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Planning a Rural Fire Protection Service

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Fire remains one of the major problems of this country and causes more loss of life and property than all natural disasters combined. Small towns and rural areas reported a greater frequency of fires with higher death rates and dollar losses per capita than larger cities and metropolitan areas. As more people move into small towns and rural areas, provision of adequate fire protection services becomes even more important. The following information can assist local decision makers in planning new or additional fire services.

Planning the fire service

Steps to be followed in the initial stages of designing a rural fire service include: determining the service area; estimating expected number and types of annual fires; and estimating costs. A brief discussion of each step is presented below along with a discussion of potential sources of funding.

Determining the service area

Local considerations are important in the determination of a fire service area. These include location of fire services in nearby communities, physical barriers (rivers, poor roads and poor bridges), local telephone service area, and response time from station(s) to fire sites. In addition, the fire protection service may also want to provide rescue or ambulance service.

Once an area's boundaries are defined, it is important to know certain things about the area itself, including:

- Total population
- Size of area
- Number of residences and businesses and their locations
- Number of registered vehicles.

Locations of any fire hydrants should be known, also. Potential sources of water in rural areas — lakes and rivers — should be investigated and noted on a service area map. Portable pumps may be needed to use natural water sources. Also, a county road numbering system would facilitate locating fire sites.

Estimating expected annual fires

Knowledge of the number and types of fires to be expected in a year is valuable for planning equipment purchases and training programs. Fire frequency coefficients (FFCs) for the Ozarks regions of Oklahoma and Missouri have been developed for use in predicting this information. The FFCs in Table 1 present two methods for estimating number of fires.

Table 1

Annual fire frequency coefficients for selected Oklahoma and Missouri Ozarks counties, 1979.*

Demographic characteristic		Fire frequency coefficient**
Method one		
Population		54
Method two		
Acres		5,125
Registered vehicles		265
Business establishments		12
Residential units		62
Other***		386

*Tulsa County, Oklahoma and Greene County, Missouri, have been omitted from this analysis.

**To be interpreted as, for example, one fire occurring per 54 people in the study area.

***This fire frequency coefficient has been based on area population. It includes fires occurring at institutions, places of public assembly, educational facilities, storage facilities, other special property, railroad cars, aircraft, heavy equipment, agricultural equipment and watercraft.

In the first method, the FFC for population is 54. This means one fire is predicted annually for every 54 people in the service area. To estimate the total number of fires, use the following formula:

$$\frac{\text{Service area population}}{\text{estimated annual fires}} = 54$$

A second estimate may be obtained using the other FFCs in Table 1. This estimate requires knowledge of acreage, registered vehicles, business establishments and residential units, as well as area population.

Divide each of the above by their respective FFCs and add together to obtain the total number of fires expected. A third estimate might be obtained by surveying residences and businesses in the service area.

Estimating capital costs

Initial capital expenses will include fire trucks, communication system, fire station and protective gear for the firefighters. Since rural areas differ in topography, roads, traffic, distance of response, types of structures and availability of water, much consideration must be given to the decision of which fire apparatus will best protect your service area. Table 2 lists price ranges for three types of pumpers and average prices for two types of tankers. Detailed descriptions of each vehicle are included in the OSU bulletin listed in the references. The grass and brush rig does not have the extinguishing capacity and fire hose normally needed for structural fires. Some communities have remodeled surplus military vehicles for fire protection. Availability of used equipment for sale should also be investigated.

Table 2
Capital costs of new and renovated surplus fire apparatus, May 1981

Apparatus*	Dollars
Pumper	
Standard	53,000-60,000
Grass and brush**	20,000-28,000
Renovated surplus	7,000-8,000
Tanker***	
1,250-gallon	55,000
Renovated surplus	4,000

*Detailed descriptions are available in the USDA bulletin.

**Slip-on units are also available that would be suitable for grass and brush fire use. A 300-gallon capacity unit averages \$5,800 and could be mounted on a 1-ton pickup.

***Tankers may be additionally equipped with a portable folding tank. A tanker could dump its water into the portable tank once it reaches the fire scene and immediately move to a nearby water source to replenish its supply. A 1,000-gallon capacity portable tank would cost about \$800 to \$950.

A dependable communication system will greatly improve the efficiency of a rural fire department. A phone-activated system or sheriff's dispatching may be used for the initial reporting of fires by the public. Radio communication among dispatchers, stations and apparatus is uniquely suited to the mobility requirements of rural services. Channels on the VHF and UHF bands have desirable features and may provide the most efficient coverage of an area. If a VHF or UHF system is economically beyond the reach of your community, the use of a citizen band (CB) system may be a temporary solution. Costs of radio components are shown in Table 3.

Table 3

Capital costs of new communication equipment, by type of system, May 1981

Equipment	Type of system* and cost		
	VHF	UHF	CB
Base station and remote console installed	\$4,960	\$6,560	\$120**
Mobile radio installed	\$2,060	\$3,040	\$100***
Tower installed	\$1,525	\$1,525	n.a.****
Antenna	\$270	\$270	\$50*****
Transmission line per foot	\$2.84	\$2.84	\$1.50

*VHF = very high frequency; UHF = ultra high frequency; CB = citizen's band.

**Price for base unit only.

***Includes antenna for mobile unit.

****n.a. = not applicable.

*****Price for an 18-foot antenna, allowing a range of 10 to 14 miles.

A fire station should be provided to store fire apparatus at temperatures above freezing. It may also be used for storing auxiliary equipment and as a meeting place for firefighters and other groups. The station may be constructed under contract or by local citizens or an existing structure may be remodeled.

Estimated cost for a new all-metal structure with concrete floors and with heating and air conditioning for the meeting room and restroom is \$27 per square foot for complete contracting.

Protective clothing for structural fire fighting normally consists of turnout coats, boots, helmets, gloves and pants. Suits are available for other types of fire fighting. The firefighter should understand the design and purpose of the various types of protective clothing and be especially aware of each garment's inherent limitations. Costs of basic suits for structural fires range from about \$200 to \$275.

Statistics on firefighters injured each year by inhaling toxic gases clearly indicate that the provision of protective breathing apparatus should receive a high priority. A 30-minute self-contained unit will cost about \$800 to \$950.

Estimating operating and maintenance costs

Operating expenses for a fire station include insurance, water, sewer, trash, electricity for heating and air conditioning, and maintenance. Vehicles must be kept operational for every fire call, necessitating preventive maintenance and repair work. Insurance, gas, oil, tires and miscellaneous items must also be included in the budget. Communication system service may be handled through an annual service contract. These expenses are summarized in Table 4. Volunteer labor could reduce maintenance costs.

Three types of labor arrangements are used in fire service departments: volunteer, part-paid and full-paid. Volunteer systems are common in small, rural communities. However, some communities of under 10,000 population in Oklahoma and Missouri do have part-paid departments. Full-paid systems are most common in larger communities.

Volunteers often receive some small compensation for their services. In many communities, a volunteer receives \$5 per fire attended and \$6 per monthly meeting attended. An "all-volunteer" system may also have a chief and/or training officer to handle scheduling of monthly meetings and training sessions and to supervise equipment and maintenance of apparatus.

Table 4

Annual fire department operating and maintenance costs, 1980.*

Cost category	Expense (dollars per unit)
Fire station**	
Insurance	2.40 per \$1,000 value
Water, sewer, trash	156 per year
Electricity***: meeting room and restroom	1.28 per square foot
vehicle storage area	0.42 per square foot
Maintenance	200 per year
Vehicle(s)	
Insurance****	40 per \$1,000 value
Repairs*****	535 per truck
Gas, oil, tires***** large vehicles	0.39 per mile
grass and brush rig	0.22 per mile
Miscellaneous, including small equipment*****	1,131 per truck
Communication system*****	
VHF or UHF base unit	450 per unit
VHF or UHF mobile unit	120 per unit
CB base or mobile unit	35 per unit

*If local costs are available, they should be used in estimating operating costs replacing data in this table.

**From Doeksen, OSU.

***Electricity is used for heating and air conditioning in this study.

****Includes collision (\$500 deductible) and physical damage (\$250 deductible).

*****Based on records of 15 volunteer and part-paid systems as submitted to the Missouri State Auditor's Office.

*****Time frequency may be more important than road miles. Change oil twice a year or every 500 miles. Tire life averages 10,000 miles, or 5 years.

*****Service contracts for UHF and VHF, budget amount for CB.

Financing a fire department

Volunteer labor has long played an important role in the provision of fire protection services across America. Citizens may donate other things, besides their labor, to the successful operation of their community's fire service. Small equipment and consumable supplies are always needed and may be furnished by local citizens. Benefits — picnics, dances, pie suppers, etc. — may be held to raise money as well.

Fees may be charged on a per-run basis, by subscription (or membership), or some combination of the two to handle the costs of fire protection services. Fire protection districts may be established in Missouri.

Once a district is established, bonds may be voted in by the people to finance capital items. In addition, property taxes may be fixed by the directors or approved by voters. Commercial bank loans can also be used to finance capital purchases. Cities and/or fire protection districts may sign inter-local cooperation agreements and/or mutual aid agreements. Cities may purchase equipment for use by volunteer fire protection associations and contract with them for fire protection.

Several federal agencies can provide assistance to rural communities interested in providing fire protection services to their citizens and the residents of the surrounding countryside. For example, some community facilities loans are available through the Farmers Home Administration of USDA. For additional information, contact your local FmHA office.

Grants for fire protection of non-federal lands are available from the Forest Service of USDA to state forestry agencies. These funds may cover such costs as equipment purchasing, training and education. Acquisitions and use of federal excess property by state foresters for fire control use is also authorized. For further information on these programs, contact the Missouri Department of Conservation.

Fire training

Members of rural and small-town fire departments should receive training in fire fighting. In Missouri, such training is available from the Fire and Rescue Training Institute, <http://mufrti.org/> of the MU Extension. Courses include both firefighting skills and management skills. The Missouri Department of Conservation also provides training in controlling brush and grass fires.

Additional information

Information in this guide concerning frequency of fires, equipment costs and operating costs is based upon a joint study in the Ozarks region by the U.S. Department of Agriculture, Oklahoma State University and MU. More detailed information and/or forms for planning a fire service are presented in the OSU report:

- Nelson, M.K. and G.A. Doeksen. *Fire Protection Services Feasibility Guide for Local Decision Makers in the Rural Ozarks*, Bulletin, Oklahoma State University.
- More information concerning fire protection districts is available from the Department of Community Development.
- Dohm, R., *Summary of Statutory Provisions Relating to the Incorporation, Organization, Powers and Finances of Fire Protection Districts in Missouri*. Bulletin number 1, February 1980.
- A list of audio-visual materials and course descriptions is available from MU Extension Fire and Rescue Training Institute, 205 Lewis Hall, 573-882-4735 — ask for the publication *Missouri State Fire Prevention, Public Education and Training Resource Catalog, and Fire Training Classes*.

Related MU Extension publications

- G1907, Residential Fire Detection
<http://extension.missouri.edu/p/G1907>
- G1908, Fires in Agricultural Chemicals
<http://extension.missouri.edu/p/G1908>
- NRAES39, Fire Control in Livestock Buildings
<http://extension.missouri.edu/p/NRAES39>

Order publications online at <http://extension.missouri.edu/explore/shop/> or call toll-free 800-292-0969.



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