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MUNICIPAL TECHNICAL
ADVISORY SERVICE



SCOTTS HILL, TENNESSEE

Fire Management Study

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Introduction and Scope of Work

MTAS conducted this study at the request of Scotts Hill City Planner David Austin after a phone conversation between Mr. Austin and MTAS Fire Management Consultant Dennis Wolf in September 2011. The study request resulted from a desire for Scotts Hill to evaluate the possibility of improving its ISO rating from a Class 7 to a Class 5. The purpose of this study was to evaluate the entire fire department and make recommendations related to fire department management, operations, resources, and enhanced level of services. The scope of this study included review of the present ISO rating, meeting OSHA and NFPA requirements, and best practice management of the fire department. Best practices are defined as acceptable performance standards in the fire service that are recognized and used to improve operations and safety. The recommendations provided in this report are also based on several local criteria: 1) size of the community, 2) land usage, 3) existing and potential use of resources, 4) public perception of services, and 5) basic geographical features of the community. There are alternative methods of providing fire protection to this community and all such methods were considered. The recommendations are from a customized blend of these alternatives that best suited the conditions at the time of this report.

Background

The Town of Scotts Hill was incorporated in 1917 and is located in West Tennessee in both Decatur County and Henderson County. Scotts Hill is approximately twenty miles from Lexington, forty-two miles from Jackson, and midway between Memphis and Nashville on Highway 100. The town covers approximately three square miles and is home to approximately 984 people. The most common industries are manufacturing, construction, retail trade, and transportation and warehousing.

The town is governed by a Mayor-Aldermanic form of government with a board of a mayor and seven aldermen, and the mayor exercises general supervision of all municipal affairs.

The Scotts Hill Fire Department is a volunteer fire department. The fire department is duly recognized by the State of Tennessee and the fire chief is appointed as an Assistant to the Commissioner of Commerce and Insurance.

Fire protection is a local policy issue, and a community must balance local resources against acceptable risk. The Town of Scotts Hill has chosen to provide fire services as a town function through a municipal fire department established in Title 6 of the Town Charter. The Scotts Hill Fire Department is a mostly volunteer combination fire department recognized by the State of Tennessee. The fire chief is the only paid employee and there are thirteen volunteer firefighters and three public safety officers. The fire department operates two engine companies and one aerial ladder truck from a single fire station (see Table 1 for a list of apparatus). Staffing levels on engines is by volunteers.

Scotts Hill Fire Department Equipment				
Unit ID	Pump Capacity in gpm	Water Tank Capacity in Gallons	Year Made	Notes
E30	1,250	1,000	2004	First out, town. (Freightliner)
E31	1,500	750	1978	Support. (Mack)
T30	350	2,000	1980	First out, county support, town. (GMC)
B30	N/A	750	1978	Reserve. (Ford)
S30	N/A	N/A	2003	Service/support unit. (Ford)
	N/A	N/A	1983	Service/support unit. (Chevy)

Table 1 – Scotts Hill Fire Department Stations and Apparatus

Because of the efforts of the town and the fire department, Scotts Hill residents and business owners enjoy an Insurance Services Office (ISO) Public Protection Classification of 7, which it received in 2005. This places Scotts Hill in the top two-thirds of communities in Tennessee (see Figure 1) and in the United States (see Figure 2) in terms of fire protection and indicates that Scotts Hill has made good decisions in planning for community fire protection.

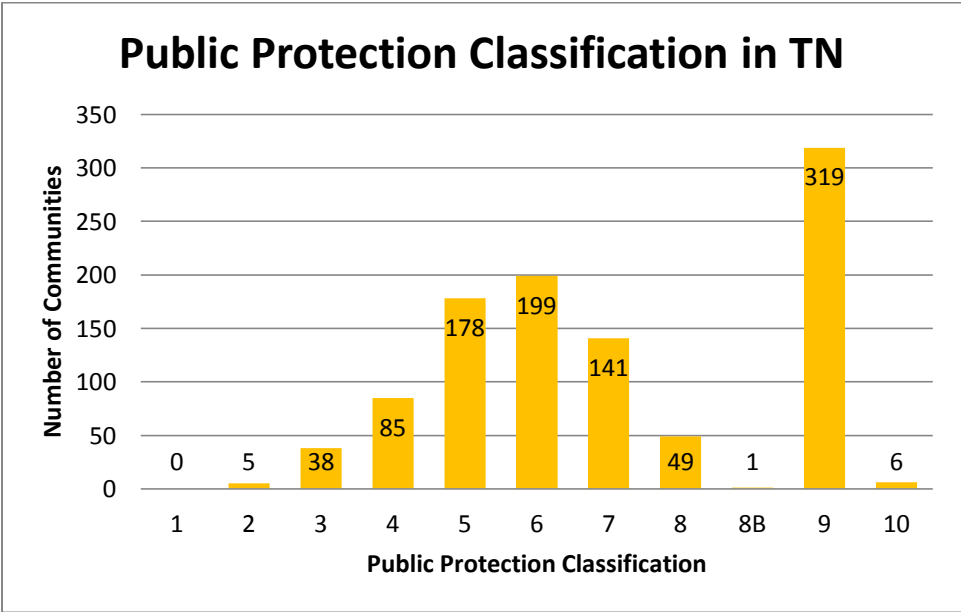


Figure 1 – Public Protection Classification (ISO Rating) in Tennessee

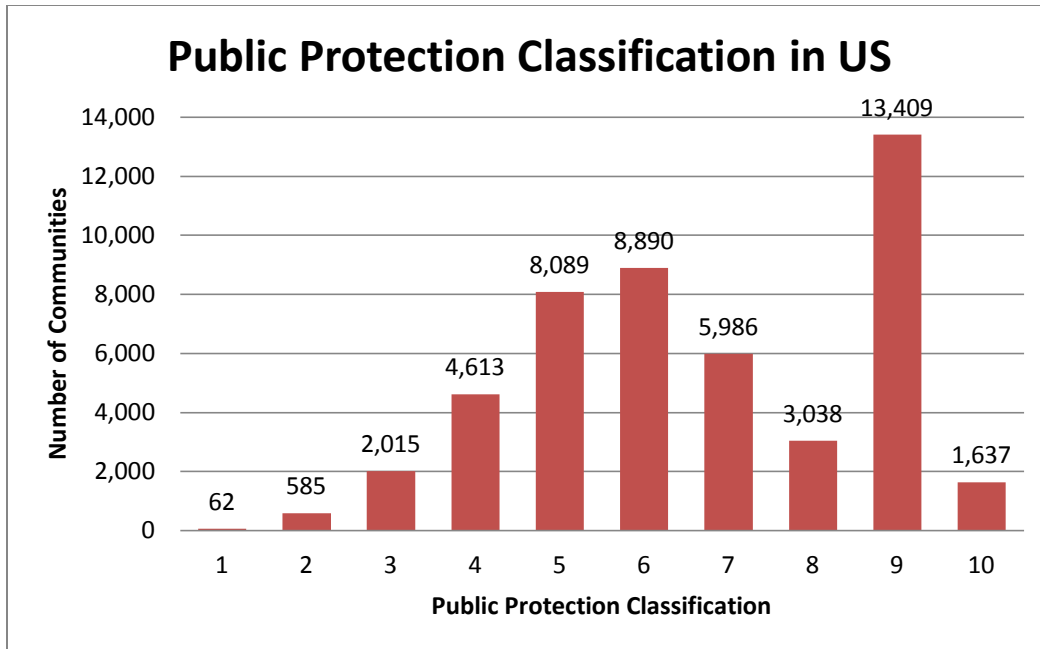


Figure 2 – Public Protection Classification (ISO Rating) in the US

Communications

Since Scotts Hill lies within the counties of Henderson and Decatur, calls for service originating in Henderson County go directly to the Henderson County 911 office, and the Henderson County 911 office dispatches the Scotts Hill Fire Department. Calls for service originating in Decatur County are transferred to the Henderson County 911 office, and the Henderson County 911 office dispatches the Scotts Hill Fire Department. Decatur County 911 is in the process of installing equipment to allow the Decatur County 911 office to dispatch the Scotts Hill Fire department directly, which will avoid the delay associated with transferring the call. In 2005, ISO awarded 58.2% credit (5.82% out of 10.00% maximum) for receiving and handling fire alarms. Scotts Hill cannot direct the management and operations of the Henderson County or Decatur County 911 agencies, so limited opportunity for improvement exists. The deficiencies noted were the need for a second emergency fire line, the need to list the business number in the telephone directory, the need for additional on-duty operators, lack of monitoring the primary dispatch circuit for integrity as required by NFPA Standard 1221, and the need for an emergency power supply that complied with NFPA Standard 1221. The score of 58.2% is sufficient for a relative classification of Class 5 for receiving and handling fire alarms, so even without improvement, this component should not prevent Scotts Hill's from improving its ISO rating. Since 2005, the business number is listed in the phone book to ISO requirements, so some improvement of credit is anticipated.

Water Supply

Water for public consumption and fire suppression is provided by the Scotts Hill Water Department. No significant improvements have been made to the water supply since the ISO evaluation in April 2005, when the water system received 12.97% out of a

maximum 40%. The water system is limited by the supply works, the size of the distribution mains, and the spacing of fire hydrants. In most areas the water pressure and the gallons-per-minute fire flows needed for fire suppression operations are not adequate to protect the properties at risk (see Appendix B).

The water supply works should be designed to provide water for both domestic consumption and fire protection. For 1 and 2 family dwellings not exceeding 2 stories in height, ISO requires a minimum basic fire flow of 1,500 gpm if the buildings are less than ten feet apart, 1,000 gpm if the buildings are between eleven and thirty feet apart, 750 gpm if the buildings are between thirty-one and one-hundred feet apart, and a basic fire flow of 500 gpm if the buildings are more than one-hundred feet apart. Basic fire flows for commercial properties are calculated on an individual basis.

To overcome a limited water supply, the fire department uses tankers and dump tanks for water on some fires to provide sufficient water for suppression operations. Drafting sites are another option, but to be considered by ISO they must be capable of supplying 250 gpm for at least 2 hours, be accessible in all weather, and be available in a drought. ISO will give credit for all water supply points including pressurized hydrants, dry hydrants or drafting sites. Drafting sites without a dry hydrant are considered to be cisterns. A drafting site with a dry hydrant that was installed to NFPA Standard 1142, *Water Supplies For Suburban and Rural Firefighting*, is credited as hydrant with a pumper outlet.

The largest water main in the system is a ten-inch main on Highway 100 that was installed to serve the high school. Six-inch mains serve the center of town, and most residential areas are served by four-inch mains. Four-inch mains are not sufficient for fire protection, and state law will not allow a fire hydrant to be installed on a four-inch main. Scotts Hill has taken steps to provide adequate water for fire protection in future developments. Section 14-201(3) in the code of ordinances requires that new water mains must be installed in such a manner as to serve adequately for both domestic use and fire protection, and requires water mains of no less than six inches in diameter. However, the limitation in the amount of water that can be produced by the wells and water plant will limit the amount of water available for fire protection.

Large diameter hose (LDH) can be used to overcome hydrant spacing limitations, and credit is based on the size of the hose, how much LDH is carried, and whether a pumper is placed at the hydrant or not.

For full credit for fire hydrants under the ISO grading schedule, all hydrants must have a 4-inch or larger pumper outlet, two 2½-inch hose outlets, and have a 6-inch branch connection. ISO prorates credit if all hydrants do not meet this specification. Sixty-percent of all fire hydrants have both the pumper connection and hose connections. The distribution of fire hydrants by main size is shown in Table 2. A pumper cannot connect directly to a fire hydrant and engage the fire pump on a water main smaller than six inches, so the department can use hydrants on these mains to refill water tanks only.

Water Main Size	Hydrants with Pumper Outlet and Two 2 ½-inch Outlets	Hydrants with Two 2 ½-inch Outlets Only
4-inch or smaller	24%	76%
6-inch or larger	76%	24%
Table 2 – Distribution of Fire Hydrants by Type and Main Size		

For full credit, all fire hydrants must open and close in the same direction and all fire hydrants must have the same size operating nut. All of the hydrants open and close in the same direction, but only ninety-to-ninety-five percent of the hydrants have the same size operating nut. The town should undertake a project to standardize all fire hydrants.

For full credit, all fire hydrants must be inspected semi-annually. The inspection must include checking the hydrant for proper operation, a static pressure test to check for leaks, and the hydrant must be flushed. If hydrants are not flushed during an inspection ISO considers the inspection to be incomplete reduces the credit by 10 points. If the hydrant is not subjected to a static pressure test, ISO deducts an additional 10 points. In Scotts Hill, all fire hydrants are inspected every six months, and all hydrants are flushed annually. The inspection does not include a pressure test for leaks. In the future, all fire hydrant inspections should include a static pressure test per NFPA or American Water Works Association manual M-17 practices.

Community Risk – General Overview

Scotts Hill covers approximately 3.82 square miles and has a population of 984 people per a 2011 census estimate. The town’s urban growth boundary is 15.2 square miles.

The town does not have zoning classifications, but it appears that the majority of the land in Scotts Hill is used for residential and agricultural purposes.

The major transportation route of US Highway 100 serves Scotts Hill. There are no geographical barriers in the road network.

Manufacturing, construction, retail trade, warehousing occupancies make up the largest segment of Scotts Hill’s economy, and these risks are distributed throughout the community. A community’s basic fire flow determines many things in the ISO grading schedule, including the number of needed engine companies and the needed capacity of the water system. For Scotts Hill, the basic fire flow is 3,000 gallons-per-minute. The water system should be capable of supplying enough water to meet the community’s domestic and fire protection needs, and the fire department should be capable of delivering the water effectively to suppress fires. Properties protected by automatic sprinkler systems are not considered when determining the needed fire flow for a given community.

Scotts Hill does not have enough buildings that are either three or more stories in height or measure at least 35 feet to the eave to require a ladder truck, but the town does need a service company. The commercial and retail occupancies are important to Scotts Hill's tax base in that loss of a commercial building would have negative impacts on the local community and economy. The town should plan to protect these community assets by providing the Scotts Hill Fire Department with sufficient resources for response, by requiring built-in fire protection through local fire codes, and by on-going property maintenance and upkeep through fire code compliance inspections.

Fire Department Overview

The Scotts Hill Fire Department is organized under Section 6(k) in the town charter and is a recognized fire department by the state fire marshal's office. The department reports to the Tennessee Fire Incident Reporting System (TFIRS) and maintains good records of responses and activities.

A single fire station located on Highway 201 near Highway 114 serves the town. The station was opened in July 2002 and provides adequate distribution of fire apparatus over the 3.82 square miles of the town (see Figure 3). The blue line on the map represents the corporate limits, and the red line represents the 1.5-mile response district defined by ISO. Since Scotts Hill is a volunteer department, the fire station is not staffed 24/7. This means that while most of the community is within 1½ road miles of a fire station, there is usually a delay of between three to five minutes after the fire department is notified of the call before the apparatus starts to respond as the volunteer firefighters must arrive at the fire station to staff the apparatus.

The department operates a first out engine/tanker, a first out tanker, a reserve engine, a brush unit, and a support/service unit. The age of the fire engines, oldest to newest, is 34 years (1978), 32 years (1980), and 8 years (2004). All apparatus are pump tested annually and have passed their pump test.

The department has a comprehensive standard operating procedures (SOP) manual that covers policies and procedures regarding the operation of the department, emergency response practices, training, safety, apparatus and equipment maintenance, daily station duties, duties of the fire department's officers, etc. The rules and regulations for the fire department were adopted by resolution of the Board of Mayor and Aldermen. The fire chief has a copy of the manual in his office, and the manual is available to every member of the fire department.

The department has a respiratory protection program that complies with OSHA/TOSHA regulations.

The department has mutual aid agreements with surrounding departments to provide for manpower and other assistance on large incidents that exceed local resources.

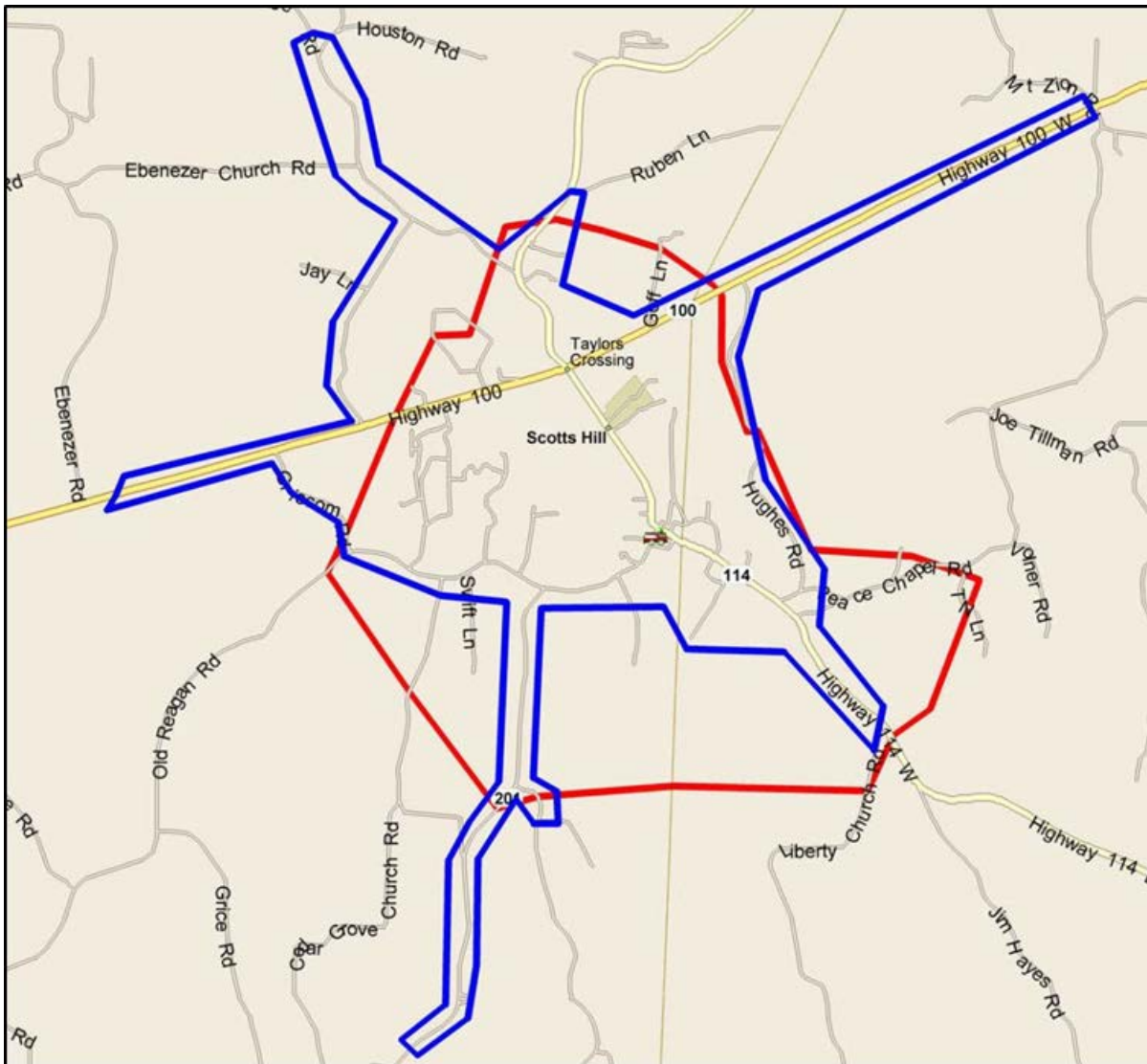


Figure 3 – Town Limits and 1½ Mile Response Zone of Scotts Hill’s Fire Station

As a department of the Scotts Hill municipal government, the department’s annual operating costs are funding from the town’s general fund. The annual operating budget for 2011 is \$17,794.34. The Scotts Hill Fire Department has a basic five-year master plan that identifies steps for improvements and the replacement of apparatus. The department has three pumpers manufactured in 1978, 1980, and 2004.

The town has not adopted a fire code. The easiest fire to fight, and the fire that causes the least amount of damage, is the fire that never starts. A fire code can help prevent fires through the regulation of hazardous processes, the proper maintenance of existing buildings and occupancies, and through code enforcement to find and correct fire hazards. Through requirements for built-in fire protection features, such as sprinkler systems, a fire code can limit the size of fires that do occur. Scotts Hill should consider adopting and enforcing a fire code. If Scotts Hill elects to adopt a fire code, state law requires that a municipality adopted a code that is no more than 7 years older than the most current published edition of the model code adopted.

In addition to the emergency response services of fire suppression, first responder, and hazardous materials awareness initial response, the Scotts Hill Fire Department provides other essential services to the community including fire safety inspections (done as part of pre-incident fire planning), fire cause determination, arson investigation, public education, the distribution and installation of smoke detectors, community CPR instruction, and special event participation. These programs add value to the community.

The fire department has a comprehensive policy manual with rules and regulations. These rules and regulations address employee safety on the fire ground and in the station. The department has a designated safety officer. The department uses the National Integrated Management System (NIMS) Incident Command System (ICS), and follows OSHA's 2-in/2-out policy. The department uses a personal accountability system on the fire ground, and personal alert safety system (PASS) devices are on all self-contained breathing apparatus (SCBA). Portable radios are available for every firefighter entering a hazardous area. The department has one thermal imaging camera. Housekeeping practices in the fire station are good, and adequate storage facilities are available. Flammable and combustible liquids are not stored in the fire station. Carbon monoxide has been shown to be a safety and health issue for firefighters, and the fire station has carbon monoxide warning signs required by OSHA 1910.145. However, the station does not have a vehicle exhaust system.

Within the last three years, the fire department has had no reports of infectious disease exposure, five reports of hazardous materials or chemical exposure, and no firefighter injuries. The fire department maintains employee medical surveillance and exposure to hazardous materials records in accordance with OSHA regulation 1910.120.

The town and the fire department have written job descriptions for all fire department positions. The department does not have a written recruitment and selection policy for new members and relies on verbal recruitment techniques to recruit new members. The chief noted that managing a large number of volunteers is challenging. The town conducts background checks on all new firefighters and verifies annually that all personnel who drive fire department vehicles have a valid driver's license. Personnel must be at least 21 years of age to drive fire apparatus. There have been no accidents involving fire department vehicles in the last three years. The town has a policy that requires immediate drug screening/testing for drivers involved in an accident while driving fire department vehicles or apparatus.

The department participates in the state fire fighter certification program through the Tennessee Commission on Fire Fighting and Personnel Standards and Education. Six firefighters hold state Firefighter I certification.

The fire chief has been appointed an Assistant to the Commissioner of Commerce and Insurance as required by TCA 68-102-108 (b)(1) which provides the authority to enforce the fire code and state laws and regulations. The fire chief has completed the fire chief orientation class required by TCA 68-102-108(c).

The department participates in the Tennessee Fire Incident Reporting System (TFIRS) program as required by TCA 68-102-111(a) and maintains response records. In 2010, the average response time for all fires was 5:30 minutes. The department arrives on the scene within six minutes, thirty-five seconds (6:35) on 80% of all responses. Response time is measured from the time the fire department is toned out, which means ring time and call processing time is not included in the fire department's response time, so the total response time is longer than what is reported.

The normal first alarm response assignment is two engines, two tankers, one service unit, and one chief. The department does not have minimum staffing requirements per apparatus or shift, which is not unusual for a volunteer fire department. The annual call volume for 2010 was 45 runs, which included mutual aid given calls, with 14 runs being fire calls, and 2 runs being structure fires. There were 31 calls inside the Scotts Hill town limits. The average number of suppression personnel on the scene of a structure fire (TFIRS Code 111) in 2010 was 14, and NFPA 1720 recommends for a volunteer fire department no fewer than ten personnel total on a low-hazard incident such as a single-family dwelling fire. Over the past five years, the average number of firefighters for a TFIRS Code 111 structure fire is 15.3. This number includes firefighters who respond on mutual aid. Reviewing the structure fires for the last 12 months (see Appendix A for the listing of the most recent structure fire (TFIRS code 111) responses), shows the department averaged 6.8 Scotts Hill firefighters per structure fire. While mutual aid response is important, the response times of mutual aid companies are considerably longer, which contributes to increased fire loss and poor outcomes.

TFIRS Series Code	Description	Number of Responses	Percent of Total Responses	Total Person-hours All Incidents	Average Person-hours Per Incident
100	Fire	14	45.2%	112.5	5.5
200	Overpressure Rupture, Explosion, Overheat (No Ensuing Fire)	0	0.0%	0	0
300	Rescue and Emergency Medical Service (EMS) Incidents	7	22.6%	52.5	1.5
400	Hazardous Condition (No Fire)	2	6.5%	6	1.0
500	Service Call	5	16.1%	30	1.5
600	Good Intent Call	0	0.0%	0	0
700	False Alarm & False Call	1	3.2%	5	1.0

800	Severe Weather & Natural Disaster	1	3.2%	55	55.0
900	Special Incident Type	1	3.2%	5	1.0
	TOTAL	31	100.00%		
Table 3 – Total Emergency Responses within Scotts Hill for 2010					

Table 4 shows the total fire loss for the past five years, with fires classified as structure fires highlighted in yellow. The fire department investigates all fires as required by TCA 68-102-111(a), and is successful in determining the cause on about 40% of the fires, so cause and origin information is available to assist in developing fire prevention programs.

TFIRS CODE	FIRES	LOSS	AVERAGE LOSS
100 – fire, other	2	\$1,525	\$508
111 – structure fire	12	\$200,900	\$66,967
112 – structure other than building	1	\$2,545	\$2,545
120 – mobile prop used as struc.	1	\$1,000	\$1,000
131 – passenger vehicle fire	8	\$13,755	\$4,585
137 – camper, RV fire	1	\$10,000	\$3,333
138 – heavy equipment fire	1	\$50,000	\$16,667
561 – unauthorized burning	1	\$75	\$25
TOTALS	27	\$279,800	\$93,267
AVERAGES ALL FIRES		\$10,363	\$3,454
AVERAGE STRUCTURE FIRES	14	\$204,445	\$68,148
AVERAGE ALL OTHER FIRES	13	\$75,355	\$25,118
Table 4 – All Fires with a Loss Years 2006 – 2010			

Scotts Hill has three first line units, meaning apparatus that is equipped and ready for immediate response. The fire department has one reserve, or backup, unit. The unit carries 750 gallons of water but does not have a recognized fire pump, so it does not qualify as a reserve engine. ISO requires that a community have at least one reserve engine and ladder truck for every eight, or fraction thereof, required engines or ladder trucks, and the fire department does not comply with this requirement. NFPA Standard 1901 recommends that properly maintained fire apparatus that is fifteen years or older be placed in reserve service, and apparatus more than twenty-five years old not be used for emergency response. Older apparatus lacks the safety features and operational capabilities found on newer apparatus, such as enclosed seating areas, auxiliary braking systems, reflective striping, improved warning light requirements, and increased tip load requirements for aerial devices.

Apparatus	Year Built	Age	Type	Move To Reserve Service	Retire from Emergency Service	Estimated Replacement Cost
First Out Apparatus						
E30	2004	8	Engine	2019	2029	\$450,000
E31	1978	34	Engine	1993	2003	\$450,000
T30	1980	32	Tanker	1995	2005	\$450,000
Reserve Apparatus						
B30	1978	34	Support	1993	2003	\$450,000
Table 5 – Age of Fire Apparatus						

The fire department operates apparatus that met NFPA standards at the time of manufacture. The oldest apparatus are the 1978 Mack pumper and the 1978 Ford brush unit. The town performs maintenance and repair on the fire apparatus and maintains maintenance records. Scotts Hill has two first out pumpers that are more than fifteen years old. The reserve unit exceeds the recommended maximum age for the apparatus to be used for emergency service (see Table 5). The town should implement a program to replace apparatus on a fifteen year/twenty-five year life cycle so that the town can budget for this capital expense and the fire department can develop specifications in a timely manner. The town should retain properly maintained and serviceable apparatus that reaches the age of fifteen years as reserve apparatus. The town should retire the apparatus from service once the apparatus reaches twenty-five years of age. The town may consider retaining older apparatus with possible historical value, for public relations, parades, or other non-emergency service. For liability reasons, if the town elects to dispose of older apparatus, the town should make sure that it does not sell the apparatus to another fire department for use in emergency service.

MTAS recommends that the town replace E31, T30, and B30 as soon as practical and possible.

The department performs an annual pump test to NFPA Standard 1911 requirements on all pumpers and tests all fire hose annually to NFPA Standard 1962 requirements. Records of pump and hose tests are available for the last three years. All ground ladders should be tested annually to NFPA Standard 1932.

All personal protective equipment (PPE or turnouts) used by the fire department met NFPA and OSHA standards in effect at the time of manufacture. The department has and enforces a policy requiring the proper wearing and use of PPE. The department has a policy for the regular inspection and maintenance of PPE, and all PPE found to be damaged or defective is removed immediately from service and repaired or replaced as appropriate. Per NFPA Standard 1871, all PPE that is more than 10 years old from the date of manufacture should be retired from service, and the department has a

replacement schedule for PPE. Approximately 60% of the turnout gear is less than six years old.

The department uses self-contained breathing apparatus (SCBA) that meet NFPA standards, and has used grants to obtain new SCBA. All personnel are fit tested annually as required by OSHA 1910.134 and appropriate records are maintained. The department has its own breathing air compressor to refill SCBA cylinders, and the air produced by the compressor is tested quarterly to insure that it is safe to breathe.

The fire department has a policy and practice in place to inspect hand tools and equipment on a regular basis and to repair or replace them as appropriate.

The fire station does not have an automatic start backup generator. As a critical facility for the community, the fire station should have one.

The fire department has a dedicated training officer and a training program. Regular training sessions are held monthly. Scotts Hill firefighters completed a total of 1,294 hours of training in 2010. In 2010, the department conducted one training drill of at least three hours duration and conducted two training drills of at least three hours duration with mutual aid departments. The department did not train as frequently as required by ISO.

The fire department has access to the state fire academy in Bell Buckle, which has a drill tower, flammable liquids training prop, and other training aids. However, the fire academy is about 120 miles and several hours distant, and the schedule of volunteers limits the department's ability to use the facility for regular training.

The department has a well-equipped training classroom in the fire station. The department has a comprehensive training library that meets most of the ISO recommendations. For full credit for the library, the department should have a copy of the NFPA Standards 1201, 1610, and 1411. The recruit training program is 86 hours in length and includes the 22 hour live burn program and meets state standards, but not all fire fighters are trained to this level (about 83% are). Six firefighters are Firefighter I certified by the Tennessee Commission on Firefighting and Personnel Standards and Education. The department uses Henderson County to provide a 40-hour training program for new drivers. The department does not conduct officer training classes for fire officers.

The fire department conducts semi-annual pre-fire planning inspections of all 130 commercial, industrial, religious, education, and multi-family occupancies in Scotts Hill. ISO gives significant training credit for pre-fire planning if all firefighters participate in the inspections and/or train on the pre-plans semi-annually and document that training. All firefighters in Scotts Hill train on the pre-plans semi-annually, and this training needs to be documented properly or no credit will be given.

For maximum training credit, ISO looks for the training hours shown in Table 6.

Hours of--→ Position	Company Training	Drills (at least 2 night)	Hazmat/ Radiologic al	Driver Training	Officer Training	Total Hours Needed for Full Credit
Firefighter	240	24	3	0	0	267
Driver	240	24	3	12	0	279
Officer	240	24	3	0	12	279
An officer who also drives	240	24	3	12	12	291

Note: Pre-fire plan training does not count towards meeting the above hours (see below).

Table 6 – ISO Minimum Required Training Hours

It is highly improbable that a volunteer firefighter will achieve 267 hours of training in a year. ISO gives prorated credit for training hours provided each firefighter has a minimum of 24 hours of training annually. Obviously, the more training hours achieved, the higher the partial credit. ISO still expects all drivers and officers to achieve the additional respective training hours on top of the regular firefighter training hours. The 24 hours of drills (eight three-hour drills) is worth one-third of the training points available, so emphasis should be placed on having every member participate in the required number of drills.

Pre-fire plans training that is properly conducted and properly documented is also worth one-third of the total training points available. This training is in addition to the training hours listed in Table 6. For maximum credit all commercial, industrial, religious, educational, institutional, and habitational buildings (except < 4-family dwellings) should be visited and inspected semi-annually for pre-fire planning purposes by firefighters who would respond to the building. If the pre-fire planning is completed by non-company fire department personnel (fire prevention or fire inspectors) no credit is available unless records and sketches are created and firefighters use them in verifiable training. Each firefighter should train and be familiar with each pre-fire plan in Scotts Hill twice annually. There must be at least three actual documented on-site inspections by fire department personnel for maximum credit. Pre-plans can be used in training by simply presenting each one, creating simulations of incidents, by individual review of the preplans, or by actually participating in the on-site inspection. All five of the following key points must be met to receive maximum credit.

- 100% of the buildings
- 100% of the personnel
- Semi-annual inspections
- Proper documentation of all the above
- Pre-Plans must follow NFPA Standard 1620

In April 2005, ISO gave the fire department 4% credit (0.36 points out of a maximum 9 points) for the training program. Without the details from the 2005 survey, it is not possible to know the exact deficiencies, but it can be assumed from the minimal credit

that the entire program needed improvement. The department now has a good library, some training props, and a training officer to oversee the program. The department is doing pre-fire planning and if all firefighters train on all preplans and document the training significant credit is available. Additional training points, and the corresponding benefit of better trained firefighters, are available through drills and officer training. All fire department members should participate in three hour drills. ISO does not give credit if the training facilities are not used. More credit will be given for the use of the facilities, so more hands on training using the tools, equipment, and training props should be held and documented. All members should train on all pre-fire plans semi-annually and document the training. Officers should complete twelve hours of officer training annually in classes that meet NFPA Standard 1021. New drivers should complete a driver training program of at least forty hours in length. All drivers should complete twelve hours of driver training annually.

When ISO visited Scotts Hill in 2005 the field agent witnessed eight fire flows, and all eight were deficient in that the water system could not supply enough water for the given hazard. Water supply counts for 40% of the evaluation of a community's fire protection classification, and Scotts Hill received 32.4% credit (12.97% out of 40% maximum credit) for the water system. The water system is not capable of supplying adequate fire flows to many of the risks in the community, so the fire department uses pumpers with large booster tanks and a tanker to help offset the deficiency in the water system. Having sufficient water available for fire protection is important, as a major fire in an occupancy with a large taxable value would negatively affect Scotts Hill's economy. If the loss was severe enough, the company might not recover and local jobs would be lost.

All of the fire hydrants open and close in the same direction, but only 60% of the hydrants have a 4" or larger pumper connection and two 2½" hose connections, and between five and ten percent of the hydrant have a non-standard operating nut. For maximum credit, all hydrants should have a pumper outlet and two hose outlets and should open in the same direction. The fire department inspects all fire hydrants semi-annually, but does not conduct a static pressure test on both visits and flushes the hydrants annually. In 2008, the town received 74% credit (2.23 points out of a maximum of 3 points) for inspection and condition of the fire hydrant. For full credit under the ISO fire suppression rating schedule, the fire department needs to continue the semi-annual inspections, document that the hydrants are flushed at least once per year, document that both inspections include a test at domestic pressure, and make sure that detailed inspection records are maintained. All hydrants should be easy to spot, able to be used by a fire engine, and in good mechanical condition. Damaged or inoperable fire hydrants should be repaired promptly and records should be kept of repair and maintenance efforts.

In April 2005, the water system received credit equivalent to an ISO rating of 7. The major problem with the water system is that the supply works as a whole is not capable of supplying enough water to meet the community's basic fire flow. Improvements in the procedures for the inspection of the hydrants will result in some improvement in the

water supply score, but will probably not be sufficient to raise the score of the water system above a relative ISO Class 6.

Future Needs

The community is protected by the Scotts Hill Fire Department, a volunteer department with fire dispatching resources provided by two dispatch centers: the Decatur County and Henderson County 911 Centers. In the event of a major fire or large incident, additional engine companies and resources are available from neighboring fire departments through mutual aid. While mutual aid is beneficial, mutual aid companies have long response times and cannot be counted on to be part of the initial response.

To help attract and retain commercial and residential development, Scotts Hill will need to offer the service of good fire protection. At 3.82 square miles, Scotts Hill has an adequate number of fire stations to provide service given the annual call volume, but is not able to respond a sufficient number of personnel to structure fires to provide an efficient and effective fire suppression effort.

Firefighting is very labor intensive, and extremes of heat and cold affect a firefighter's ability to perform strenuous work over long periods of time. Many tasks must be performed on the fire ground, including search and rescue, protecting exposures, forcible entry, ventilation, control of utilities, water supply, applying water through hose lines, salvage, and overhaul, in addition to complying with the OSHA regulation (known as 2-in, 2-out) requiring a rapid intervention team. In reviewing the number of personnel that responded to the most recent structure fires (see Appendix A), the fire department was able to respond a maximum of 10 firefighters to one incident and as few as 2 fire fighters to another incident, with average number of responding personnel being 6.8, which includes the chief officer. ISO requires that a chief officer respond to every incident, but ISO does not count that chief officer as one of the firefighters needed under the grading schedule. This means that ISO would give credit for an average of 5.8 firefighters per structure fire. Mutual aid response increases the total number of firefighters on the scene, but mutual aid response takes time and is not as efficient or effective as the first alarm response.

The level of fire protection provided in a community is a local policy decision balancing local risk against available resources. There is considerable debate about the minimum number of firefighters needed on an engine company, but there is a general consensus throughout the fire service that a minimum of sixteen firefighters should be on the fire ground on the first alarm to provide a safe and effective firefighting effort or the risk for injuries or fatalities increases, flame spread increases, and property loss increases. NFPA recommends a minimum first alarm response to different classes of hazards and this response is summarized in Table 7 below. The information in the chart and the descriptions of the hazards are taken from Table 12.1.1 on page 12-12 of the NFPA Handbook 20th edition.

	High Hazard	Medium Hazard	Low Hazard
Engines	4	3	2
Aerial Ladder Trucks	2	1	1
Chief Officers	2	1	1
Firefighters	24	16	14
Safety Officers	1	1	1
RIT personnel	2	2	2
Total Personnel	29	20	18
Table 7 – Typical Initial Attack Response Capability			

High Hazard: Schools, hospitals, nursing homes, explosives plants, refineries, high-rise, and other high life hazard or large fire potential occupancies.

Medium Hazard: Apartments, offices, mercantile, and industrial occupancies not normally requiring extensive rescue or fire fighting forces.

Low Hazard: One-two-, or three-family dwellings and scattered small businesses and industrial occupancies.

This report recognizes that the Town of Scotts Hill has a volunteer fire department and does not have the fiscal resources to provide the full initial response capabilities recommended by NFPA. The information is provided to use as a guide for determining a minimum level of response acceptable to the community for given risk levels, to illustrate the importance of on-duty staffing, and to emphasize the need for a robust volunteer program.

The phenomenon known as flashover should be considered when establishing staffing and service levels. As a fire grows in size, it gives off heat that heats other objects in the vicinity of the fire. At some point, all of the objects in the fire room reach their ignition temperature and ignite. The entire room bursts into flame, and the temperature rises to a point where no person can survive, including fire fighters. This is called flashover. The NFPA Fire Protection Handbook states: "During flashover, however, the temperature rises very sharply to such a level that survival of persons still in the room at that stage becomes unlikely. Thus the time interval between the start of the fire and the occurrence of flashover is a major factor in the time that is available for safe evacuation of the fire area." The development of fire conditions to reach the point of flashover is a function of temperature rise over time. As shown in the graph in Figure 4, flashover can occur as early as four minutes of the start of a fire. Therefore, a sufficient number of fire stations strategically located to provide quick response times can reduce the incidence of flashover, thus saving lives and property. Scotts Hill's single fire station is nearly centrally located, so the response time increase with distance throughout the community is proportional. The average response time is 5:30, but the clock stops when the first unit arrives on the scene regardless of whether there are enough firefighters on the scene at that point to begin effective fire suppression operations. A

quick response time (between 6 to 7 minutes on 90% of responses) with a sufficient number of firefighters is advantageous as fire fighters need time after arrival to setup, rescue occupants if needed, lay fire hose, and gain access to the seat of the fire before they can actually begin to extinguish the fire. MTAS recommends a response time standard of having the initial company on the scene within six-minutes, thirty-five seconds (6:35) of the initial call to 911 on 90% of all responses. The Scotts Hill Fire Department places the first unit on the scene within 6:35 on 80% of all responses.

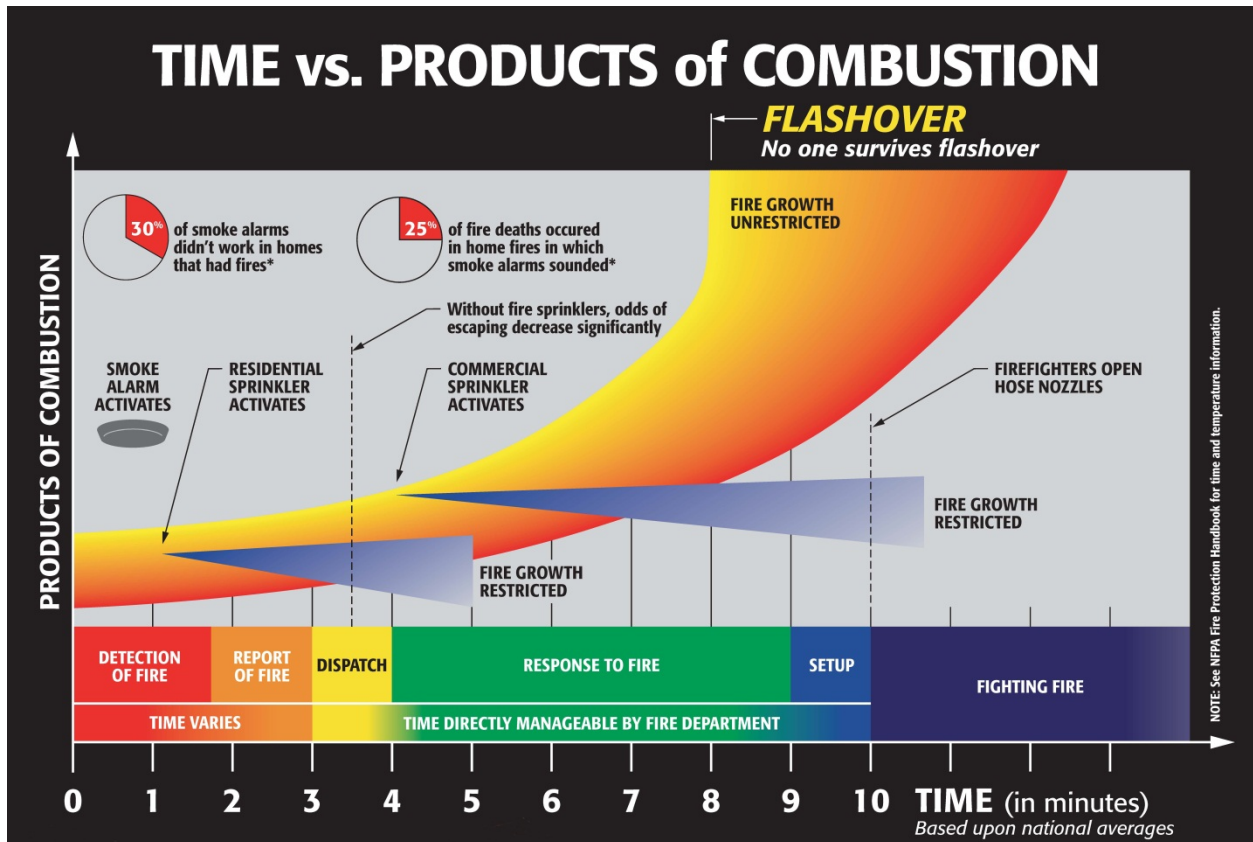


Figure 4 – Generalized Flashover Curve

With the above in mind, there are several challenges facing Scotts Hill including:

- Funding for fire services,
- Minimum staffing levels,
- Equipment,
- The need to replace apparatus, and
- Volunteer recruitment and retention.

Future fire station(s)

Scotts Hill's urban growth boundary is 15.2 square miles. Right now, a single fire station is sufficient for adequate fire protection. Without a map of the urban growth boundary area and a road system of the undeveloped area, it is difficult to tell if the current fire station should be relocated, or to predict where a new fire station or stations should be built to provide the best distribution of resources. Two models can help estimate the number of fire stations needed based on square miles. The first is a model based on the ISO response district of 1.5 miles as measured over roads. The average size of such a district is approximately 4.5 square miles, which means Scotts Hill would need 3.38 fire stations at build out. The other model is based on NFPA's travel time requirement of 240 seconds for the initial arriving company. The average size of such an area is 7.3 square miles, which means Scotts Hill would need 2.08 fire stations upon reaching build out. For long range planning purposes, the town should plan for at least one additional fire station in the future.

Funding for fire services

In paid departments, the largest expense is paid personnel, which is why a volunteer fire department makes fiscal sense provided the community supports the fire department by providing a sufficient number of qualified volunteers. If this is not the case, the town should look for ways to fund a sufficient number of paid personnel to provide 24-hour coverage. The Federal Emergency Management Agency (FEMA) has a grant program called SAFER (Staffing for Adequate Fire and Emergency Response). The SAFER grant was created to provide funding directly to fire departments to help increase the number of trained on-duty firefighters available in their communities. SAFER grants can be used to hire paid personnel, and volunteers departments can use SAFER grants for programs to recruit new volunteers and to provide incentives to retain existing volunteers. Recruitment campaigns, marketing activities, junior firefighter programs, and length of service award programs are examples of programs that have been funded with SAFER grants.

SAFER is a matching grant, so if Scotts Hill applied for a received a SAFER grant, the town would be obligated to fund 50% of the cost over the period of the grant, which has ranged from three to five years in past grants. Scotts Hill should consider applying for a SAFER grant to increase the number of trained firefighters available in the community. As a resource for more information on how to use SAFER funds for recruitment programs, in 2011 the Pleasant View Volunteer Fire Department (\$31,000) and the Selmer Fire Department (\$143,652) received SAFER grants for recruitment programs.

Minimum full time staffing levels

The department is a volunteer department and does not have a minimum staffing level policy.

In reviewing the most recent structure fires over the past twelve months (see Appendix A), it was noted that there were responses by on-duty volunteer personnel. On-duty

volunteer personnel are volunteers who work an assigned shift at the fire station and respond to alarms from the fire station rather than respond from home/work to the station to get the fire truck, or from home/work to the scene. For on-duty manning, ISO gives credit for on-duty staffing and on-call staffing and does not differentiate between paid and volunteer in giving staffing credit. A volunteer working a shift at the station is credited the same as a paid firefighter working a shift at the station: 1-for-1 credit, while off-duty response is credited at 3-to-1. To receive credit for volunteer ride out hours, the hours must be scheduled and the ride out time must be documented. A volunteer cannot just “show up and ride out” and have the time count as on-duty time. Volunteers count as on-duty personnel as long as they are scheduled, present, available to respond, and the time is properly documented. Therefore, the fire department should establish a written policy creating a volunteer firefighter work schedule where volunteers ride out following a schedule and the time is documented properly.

Consensus in the fire service is that an effective initial response to a residential structure fire minimum requires sixteen firefighters. NFPA 1720 recommends a minimum response level of ten firefighters for a volunteer fire department. In 2010, Scotts Hill averaged 6.8 firefighters on the scene of a structure fire, which means that firefighting operations are not as efficient or effective as they could be as many fire ground tasks cannot be performed simultaneously, or there may not be enough firefighters on the scene to mount an interior fire attack, both of which increase the amount of property lost. Having an insufficient number of firefighters makes it more difficult for the chief to comply with the OSHA 2-in, 2-out regulation as those few personnel will be needed for active suppression operations. Since the same amount of work must be done on every fire, fewer personnel on the scene means that the firefighters work longer without relief, and fatigue compromises safety and increases the chance for injury.

Scotts Hill should plan to increase the number of firefighters available to respond to fires. This can be done by increasing the number of active volunteers, hiring part-time firefighters, hiring full-time firefighters, or some combination of these options. However, adding paid personnel is a recurring and increasing expense, and Scotts Hill has no paid firefighters now.

Volunteer recruitment and retention

A volunteer fire department is economical only if there are sufficient volunteers available in the community to provide an effective response. As noted above, volunteers can be used in creative ways, such as working scheduled shifts, to staff a fire station part of the time.

Recruitment can take many forms. The most effective recruitment tool is for a current volunteer firefighter to ask someone he or she knows to consider becoming a volunteer firefighter. Other recruitment tools include:

- An open house either on a regular drill night or at specific times during the year
- A sign in front of the fire station asking for volunteer firefighters
- An ad in the local paper
- Asking a local reporter to ride along for a day and write a story about what the fire department does and in the story mention the need for volunteers
- An insert in church bulletins
- Flyers handed out at community functions
- Having the fire chief speak to local community groups about the need for volunteer firefighters
- A citizen's fire academy where residents come for a couple of hours every week for several weeks and see what a firefighter does. Even if they don't become volunteers the department will have some new fire department advocates in the community.
- A way on the fire department's website for people to apply to be a volunteer
- Using social media such as Facebook and MySpace
- A neighborhood door to door campaign
- Talk with administrators at Tennessee Technological University in Cookeville about recruiting students there to serve as volunteer firefighters in exchange for room and board at a fire station
- Using the National Volunteer Fire Council as a resource for recruitment ideas. Their website is <http://www.nvfc.org>

Once the department has volunteers, it is important to retain them. The fire department spends time and money training and equipping a volunteer, and the volunteer gains knowledge and experience that is valuable and difficult to replace if the volunteer leaves. Retention tools include:

- Department uniforms
- Per call compensation incentives
- Length of service awards program (Scotts Hill has a program)
- Featuring a volunteer in a newspaper story
- Publicly recognize volunteers who have made a significant accomplishment on a call, or in completing a training program, or in the community
- Just saying "thanks for all you do" is very rewarding

Equipment

Because of the community's basic fire flow, Scotts Hill needs three engines for full credit, plus one reserve engine. In April 2005, the department received 85% credit for Engine 30 because of insufficient equipment. The department received 0.21% credit for a reserve engine, although this was for some equipment carried on a non-fire engine, as the department does not have a reserve pumper. The department received 79% credit for a service company and no credit for a reserve service company. For full credit, the equipment inventory on all units needs to comply with the minimum equipment list in the ISO grading schedule.

ISO will most likely count U30 and U31 as two of the three needed engines, and may credit the tanker (T30) or the brush unit (B30) as the third engine, depending upon which unit may give Scotts Hill the most credit. Whichever unit is not credited as the third needed engine would most likely be credited as the needed reserve engine. This means the 1983 Chevy and 2003 Ford will probably be credited as the needed service truck and reserve service truck. It is important to have as much of the required equipment as possible on these units to receive the maximum credit possible for a service truck.

The need to replace apparatus

Within the last decade, the NFPA standards covering the construction of fire apparatus have changed to reflect advances in technology, functional capability, and firefighter safety. Since the trucks are already paid for, it may seem to be cost efficient to continue to use older apparatus for first line service. However, older apparatus have few of the safety features, such as antilock braking systems, air bags, ergonomic design, and reinforced cabs, found in newer apparatus. In addition, the engine, transmission, and fire pump are old and the pumper may have difficulty passing the annual pump test. For these reasons, it is a good business practice to plan for the depreciation and orderly replacement of fire apparatus just as other capital assets are replaced when their useful life has ended.

Scotts Hill operates apparatus that met NFPA standards at the time of manufacture. The 1978 Mack and 1978 Ford brush truck are the department's oldest apparatus at 34 years old. The 1980 GMC tanker is 32 years old. NFPA 1901 Annex D recommends that apparatus that is more than 15 years old be placed in reserve service, and apparatus that is more than 25 years old be replaced. All three trucks are candidates for replacement.

MTAS recommends the development of a formal replacement schedule for all fire apparatus, planning for apparatus to have a projected first out service period of 15 years followed by a reserve service period of no more than 10 years provided the apparatus has been properly maintained and is still in serviceable condition. The department should specify apparatus with minimum seating for four firefighters and pumps rated to deliver at least 1,500 gpm. Because of water supply concerns a pumper/tanker is recommended.

ISO requires that a town have at least one reserve fire engine for every eight needed engines or fraction thereof. Scotts Hill needs one reserve fire engine, and it does not have a true reserve fire engine.

Recommendations

The most efficient and cost effective way for the Town of Scotts Hill to provide an all-hazards service delivery program that addresses community risks and needs is in the following recommendations.

1. Continue to use the volunteer fire department model as this type of fire department for a community the size of Scotts Hill can provide adequate, cost-effective services.
2. To maximize the efficiency and effectiveness of the volunteer model, increase the level of volunteer response through a combination of increased response levels of existing volunteers, recruitment of new volunteers, and development of a volunteer ride out program to increase the credit for on-duty manning.
3. To maximize the efficiency and effectiveness of the volunteer model, develop a formal recruitment and retention program.
4. Appoint a volunteer coordinator to manage the recruitment and retention program.
5. Continue to maintain good working relationships with other fire departments as these departments provide mutual aid response to augment Scotts Hill's fire suppression capabilities.
6. Adopt a response time standard for the community. Scotts Hill is a perpetual organization that will outlast current leaders, and a response time standard will serve as a planning guide for future leaders. This study recommends a response time standard of 6:35 (six minutes, 35 seconds) for 90% of all responses, which is based upon recommendations found in NFPA Standard 1710, Standard for the Organization and Deployment of Fire Suppression Operations. The 6:35 breaks down as follows: ring time – 15 seconds, call processing time – 60 seconds, fire fighter turnout time – 80 seconds, travel time – 240 seconds. Scotts Hill officials can use this standard to plan for future fire service improvements.
7. Adopt a minimum response standard for the community. The response standard should identify the minimum number of firefighters the department desires to have present on every structure fire response. Use this standard to establish volunteer firefighter recruitment and retention goals. The standard adopted should be based on the level of service the community desires and can afford, and consideration should be given to NFPA Standards 1710 and 1720 in developing the standard Scotts Hill adopts.
8. Adopt a sprinkler ordinance for all new commercial construction. ISO does not consider properties protected by a code compliant automatic sprinkler system when determining the needed fire flow for a community. In buildings protected by sprinklers, the sprinkler system either extinguishes the fire before the fire department arrives, or holds the fire in check until the fire department arrives to complete extinguishment. This is important since the water system is not capable of delivering the needed fire flow should the building be fully involved. In a sprinklered building, the amount of time between the occurrence of a fire and reopening for business can be as little as a few hours versus months for a non-sprinklered building.

9. Research and consider adopting a residential sprinkler ordinance to require residential sprinklers in all new residential construction. Tennessee's fire mortality rate for civilians has been among the highest in the nation. During 2002-2010, the time period for the Tennessee Fire Mortality Study, the national fire mortality rate declined, but the rate in Tennessee increased. Residential structure fires account for about three-fourths of all civilian fire deaths in the state. Residential sprinklers save money and lives and are a good investment in a home, but they are controversial in many communities which is why this study recommends research on residential sprinklers before considering adopting an ordinance. Adopting an ordinance would be proactive for community safety.
10. Increase the level of training by conducting a minimum of eight three-hour training drills each year, a minimum of 24-hours of training per firefighter annually, at least twelve hours of training annually for officers and drivers, and document all pre-fire planning training. Train at least one per quarter with mutual aid departments.
11. Develop an apparatus replacement schedule and begin planning and budgeting for the scheduled orderly replacement of fire apparatus based on first out apparatus being no more than 15 years old, reserve apparatus being no more than 25 years old, and apparatus older than 25 years being retired from service. MTAS recommends that the town replace E31, T30, and B30 as soon as practical and possible.
12. Because of the water supply deficiency, develop specifications for 1,500 gpm pumper/tankers to replace the older pumpers.
13. Develop specifications for a new service unit, including any needed tools and equipment to fully meet the ISO requirements for a service truck, and replace the 1983 Chevy.
14. Begin planning and budgeting for immediate equipment needs including all tools and equipment needed to bring all engines into compliance with the equipment schedule found in the ISO Fire Suppression Rating Schedule.
15. Adopt a fire code that is a published version year 2005 or newer and begin a code enforcement program. The code adopted must be within seven years of the most recent published edition of the proposed model code, which is the 2012 edition.
16. Budget for a vehicle exhaust removal system for all apparatus bays.
17. Develop a policy for regular inspection, maintenance, and replacement of damaged hand tools and firefighting appliances.
18. Test all ground ladders annually to NFPA Standard 1932.
19. Develop a standard for fire hydrants and a plan to replace or upgrade all non-standard fire hydrants. Approximately 5% to 10% of the hydrants have a non-standard operating nut, and only 60% of the fire hydrants have a 4" or larger pumper connection and two 2½" hose connections. For maximum credit under ISO, all hydrants should have standard size operating nuts and a 4" or larger pumper connection and two 2½" hose connections.
20. Conduct a fire hydrant flow test of the fourteen fire flow tests run in 1997 to see if any of these flows are still deficient. If they are, conduct a study to see what is needed to improve the needed fire flow for these risks.

Appendix A – Structure Fire First (Initial) Alarm Personnel Response

Date	Time	Chief Officer(s)	Off-duty Vol.	On-duty Vol	Off-duty Paid	On-duty Paid	Total Personnel
02/12/2011		1	0	9	0	0	10
02/03/2011		1	3	0	0	0	4
10/25/2010		1	0	1	0	0	2
10/21/2010		1	8	0	0	0	9
10/10/2010		1	8	0	0	0	9
	Average	1	6.3	5	0	0	6.8
Chief Officers:	The number of responding Chief Officers who did not perform firefighting duties . This means they served as the command officer or performed some other function.						
Off-duty Vol.:	The total number of call or volunteer personnel, including officers performing firefighting duties, who responded from home, business, etc.						
On-duty Vol.:	The total number of call or volunteer personnel, including officers performing firefighting duties, who responded from a regular on-duty assignment at the fire station						
Off-duty Paid:	The total number of paid personnel, including officers performing firefighting duties, who responded from an off-duty status.						
On-duty Paid:	The total number of paid personnel, including officers performing firefighting duties, who responded from an on-duty assignment at the fire station.						

Appendix B – Hydrant Flow Data Summary from 04/14/2005
 (Deficient fire flows are highlighted in yellow)

Test No	Needed Fire Flow (gpm)	Limited by Supply Works (gpm)	Limited by Distribution Mains (gpm)	Limited by Hydrant Spacing (gpm)
1	3,500	2,107	300	
2	3,500	2,107	2,400	1,420
3*	4,500	1,959	300	1,500
3a	3,000	2,107	300	2,590
4	3,000	2,107	1,100	
5	1,500	660	450	1,000
6	500		400	
7	2,250		700	929

*Needed fire flows exceeding 3,500 gpm are not considered in Item 616 (Credit for Supply System) in the Fire Suppression Rating Schedule in determining credit for the water system.

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