on these records. It is necessary to do more then just collect data. It should be analyzed and interpreted in relation with other statistics and factors. Training for use and interpretation of data by department personnel should be included when a reporting system is implemented.

The fire chief should review legal requirements relating to reporting and retention of records and specify the records to be kept and the method[s] of gathering data. All records should be examined for their usefulness and effectiveness to assist management. Records should be kept only for a valid management or legal purpose. A records retention and disposal system should be instituted. The use of computers has enhanced the recording keeping functions in many fire departments. Computers can enhance the quality of the data in the file by editing the data as it is entered. They also allow for a quick retrieval of specific records or data, easy summarization of data into management reports, and the ability to cross-tie information between files; e.g., incident data and inspection data.

Reports on emergencies are essential to providing an accurate record of a department's activities. Reports should outline conditions encountered at an emergency and all actions taken by the department to control the condition. They should serve as a basis for determining incident responsibility. Reports also serve as a basis for determining local, state, and national fire trends and establishing the needs of a fire department. Each fire company should record necessary information on each response. The officer in charge of each alarm should collect the company information and consolidate the data in them that applies to a particular alarm of fire. This should be the basic record summarizing the operations of the department. From these reports, information should be available for daily, monthly, and annual reports of the work of the department. When a fire occurs in a building, the report of the officer in charge should cover operations of the department, investigation of the fire, and details to the loss incurred. If subsequent data is collected as a result of additional investigations by members of the department, it should be added and filed with the report. A system should be developed to provide accurate fire loss data. Providing fire suppression officers with training in loss determination and developing working relationships with public loss adjusters are elements of a system. A fire record journal should be kept to provide a chronological record of all fires and alarms. The journal should include the date, time, location of the incident, the names of persons sustaining a loss, together with a brief description of the incident.

The status of fire department operations should be periodically summarized. For many department, a monthly frequency is adequate. The report should summarize the department's work for the period. It should be arranged to present information for convenient review by the fire chief and other administrative officers, by staff bureaus, and by any municipal executive or governing board. This report should classify alarms and total losses, using the best figures available. Fires and inspections should be tabulated according to standard occupancy classes so results can be compared with the current year to date and the same period of the previous year. Similar comparisons should be presented on the work of each fire company and the work of the various staff bureaus.

Personnel information, particularly on absences and details to other duties, should be separated to assist in decision making to maintain adequately staffed fire companies. The fire chief should submit an annual report to the administrative head of the township. The annual report should include a complete summary or the department's periodic reports as well as a discussion of department policies, important changes during the year, and recommendations of the coming year. An annual report for general circulation to the citizens and other concerned individuals may be desirable. This annual report should be prepared for public information purposes and should present an accurate picture of the community's fire protection in a concise manner.

PART II

SCIO'S BACKGROUND/HISTORY

Prior to creating the Scio Township Fire Department on July 1, 1988, the Dexter Areawide Fire Department supplied fire protection for Scio Township. During the year prior to the establishment of the Township's new fire department, an exhaustive search was undertaken to find the right individual to lead the new department. Wil Dane, who was selected for this position, had an extensive background in the fire service: eight years as a fire fighter/EMT with the Summit Township Fire Department in Jackson, Michigan; one year as a coordinator with the Division of Continuing Education at Louisiana State University through their Firemen Training Program; five years as Chief Administrative Fire Marshal of the Enforcement and Investigation Division of the Louisiana State Fire Marshal's Office; and most recently 18 months as the Fire Chief for City of Three Rivers, Michigan. The chief was given a mandate, to have a fire department operational in six months. Failure would mean the township would be without fire protection. The new chief began official duties on December 7, 1987, and for the next six months, the arduous tasks associated with building the new department and complying with the township's edict was achieved.

On December 15, 1987, proposed rules, regulations, and operating guidelines for prospective members were adopted by the township's Board of Trustees. The next order of business was to recruit, interview and select a sufficient number of prospective members to begin a state sponsored training program on January 11, 1988. This was accomplished and 30 recruits began training to become fire fighters. Only 40% of those who entered the program completed it. In addition, seven residents of the Township who were also full time members of the Ann Arbor Fire Department, and three members of the Dexter Areawide Fire Department who were originally recruited to staff the Scio sub-station, were recruited as members.

On July 1, 1988 the Scio Township Fire Department went operational. The department had 22 members and owned three fire trucks which were all housed at its headquarters station, constructed in late 1986 and early 1987 on Zeeb Road. At the present time the Scio Township Fire Department has 21 members, although there have been many personnel changes throughout the years. It operates out of the same headquarters fire station with four fire trucks, as a new brush truck was added to the fleet several years ago. Even though the fire department looks as it did eight years ago, the Township has changed considerably. Based on figures supplied by the Township's Assessor, there have been approximately 1000 new buildings added to the Township's countryside over the past eight years. However, this figure does not include this many new mobile homes, nor does it include additions to commercial and industrial facilities. A clear increase in population has occurred. Recent reports have Scio's population at approximately 150% of what it was reported as being when the fire department went operational. This increase in life and property is being protected with the same equipment as it was in 1988, with one exception; the fire trucks are eight years older.

The fire trucks of Scio Township consist of one certified pumping truck [Engine-1], two non-certified pumping trucks [Tanker-1 and Rescue-1] and a brush truck. Pursuant to the National Fire Protection Association's [NFPA] standards on fire apparatus, a certified pumping apparatus must have a minimum of a 500 gallon per minute [gpm] pump; be able to pump 100% of its rated capacity at 150 psi, 70% of its rated capacity at 200 psi and 50% of its rated capacity at 250 psi; a hose bed of at least 55 cubic feet; and a water tank of at least 300 gallons. Scio's Engine One meets this criteria. The tanker has a 450 gpm PTO pump but is plumbed so that it will only pump approximately 308 gpm from tank or draft. The rescue truck has a 250 gpm PTO that will pump its capacity.

This is why the Scio Fire Fighters consider themselves "the best one truck department in the nation." Scio's Engine-1 is its only rated fire truck.

Of the 21 members of the fire department, 100% are certified Fire Fighter I, over 90% are certified Fire Fighter II and 71% are licensed Emergency Medical Technicians. One hundred percent of the command staff is certified Fire Officer I, 83% are Fire Officer II, and 67% are Fire Officer III. The department offers a one night per week training program, with the exception of June through August when training is held only two nights per month. Three of Scio's members are state certified fire instructors and two more are provisional instructors. The chief is a certified instructor advisor. The fire department membership is proud of our training program, and feel it is second to none in the area. We believe Scio Fire Fighters receive more training than many full-time members of paid departments. Another accomplishment we are proud of is the fact that we seldom have a total loss fire in a building. The two largest were abandoned buildings which after a risk analysis by the incident commander, were considered too great a risk to township firefighters to mount an aggressive interior attack. This caused a defensive strategy and the buildings were lost.

FIRE FIGHTING STRATEGIES

In order to have a fire, three materials must be combined in sufficient amounts: heat, fuel, and oxygen. To extinguish a fire, one of four things has to happen: remove the air, remove the heat, remove the fuel, or inhibit the fire's chain reaction. Many people think that water applied to a fire removes the air. This is not the case. Proper water application removes the heat and it does this by converting the water to steam through absorbing the BTU's the fire produces. To bring one pound of water from 70° F to its boiling point [212°F], 142 BTU's are necessary. When water has reached its boiling point, 970 additional BTU's are needed to turn it into steam. Proper water application is important as sufficient water must be applied in order to absorb the BTU's the fire produces. If not enough water is applied, the total BTU's are not absorbed and the fire will continue to increase. A pound of wood gives off approximately 700 BTU's when it burns. However, a pound of plastics gives off approximately 2100 BTU's. In the past few years plastics have replaced wood as the core of those things we surround ourselves with. That is why today fire departments ask for larger; hose, capacity pumps, diameter and/or capacity nozzles, etc.

Another very major reason is the building industry. Evolving over the past few years has been the predominate use of lightweight construction; utilizing primarily lightweight floor, ceiling and roof trusses. This type construction is one of the sturdiest to be found and supposedly has kept the cost of housing affordable. However, fire suppression forces don't deal in construction; they handle destruction. Furthermore, a distinct characteristic of "truss" construction is it's design as a unit; when one member fails, so does the entire system. Many fire fighter deaths are attributed to the sudden failure of lightweight truss construction. A rule of thumb when dealing with lightweight construction involved in fire, no matter whether it is wood or steel, is that after ten minutes of flame contact the construction will fail and the building is subject to sudden collapse. This is important to discuss so that it is easier to understood why fire departments require access to buildings, request additional hydrants strategically placed, and advocate the addition of automatic suppression systems. All of these items make us more efficient and safer in our operations.

EVALUATION TOOLS

Fire suppression is one element of fire protection. Suppression includes all actions and activities that are designed to control or extinguish fires once they have started. Suppression capability is an expression of how much firefighting power can be put into action when there is a fire. It includes the amount of apparatus, equipment, and personnel available; the time needed to respond and place equipment in action; the water supply; the application of strategy and tactics; the level of training; and all of the components that add up to effective fireground operations. The fire department is often the last line of defense between what is expected and what actually happens.

Determining suppression capability is important to a community for planning purposes. When the suppression capability is compared with the risk, it will reveal either a balance or an imbalance between the two. Ideally, the amount of suppression capability should just balance the identified risk, indicating that the fire department's forces are adequately staffed, trained, equipped, and capable of dealing with the predictable fire situations in the community. It also may reveal, that a community is overprotected, that is it has more fire suppression capability then required to match the identified risks.

If the fire department has more capability than it needs to do its job, resources are being wasted. In most communities however, results are more likely to indicate that there are locations in the community where the risk exceeds the capability of the fire suppression forces. There are predictable fire situations that cannot be adequately handled by the available fire fighting resources. This is known as "unprotected risk." Unprotected risk is the imbalance that exists between the amount of risk and the suppression capability.

While we cannot predict when a loss-producing event will occur, we can with some degree of certainty say that it is more likely to occur in one building than in another. Determining the needed fire flow for a building is one of the most basic and useful tools a fire manager can utilize in developing a strategy for a building fire. Fire flow is the amount of water needed to extinguish a fire in a building. Fire flow is always given in gallons-per-minute [gpm] and should be available for a fixed period of time.

GPM delivery capability is a method of expressing suppression capability in terms of gallons of water per minute that can be effectively applied by the fire fighting forces. While gpm delivery capability is not an all-inclusive expression of fire suppression capability, it provides a standard measure that can be applied to a variety of situations. This allows a direct comparison with the gpm demand expression that may be calculated for target hazards. The needed fire flow allows the fire manager to study resource needs in terms of personnel, water supply and apparatus before the incident. In most cases the fire flow calculated exceeds that which is really needed to control the fire; however, a margin of safety is considered necessary under most circumstances.

The best method for calculating fire flow in the fire service today is based upon the Insurance Services Organization Guide for determination of required fire flow, and is recommended by the National Fire Academy whose staff was responsible for its development. They were able to simplify a formula for use in the field by fire service personnel. For fire risk analysis purposes, accurate completion of the formula is essential in determining the needed fire flow for a building.

Starting with a calculated fire flow demand for the location under consideration it can be determined how well the fire fighting force can deliver the calculated fire flow. The suppression capability evaluation is based on two separate assessments of fireground operations; initial attack evaluation and sustained attack evaluation.

Initial attack evaluation examines the fire department's ability to respond quickly and place an aggressive offensive attack into operation. Sustained attack evaluation is based on the fire department's ability to launch a heavy defensive fireground operation. In either case, the evaluation is based on an effective gpm flow rate that can be applied.

250 Pel - Pel

Table 1: Target Hazards [shown in GPM]

	Fire Flow		Risk	
	Init.	Sust. Req.	Protected	Unprotected
Cambridge Club Apts.	700*	5500	1650+	3850
Parkwood Condos.	700*	3500	1650+	1850
Inland House Restaurant	700*	1750	1650+	100
Honey Creek Shp. Cntr.	750*	4500	1650+	2850
Belmark Lanes	750*	5000	1650+	3350
Jim Bradley Pontiac	750*	4500	1650+	2850
Allied [Warehouse]	750*	7500	1650+	5850
Several Avg. Dwellings	750*	1500	1650+	-00-
Several Avg. Dwellings	625**	1500	1250++	250
Several Avg. Dwellings	625**	1500	500+++	1000

*Based on Engine-1 operating in a hydrant district.
**Based on Engine-1 operating from tank in a non-hydrant district.
+Based on defensive operation in a hydrant district.
++Based on defensive operation in a non-hydrant district from draft.
+++Based on an average mutual-aid tanker pumping to Engine-1 from their tank in a non-Hydrant District.

A relatively small initial attack flow may be able to control a fire before it requires a much larger flow if it is provided quickly. Initial attack capability is known as the amount of water in gpm that can effectively be flowing utilizing fire department personnel and hand lines within ten minutes of receipt of the alarm. However, if the fire exceeds this effective initial attack capability, the fire can be expected to grow.

The measurement of suppression capability must include both initial attack operations and full scale fire fighting operations. The measurement must also include not only the ability to apply water to the fire but also the ability to engage in search and rescue, forcible entry, ventilation, preservation of property, and any other additional support activities required by the situation.

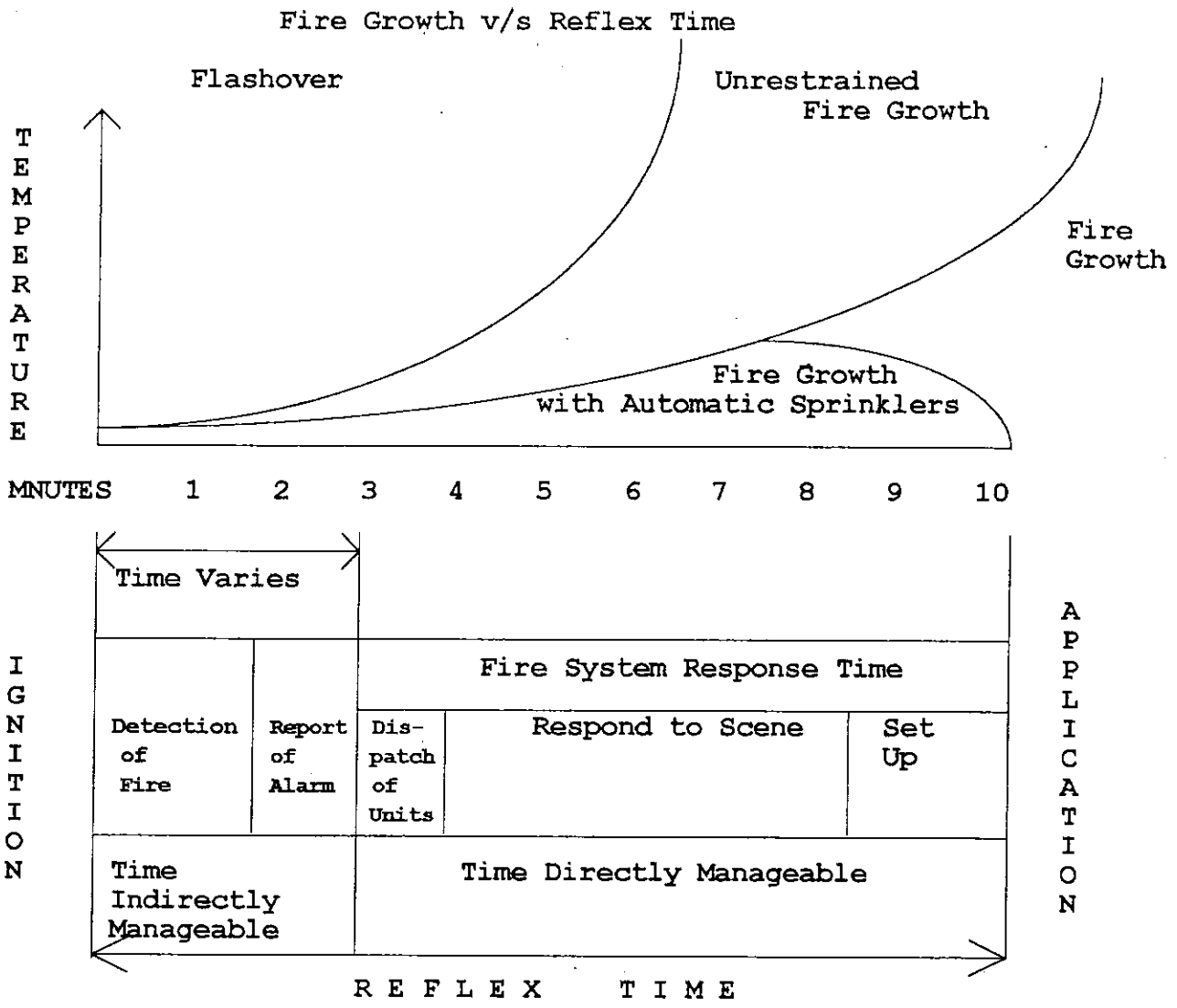

Figure 1, illustrates the relationship of the growth of a fire, from ignition to application of extinguishing water, and the normal response and set-up of fire fighting personnel.

Thirty minutes is used as the basic time frame for measurement of the fire department's ability to provide the full gpm fire flow for a particular location. This reflects a time that permits the initial attack force to arrive, begin operations, call for reinforcements and then allows time for the additional units to respond and get into action themselves. This thirty minute time frame is a simple reflection of reality, since a fire will continue to grow until the fire suppression force is successful in overcoming it or until the fire burns out because it has devoured all of the available fuel. An inadequate initial attack will allow the fire to grow to fully involve the defined fire area, requiring a sustained attack.

The full gpm flow demand is based on maximum involvement of the fire building. An evaluation of fire suppression capability can provide a measure of how well the fire department is prepared to engage in effective fireground operations. While this is highly dependent upon the resource levels of a department in terms of personnel, apparatus, equipment and response times, it also reflects on the training and standard operating procedures employed. Adjustments to the apparatus and equipment and in the numbers of personnel, their training level and procedures in place may substantially improve a department's performance.

TIME-TEMPERATURE CURVE

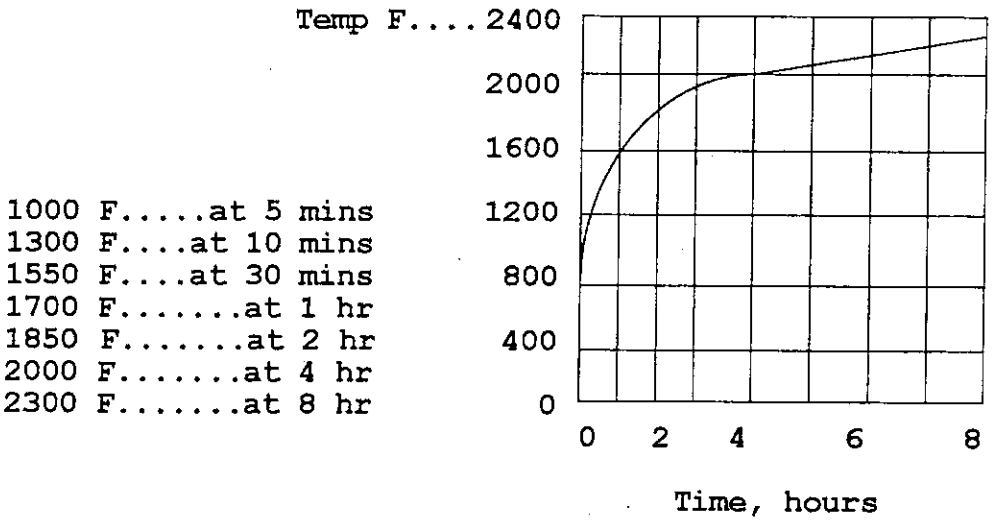

Figure 2, illustrates the Standard Time-Temperature curve.

The standard time-temperature curve is somewhat near the maximum representative of the severity of a fire completely burning out a building and its contents. After the adoption of the time-temperature curve, fire tests were conducted on buildings. These buildings were allowed to burn to destruction to determine the actual fire behavior of the buildings, compared with the conditions represented on the curve. The tests showed that while the temperature rise during the initial stages of the test were more rapid than that represented by the standard time-temperature curve, over-all results indicated that the curve approximated the maximum fire severity of the actual tests.

Table 2: Standard Time-Temperature Curve For Controlled Fire Tests

Time hr:min	Temperature oF
0:00	68
0:05	1000
0:10	1300
0:15	1399
0:20	1462
0:25	1510
0:30	1550
0:45	1638
1:00	1700
2:00	1850
3:00	1925
4:00	2000
5:00	2075
6:00	2150
7:00	2225
8:00	2300

Illustrates the temperature in the test buildings at various times during the test.

RISK ANALYSIS

Risk analysis at a fire scene determines whether or not the risk to the operating personnel outweighs the benefit of saving a life or property. This many times causes the Incident Commander [IC] to change the incident strategies. There are three modes in which a fire suppression crew operates: offensive, defensive and transitional. In order for the IC to determine whether to go offensive or defensive, they must be able to determine whether or not the gpm capacity of the crew/apparatus/hose configuration is sufficient to absorb the BTU's being produced by the fire. Of all the restraints placed on the IC, the most basic is the amount of fire which can be attacked with the gpm flow available. If the available flow is equal to or greater than the need, an aggressive offensive attack can be mounted. If the flow requirement exceeds that which can be provided, a defensive posture must be assumed. If the action plan implemented by the Incident Commander includes an aggressive offensive attack and this plan is not successful in acquiring control shortly, the fire will continue to enlare allowing the flow rate to be greater than the application capability.

At this point, the mode of operation must be changed from offensive to defensive. When this happens, it is know as a transitional mode, and it is essential that everyone operating on the fireground is made aware of this and a tremendous amount of coordination is required to make it happen quickly and safely.

When having to move through a transitional mode from an offensive to a defensive mode, the IC's knowledge, through experience, training and education is taxed. The single biggest reason for this operational mode change is because the action plan of the IC did not work. Now, "plan B" has to be implemented and the IC has to determine how to effectively deal with a fire condition that is growing more and more out of control.

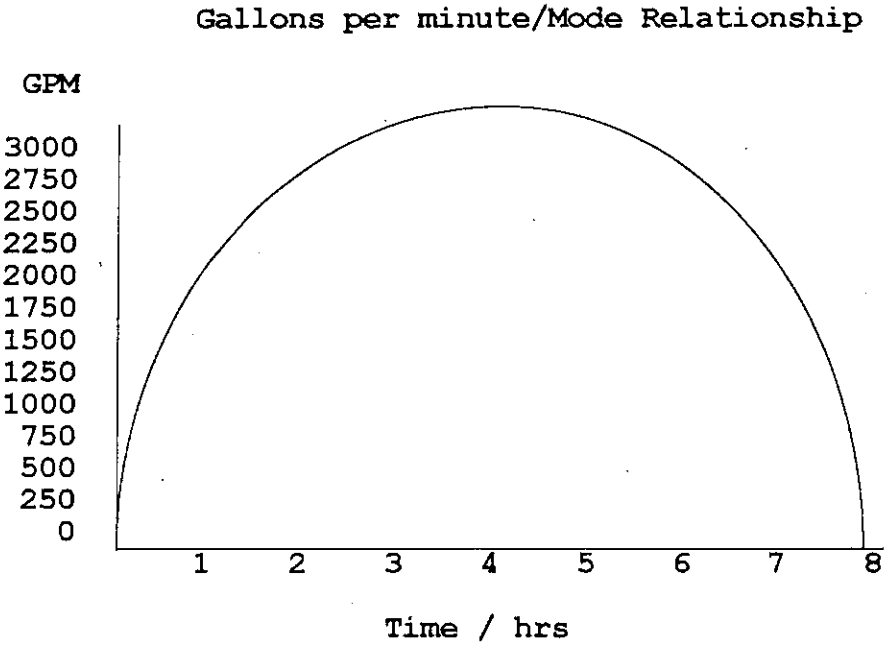

Figure 3, illustrates the gpm required to control a fire over a prolonged period of time. As the fire enlarges, it will continue to consume the building eventually devouring available fuel. As this occurs, the available fuel diminishes to a level that lesser a gpm will bring control.

One purpose of this report is to provide information to evaluate the fire service needs, both current and future, of Scio Township. To do this requires determining the risk to the Township and the protection capability of the fire department. Once these are determined, the protected and unprotected portion of the risk can be identified.

Risk is the potential vulnerability to fire with the possibility of loss, injury, disadvantage or destruction. Risk is measured by determining what can be destroyed by fire and the consequences of that fire in terms of property, life, and community loss. If the stated risk is deemed unacceptable, then apparatus and equipment, staffing levels, public education programs, and conditions such as codes and regulations should be enhanced to reduce the unprotected risk.

From the viewpoint of the fire department, unprotected risk exceeds the service delivery capability of the fire suppression forces available to the community. [It is worth noting, that the fire service definition of unprotected risk is much different then the one used by the insurance industry. The insurance industry refers to a non-sprinklered occupancy as an unprotected risk.] The identification of unprotected risk leads directly to the primary question: How much risk is the community willing to accept? Acceptable risk is an expression of how much unprotected risk the community is willing to tolerate. Acceptable risk also includes the amount of acceptable loss.

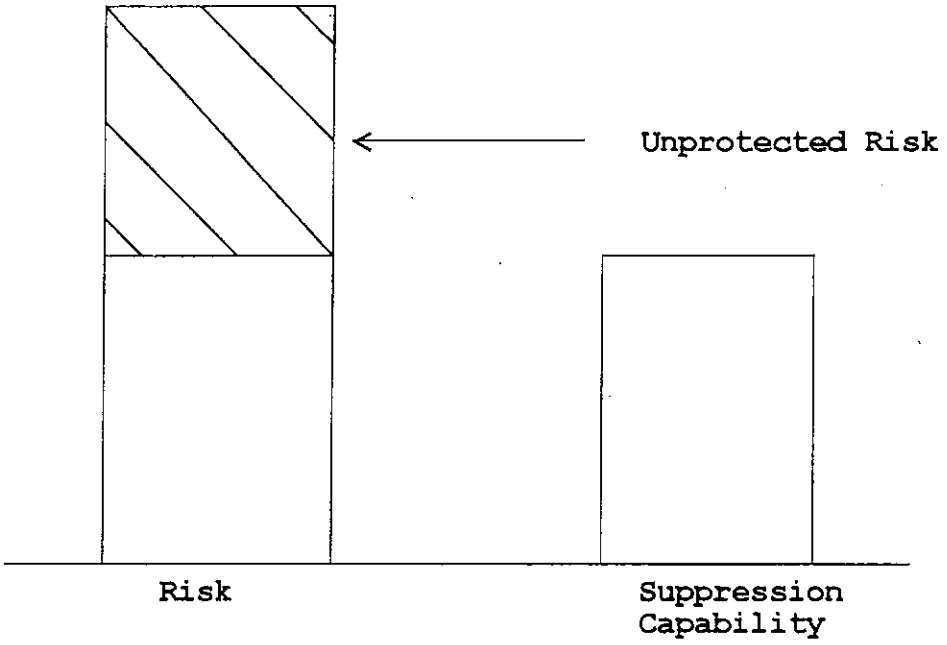

Figure 4, illustrates the relationship between the departments suppression capability and the risk it is to protect. When the gpm required to control a fire in the risk exceeds the suppression capability of the department, the unprotected portion is called the unprotected risk.

Usually the relationship between unprotected risk, acceptable loss and the cost of increasing suppression capability are not well understood because the choices have never been specifically stated. In order to examine the acceptability of unprotected risk one needs to ask the question: Is this risk representative of the entire community? The unprotected risk may be one unique location in the community. On the other hand, there may be numerous locations that reflect a similar risk level. Whether or not the level of unprotected risk is consistent within the community may influence its willingness to provide public fire suppression. The level of acceptable risk has implications in terms of life safety, property protection and community consequences.

The goal of any fire protection manager is to minimize the imbalance between risk and suppression capability. Although it may be impossible to eliminate the risk caused by a catastrophic series of events, it is possible to prepare for the situations that are predictable.

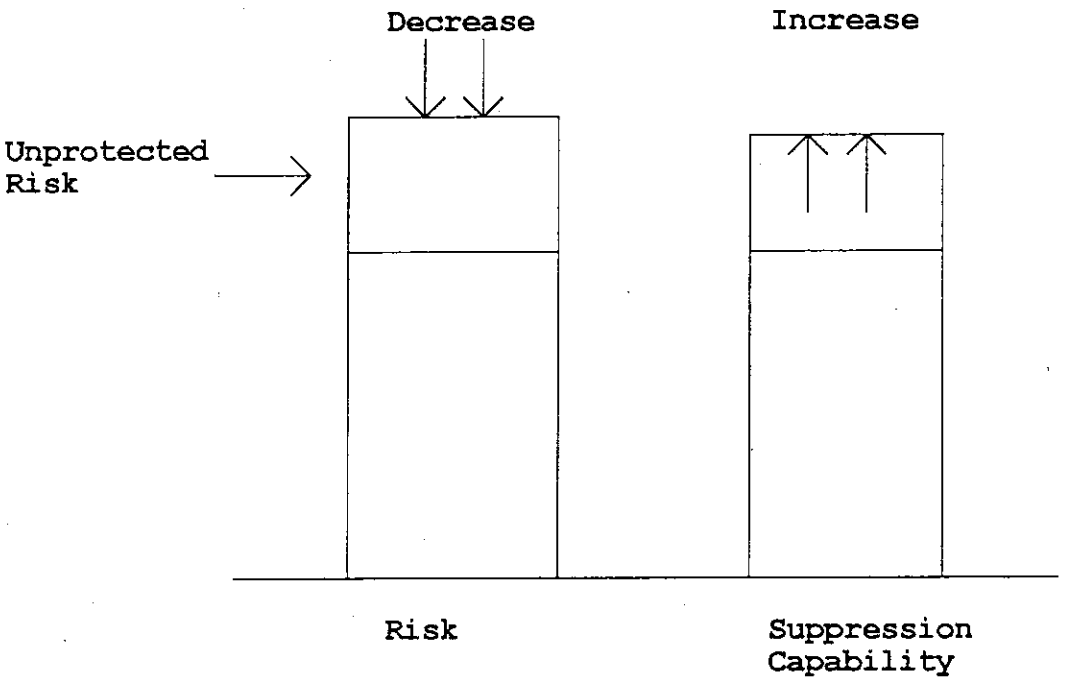

Figure 5, illustrates the imbalance between risk and suppression capability and how changes in suppression capability or changes in risk can create a balance.

The imbalance between risk and suppression capability is affected by changes in suppression capability or changes in risk. Areas of potential improvements exist on both sides of the equation. Suppression capability can be improved in a number of ways: more personnel, better training, improved strategy and tactics, new apparatus, different fire station locations, mutual aid, automatic aid, improved communications, or a better water distribution system. The risk is affected by changes in building and fire codes, educating the public, convincing property owners to make voluntary improvement, combating arson, and by aggressively and consistently enforcing existing codes and ordinances.

It is not always possible for the fire protection manager to make improvements in every area. The areas of potential change are effected by budgets, politics, laws, legislation, public pressure, awareness and acceptance, as well as effective management policies. The first step, is the identification of the available alternatives after the specific problem has been identified.

The purpose of conducting a risk analysis and suppression capability analysis is to identify the area[s] of imbalance and to point out the problems that must be addressed. Only with an understanding of the problem[s] can we accurately begin to focus on a solution.

ANALYSIS OF SCIO'S CHALLENGE

The mission statement for the Scio Township Fire Department is, "*In any emergency, at any time, the absolute best service we can provide.*" Yet, it's even more far reaching than "in any emergency", it includes all aspects of the department's operation. The Scio Township Financial Report of March 31, 1996 reveals that of the four major general fund expenditures by function, fire is the only function that shows a funding decline over the past three budget cycles. In contrasting this information with the Township's financial report of budget year 1995, the 1996 fire department expenditures were $33,000.00 or close to 13% less than in 1993. Throughout this time not one fire department program was discontinued; all programs were enhanced and in fact, new ones were and still are being added. Recently, fire department staff examined Fire Department Budgets of 24 municipalities throughout Michigan, with approximately the same SEV's as Scio Township. Of these, Scio Township ranked 24th in budget appropriation.

Members of the Scio Township Fire Department believe they have been living "on the edge" since the department went operational. And, for the most part they think their greatest shortcoming has been "we've done to good a job." Their question has been, "how much longer can we be asked to do so much, with so little?" and "is it really worth it when at any time we may be asked to place our lives on the line, knowing full well the community's expectation, exceed our capability."

The economic outlook for the township is promising. We've had an ever increasing SEV and population due to new construction and it seems there will be more of the same in the future. However, the fire department is protecting the whole of Scio Township with the same equipment and essentially the same protection level it was when it went operational in 1988.

In 1994 the fire department was 21.8% of the general fund expenditures, in 1996 it was 15.9%. With an 11.8% increase in the total general fund expenditures during this period, it's easy to determine that the fire protection needs of the township have not kept up with the service demand. If extenuating circumstances such as budget shortfalls were to blame, funding deficiencies would be more understandable and easier to "sell" to fire department personnel. However, this is not the case.

Earlier it was stated that fire protection is considered to be a local government responsibility, and the local governing body should adopt a statement of purpose that includes the types, scope and level of service that are to be provided by their fire department, and should delegate authority to the fire chief and other officers to manage and operate the fire department. This has not been done, and suggests the need to develop a Fire Protection Master Plan for Scio Township. Master Planning requires three criteria be met:

1. support of the board,
2. sufficient Township staff resources to complete the task, and
3. adequate funding for the project.

The Federal Emergency Management Agency, through its National Fire Academy, has developed a detailed process for a community to develop a fire protection mater plan. Fire department staff attended a one week program on this subject and are prepared to work with a committee desiring to bring a Scio Township Fire Protection Master Plan to fruition.

ASSESMENT OF SCIO'S NEEDS

For years our training has taught that any interior attack of fire needs a back-up attack/rescue line with a minimum of two personnel assigned to its operation. And, reportedly this is now a Michigan OSHA mandate. From a practicality aspect, if there is a problem inside the structure and the attack crew needs assistance, there is a strong likelihood that the condition could be caused by pump failure. So, the back-up line should always be from a second fire truck. Additionally, a standard operating procedure, for any fire department in the nation, when dealing with a fire involving a sprinklered property, is to send a minimum of two pumping engines to the alarm. One should go directly to the fire department connection to support the sprinkler system and the other directly to investigate or attack the fire. Scio Township cannot presently accomplish this with their own resources. The fire department needs at least one additional certified pumping apparatus to provide minimal protection for its tax base and more importantly, the level of safety required for its firefighting personnel.

A standard evaluation method for initial attack capability is the NFPA Standard 1410 - *Initial Fire Attack*. This standard focuses on the ability to deliver 400 gpm with two attack lines and a larger backup line within a reasonable time. The water application capability is an important aspect of initial fireground operations, and should be considered in relation to the need for search and rescue, ventilation, forcible entry, and other support functions that must be carried out simultaneously. The need to perform these necessary functions compromises the ability to place attack hose lines in operation when personnel on the fireground is limited.

The evaluation method in NFPA 1410 may be used as a starting point in estimating the 10 minute initial attack capability of a fire department, with adjustments to allow for these additional necessary functions. The personnel required to perform these other functions must be in addition to those used for placing hose lines in action or they must be subtracted from the number of personnel available for working with hose lines. This provides an evaluation measure in terms of gpm, which can be effectively applied, while simultaneously providing fireground command, search and rescue, ventilation, forcible entry, and support functions with the initial attack force.

The evaluation is based on gpm effectively applied to combat the fire within 10 minutes after the alarm is received. Effective initial attack fire fighting requires more than the application of water on the fire, additional assignments and tasks are identified that must be fulfilled by the initial attack force.

- HOSE LINES: Attack lines [hose lines] must be placed in operation by a minimum of two personnel with full protective clothing, using Self Contained Breathing Apparatus [SCBA]. Both personnel must stay with the line to provide for mobility. [A 2 1/2 inch attack line requires 3 personnel] An attack line must be supported by an uninterrupted water supply. A pump operator must be assigned for each pumping apparatus supplying water.
- SEARCH AND RESCUE: Sufficient personnel must be assigned to perform search and rescue in any occupied structure. A minimum of two personnel must be assigned. Additional teams of two personnel should be assigned for each 2,000 square foot of occupied area subject to smoke, heat, or fire.
- SUPPORT FUNCTIONS: At least one firefighter must be assigned to perform forcible entry, utility control [water, gas and electric], and related support functions for each attack line placed in operation.
- VENTILATION: At least two personnel must be assigned to perform ventilation ahead of initial attack. When vertical ventilation is indicated these personnel must be able to reach the roof via ladders and have primary ventilation accomplished within this 10 minute time frame.
- COMMAND: At least one individual must be assigned as the IC to direct operations. This person should not be engaged in any other fire fighting function.

A PRACTICAL SOLUTION TO THE CHALLENGE

Insurance rates are determined by an organization that rates each fire department on certain pre-established criteria. The organization which develops the criteria is the Insurance Services Office [ISO] and in Michigan it known as the Insurance Services Office - Commercial Risk Services, Inc. When hired, the fire chief was instructed by township management to develop a "10-4 plan," whereby the Township in ten years would achieve an ISO rating of 4. To put the "10-4 plan" in perspective, a 10 is equal to no fire protection and a 1is the best there is.

The City of Detroit has an ISO 2, Ann Arbor City has an ISO 4, and Canton Township has an ISO 5. Having an ISO 4 is a desirable, but could not be obtained without a huge commitment by all involved. Township management thought that an ISO 4 could be achieved and that the community would support it, as would the Township through budget allocation. Scio Township has had its own fire department for over eight years yet it still holds the same ISO classification [8, 9, and 10] that it did in 1988.

Table 3: Western Washtenaw County ISO Classifications

Township/Village	ISO Classification
Ann Arbor Twp.	6
Chelsea	6
Dexter	7
Lima Twp.[Chelsea F. D.]	6
Lodi Twp.[Saline F. D.]	6
Manchester Twp. [Manchester F. D.]	6
Manchester	6
Saline Twp.[Saline F. D.]	6
Saline	6
Sylvan Twp.[Chelsea F. D.]	6
Webster Twp.[Dexter F. D.]	7

To explain the ISO rating system, let's note a typical $150,000 home in Scio Township. If this home was within five miles of a station and within 1000 foot of a hydrant, it would be rated ISO 8 and its yearly fire insurance premium would be around $594. For the purpose of comparison, consider this ISO 8 as the base. If this same home was less than five miles from a station, but greater than 1000 foot from a hydrant, it would be rated ISO 9 and its yearly fire insurance premium would increase to $736 [a 24% increase]. Again, if this same home was more than five miles from a station and more than 1000 foot from a hydrant, it would be rated ISO 10 and it's yearly fire insurance premium would be $870 [a 46% increase].

An ISO 7 carries the same weight as an ISO 8. But, an ISO 6 is different. If we compare the same $150,000 home as we did previously and could give it an ISO 6, the annual fire insurance premium would only be $532.

What significance does this have for the home owner? If they are one of the majority who are in an ISO 9 area, we can offer them a savings of $204 per year or a 38% savings in their fire insurance premium. If they happened to be one of the few in an ISO 10 area, their annual fire insurance premium would be $338 or 63% less then it currently is. Even those currently in an ISO 8 area would save $62 or 11%.

There is various criteria a department must meet to be rated an ISO 6. Probably the greatest is pumping and water carrying capacity of its fire trucks. Our fire department would have to carry an additional 1,500 gallons of water on its fire trucks to ensure it can flow 250 gpm for 15 minutes to even consider lowering its ISO rating. This criteria is for areas outside the hydrant district. Inside the hydrant district, to even consider lowering the ISO rating, we would need to improve our pumping capacity by 2,250 gpm. This criteria can only be achieved by the acquisition of addition fire trucks with high volume pumps and large capacity tanks. It cannot be achieved by utilizing mutual aid and or first alarm response agreements. Scio Township must supply a first line of defense for its tax base if it ever wants to see its ISO rating lowered.

In conversation with the Township's Assessing staff, it was learned that the SEV of Scio Township is approximately $600 million. One mill of taxation generates about $600,000 per year. If we were to take the previously examined $150,000 home, it's SEV would be $75,000. At a tax of one mill, it would pay $75 per year. If the Township were to have a one mill tax, especially earmarked for fire department capital expenses, it would cost the majority of Scio Township homeowners less then $100 per year and we could offer most of them virtually equal the tax in real savings. And best of all, the millage is deductible on their tax form where their fire insurance premium isn't.

Lowering insurance premiums for homeowners should not be a driving force behind building a firm foundation for fire protection. Previously it was stated that "even in a jurisdiction of detached dwellings a minimum of two engine companies should be provided." This recommendation was supplied by a NFPA Standard. The NFPA is a principal source of consensus fire protection standards and codes which have been woven into the body of law at all levels of government. NFPA codes and standards are written by voluntary technical committees, balanced to fairly represent all points of view, and charged with preparing fire safety standards that are equitable without prohibitive expense, interference with established processes and methods, and without undue inconvenience.

Additional support for improving fire protection comes from the Fire Protection Handbook , which states "a standard first alarm response is two engines and one ladder." It further states that these response requirements, and it lists various criteria all based upon the gpm requirements for fire control, are a rather conservative minimum standard and that many fire departments will exceed this as pre-fire planning indicates the need for additional apparatus and staffing because of life hazard or in order to run hand lines to control fires inside of buildings rather than application of maximum fire flow to merely confine the fire.

Parallel support comes from the International City Management Association's Managing Fire Services. This states "the standard formula for determining the volume of water needed and the number of hose lines to be advanced at a working structural fire is based on a minimum of two engine companies with at least eight fire fighters." It further states, "various controlled and statistically based experiments by some cities and universities reveal that if about sixteen trained firefighters are not in operation at the scene of a working fire within the critical time period, then dollar loss and injuries are significantly increased, as are the square feet of fire spread."

Suppression capability is not the only challenge for a fire department. There are numerous other duties associated with the effective administration of the Scio Township Fire Department, many which have been outlined in this report already. One of particular importance is the Fire Marshal functions of plan review, inspection and pre-incident survey development.

Conflicting data exists as to the number of business occupancies in Scio Township. However, it is safe to say that there are at least 400 and it may be as high as 1000. Plan reviews should be conducted of any new construction, renovation or occupancy change with the exception of one and two family dwellings. Additionally, a fire and life safety inspection should be conducted annually of each business occupancy, although biannually may be a more laudable goal. And finally, a pre-incident survey should be completed for each of these same occupancies and can incorporate Fire Fighter Right-to-know information. The pre-incident survey process is time consuming.

Fire Fighter Right-to-know is a state mandated program that mandates the local fire chief as the sole person responsible to instruct all members of the fire department as to what types and quantities of hazardous materials they may encounter in their fire suppression and rescue activities. Furthermore, a federal mandate, SARA Title III, states certain additional requirements for fire departments if a local facility stores or uses any of the 144 most harmful hazardous materials. There are about 12 of these known SARA Title III facilities in Scio Township.

Fire Marshal support activities, other than the chief's administrative duties, are probably the most important activities the fire department performs. In February of 1992, the fire department was reorganized. At this time the Fire Marshal duties were assumed by the fire chief. This move was necessitated for several reasons, one of which was due to the increase in the amount of fire marshal associated activities that needed attention, particularly written documentation of the fire department's Fire Prevention Code requirements for buildings.

It is vital for any fire department to prevent or lessen the severity of fire in its jurisdiction. In pursuit of this goal, the Scio Township Fire Department currently performs plan review of: all site plans submitted for Planning Commission review; all zoning compliance applications for other then residential property; all private road requests; all fixed fire suppression and alarm systems; and, any other zoning/planning petition which requires our comment. These sometimes involve several reviews of revised plans and comprise considerable time of department staff.

Other Fire Marshal activities, such as Fire Safety Inspections, are done hit-or-miss; mostly on complaint. However, whenever a final zoning compliance inspection is made by township staff and the fire department is advised, the fire department will also conduct an inspection. Our pre-incident survey program is in no way what it should be. Awhile ago, an attempt was made to survey all commercial and industrial properties in the Township. However, because of the number of properties and the amount of time each survey takes to complete, the paid-on-call staff was unwilling to undertake this extensive project without compensation. And, the goal of achieving a pre-incident survey of all non-residential property in Scio Township did not occur.

Administratively, the fire department is dynamic. It is oftentimes difficult for the layman to comprehend that a small in size fire department has the same administrative functions and obligations to carry out as a fire department in a much larger municipality; it's only on a smaller scale.

For example, we are mandated under state and federal laws to develop programs for Bloodborne and Airborne Pathogens, Right-to-know, First Responder Medical, etc. We also must adhere to Michigan State Police Fire Marshal and Fire Fighter's Training Council mandates for incident reports, training, emergency vehicle licensing and operation, etc. It is our experience that the biggest difference between a larger department and one of our size is that usually the bigger department has a larger staff to handle the administrative functions. For them, it doesn't turn out to be as much a "one person" job. Even though the staff of the Scio Township Fire Department may be small in number, the issues they confront are complex in nature.

The fire department is responsible for maintenance of it facility. With the exception of snow removal and lawn care, all other maintenance functions are handled by department staff. Additionally, from time to time, because they are the lessor, the sheriff's department requests our staff to perform maintenance type functions. It should be noted that no money received by the Township for rent on the sheriff's department portion of the complex is credited to the fire department budget. But, for the most part, any time there is a repair item for the sheriff's department portion of the building, it is expensed to the fire department.

Vehicle repair and preventive maintenance is a responsibility of fire department staff. With the exception of heavy repair and those things that are more economical to send out, most repairs are handled in house. Additionally, weekly and monthly equipment checks are mandated by Michigan OSHA.

A tremendous amount of staff time could be expended in maintenance and repair functions for vehicles building and grounds. We try to do as much as we can, time permitting, But, it is getting harder and harder to request paid-on-call staff to volunteer their personal time to perform these functions. Bear in mind that a tremendous amount of their already available time is spent training and responding to emergencies. Not to mention they all have regular full-time jobs and families.

PART III

SUMMARIZATION AND RECOMMENDATIONS

Throughout this report, a correlation between what is considered minimal protection, according to nationally recognized standards and literature, regarding fire department management and the Scio Township Fire Department has been attempted. In doing so, it has been shown that Scio Township does not currently provide what is considered minimum fire protection to its property owners and constituents. Why this has been allowed to happened is not important. How we can achieve a equitable resolution, is. How we set out to provide what is considered minimum fire protection and planing for the future to enhance its delivery, may be a challenge. However, there is more than one avenue we can all pursue to achieve it.

ACCEPTABLE RISK

It is important that the acceptable risk of Scio Township be determined and evaluated. Acceptable risk is determined by defining the total risk minus the suppression capability of the fire department, and determining if the remainder, the unprotected risk, is acceptable. [NOTE: More often then not, a municipality does not utilize this formula to determine its acceptable risk. What is oftentimes the case is the municipality will work backwards by determining the funding levels it is willing to provide, and then the acceptable risk is defined.]

The unprotected risk of the sample target hazards listed in Table 1 range from zero to 5850 gpm. If 5850 gpm is acceptable, then it is expected of the Township to do nothing to enhance the suppression capability of its fire department. However, if it is decided that something less then 5850 is acceptable, then there are various tasks that could be completed to achieve that goal. The four items that could be manipulated are:

1. apparatus/equipment,
2. staffing,
3. codes/regulations, and
4. public education.

SUPPRESSION CAPABILITY MODIFIERS

The Township could decide to purchase additional certified pumping fire trucks. They could:

1. Purchase 2 to 3 used apparatus that are in sound mechanical condition and no more then 10 - 12 years old. Depending on the size of the pump and the number of discharges, the Township's unprotected risk could be decreased 2500 to 3750. Tank size is also a very important element here if the Township decides lowering insurance premiums is important. Purchasing apparatus that has already used up approximately one half of its useful life and could possibly be someone else's mechanical problem may not serve the Township's intent and may be considered a short term fix.

2. Purchase 2 to 3 new apparatus. In doing this the unprotected risk could be lowered 4500. If all three apparatus were to have 1500 gpm pumps and sufficient equipment and appliances to move the water, a 4500 gpm flow could be developed. Although this flow would only be for a short duration, it may be long enough to gain control of the fire [see figure 3] and allow overhaul with lesser gpm flows.

3. Purchase a combination of new and used apparatus. This could effect the unprotected risk upwards to 3000 to 4000 gpm. Again, this may not serve the Township's intent and be a short term fix.

Any of the three listed options are viable. Numbers 1 and 3 are risky. However, if you consider anything in this report accurate, you should realize that continuing on our present path is just as dangerous. Determining the acceptable risk for the Township is prudent for planning purpose, and should be done. But, more importantly than determining acceptable risk is securing an additional certified pumping fire truck for the safety of fire department personnel. This should be addressed immediately.

Attempting to decrease the acceptable risk by increasing staffing levels cannot be accomplished with out additional pump [gpm] capacity. However, the fire department should enhance its recruitment effort, especially targeted towards those available daytimes. And, the Township should realize this benefit and appropriate sufficient funds for training and outfitting the additional personnel.

It is reasonable that option 2 should be pursued and be given a top priority.

RISK MODIFIERS

The Township could decide to enhance its codes and regulations. In doing so, it could make it the responsibility of the developer to provide the extra level of protection required to lower the risk. However, to do this would require the building of more fire resistive buildings or the addition of a fixed fire suppression system. To our knowledge, this can only be accomplished in one of two ways:

1. Develop its own Scio Township Building Code limiting height, area and construction type, and provide a Building Department to enforce it. Currently, the building code enforcement for Scio Township is handled by Washtenaw County. Because of conflicting codes, they would be unable to continue to enforce a different and more stringent code. However, should this be considered a viable alternative, it is conceivable that the Scio Township Building Code Enforcement Department be located within the fire department.

2. Require the installation of automatic sprinklers in any building greater then a pre-determined square footage. This too is not considered a viable alternative. Michigan is considered a mini/maxi state. What this means is in the areas of fire suppression, the minimum state requirement is also considered the maximum. In order to require sprinklers, Scio Township would have to petition the State Construction Board to allow a local regulation more stringent then the state code. While this may be a laudable goal, to my knowledge no municipality has been successful in doing so.

There is at least one major fallacy to both of the above options. What do you do with existing buildings and those buildings which have already been approved, but not yet constructed? Do you ignore them and consider their risk acceptable? Or, do you do something about lowering the acceptable risk? If you decide to lower the risk it would require to retrofit as in number two above, or the purchase of additional certified pumping fire trucks.

Public education is not a short term fix. It takes years to educate the public in fire safety. Currently the Scio Township Fire Department is active with public education. However, educating the public masses in Scio Township is difficult as target groups such as schools, service groups, etc., are non-existent.

UNPROTECTED RISK ANALYSIS

It is obvious that the most logical way for Scio Township to lower its unprotected risk is to increase the suppression capability of the fire department.

Recommendation 1: It is recommended that Scio Township immediately purchase two [2] quality used certified pumping fire trucks to augment its existing one.

The number one priority in this area would be the purchase of a multi-versatile truck. It is preferred that this truck be a truck with: a large capacity pump, preferably a 1500 gpm although a 1250 gpm would suffice, and; an aerial device, preferably 100' although 85' would suffice, with a full complement of ground ladders.

This type truck is essential as it would enhance our pumping capacity, allow us the second pump for back-up/rescue lines [fire attack hose] and sprinkler/standpipe system connection, provide the level of safety required for operation on lightweight truss constructed roofs as we could operate off of the ladder instead of the roof itself, and provide an elevated waterway for defensive operation at large residential, business and industrial incidents. In addition, currently we have roofs of certain buildings we cannot access with our ladders. The full complement of ground ladders [a minimum 162' of various kinds and lengths] would allow us to reach some inaccessible areas that an aerial might not reach.

The number two priority in this area would be the purchase of a pumper/tanker truck. It is preferred that this truck be a truck with: a large capacity pump, preferably a 1250 gpm although a 1000 gpm would suffice, and; a large capacity tank, preferably 2000 gallon.

It is recommended that should this become a reality, the current tanker truck of the fire department be sold. It is thought that the sale of this truck could bring upwards of $40,000. However, should the Township think it expedient to strive for a lowering of their ISO classification and it unwise to sell the apparatus at 50% of its purchase price after 9 years, keeping it would allow the Township to exceed the 250 gpm for 15 minutes rule established by ISO. Therefore, bringing the Township one step closer to an ISO 6.

Recommendation 2: It is recommended that Scio Township determine what level of fire protection they will provide the community and provide adequate funding for same.

It is imperative that the fire department know what level of service they are expected to provide. Additionally, once this is determined, an adequate funding mechanism needs established.

For example: the Board might consider developing strategy and support base for a one-mill tax for fire department capital items for ten years. This tax would generate approximately $6,000,000.00 and could be utilized for: a replacement aerial if recommendation number one is implemented and if not, a new aerial with pump; an additional equipped engine and a replacement engine current engine-1; a replacement tanker if recommendation number one is implemented and if not, a new tanker; additional station and land; a replacement rescue; an additional rescue; to recruit, train and equip additional personnel; to upgrade existing station; to build a basic training tower and related facility; and, for contingencies, engineering, consultants, etc.

> **Recommendation 3:** It is recommended that the Scio Township Board authorize the Township Manager to confer with fire department staff to develop a Scio Township Fire Protection Master Plan and implementation guide.

It has been said; "if you fail to plan, you plan to fail." Scio Township is too dynamic not to develop a Fire Protection Master Plan. Without a plan for the future, we will constantly vacillate with fire department capital and operational topics.

- Recommendation 2 was given higher priority then Recommendation 3 due to the fact that developing a Fire Protection Master Plan will take time and a level of service needs identified in the interim.

> **Recommendation 4:** It is recommended that the Township authorize the hiring of a full time Fire Marshal, and that the Township Manager and Fire Chief develop strategy to add one additional full time person to the fire department staff.

As outlined in the body of this report, the Fire Marshal functions are essential to the operation of the fire department. Currently Fire Marshal functions, such as plan review, are undertaken by the fire chief. Freeing the chief of these responsibilities will allow him the time to perform the numerous administrative functions that need immediate attention.

An additional full-time employee is needed to assist with daytime emergency response, administrative functions, inspection and pre-incident survey functions, vehicle, equipment and building maintenance, etc. Time permitting, this person could possibly be utilized as a maintenance/custodial person at the Township Office.

CONCLUSION

The fire service has been around for hundreds of years. Throughout its existence substantial change has and is continuing to occur in the management of its resources. From the evolution of the first American fire departments by such early chiefs as Benjamin Franklin and George Washington, to today's modern chief. Early chiefs were primarily concerned with the assembling of sufficient volunteers to staff a bucket brigade during a fire emergency. Today's chief, who is oftentimes referred to as the community's Emergency Services Director, is concerned with the protection of humans from the perils of fire and other disasters.

Oftentimes, today's chief may have the additional responsibility of Emergency Medical response and Hazardous Materials mitigation thrust upon them. With these additional responsibilities, today's fire chief makes it even more apparent that gone are the days of selecting the best "fire fighter" and elevating them to the position of chief. Today's fire chief is not only expected to be proficient in the strategy and tactics of hazard mitigation; but also, to provide the leadership necessary to accomplish this task with minimal personnel and other resources, while assuring the department's operations are done as efficient, yet effective, as possible.

It has been said that "the fire service is 150 years of tradition unhampered by progression." Today's fire chief knows that although this may have been true in the past, it can no longer exist; not now or in the future. Today's chief knows that inventories are managed and people are led. Furthermore, the people of the organization are the most valuable resource. The fire chief of today has to exhibit the leadership qualities to not only bring a quality organization together, but keep it together and focused on its mission.

One important aspect of keeping an organization focused, is giving it the proper tools to perform the job. Essentially, this is the jest of this report; if we are to provide fire protection to our citizens, let's begin by providing it at a minimal level and then plan for the future to determine if it will be status-quo or enhanced.