Escape Potential

T.1 Spot fires - The predicted spotting distance for the upper wind-speed-end of the prescription is up to 1 mile; however, this prediction is the spotting distance from a wind-driven headfire with a fully developed convective column. The spotting distance from the short runs and backing/flanking fires produced by the firing operation would be considerably less—the greatest spotting distance noted in "Burning by Prescription in Chaparral" is only 300 ft, with wind gusts up to 20 mph.

Spot fires should be expected under the entire range of prescribed conditions. A higher probability of ignition increases the likelihood of a spot fire occurring. Table 1 shows the probability of ignition in sunlit and shaded fuelbeds based on varying temperatures and RHs.

Table 1—Probability of Ignition for Sunlit and Shaded Fuelbeds

Temperature (F)	Relative Humidity (%)							
	15–19		20–24		25–29		30–34	
	Sunlit	Shaded	Sunlit	Shaded	Sunlit	Shaded	Sunlit	Shaded
60^o–69^o	70%	40%	60%	40%	50%	30%	50%	30%
70^o–95^o	90%	60%	80%	50%	70%	40%	60%	40%

T.2 Control-line width - A training guideline for firing operations (CDF-234 & S-590) is that the width of a control-line should be approximately 4 times the FL. This width sufficiently prevents slop-overs caused by radiant heat or direct flame contact. The firing operation would place approximately 7-ft flanking/backing FLs adjacent to the control line. An approximately 30-ft-wide control line would defeat direct slop-overs from those flames. When the combined width of the control line and burned zone reach approximately 120 ft, direct slop-overs would be prevented—even from 30-ft headfire FLs.

T.3 Escaped-fire spread projections – To project the potential spread of an escape, four hypothetical spot fires have been modeled. The most severe conditions within the prescription are assumed for these hypothetical spot fires. Although the locations and wind directions that were selected for theses spot fires are arbitrary, they are indicative of the potential problems. The projections show the approximate spread of an escape during the first hour without any suppression activities (during operations, escapes will be suppressed). These four projections represent a spot fire's average rate-of-spread (ROS) in each fuel type.

It should be noted that these projections represent just a small portion of possible spot fires; therefore, it is not practical to detail the elements of the presumed fire environment used in these projections.

T.4 Assumed conditions - All of the sets of conditions that define the upper end of the prescription are correlated with essentially the same ROS and FL, and they would yield similar predictions. The assumed conditions listed in Table 2 are typical of the windier sets of conditions, which comprise the most severe end of the prescription range.

The wind-reduction factors used are based on average 3-min. wind speeds taken simultaneously at a 6-ft height and at the 20-ft RAWS height. From those observations a "roughness coefficient" of $z_0 = 0.108$ was determined. Adjustments between mid-flame height and 20 ft were based on the following equation: $u_2 / u_1 = [\ln(z_2 / z_0)]/[\ln(z_1 / z_0)]$, where z_1 and z_2 represent height above the ground, and u_1 and u_2 represent the corresponding wind speeds. Further reductions in wind speed due to sheltering by vegetation were based on the guidelines used in the FBPS. Table 3 lists the predicted ROS for the various fuel models based on the assumed conditions listed in Table 2.

Table 2—Assumed Conditions

Slope			0%
Wind speed at 20-ft level			14 mph
Wind reduction factors	Fuel model 6		0.78X
	Fuel models 2, 8, and 9 (under closed stand)		0.1X
	Fuel model 2 (partially sheltered in patchy brush stands)		0.28X
FM	1 hr		8%
	10 hr		7%
	100 hr		8%
	Live herbaceous for fuel model 2	Under closed stands	100%
		Open patches of sparse grass	80%

Table 3—Predicted ROS Based on Assumed Conditions

Fuel Model/Fuel Type	ROS (ft/min.)
6 (dormant brush)	91
2 (under closed stand)	6
2 (patchy grass in brush stands)	25
Litter (avg. of fuel models 8 and 9)	1
Brush-litter (avg. of fuel models 6 and litter)	46
Brush-grass (avg. of fuel models 6 and 2 (patchy grass in brush stands)	58
Avg. of brush-litter and brush-grass fuel types	52

T.5 Controllability

The overall spread of the hypothetical spot fires has been based in part on fuel model 6, because that in combination with other models give a fairly realistic sense of how a spot fire might spread in the first hour. The predicted flame length for those fires in the "model 6" brush is 9 ft—within the recognized "11-ft limit" recommended for direct control methods. However, it is important to remember that the spread projections and flame lengths are averages, and deviations about the average will occur, including longer flame lengths. Also, within the fuel bed are patches and pockets of fuel that might burn like fuel model 4 and might produce flame lengths of 30 ft or so, especially if the flareup coincides with a gust of wind. Those flareups would be localized and transient. There would be direct attack opportunities at least in the early stages of a spot fire and in the periods of less-than-maximum fire intensity during the course of the spot fire, and all opportunities would be fully exploited.

A fire behavior prediction can help guide operational decisions, providing approximate measures of the expected fire behavior in an overall sense. But it cannot provide the complete, unambiguous answer to controllability. In the end, the judgement of the potential control problems presented by spot fires must be an operational decision, based not only on expected fire behavior but also such things as suppression resources, weather trends, and what lies in the path of an escaped-fire.

T.6 Fitch Park spot fires -The brush fields on the north side of the burn site (Figure 1) are represented by fuel model 6. These brush fields are more varied in structure and less continuous (both horizontally and vertically) than the homogeneous "model 4" manzanita stands within the burn site. It is assumed that a spot fire would initially spend at least 10 min. as a litter fire before developing enough intensity to progress into the crown fuels—during that time, it would likely generate visible smoke. In addition, it is assumed that the fire would not run continuously as a crown fire; instead it would alternate between flare-ups in the crown fuels and surface spread in the litter (fire in the litter is modeled as an average of fuel models 8 and 9). The overall fire spread in this area is based on the fire spending an equal amount of time in the litter and the crowns of the brush; therefore the predicted ROS is 46 ft/min.

Areas of coast live oak exist within the stand, especially near the locations where the spot fires would encroach Fitch Park. The live oak canopy is not expected to support a spreading crown fire. It is expected that the fire would spread as a surface fire in the sparse grass and poison oak under the coast live oaks. Spread in the coast live oak stands is predicted with fuel model 2 under fully sheltered conditions (closed-canopy understory); therefore the predicted ROS is in these areas is 6 ft/min.

A significant air attack would be underway by the time a spot fire had spread to the 15-min. perimeter location. Retardant/water drops could easily span the head of such a fire. Assuming the forward spread of such a fire was stopped at the 15-min. perimeter location, the final size of the contained spot fire would be approximately one-quarter acre or less. If control actions were not taken, both fires would approach the Fitch Park outer-perimeter road within an hour, and they would expand to approximately 2½ and 12 acres, respectively.

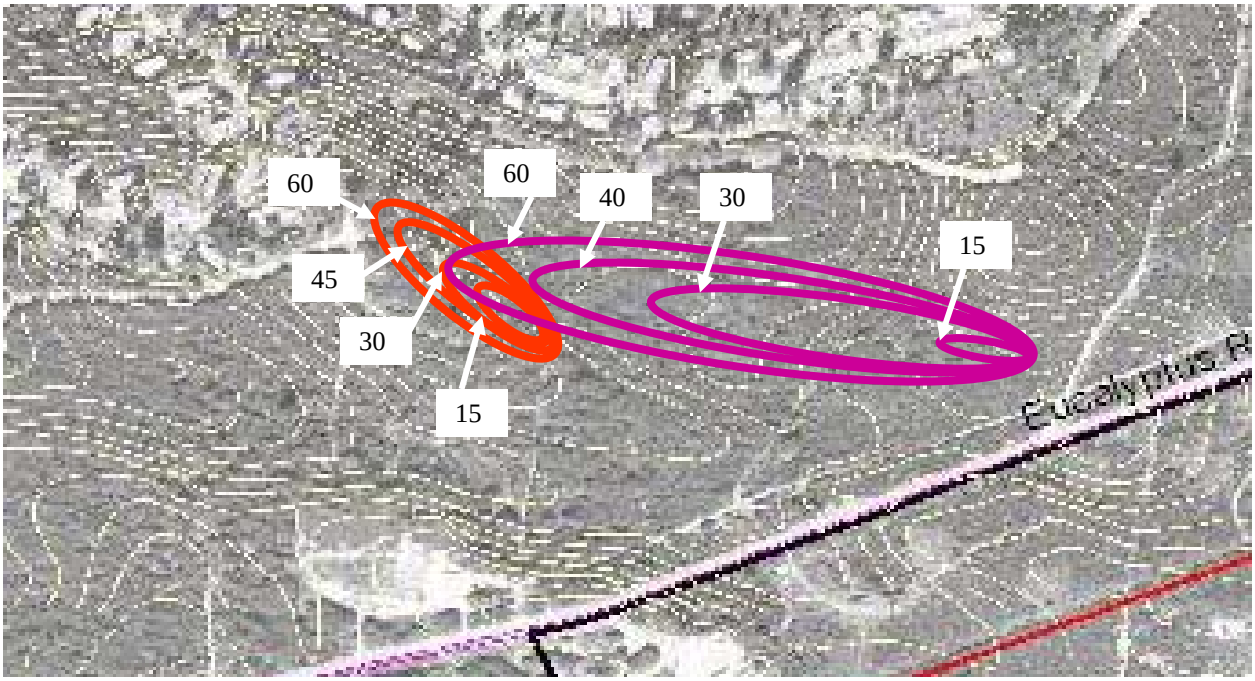

Figure 1—Perimeter projections for hypothetical spot fires on the north side of the burn site moving towards Fitch Park. Successive perimeters are shown for 15, 30, 45 (40 on the purple spot), and 60 min. after initiation of the spot fire.

T.7 Eastside spot fires - The hypothetical spot fires on the east side of the burn site would be ignited in relatively more open fuel beds than those near Fitch Park. It is assumed that a fire would begin spreading within approximately 5 min. after the initiation of the spot fire. In addition, it is likely that smoke would be visible during that time.

T.7.1 Southeast spot fire - The southeast spot fire (Figure 2), which would be located near the intersection of Broadway Avenue and Orion Road, would be burning in patchy short brush with sparse grass in the open areas. The brush would be fairly wind-exposed, and the sparse grass would be partially wind-sheltered by the brush. It is assumed that the fire's overall ROS would be an average of the fuel model 2 ROS combined with the brush-litter fuel type ROS, which is approximately 52 ft/min.

A 200-ft-long retardant drop within the first 15 min. could span the head of the fire. Stopping the forward spread of the fire in the first 15 minutes combined with follow-up perimeter control would limit the fire size to about 1½ acres. If control actions were not taken, the fire would extend east towards a fuel break within an hour, and it would expand to approximately 35 acres.

Figure 2—Perimeter projections for a hypothetical spot fire on the southeast side of the burn site. Successive perimeters are shown for 15, 30, 45, and 60 min. after initiation of the spot fire.

T.7.2 Northeast spot fire - The northeast spot fire (Figure 4), which would be located near the intersection of Eucalyptus Road and Orion Road, would first spread down the lee-side slope under a stand of live oak trees. It is expected that the fire would spread slowly for approximately the first 30 min. If the fire crossed the road at the bottom of the slope and moved into the short brush fields, it is assumed that its overall ROS would be to be an average of the fuel model 2 ROS and the brush-litter fuel type ROS, which equals 52 ft/min. It appears that the grass interspersed in the fuel bed in this area is less than that of the fuel bed in the southeast spot fire; therefore, it may be appropriate to use the 46 ft/min. brush-litter average ROS, which would not significantly change the projection.

Retardant/water drops to stop the forward spread of the fire in the first 15 min. combined with follow-up perimeter control would limit the fire to less than an acre. If control actions were not taken, the fire would extend east towards Parker Flats Road within an hour, and it would expand to approximately15 acres.

Figure 3—Perimeter projections for a hypothetical spot fire on the northeast side of the burn site. Successive perimeters are shown for 30, 45, and 60 min. after the initiation of the spot fire.