FORMER FORT ORD, MONTEREY, CALIFORNIA
MILITARY MUNITIONS RESPONSE PROGRAM

FINAL

MRS-RANGES 43–48
PRESCRIBED BURN
AFTER-ACTION REPORT

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PARSONS

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MRS-RANGES 43–48
PRESCRIBED BURN
AFTER-ACTION REPORT

Signature Page
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Prepared by: _____ Date: 4-1-04
J. Duval
Technical Writer

Reviewed by: _____ Date: April 5, 2004
R. Pike
Fire Stop Planning Section Chief

Reviewed by: _____ Date: 4/5/04
C. Duymich
Burn Project Manager

QC review by: _____ Date: 4/5/04
A. Kothleitner
Quality Control Manager

Approved by: _____ Date: 4-5-04
G. Griffith
Program Manager

MRS-Ranges 43–48
Prescribed Burn
After-Action Report

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ACRONYMS AND ABBREVIATIONS

AAR	after-action report
AIS/ASS	aerial ignition specialist/aerial suppression supervisor
HELCO	helicopter coordinator
CARB	California Air Resources Board
CDF	California Department of Forestry
DTSC	Department of Toxic Substances and Control
EPA	Environmental Protection Agency
FBPS	Fire Behavior Protection System
FL	flame length
FM	fuel moisture
FO1	Fort Ord (RAWS) 1
FO2	Fort Ord (RAWS) 2
FWM	fire weather meteorologist
GPM	gallons per minute
HMP	Installation-Wide Multispecies Habitat Management Plan
IA	Interim Action
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NPS	Naval Post Graduate School
NWS	National Weather Service
OMC	Ord Military Community
PM_{10}	particulate matter less than 10 microns
POM	Presidio of Monterey
PDT	pacific daylight time
RAWS	remote automated weather station
RH	relative humidity
ROS	rate of spread
SEAT	Single Engine Air Tanker
UCAR	University Corporation of Atmospheric Research

DEFINITIONS AND TERMS
Wildland Fire[a]

Aerial Ignition	Ignition of fuels by dropping incendiary devices or materials from aircraft.
Black Line	During fire suppression, burning the fuel between a control line and the edge of the fire.
Bucket Drops	The dropping of fire retardants or suppressants from specially designed buckets slung below a helicopter
Burn Out	Setting fire inside a control line to consume fuel between the edge of the fire and the control line.
Combustion	The rapid oxidation of fuel in which heat, and usually flames, are produced. Combustion can be divided into four phases: pre-ignition, flaming, smoldering, and glowing.
Contain	To keep the fire within established boundaries of constructed firelines under prevailing conditions.
Control Line	All constructed or natural barriers and treated fire edges used to control a fire
Controlled	The completion of control line around a fire, any spot fires therefrom, and any interior islands to be saved; burned out any unburned area adjacent to the fire side of the control lines; and cool down all hot spots that are immediate threats to the control line, until the lines can reasonably be expected to hold under the foreseeable conditions.
Creeping Fire	Fire burning with a low flame and spreading slowly.
Crown Consumption	Combustion of the twigs, and needles or leaves of a tree during a fire.
Direct Attack	Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel
Drift Smoke	Smoke that has drifted from its point of origin and is no longer dominated by convective motion. May give false impression of a fire in the general area where the smoke has drifted.
Escape	A fire which has exceeded or is expected to exceed initial attack capabilities or prescription.
Fire Behavior Prediction System (FBPS)	A system that uses a set of mathematical equations to predict certain aspects of fire behavior in wildland fuels when provided with data on fuel and environmental conditions.

Flame Length (FL)	The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.
Flank	Part of a fire's perimeter that is roughly parallel to the main direction of spread.
Fuel	Combustible material
Fuel Break	A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.
Fuel Model	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
Fuel Moisture	The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212°F.
Head	The most rapidly spreading portion of a fire's perimeter
Hot Spot	A particularly active part of a fire
Incident Objectives	Statements of guidance and direction necessary for the selection of appropriate strategy(s), and the tactical direction of resources. Incident objectives are based upon agency administrators' direction and constraints. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.
Inversion Layer	Atmospheric condition in which the temperature increases as the height increases.
Live Fuel (FM)	Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.
Live Fuel Moisture	Ratio of the amount of water to the amount of dry plant material in living plants.
Offshore Flow	Wind blowing from land to water
Onshore Flow	Wind blowing from water to land
Prescribed Burn	A management ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Pretreat	The use of water, foam or retardant along a control line in advance of the fire. Often used where ground cover or terrain is considered best for control action.
Rate of Spread (ROS)	Rate of forward spread of the fire front.
Red Flag Warning	Term used to signify an ongoing or imminent critical fire weather pattern.
Residual Smoke	Smoke produced by smoldering material after the initial fire front has passed through the fuel.
Secondary Control Line	Any fireline constructed at a distance from the fire perimeter concurrently with or after a line already constructed on or near to the perimeter of the fire. Generally constructed as an insurance measure in case the fire escapes control by the primary line.
Slop-over	A fire edge that crosses a control line or natural barrier intended to confine the fire.
Smoke Plume	The gases, smoke, and debris that rise slowly from a fire while being carried along the ground because the buoyant forces are exceeded by those of the ambient surface wind.
Smoldering	A fire burning without flame and barely spreading.
Spot Fire	Fire ignited outside the perimeter of the main fire.
Strip-Head Fire Pattern	A series of lines of fire ignited near and up wind of a fuel break so they burn with the wind toward the fuel break
Suppression	All the work of extinguishing or confining a fire beginning with its discovery.
Torching	The burning of the foliage of a single tree or a small group of trees, from the bottom up.
Wet Line	A line of water, or water and chemical retardant, sprayed along the ground, and which serves as a temporary control line from which to ignite or stop a low-intensity fire.

[a]Source: Wildland Fire Research and Development Collaboratory, University Corporation of Atmospheric Research (UCAR) Glossary (http://www.rap.ucar.edu/projects/wfc/acronym/glossary/.html)

CHAPTER 1
INTRODUCTION

On October 24, 2003 the Army initiated a prescribed burn at the Former Fort Ord on the Ranges 43–48 munitions response site (MRS). The burn was performed as part of an Interim Action (IA) to protect the public from the threat posed by the munitions and explosives of concern (MEC) known to exist on the site. This after-action report (AAR) summarizes and evaluates this prescribed burn and provides lessons learned for future burns.

1.1 RANGES 43–48 PRESCRIBED BURN BACKGROUND

As the lead agency at the former Fort Ord, the Army concluded in early 2002 that an IA was required to protect the public from three high-risk MRSs at the former Fort Ord—Ranges 43–48, Range 30A, and MRS-16—while final remedial solutions were being developed [Ref. 1]. A quick action was needed in these three sites because they are accessible and in close proximity to the public (Figure 1-1), susceptible to trespassing, and contain highly dangerous MEC on or near the surface that are obscured by dense vegetation. Of the three IA sites, Ranges 43–48 was determined to be the highest priority because of its close proximity to homes and schools in the city of Seaside and the Ord Military Community and the sensitive types of MEC present on it.

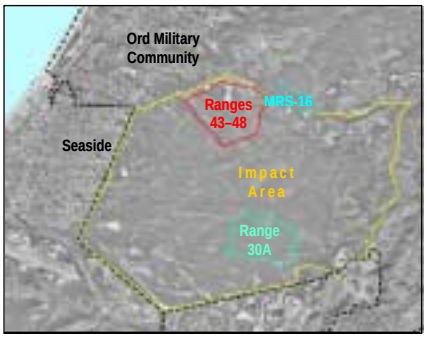


Figure 1-1—IA site locations

The alternatives identified for Ranges 43–48 consisted of a vegetation clearance, a MEC remedial action, and detonations of MEC. A vegetation clearance was needed at Ranges 43–48 because the site was covered by dense maritime chaparral that concealed the MEC on the site's ground, which made it too hazardous to complete the MEC remedial action. Several vegetation clearance alternatives were evaluated, and a prescribed burn was selected because it was determined to be the safest method for personnel, in addition to being the best clearance method for rejuvenating the habitat [Ref. 1].

The Amy's MEC cleanup contractor, Parsons, subcontracted Fire Stop, an experienced wildland fire suppression and prescribed burning company, to plan and conduct the prescribed burn.

1.2 CONSTRAINTS ON BURN OPERATIONS FROM MEC

Although prescribed burning was considered the safest vegetation clearance method, the potential for MEC exploding in the fire and propelling fragments as far as 1,700 ft still placed several constraints on the burn operations.

Because of the potential fragmentation from MEC detonations, a 1,701-ft safety exclusion zone was established around the burn site. A major consequence of this safety zone was that

firefighters could not be positioned on the ground near the burn site—unlike most prescribed burns—to help detect and control spot fires, and extinguish hot spots.

For the safety of aerial resources, a minimum 200-ft flyover and drop height was also established. As a result, the helicopters' tether lines from which water buckets are suspended from had to be lengthened in order to keep the buckets close to the flames so that the water drops would not dissipate before reaching their targets (using longer tether lines, though, created the potential for less accurate water drops, depending on fire and weather conditions).

To address these constraints, Fire Stop designed a burn plan with additional helicopters for suppression, holding, and contingency operations.

Another significant impact from MEC occurred when it was determined that the presence of MEC made it too dangerous to complete vegetation cutting along the southern portion of Evolution Road and the western portion of Broadway Avenue. This vegetation cutting was part of the Army's plans to widen the fuel breaks surrounding the site in order to enhance their ability to contain the burn.

1.3 SUMMARY OF MAJOR EVENTS

The goal of the prescribed burn was to clear most of the brush while minimizing smoke impacts to the nearby communities. To achieve this goal, the Army established criteria for several fire, weather, and atmospheric conditions—temperature, relative humidity, wind speed and direction, and mixing height—that had to be met in order for the prescribed burn to occur. The Army's "burn prescription" was designed to burn the vegetation effectively, with the smoke from the fire rising high into the air and then carrying out towards Monterey Bay. Generally, the weather at Fort Ord meets the designed prescription only a few days a year, usually in the fall.

After months of planning and coordinating the Ranges 43–48 prescribed burn in 2002, the weather forecast appeared to be appropriate for a burn on November 19, 2002. After mobilizing burn equipment and resources, and relocating over 200 families, the forecast changed and the burn was postponed. Shortly thereafter, the rainy season began, making the brush too wet to burn, and the Army was forced to cancel the rest of the 2002 burn season.

The 2003 burn season began in July. The forecast appeared again to be in prescription for a burn on October 13 so the Army mobilized resources. But the weather deteriorated and the Army canceled the burn. On October 21 the Army mobilized resources for a October 24 burn. Finally, on October 24, 2003, with the forecast staying in prescription, Fire Stop completed a go/no-go checklist, conducted a test burn, and began the prescribed burn.

During the prescribed burn, two spot fires breached the site's western primary control boundary. An escape was declared and contingency operations were implemented to contain the fire. The fire burned an additional 1,000 acres between the Ranges 43–48 and Seaside (MRS-SEA.1–4) sites (Figure 1-2) before being contained. The contingency operations concluded on October 31 and the fire resources demobilized on November 1.

The fire cleared almost all of the vegetation from Ranges 43–48, revealing numerous MEC previously hidden by the brush (Photograph 1-1). On November 10, teams began removing MEC from the surface of Ranges 43–48 (Photograph 1-2).

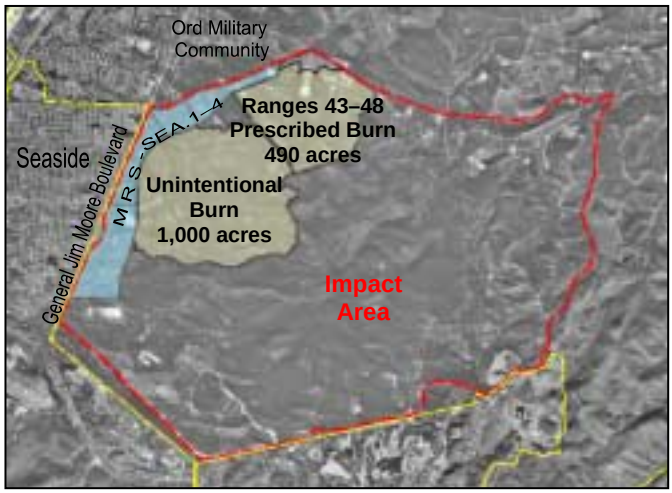


Figure 1-2—1,000-acre Unintentionally Burned Area

Photograph 1-1—3.5-in. Rockets Uncovered by the Ranges 43–48 Prescribed Burn

Photograph 1-2—Teams began removing MEC from the surface of Ranges 43–48 shortly after the burn.

CHAPTER 2
CHRONOLOGY

This chapter summarizes the significant events of the 2002 and 2003 burn seasons.

2.1 2002 PRESCRIBED BURN SEASON

2.1.1 BURN PRESCRIPTION ESTABLISHED

The Ranges 43–48 Prescribed Burn Plan [Ref. 2] established a burn prescription consisting of a specific fire weather forecast that was required for the prescribed burn to be conducted.

The fire conditions were set such that the prescribed burn that would clear the vegetation yet remain controllable. These conditions outlined in the burn plan (section 7) consisted of a temperature of 60–95°F, relative humidity of 15%–35%, live fuel moisture to 60%–80%, 10-hr fuel moisture of 3%–8%, and mid-flame wind speed of 5–12 mph.

Stringent weather parameters were also established so that the smoke from the prescribed burn would not impact the surrounding communities. Fire ignitions would only be conducted if the weather forecast showed that the following meteorological conditions would be present: a temperature of 55–85°F, relative humidity of 10%–60%, an east to northeast wind (40–140°) going 0–15 mph, and a mixing height greater than 1,000 ft with a neutral to unstable atmosphere.

Fire Stop's fire weather meteorologist (FWM), who is experienced in conducting prescribed burns in coastal California, monitored the weather conditions during the burn season and issued forecasts regularly that summarized the weather conditions and stated whether they met the burn prescription. In addition, the FWM regularly consulted with a meteorologist at the Naval Postgraduate School (NPS) and meteorologists at the California Air Resources Board (CARB) on the predicted weather.

2.1.2 PREPARATORY WORK CONDUCTED

Between August and October 2002 the Army conducted limited brush cutting activities inside and/or outside the fuel breaks surrounding the site (45- to 50-ft-wide brush-cleared, dirt or paved roads used to control wildfires from) as part of preparatory work for a fall burn. The Army originally planned the brushcutting so that the fuel breaks would be widened to four times the expected flame lengths, per wildland firefighting standards for control boundaries. But restrictions on maritime chaparral cutting at the former Fort Ord reduced the amount of vegetation that could be cut and the desired control boundary widths could not be obtained.

For the limited brush cutting, the site's perimeter was divided into five areas ('A' through 'E') that each required various vegetation clearance activities based on existing site conditions. The preparatory work performed in each area is summarized below:

- **Area A:** A 300- to 1,000-ft-wide vegetated area between the burn site's northern primary control boundary and Eucalyptus Road (the site's northern secondary control boundary) was cut to a 4-in. height.
- **Area B:** A 100-ft-wide strip of brush inside the northeastern section of Eucalyptus Road and the northern section of Orion Road comprising the northeastern portion of the primary control boundary was cleared and the trees 100 ft to the inside were pruned.

- **Area C:** A 45-ft-wide strip of brush inside Orion Road (the site's eastern primary control boundary was cut to a 2½- to 3-ft height and the trees 100 ft inside the fuel break were pruned or removed. A 45-ft-wide strip of brush inside Broadway Avenue (the site's southern primary control boundary was cut to a 2½- to 3-ft height. It should be noted that the vegetation cutting on Area C was stopped on Broadway Avenue approximately 1,200 ft from the Broadway Avenue–Evolution Road intersection because of MEC-related safety concerns
- **Area D:** The trees 100 ft inside the southern half of Evolution Road (the site's western primary control boundary) were removed and the trees 50 ft outside were pruned to 8 ft. It should be noted that it was originally planned that the vegetation 60 ft outside this section of Evolution Road would be cut, but the cutting was cancelled because of MEC-related safety concerns.
- **Area E:** The brush underneath trees within 50 ft outside the northern half of Evolution Road was cleared and the trees in this area were pruned to 8 ft.

In addition, the brush on MRS-SEA.1–4 was cut and the surface and subsurface MEC removed as part of removal activities conducted between 2002 and 2004. This site served as an approximately 500- to 1,200-ft-wide brush and MEC-cleared buffer for the burn site's western tertiary and northern secondary control lines. The brush adjacent to the fuel break surrounding the Fitch Park Housing area was also cut to widen the fuel break by approximately 150 ft. Figure 2-1 depicts the brushcutting operations performed around MRS-Ranges 43–48.

2.1.3 Resources Mobilized for November 19 Prescribed Burn

The weather forecast showed that the conditions on November 19 would meet the burn prescription. The Army authorized Fire Stop to mobilize resources on November 16.

2.1.4 November 19 Prescribed Burn Postponed

On the evening of November 18, the Army observed that the weather had changed and decided that it could no longer be sure that the desired conditions for minimizing smoke impacts would be present. The Army shortly thereafter announced the postponement of the burn.

2.1.5 2002 Burn Season Cancelled

After the prescribed burn was postponed, weather conditions failed to meet the burn prescription again in November. In December, heavy rainfall soaked the brush, making it too wet to burn and causing the Army to cancel the 2002 burn season.

2.2 2003 PRESCRIBED BURN SEASON

2.2.1 Burn Prescription Amended

For the 2003 burn season, the burn prescription was slightly modified. A 0–10 mph west/southwesterly wind was added as an alternate wind condition for the burn; the minimum relative humidity was reduced from 20% to 15%; and the mixing height was increased from 1,000 ft to being at least 1,500 ft within 2 hrs of ignition.

Fire Stop's FWM again began to monitor the weather conditions and issued forecasts twice a week. These forecasts designated the upcoming days as meeting or not meeting the burn prescription. The FWM also began consulting regularly with NPS and CARB meteorologists on the predicted weather.

2.2.2 OCTOBER 13 PRESCRIBED BURN ABORTED

Fire Stop's FWM issued a forecast on the evening of October 5 stating the weather would meet the burn prescription from October 12–13. But on October 8, the forecast changed as the movement and strength of the high pressure area would be insufficient to produce the northeast winds needed to finish the prescribed burn in time before the daily sea breeze would become prevalent. On October 9, the weather shifted again and became conducive for conducting the prescribed burn. With the expected in-prescription weather, burn resources mobilized on October 10. But on October 11, the weather pattern deteriorated. As a result, the October 13 burn was cancelled and the burn resources demobilized.

2.2.3 PRESCRIBED BURN CONDUCTED OCTOBER 24

Please note that all times shown are pacific daylight time (PDT) (PDT ended on October 26 at 2 a.m.), unless indicated otherwise.

2.2.3.1 Weather Predicted to Meet Burn Prescription on October 24

On October 19 it was predicted that an eastward moving low-pressure system would create the necessary offshore wind for a prescribed burn on October 24–26. It was initially believed that the weather for October 24 could meet the burn prescription, while the weather for October 25–26 would meet it (Appendix A, page A-17). As the week progressed, the weather for October 24 was upgraded to "in prescription", while the weather for the October 25 stayed in prescription. The weather for the October 26, however, was downgraded to "possibly being in prescription".

2.2.3.2 Decision to Burn Made

After the October 19 forecast showed that the weather would meet the burn prescription, the Army consulted with regulatory agencies—the Environmental Protection Agency (EPA) and the Department of Toxic Substances Control (DTSC)—and they agreed that an opportunity to burn existed.

With the weather remaining in prescription, Fire Stop's FWM began on October 20 issuing daily weather forecasts and discussing them with the CARB duty meteorologist via a conference call. Appendix A includes the daily forecasts and the forms filled out by Fire Stop's FWM documenting the conference calls with CARB.

A summary of each day's activities that led to the decision to burn is provided.

- **October 20:** CARB stated that a burn day designation "looked good" for the October 25, but that October 26 would be the best day to burn.
- **October 21:** The Army decided to mobilize for a prescribed burn on October 24 (section 2.2.3.3). This decision was made after verifying that the weather prescription for October 24 was forecasted to be met, verifying the availability of burn resources, and consulting with the regulatory agencies.

  On the daily conference call with CARB, CARB stated that the October 24 could be a burn day but October 25 was expected to be a no-burn day. Fire Stop's FWM also discussed the weather with National Weather Service at Monterey, who agreed that the October 24 was the best day for burning while October 25 provided a good backup day. In addition, the National Weather Service (NWS) stated that a red flag warning (a designation for an ongoing or

imminent critical fire weather pattern) would be issued for these days for the Monterey County interior—but not for the Monterey coast.

- **October 22:** The Army's meteorological team continued to monitor the weather and update the forecasts. The Army consulted with the regulatory agencies. Because it was expected that a red flag warning would be issued for inland Monterey County and the potential for Fire Stop's subcontracted burn resources being dispatched to the southern California wildfires, the Army authorized Fire Stop to obtain additional resources in order to be better prepared in the event of a contingency.

  On the daily conference call with CARB, CARB stated that October 24 and 25 would likely be no-burn days because they did not believe the mixing height would reach 1,500 ft. The NWS and NPS meteorologists, though, stated that the weather conditions would meet the burn prescription.

- **October 23:** The Army's meteorological team continued to monitor the weather for October 24, checking that it would meet the burn prescription, and they updated the forecasts. Throughout the day, the Army consulted with CARB, mainly discussing the forecasted mixing height for October 24, and they consulted with the regulatory agencies.

  At 3:45 p.m., CARB designated October 24 as a no-burn day for the North Central Coast Air Basin based on its forecast that the mixing height would not reach 1,500 ft.

  At 6:00 p.m., a planned conference call with the Army, the regulatory agencies, and CARB was held to discuss the status of the criteria for conducting the prescribed burn (weather forecast meeting the burn prescription and sufficient resources being available). During the conference call, CARB designated October 24 as a marginal day for the Ranges 43-48 prescribed burn.

  It was concluded the Army would proceed with the Ranges 43-48 prescribed burn, pending verification on the morning of October 24 that the burn prescription had been met.

- **October 24:** Based on the forecast issued the morning of October 24, the Army determined that the burn prescription had been be met and proceeded to fill out the Burn Day Go/No Go Checklist and conduct a test burn. Based on the test burn results, the Army decided to proceed with the prescribed burn over the entire site (sections 2.2.3.6–2.2.3.9, page 2-8). Fire Stop's FWM had a conference call with CARB, who stated that October 25 was a no-burn day.

2.2.3.3 Resources Mobilized for October 24 Prescribed Burn

On October 21 and 22, the burn resources began arriving at the former Fort Ord. Table 2-1 lists the equipment mobilized, which are briefly discussed, by operation, in the following sections.

It should be noted that the equipment listed below includes a task force–four fire engines and a water tender—that was not listed in the Prescribed Burn Plan (these were the additional resources obtained so that the burn team would be better prepared in the event of a contingency).

Of the ten fire engines, there was one Type 1, one Type 3, one Type 4, and seven Type 6s. Type 1 and 2 engines are generally non all-wheel drive engines with heavy pumping capacity that are used for protecting structures and crash-rescue operations. Type 3–6 engines, known as wildland engines, are 4-by-4 and have tanks with a 200- to 400-gallon capacity.

Of the six water tenders, there were five Type 2s and one Type 3 (Big Foot). Both types have a pump with a 200-gallon per minute (gpm) capacity, but the Type 2 has a tank with a 2,500-gallon capacity while the Type 3 has a 1,500-gallon capacity.

Table 2-1—Burn Equipment Mobilized

Equipment Type	Qty
Bulldozer	2
Fire Engine	10
Helicopter	13
Helicopter Dip Tank	2
Helitorch	4
Portable Water Tank	4
Single Engine Air Tanker (SEAT)	2
Terra Torch	1
Utility Vehicle	2
Water Tender	6

A Pre-Treatment

The SEATs and water tenders were used to pretreat the primary control boundaries with retardant and foam/water. The burn plan called foam/water and/or retardant to be sprayed a minimum 50 ft along the outside perimeter of the burn site and a minimum 100 ft along the critical side(s) (based on the forecasted and actual weather, and fuel conditions) the day before the scheduled prescribed burn.

B Ignition

Five helicopters were used for igniting the burn. Four helicopters were equipped with helitorches—182-liter drums filled with alumagel (gelled gasoline) that were suspended from the helicopters and were used to fire ignited alumagel onto the brush below (Photograph 2-1). Another helicopter was outfitted with a bucket for water drops.

C Surveillance

Three helicopters were used to manage the burn operations. The Burn Boss supervised the prescribed burn operations from one helicopter, another helicopter was equipped with an infra-red (I/R) camera to detect any hot spots through the smoke, and a third helicopter was outfitted with a video camera to record the burn operations and for the Army's management center to spot any smoke impacts.

Photograph 2-1—Helitorches suspended from helicopters fired ignited alumagel onto the brush below for conducting the prescribed burn ignitions.

D Holding and Contingency Operations

The equipment used for controlling spot fires and during contingency operations included the two SEATs, six helicopters, ten fire engines, two bulldozers, four water tenders, and the water and dip tanks. Three of the fire engines were used to patrol the Fitch Park housing area.

In addition, the Ord Military Community (OMC) Fire Department supplied three fire engines and the California Department of Forestry (CDF) later provided two SEATs and three fire engines.

2.2.3.4 Site Preparation Conducted

On October 23 the SEATs and water tenders were used to pretreat the fuel breaks to further enhance their capacity to contain the burn. The SEATs applied an approximately 100-ft-wide strip of retardant along the outside of Orion Road, Broadway Avenue, and Evolution Road. The water tenders sprayed water 60 ft inside and outside Eucalyptus Road, 60 ft inside Evolution Road, and 60 ft inside Orion Road. In addition, water was sprayed 60 ft outside the Fitch Park fuel break. Photographs 2-2, 2-3, and 2-4 show these preparatory activities being conducted.

Photographs 2-2, 2-3, and 2-4—Site preparation activities. A SEAT sprays retardant on Broadway Avenue (left); an aerial view of the Broadway Avenue–Orion Road boundaries after being sprayed with retardant (middle); a water tender sprays water/foam on the vegetated side of Eucalyptus Road (right).

2.2.3.5 Safety Exclusion Zone Established

On October 23, a 1,701-ft exclusion zone was set up around the perimeter of the burn site to ensure public safety. The major roads around the Impact Area were closed and barricades, signs, and uniformed security guards were posted at the road closure points. Uniformed security drove around the closed roads to ensure that there were no security breaches, while the Presidio of Monterey (POM) police drove around the Fitch Park housing area. Warning signs were posted at all the trail intersections just outside the exclusion zone reminding recreational land users to remain outside the exclusion zone. The exclusion zone remained enforced until the evening of October 29, when General Jim Moore Boulevard, Barloy Canyon Road, and South Boundary Road were re-opened. The roads immediately adjacent to the burn site remained closed until the contingency operations were completed on October 31.

2.2.3.6 Burn Prescription Met

On October 24, at 7:00 a.m., Fire Stop's FWM issued a fire weather forecast showing the predicted fire weather and atmospheric conditions for the day (Appendix A, page A-21) and continued to monitor the weather. Based on this forecast, the Army's meteorological team determined that the burn prescription had been met and began filling out the Burn Day Go/No Go Checklist.

2.2.3.7 Burn Day Go/No Go Checklist Signed

After determining that the burn prescription had been met, Fire Stop completed the Burn Day Go/No Go Checklist certifying that all preparations for the prescribed burn had been completed and requirements for equipment, personnel, general burn operations, and public safety had been satisfied (Appendix B, page B-4). It should be noted that the OMC Fire Chief cited on the checklist that it was a no-burn day because of the red flag warning but also wrote that all weather conditions had been met per the burn prescription. After the Burn Boss and OMC Fire Chief signed the checklist, the ignition helicopters launched and prepared to conduct a test burn.

2.2.3.8 Test Burn Ignited

Per section 10.2 of the prescribed burn plan [Ref. 2], a test fire was conducted prior to igniting the entire burn site to determine if the burn objectives could be accomplished. At 8:55 a.m. a 1-acre fire was ignited slightly east of the burn site's northwest corner (Photograph 2-5). Fire Stop completed a burn day monitoring form documenting the observed weather, fuel consumption rate, flame lengths, smoke column height, and smoke dispersal pattern (Appendix B, page B-6). Based on the conditions observed the Burn Boss, FWM, and the Fire Behavior Analyst recommended proceeding with the prescribed burn over the entire Ranges 43–48 site.

2.2.3.9 Prescribed Burn Ignited

At 9:06 a.m. the prescribed burn began. Fire was dropped using an arcing strip-head fire pattern. These aerial ignition paths started on the northern primary control boundary and curved southwest towards the edge of the vegetated areas along the inside of Evolution Road. Fire was dropped quickly along subsequent paths that were spaced approximately 350 to 450 ft to the east of the one preceding it. The goal of using this method was to pull the burn away from the control lines and keep the fire hot enough for it to lift the smoke high into the air. Photograph 2-6 shows an example of the arcing ignition paths used and Figure 2-2 shows the ignition pattern used to burn Ranges 43–48.

Photograph 2-5—A test burn was ignited at 8:55 a.m. near the Eucalyptus Road–Evolution Road intersection to determine whether the prescribed burn objectives could be accomplished.

Photograph 2-6—An example of the strip fire ignition paths used between Eucalyptus Road and Evolution Road.

2.2.3.10 Control Line Burn Ignited

Starting at approximately 9:20 a.m., ignitions were conducted with the helitorch along the inside of Evolution Road to ensure that the western primary boundary could contain the fire as it was building in the site. This "burning in" of Evolution Road began near the Eucalyptus Road–Evolution Road intersection and continued approximately 1,500 ft south along the inside of the boundary. The helicopter then headed back up the site dropping fire in an 800-ft-long line directly east of the first path until reaching a barren patch of land (Photograph 2-7).

Photograph 2-7—The vegetation inside Evolution Road (left) was ignited to help contain the burn by widening the cleared area between the fire building in the site (right) and the vegetation outside the site.

At 9:23 a.m., a spot fire ignited on the Evolution Road boundary near Stinger Road. At 9:27 a.m. a suppression helicopter began dropping water in the area of the spot fire. This spot fire was contained.

2.2.3.11 Evolution Road Control Boundary Breach

Between 9:46 and 9:57 a.m. two more spot fires ignited north of the Evolution Road–Broadway Avenue intersection (Figure 2-3). These spot fires, though, breached the Evolution Road boundary.

As described in section 1.2, the explosive hazards posed by the MEC on the ground meant that these fires could only be fought from the air. Helicopters dropped water on the spot fires, but the low-lying smoke from the control line burn was reducing visibility and the wind was blowing the water drops from their targets. The spot fires quickly moved west.

2.2.3.12 Spot Fires Merge and Grow

While the SEATs and helicopters dropped retardant and water on the flames, the OMC fire chief monitored the suppression efforts and the fire's progress, and began consulting with burn team and local fire agencies on making an escape declaration.

By 10:18 a.m. the two spot fires had merged and grown to approximately 30 acres. The head (most rapidly spreading part) of the fire moved quickly west towards the western secondary control line, Austin Road. Meanwhile, its right flank (side that moves roughly parallel with the head) was moving parallel with Stinger Road just above the road; its left flank was moving

Figure 2-3—Locations of Spot Fires Breaching Evolution Road Boundary.

southwest towards Broadway Avenue. By 10:30 a.m. the fire had expanded to approximately 80 acres. Around this time, the fire approached Austin Road and crossed it.

2.2.3.13 Escape Declared

With flame lengths above 30 ft, and the aerial suppression efforts unable to control the fire as it was spreading and heading west towards the brush-cut Seaside sites, the OMC fire chief declared at 11:00 a.m. that the fire burning outside Ranges 43–48 was an escape.

Once this occurred, the ignitions inside Ranges 43–48 stopped (at this time, ignitions had been completed over half the burn site, with the extent of the fire inside Ranges 43–48 covering approximately 310 acres by 12:20 p.m. and approximately 340 acres by 5:30 p.m.).

Per the prescribed burn's contingency plan [Ref. 3], the OMC Fire Chief assumed command of the burn operations and issued objectives for the contingency operations (Appendix C).

One of the SEATs and the other helicopters continued to drop retardant and water on the fire (the other SEAT's drop door malfunctioned after its first drop and had to leave the site for repairs; this SEAT was fixed and returned onsite later in the afternoon). In addition, the helitorches on the ignition helicopters were replaced with water buckets, and the helicopters then began to help with the water drops.

2.2.3.14 Escape Contained

By 11:15 a.m. the head of the fire reached the Seaside sites, where the vegetation had been cut in spring 2002 as part of removal activities in the site. After the fire ran into a 45-ft-wide brush-cut fuel break (the Blue Line) and the approximately 500- to 1200-ft-wide brush-cut Seaside sites, it died out (Photograph 2-8).

With the head of the fire contained, contingency operations focused on suppressing the left flank, which had crossed Broadway Avenue. The east-northeasterly wind was gradually rotating to the

Photograph 2-8—After moving into the brush-cleared Seaside sites, the head of the fire died out.

northeast, as the fire moved southwest towards the southern secondary control line, Watkins Gate Road.

CDF air tankers arrived onsite around 12:10 p.m. It was planned that CDF air tankers would make retardant drops on the left flank, while Fire Stop's helicopters would work the right flank. CDF supervisors directed their air resources to observe the 1,701-ft exclusion zone, which meant that their air tankers had to fly and make water drops from above 1,701 ft. CDF made two retardant drops from above 1,701 ft, but the retardant dissipated before reaching their targets.

To stop the fire from going further south, Fire Stop's firefighters "black lined" (removed the brush between the fire and a control line) the inside of Watkins Gate Road beginning around 2:00 p.m. Watkins Gate Road was black lined from approximately 750 ft west of Austin Road to approximately 1,500 ft from Evolution Road.

Around 3:00 p.m. the daily onshore sea breeze had overridden the offshore breeze, and the fire began moving northeast. As the fire moved back towards Evolution Road, it consumed approximately 500 acres between the areas burned in the morning and Watkins Gate Road.

The black lining operation was stopped short of Evolution Road in favor of spraying water on the fire as it burned towards the brush-cut Evolution Road fuel break. After the fire ran into Evolution Road, it died out around 5:30 p.m. (Photograph 2-9). In the end, the fire had circled a 1,000-acre area between Ranges 43–48 and the Seaside sites.

Photograph 2-9—After the fire ran into the Evolution Road fuel break (left background, it died out around 5:30 p.m.

2.2.3.15 Contingency Operations Continue

A October 24 Evening

To prevent the fire from creeping east during the night, the SEATs sprayed a strip of retardant on the brush adjacent to the east side of Evolution Road from Broadway Avenue to Watkins Gate Road. Fire Stop remained onsite to monitor the burn.

At around 7:45 p.m. a fire flared up in a grove of Monterey pine trees located approximately 1,200 ft east of General Jim Moore Boulevard. Local strike team and Fire Stop fire engines quickly returned to General Jim Moore Boulevard and prepared to extinguish any potential spot fires ignited by embers from the burning trees. No spot fires occurred outside the Impact Area, and the fire died out after running into in the Blue Line fuel break and the brush-cut Seaside sites. The local strike team engines were released, and Fire Stop's engines continued patrolling the site. All but one of Fire Stop's engines were eventually released. The one remaining fire engine patrolled the site overnight.

B October 25 and 26

On October 25, contingency operations started around 8:00 a.m. As the temperature rose, several islands of unburnt vegetation began to burn. Fire Stop began dropping water on these areas, as well as numerous other "hot spots" (active parts of a fire) burning around Ranges 43–48 and the approximately 1,000-acre unintentionally burned area.

It was decided that all pockets and islands of vegetation needed to be burnt out in order to (1) minimize smoke impacts from the smoldering brush and (2) prevent hot spots occurring in or near areas of unburned brush after resources had been released.

Fire Stop began igniting the islands and pockets of brush in and around Ranges 43–48 and the approximately 1,000-acre unintentionally burned area with the helitorch around 12:40 p.m. Inside Ranges 43–48, Fire Stop ignited the brush near Range 44 in a vertical pattern that initially followed the site's internal dirt roads. The helitorch continued moving to the east, firing each successive vertical ignition path 100 to 300 ft from the one before it (Photograph 2-10). The brush inside Ranges 43–48 was cleared by 1:40 p.m. Figure 2-4 shows the ignition paths used in Ranges 43–48 on October 25.

Photograph 2-10—The firing of the unburned brush inside Ranges 43–48 on October 25 was done in vertical paths that began near Range 44 and finished along the inside of Orion Road.

The igniting of other pockets and islands of vegetation continued on October 25 through October 26.

Activities on these days also included dropping water/foam on the number of hot spots burning around Ranges 43–48 and the 1,000-acre unintentionally burned area. Appendix D includes maps that show the hot spots around the perimeter of the burned areas being extinguished until the afternoon of October 30, when they had all been put out. Fire Stop also patrolled the site 24 hrs a day on the ground and during daylight hours from the air.

Figure 2-5 displays the sequence of events of the burn operations and shows how the fire progressed.

C October 27 to 31

The remaining contingency operations from October 27 to October 31 consisted of the continued dumping of water/foam on the number of hot spots around the burned areas and the site patrols.

2.2.3.16 Resources Demobilized on November 1

With the burn essentially out, the OMC fire chief released Fire Stop's resources on November 1 and they demobilized.

CHAPTER 3
EVALUATION

3.1 PRESCRIBED BURN GOALS

The Ranges 43–48 prescribed burn plan [Ref. 2] identified five major goals for the burn to be considered successful:

(1) Contain the prescribed burn within the primary control boundaries.
(2) Minimize smoke impacts.
(3) Clear the majority of the vegetation.
(4) Minimize environmental impacts.
(5) Avoid injuries to public and personnel.

The following sections discuss whether these goals were achieved.

3.1.1 CONTAIN PRESCRIBED BURN WITHIN PRIMARY CONTROL BOUNDARIES

The prescribed burn breached its western primary control boundary, Evolution Road, on the morning of October 24. The breach was caused by a pair of spot fires that ignited on the vegetated outer portion of the Evolution Road boundary and quickly moved west.

Retardant and foam/water were sprayed where the spot fires started, but the dense vegetation on the boundary may have prevented the retardant and foam/water pre-treatment from completely soaking into the debris below it. As a result, embers blowing west into the control boundary from the main ignitions likely ignited untreated sticks and leaves underneath the treated brush and the spot fires soon developed.

The spot fires were detected shortly after they ignited, and helicopters promptly began dumping water on them. But as the fires spread west, the water and retardant drop had to be restricted to the flanks as the limited visibility around the head made it too unsafe for the aircraft to make effective drops. When the fire ran into the brush-cut Blue Line fuel break and Seaside sites, its intensity dropped dramatically, as expected, and it was contained by suppression resources.

Section 4.1 discusses the lessons learned related to widening the control boundaries for future prescribed burns.

3.1.2 MINIMIZE SMOKE IMPACTS

For the majority of the burn operations (even when the fire was burning outside Ranges 43–48), most of the smoke plume generally traveled, as planned, high into the air and out towards Monterey Bay.

When the fire was burning at cooler temperatures (e.g., when the Evolution Road control line burn was being conducted, after running into control lines, when it was smoldering, at night), lower-lying residual smoke was observed in several nearby cities such as Seaside, Monterey, Pacific Grove, and Carmel.

Some of the above-listed instances when the fire was burning cooler are an inevitable part of the prescribed burn process; however, others can be attributed to the burn going outside its primary control boundary. Obviously, the fire consumed more vegetation than planned, which added more smoke into the air than what was expected. In addition to adding more smoke into the air, the fire outside Ranges 43–48 was still burning on October 24 when the onshore breeze became

prevalent at 3:00 p.m. As a result, the smoke was pushed to the east and some of it got trapped at low levels in the marine layer and lingered until the morning.

In addition to the visual observations, 15 air monitors were positioned adjacent to Ranges 43–48, on the former Fort Ord, and in the surrounding communities to document particulate matter measurements (suspended particles less than 10 microns in diameter [PM_{10}]). The smoke impact measurements recorded by almost all of the air monitors were above the 24-hr California Ambient Air Quality Standards (CAAQS) on October 24 and at or above the standards on October 25 [Ref. 4].

Section 4.1 discusses the lessons learned related to widening the control boundaries for future prescribed burns. Widening the control boundaries would reduce the risk of fire breaching them and therefore help minimize the number of instances when fire would be burning at cooler temperatures and generating more residual smoke that could carry into the nearby communities.

Chapter 5 contains more information on the smoke from the burn, including measures taken to minimize smoke, where the smoke traveled, and the number and origin of smoke complaints.

3.1.3 CLEAR MAJORITY OF VEGETATION

The prescribed burn removed approximately 475 of the 492 acres of the vegetation (97%) covering Ranges 43–48 (Photograph 3-1).

Photograph 3-1—The burn effectively cleared most of the vegetation from Ranges 43–48, leaving only scattered, small patches of unburned vegetation (circled).

Based on the expected density of MEC, vegetation clearance priorities—critical, required, or desired—were assigned to all areas within Ranges 43–48. For each of the three priority types, the prescribed burn plan [Ref. 2] outlined a corresponding minimum percentage of vegetation that had to be removed below 5 ft, with a maximum allowable size of any unburnt area. Table 3-1 summarizes the effectiveness of the burn based on whether the criteria outlined in the burn plan were met in each of the three types of areas.

A map displaying the percentage of vegetation burned and location of unburnt areas within has been provided as Figure 3-1. It should be noted that the unburnt areas shown on the map are generally those areas containing patches of unburnt vegetation, not areas consisting entirely of unburnt brush.

Table 3-1—Vegetation Clearance Summary

Area	MEC Density	Size (acres)	Requirement		Actual		
			Minimum Amount of Vegetation Removed Below 5 ft	Maximum Size of Any Unburnt Area (Acres)	Amount of Vegetation Removed Below 5 ft		Number of Unburnt Areas Exceeding Requirement
					Acres	Percentage	
Critical	High	319	90%	2	313	98%	0
Required	Lower than critical	143	50%	1	137	96%	0
Desired[a]	Low	40	—	—	25	63%	—

[a]No criteria was established for desired areas because they could potentially be cleared using other methods beside burning.

3.1.4 MINIMIZE IMPACTS TO HABITAT

All burn personnel followed all procedures outlined in the prescribed burn plan to minimize damage to natural resources and rare, threatened, and endangered species. All ground activities were restricted to the established fuel breaks in the Impact Area. By doing so, personnel avoided impacting areas containing plant and animal species listed in the Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord (HMP) [Ref. 5].

In regards to loss of animal life during the burn, larger mobile animals such as deer, coyote, and fox, as well as many birds, were likely able to escape into surrounding unburned areas. The burrowing animals and reptiles were likely able to hide in the ground and survive. There was likely some loss of life, though, from fleeing or non-burrowing animals (e.g., skunks, rabbits). Although the loss of any life is regrettable, by following the HMP's requirements for clearing areas of maritime chaparral through prescribed burns between July and December, a diverse population of rare, threatened and endangered chaparral plant species will be able to thrive and go on to support a wide variety of insects, bird, reptile and mammal species.

3.1.5 AVOID INJURIES TO PUBLIC OR PERSONNEL

3.1.5.1 Public

To minimize the impact of smoke from the burn on the surrounding communities, the Army established a voluntary relocation program, which allowed any Monterey County resident to move away from the area for the duration of the burn at the Army's expense [Ref. 6]. During the prescribed burn, though, the Army did receive several phone calls in which people reported smoke-related health concerns such as eye irritation or difficulty breathing.

The Army implemented several safety measures to protect the public and their property from the fire itself. The Army surrounded the Impact Area with security guards to ensure no one was in the area during the burn. The Army had a contingency plan in place before the prescribed burn,

which enabled additional helicopters, fire engines, and water tenders to be ready onsite and other outside resources to be available. With these contingency resources, the Army was able to mobilize the suppression efforts quickly and contain the fire burning outside Ranges 43–48. When the fire was burning towards the Seaside sites, the Army was able to deploy additional fire engines to General Jim Moore Boulevard rapidly in order to ensure that the fire could be contained within the Impact Area.

3.1.5.2 Personnel

There were no reported injuries to personnel.

Fire Stop implemented steps that met the accepted, established safety procedures used throughout the wildland firefighting community.

Fire Stop designed a detailed safety plan that was included in the Burn Plan [Ref. 2]. This safety plan was read by all personnel and strictly enforced by Fire Stop's safety officer. The safety plan included a job hazard analysis, which identified the potential danger involved with each of the major tasks of the burn and the appropriate actions to be taken to minimize hazards.

The safety measures that were outlined in the safety plan and taken included the following:

(1) All personnel attended mandatory site familiarization where they contractually agreed to adhere to all the safety requirements.

(2) All personnel attended twice-a-day safety meetings, as well as safety meeting in the field, which included safety messages and discussions on any unsafe acts observed.

(3) All personnel were required to meet or exceed all training standards and have the appropriate protective equipment

Air safety measures included completing a risk analysis onsite before the burn to address any hazards (the 4 M's [Appendix B]), creating a map showing all potential flight hazards (e.g., wires, towers, emergency landing areas, helibase locations, flight routes, and other areas to be avoided), and putting a crash rescue and medivac plan in place.

To plan for any medical emergency, Fire Stop established escape routes and safety zones and reserved one fire engine with a medic for crash and rescue operations.

3.2 FIRE PERSONNEL ANALYSES

Fire Stop, the POM fire department, and Parsons' independent wildfire consultant evaluated key aspects of the burn (e.g., burn prescription, site preparation, aerial ignition sequence). The evaluations made by Fire Stop and Parsons' independent wildfire consultant are described in this section; the POM fire department's evaluation will be documented in a separate report.

It should be noted the observations made by Parsons' independent wildfire consultant are based on the pre-burn site visits, the prescribed burn plan, watching the digitally recorded footage of the burn, and evaluating Fire Stop's report on the cause of the Evolution Road boundary breach (Appendix E). The wildfire consultant was not onsite during the burn and did not discuss the burn with any member of the burn team.

3.2.1 SITE PLANNING

3.2.1.1 Fire Stop

Fire Stop collaborated with the U.S. Army and Parsons to plan the Ranges 43–48 prescribed burn. One result of the planning was a burn prescription that required offshore winds and low relative humidity/live fuel moisture—conditions that simultaneously occur only a few times a year.

The planning also placed special emphasis on minimizing particulate matter dispersal in the smoke plume, while fire behavior issues such as burning during "red flag" conditions had a lower priority.

A major issue, though, was the control lines. The accepted "industry standard" among major wildland firefighting agencies is to have control lines constructed at least four times the anticipated flame lengths. The original desired control boundary widths to meet the standard could not be obtained because of restrictions on maritime chaparral cutting at the former Fort Ord. Still, some limited brushcutting was allowed around the site perimeter. MEC-related concerns, however, caused the Army to cancel the planned brushcutting on the southern section of Evolution Road (where the fire breached the control boundaries), which would have widened the brush-cleared area of this control line section from 45 to 105 ft.

In the event control lines cannot meet the standard width, it is the industry standard to implement other measures. These special measures include: (1) using sprinkler systems, (2) applying foam to pre-treat the brush adjacent to the site, and (3) black lining control lines with a terra torch to burn out brush in advance of an approaching head of a fire.

Fire Stop's plan for positioning a sprinkler system around the site perimeter could not be executed because the site's terrain required additional equipment that made installing the system cost prohibitive. The black lining of Evolution Road before the burn was not permitted because of the narrow burn prescription. Instead, the pre-treatment along Evolution Road to help contain the fire consisted of spraying retardant and water along its outer edge.

3.2.1.2 Parsons' Wildfire Consultant

The Evolution Road control boundary was inadequate to contain the fire under the existing prescription and firing techniques. The retardant and water pre-treatment prevented and slowed some spot fires, but, ultimately, it was ineffective. A sprinkler system was considered for the enhancing the control boundaries, but it could not be installed.

Many factors determine the effective width and type of treatment(s) for a control line. Some of these factors include: prescription and expected fire behavior; fuel types inside and outside the line; the types and number of control forces; and the risk and consequences of an escape.

3.2.2 BURN PRESCRIPTION

3.2.2.1 Fire Stop

The weather forecast for October 24 met the burn prescription, with a predicted mixing height between 1,500 to 2,000 ft by 11:00 a.m. based on conservative atmospheric models. The majority of the actual weather and fire conditions recorded during the prescribed burn stayed within prescription. The following sections list the observations made on the various burn prescription elements.

A Fire Conditions

- **Temperature:** The burn prescription had a temperature of 55–85°F, and the actual temperatures ranged from 68 to 76°F during the prescribed burn (9:06 a.m.–11:00 a.m.).
- **10-hr FM:** The 10-hr fuel moisture (FM) was 4% above prescription (Table 3-2), but the results of the test fire confirmed that these conditions were permissible for conducting the prescribed burn. The 10-hr FM is a minor variable in the fire model, and it is subject to observational error of a few percentage points
- **Live Fuel Moisture (FM)**: In regards to live FM, the mid-range of the burn prescription had a live FM of less than 80%. This prescribed live FM was validated during the active ignition on October 24 by getting the fire to burn at the desired intensity with a live FM between 75% and 80% (Table 3-2).

Table 3-2—Comparison of Prescribed and Actual FM

Fuel Moisture	Prescribed	Actual (October 24 9:06–11:00 a.m.)
10-hr (%)	3–8	10–12[a]
Live (%)	60–80	75–80
[a]Recorded at Fort Ord Remote Automated Weather Station (RAWS) FO2		

- **Relative Humidity (RH)**: The prescribed RH was 10%–60% and the actual RH stayed within prescription at 23%–30% during the prescribed burn (9:06 a.m.–11:00 a.m.). The contingency operations provided an opportunity to evaluate the RH element of the burn prescription. As the fire transitioned between smoldering on the surface and torching the crown foliage of the brush in spot fires, the following observations were made: when the relative humidity dropped into the mid-30s, torching began; when the relative humidity dropped into mid-upper 20s, the fire was still able to burn intensely; but when the relative humidity rose above the mid-30s, the intensity of the fire diminished.
- **Flame Length (FLs)**: The FLs stayed within the prescribed 16 to 31 ft and burned the vegetation at the desired intensity. With FLs that were 20 to 30 ft, the fire consumed the crown foliage of the brush.
- **Spot Fire Risk**: The burn prescription can minimize the risk of fire spreading across control lines by direct flame contact or by radiant heat, and that aspect of control is incorporated in the prescription. Fires in chaparral that consume the crown foliage, however, produce airborne firebrands that are capable of igniting spot fires. Any workable burn prescription, therefore, cannot eliminate the threat of spot fires; instead, it is assumed that firebrands can cross control lines. The improved control lines recommended in Section 4.1 will help minimize the risk of spot fires; however, the risk is still finite, and suppression tools that are capable of controlling spot fires that do occur need to be available. Low-lying, wind-driven smoke prevented effective use of aircraft in suppressing spot fires on the burn on October 24. The operational impacts of such obscuring smoke can be reduced by adopting a maximum wind speed lower than what the burn prescription currently allows. Reduced wind speed will reduce the number and range of spot fires. Less wind can also reduce the rate-of-spread (ROS) of a spot fire that begins to spread (though a spot fire still in the litter under the brush, when it is likely to be

controlled, feels very little wind in any case). But the main benefit of having less wind will be that aircraft will be able to be used more effectively for suppressing any spot fires that do occur (given less low-lying smoke).

B Fuel Conditions

- **Fuel Type:** Ranges 43–48 consisted almost entirely of heavy, dense maritime chaparral with a small area of grasslands and scattered stands of oak trees. Approximately 80–85% of the maritime chaparral vegetation was live. Over half of the brush was between 20 to 25 years old, with the remaining consisting of almost-equal portions of 3-, 5-, 10-, and 15-year-old ages.
- **Fuel Moisture:** Beginning June 2003, live FM samples were taken from Ranges 43 and 46 every two weeks. On June 4 the live FM was on average 139%. Once one of the samples dropped below 85% in the beginning of September, samples of the new and old vegetation growth were taken every week and factored into a blended average. By early October, the average of the blended averages in Ranges 43 and 46 had dropped to 80%, which was in prescription.

C Weather Conditions and Patterns

- **Weather Conditions:** Table 3-3 compares the prescribed weather conditions to the forecast issued the morning of October 24 and the actual conditions recorded during the active ignition phase of the prescribed burn on October 24. The data recorded is from the two RAWSs, FO1 and FO2, located at Ranges 46 and 43, respectively. It should be noted that data recorded by FO1 may have been fire-influenced, as fire can increase the temperature and alter wind behavior; the data recorded by FO2 is more representative of the actual weather conditions.

  Appendix A contains the meteorological data recorded by the Fort Ord RAWSs for each day ignitions were conducted, starting on October 24 at 6:00 a.m. until October 26 at 11:00 p.m. (PST). All the supporting weather data collected before and during the burn has also been included in Appendix A.

- **Weather Patterns:** On October 24, high pressure continued over the Pacific Northwest, causing Easterly winds during the morning and early afternoon. A light sea breeze (Westerly wind) began around 1 p.m. and continued until 6 p.m. Daytime high temperatures were in the upper 80's to low 90's. Relative humidity was 25-50% during the morning, 20-30% during the afternoon, and 25-50% during the evening. The mixing height reached 1,000 ft by 10:00 a.m. It should be noted that the profiler located in Marina used to record the mixing height did not take into account the elevated surface temperature from the burn. In addition, the profiler is situated 500 ft below the elevation of the burn site.

  On October 25, high pressure continued over the northwest, causing strong winds (up to 12 mph) towards the west in the morning until the afternoon. A light sea breeze moving northeast took over in the afternoon. Temperatures were hot as they rose to 91°F in the afternoon. Relative humidity was 31–51% during the morning, dropping to 23–26% in the afternoon. The mixing height was at 200 ft at 11:00 a.m., but as the sun continued to heat the surface, the mixing height rose to 2,100 ft at 1:00 p.m.

Table 3-3—Comparison of Prescribed, Forecasted, and Actual Weather Conditions

Weather Condition		Prescription		Forecast	Actual
		Acceptable	Preferred	October 24, 9:00–11:00 a.m. (issued October 24, 7:00 a.m.)	October 24 (9:06–11:00 a.m.)[a]
Sky		Clear skies to scattered cumulous		Clear	Clear
Wind Direction and Speed	Morning	Offshore Prescription		Direction: Northeast-East Wind Speed: 5–10 mph	Direction: 68–78° (northeast-east) Wind Speed: 6–15 mph
		Direction: 40–140°, Wind speed: 0–15 mph	Direction: 70–120°, Wind speed: 5–10 mph		
		Onshore Prescription		— (Forecast for offshore conditions)	— (Prescribed burn conducted under offshore prescription)
		Direction: 240–40° Wind Speed: 0–15 mph	Direction 270–40°, with allowable periods of calm to light winds with variable directions		
	Afternoon	Offshore Prescription		— (Morning Forecast)	— (Prescribed burn conducted under morning prescription)
		If direction 40–140°, Wind speed: 0–15 mph	Direction: 70–120°, Wind speed: 5–10 mph		
		Onshore Prescription			
		If direction 240–40°, Wind Speed 0–15 mph	Direction 270–40°, with periods of calm to light winds with variable directions		
Temperature		55–85°F	65–80°F	70–80°F	68–76°F
Relative Humidity		10–60%	15–40%	20–30%	23–30%
Late Morning Mixing Level		Greater than 1,500 ft, with a neutral to unstable atmosphere. Expected morning inversion to allow for a mixing depth of 1,500 ft within 2 hrs of ignition.		1,500 ft to 2,500 ft by 11:00 a.m.	10:00 a.m. = 1,000 ft 12:00 p.m. = 1,500 ft 1:00 p.m. = 2,500 ft

[a]Low-to-high weather condition ranges recorded by RAWS FO1 and FO2; mixing height recorded by Marina profiler

E Fire Behavior Modeling

Fire Behavior Prediction System (FBPS) Fuel Model 4 (representing mature brush such as California mixed chaparral) was selected to represent the maritime chaparral on the project area. Behave Plus was used to apply the FBPS to the burn planning. A range of weather and fuel parameters under which successful prescribed burns in chaparral have been conducted was used to model a corresponding range of fire intensities, and those intensities were in turn used to prescribe the acceptable burn conditions.

- **Fire intensity and Flame Length of the Prescribed Burn:** FL is a directly observable measure of fire intensity and was the model output used to represent the span of acceptable fire intensities. Fuel Model 4 over-predicts the ROS of fires, and consequently tends to overestimate the expected FLs. For that reason, raw FL outputs from the fire model were multiplied by 0.75 to provide a more realistic FL estimate. The broad prescription spanned weather/fuel conditions that would yield fire intensities represented by FLs from 16 to 31 ft. The burn prescription is a guide to planning the burn operation. The final determination of acceptable conditions was made by observing the test fire.
- **Spot fire ROS:** The ROS of hypothetical spot fires was predicted for conditions at the "hot" end of the burn prescription. The ROS for various types of vegetation was based on their corresponding fuel models: brush was modeled using Fuel Model 6 (medium brush); grass used Fuel Model 2 (sparse grass and understory); and litter used an average of Fuel Models 8 (small-leaf litter) and 9 (large-leaf litter). Where the hypothetical spot fires were characterized by mixed fuels, an average ROS was predicted. It was assumed that it would take at least 10 minutes for a spot fire to go from being detected to erupting into a spreading crown fire.

F Applicable Prescription on October 24

Given the live fuel moistures (FM) of 75% to 80% in late October 2003, the burn prescription that would produce acceptable fire intensity and FLs was consisted of the following elements: a temperature of 60 to 95°F; a relative humidity of 15% to 35%; a 10-hr FM of 3% to 8%; and a wind speed of 6 to 15 mph (average ambient wind speed at 20-foot height).

It should be noted that the overall burn prescription above states the maximum range of acceptable conditions, but they are not applied in extreme combinations. For example, for a given RH and temperature near the dry, hot end of the range, the allowed wind speed would be only 13 mph. The weather prescription (based on smoke transport and other aspects of the burn) further restricts prescribed conditions. In addition, operational considerations dictate what conditions are acceptable.

Using the Ranges 43–48 prescribed burn as an example, the 15 mph prescribed maximum wind speed would be tolerable where the burn had developed a wide buffer, but it would not be acceptable where the fire was directly impacting the control lines.

G Validation of the Burn Prescription

The fuel/weather conditions were within the burn prescription, with the minor exception of the 10-hr FM, which was slightly above prescription (10-hr FM is a minor variable in the fire model and is subject to observational error of a few percentage points).

The burn prescription has two basic guidelines: (1) the fire will burn with sufficient intensity (as manifested in FL) to consume the fuels and (2) the fire will not cross control lines by direct

flame contact or radiant heat ignition. Both of those predictions were met by the burn, thereby validating the basic burn prescription for the conditions that prevailed.

More specifically, the predicted FLs ranged from about 20 ft (October 25) to about 23–27 ft (October 24). FLs are difficult to measure with precision, but the observed FLs were estimated at 20–30 ft on October 24, which compares well with the mid-20s prediction.

Control lines were recommended to be at least four times the estimated flame lengths to defeat ignition by direct flame contact or radiant heat. Even though the effective control lines were no more than about three times the flame lengths (approximately 60 feet) due to the circumstances discussed in section 3.2.1.1, no direct-flame-contact or radiant-heat ignitions occurred. It should be noted that spot fires are to be expected on almost any chaparral burn and are not dealt with in the prediction of acceptable fire intensities (see section 3.2.2.1A regarding spot fire risk).

H Validation of the Spot-Fire Prediction Assumptions

The assumptions about ROS and the "development time" of a hypothetical spot fire were validated by the spot fires that did occur and the observed run of the escaped fire.

Spot fires that breached the primary control line were observed on I/R imagery approximately 20 minutes before they were known to be moving away from the line as free-spreading fires (compared to the assumption of at least 10 minutes to develop).

The long run of the escaped fire in continuous fuel beds of maritime chaparral displayed an average ROS of 0.92 mph over a 1.33-mile stretch outside of Ranges 43–48, under the influence of an average 10 mph 20-ft wind. The Fuel Model 6 ROS prediction of 1 mph under those conditions compares well with the observed ROS. (The Fuel Model 4 ROS prediction is too high.)

It should be noted that the wind speeds involved in the predictions are averages (not peak, ambient winds as measured at the FO1 and FO2 RAWS) and are taken as direct measures of mid-flame wind speeds. FO1, which was directly upwind of the escaped fire, showed anomalously high wind speeds during the run of the fire, while the nearby FO2 showed a steady 9 mph average wind. It is interpreted that the higher FO1 wind speeds were fire-influenced and do not represent the ambient wind, which is used as the model input. The post fire-run value of 10 mph at FO1 and the steady average winds observed at FO2 are the basis for the assumed 10 mph average ambient wind that drove the escaped fire.

3.2.2.2 Parsons' Wildfire Consultant

By 9:00 a.m. the weather conditions at both RAWSs hit the burn prescription perfectly and conditions remained in prescription throughout the ignition phase of the burn. Peak winds observed at the RAWSs between 9:00 and 11:00 a.m. ranged from 17–21 mph and were consistently higher than the wind speed range identified in the prescription. By 11:00 a.m., the average wind speeds recorded at Range 46 were near the high end of the prescription, with peak winds recorded at 21 mph. At Range 43, the average wind speeds were well within the prescription, with peak winds at 20 mph.

Based on the intensity generated with relatively short strip head fires and the consumption of the brush, the prescription generated a fire that was more than sufficiently intense to clear the brush effectively.

3.2.3 SEQUENCE OF FIRING OPERATIONS

3.2.3.1 Fire Stop

One of the results from trying to meet the strict smoke management guidelines was that Fire Stop could not black line the Evolution Road control boundary before the prescribed burn. During the burn, Fire Stop was trying to hold the primary aerial ignition along a narrow control line with wind conditions approaching 15 mph. Evolution Road was therefore burned in to widen the control line.

3.2.3.2 Parsons' Wildfire Consultant

The goal of the firing operation was to generate a high-intensity fire that would lift the smoke plume high into the air (to minimize smoke impacts to Monterey County citizens) while staying contained within the burn site. In order to achieve this, the main ignitions had to be conducted quickly to keep the fire hot so that it pushed the smoke plume high aloft, but they also needed to be coordinated correctly with the burning out of the control lines.

In general, control lines should be burned before the main ignitions, and the control line burns need to be done slowly so that a wider buffer can be established without the fire escaping. The Evolution Road control line burn, though, was started after the main ignitions had begun. At 9:06 a.m., the main ignitions began; at around 9:20 a.m., fire was being dropped in strips along the inside of Evolution Road, well ahead of the main ignitions paths burning towards the control line. These strips were being laid very fast and hot along Evolution Road without allowing the preceding strips to lose any heat, which put a lot of heat against the control line.

Based on Figure 7 in Fire Stop's report on the cause of the Evolution Road boundary breach (see top of page 3-14), it appears that the heavy pockets of vegetation in the location of the red arrows (escape points) should have been burned out ahead of the main ignition paths, which were coming in from the northeast. This vegetation should have been strip fired along Evolution Road and allowed to create a buffer before the fire from the main ignition paths arrived.

Assuming that the vegetation was not stripped out ahead of the main ignitions paths, it appears that the southern ends of the ignition paths, backed by the wind, ran through the vegetation and breached the control boundary. Based on the flame lengths of the ignition paths shown in the photograph, a fire running with the wind through the vegetation at the red arrows could produce flame lengths that would bend over the brush-cleared zone and road and/or saturate the pre-treated brush with embers, as well as loft embers over the pre-treated brush. This is supported by the report photos that show the breaches to be wide and intense.

Figure 7 from Fire Stop's report on the breach of the Evolution Road Boundary

It is therefore concluded that the northern breach identified in Fire Stop's report was caused by fire from the ignition path running through the heavy vegetation at the arrow, hitting the control line before it was burned out, and causing intense spotting into the pre-treated brush on the west side of Evolution Road. This breach became the northern breach shown in Figure 9 of Fire Stop's preliminary report (indicated by the top red arrow in the photograph below).

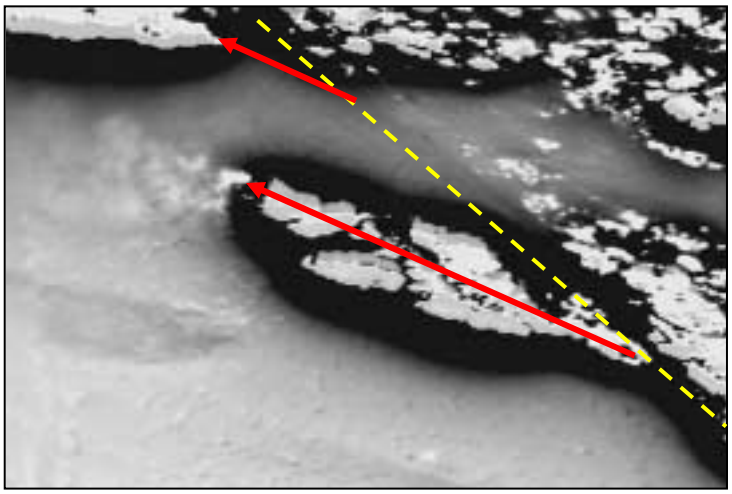


Figure 9 from Fire Stop's Preliminary Report on the Breach of the Evolution Road Boundary

CHAPTER 4
LESSONS LEARNED

4.1 CONTROL BOUNDARIES

For the Ranges 43–48 prescribed burn, the control boundaries consisted of the existing 45- to 50-ft-wide brush-cleared fuel breaks, which were enhanced by clearing the vegetation and/or pruning or removing the trees along the inside and/or outside of them. The southern section of Evolution Road control boundary consisted of a 45-ft-wide fuel break, with the trees 50 ft to the outside pruned to 8 ft and the brush underneath the trees cut. The day before the burn, water tenders sprayed water/foam 50 ft from the outer edge of all the control lines and SEATs sprayed a 100-ft-wide strip of retardant along their outer edges. This control boundary proved to be ineffective for containing the burn.

4.1.1 DETERMINING TYPE AND WIDTH FOR FUTURE BURNS

For future burns at the former Fort Ord, the effective width and type of treatment(s) for the control boundaries should be determined on a site-specific basis. Considerations should include the prescription and expected fire behavior; fuel types inside and outside the control lines; the types and number of control forces; and the risk and consequences of an escape.

4.1.2 BLACK LINING

It is Fire Stop's recommendation that the inside of the primary control lines be allowed to be black lined before the prescribed burn. This black lining should be allowed even if the weather conditions do not meet the strict smoke management guidelines.

4.1.3 PROPOSED CONTROL BOUNDARY TYPES

When determining the appropriate control boundary widths and types for future burn sites, control boundaries consisting entirely of cut vegetation or a combination of fire preventive features could be considered based on experience from the Ranges 43–48 prescribed burn.

The effectiveness of a control boundary consisting entirely of cut vegetation proved to be effective when the fire burning outside Ranges 43–48 ran into the brush-cut Seaside sites and died down shortly thereafter. Not only will this brush-cleared boundary likely contain the fire, but it will likely also reduce the amount of smoke when the fire runs into it and shorten the time of mop-up operations.

A control boundary designed with a combination of fire preventive features could alternatively be considered. This control boundary would consist of the following: (1) a 125-ft-wide brush-cleared control line adjacent to the burn site; (2) a minimum 20-ft-wide drivable road placed at least 80 ft from the inner edge of the control line; (3) a sprinkler system that would be placed along the outer edge of the 20-ft-wide roadway and operated before the burn to generate a continuous minimum 50-ft-wide "wet line" by soaking the brush and the litter underneath it; and (4) a minimum 100-ft-wide strip of long-term fire retardant that would be applied to the area adjacent to the outer edge of the wetted area.

4.2 BURN PRESCRIPTION

The burn team should reevaluate the objectives of the burn prescription. This entails carefully balancing the smoke impact minimization, vegetation clearance, and containment objectives,

while taking into consideration the width of the control boundaries and holding capabilities of the resources.

Loosening the burn prescription should also be considered so that there are more possible burn days.

Based on the issues regarding spot fires in section 3.2.2.1.A, the maximum wind speed during phases of the burn that directly impinge on a downwind control line should be 10 mph (a value subject to the concurrence of aerial-operation specialists).

4.3 COMMUNICATION

Fire Stop coordinated communications for the prescribed burn. This included preparing a Communication Plan. The frequencies designated in the plan were then made part of the Aviation Incident Communication Plan. Both air-to-air and air-to-ground communications had back-up frequencies. Both were in place and available during the burn. Fire Stop's Logistics Chief attended morning briefings to coordinate radio communications.

For two-way communication, Fire Stop had over 35 Bendix-King radios operating on the assigned fire frequencies. To alleviate traffic on the radios, Fire Stop had over 40 cell phones in use during the burn and assigned an additional 25 Motorola radios, which operated on separate frequencies, to the Fire Stop team and key personnel. The Fire Stop team members therefore carried three types of communications: cell phones, Bendix-King radios (fire frequencies); and Motorola radios (overhead frequencies).

During the transition from the prescribed burn to contingency operations, there were problems with the air-to-ground communications. During this approximately 1-hr period, the amount of traffic between the Aerial Ignition Specialist/Aerial Suppression Supervisor (AIS/ASS) and the air and ground resources performing ignition and suppression operations became overwhelming. At this time, the AIS/ASS requested assistance. The Fire Stop APM dispatched a helicopter coordinator (HELCO), which allowed the AIS/ASS to assume the responsibilities of the ignition helicopter while the HELCO took over the suppression helicopters. This corrected the communication traffic problems as the back-up systems were in use.

As part of pre-burn efforts to be better prepared in the event of a contingency, Fire Stop attempted to get the pre-assigned "tact" frequency that is issued, per standard protocol, by the emergency command center once an escape is declared. This "tact" frequency, however, was not provided to Fire Stop. During the transition from the prescribed burn to the contingency operations, when local and state fire resources were being integrated into the contingency operations, there were additional ground communications problems because the local fire agencies and Fire Stop were using different frequencies. This continued until the command center issued the "tact" frequency for all resources to use.

Aerial operations were using the three different frequencies for air-to-air ignition, air-to-air suppression, and air-to-ground operations, along with communications with the pilot. This required switching between three different channels, which may have prevented incoming traffic from being heard on other channels. Despite the heavy traffic during the transition from the prescribed burn to the contingency operations, messages could still be relayed and the problem was eventually corrected by adding the HELCO to the operations. One way to help communication on future prescribed burns at the former Fort Ord, would be for the burn subcontractor's aircraft to have radios that are equipped with a guard channel and are capable of

scanning. This would help all personnel in receiving the communications broadcast by the pilots and enable consistent air-to-air, air-to-ground, and air-to-FAA communications.

4.4 EXCLUSION ZONE FOR AERIAL OPERATIONS

Water and retardant drops need to be done within at least 200 ft to be effective. The CDF air tankers that arrived onsite to support the contingency operations were restricted from flying or making retardant drops below the site's 1,701-ft exclusion zone. The CDF made their retardant drops from above 1,701 ft, but they dissipated before ever reaching their targets.

The exclusion zones in the Impact Area can range from 200 to 2,000 ft based on the maximum fragmentation range calculation for a given sector's most probable munition (MPM). Basing the exclusion zone for aerial operations on the maximum fragmentation calculation, therefore, may preclude outside fire agencies from helping during a contingency situation on future prescribed burns.

To address this issue, the Army needs to research an appropriate calculation to determine a vertical separation distance for aerial operations. This calculation could then be used to establish a minimum safety drop and flyover height for each sector in the Impact Area and the next burn site, MRS-16.

4.5 EQUIPMENT

During the Ranges 43–48 burn, the water tenders' tires and the sandy composition of the fuel breaks left the possibility of the water tenders getting stuck on the fuel breaks. In addition, multiple water tenders could not be used in the same area because the 45- to 50-ft wide fuel breaks do not have passing areas.

Graveling the Impact Area fuel breaks or at least equipping the water tenders with large floatation tires would enable the water tenders to be driven safely on the fuel breaks. The advantage of graveling the fuel breaks, though, would be that standard 10-wheel water tenders and Type 3 thru 6 wildland fire engines could then be driven on them. This would increase the amount of water that could be applied on and around the fuel breaks during pretreatment and suppression operations.

4.6 HELITORCH BASE

A sufficient number of fire engines need to be onsite so that a Type I engine can be stationed at the helitorch base at all times in case of a fire.

CHAPTER 5
SMOKE MANAGEMENT

5.1 MEASURES TAKEN TO MINIMIZE SMOKE

A major goal of the prescribed burn was to minimize smoke impacts. The Army implemented several measures to support this goal.

Stringent weather parameters were established so that fire ignitions would only be conducted under a specific weather forecast. The weather forecast had to show that the meteorological conditions would allow the fire to burn hot enough that the smoke would rise high into the air. In addition, the burn prescription required a 0–15 mph offshore breeze to push the rising smoke towards Monterey Bay and out to sea. The Army's FWM closely monitored the weather conditions and regularly consulted with meteorologists from the NPS, NWS, and CARB on the forecasts.

In addition to the weather, the ignitions had to be conducted in a manner that would keep the fire hot and the smoke high in the atmosphere. This required the ignitions patterns to be lit quickly one after another in carefully designed pattern. For the main ignitions, Fire Stop used three helicopters to drop fire rapidly using a chevron strip fire pattern. The goal of using this pattern was to have the fire build up its heat in the center of the site as more paths were ignited. The control line burn along Evolution Road was also done using rapid ignitions to minimize smoke.

5.2 SMOKE PROGRESSION

Generally, the smoke plume (the heavy, black-grayish smoke with the particulate matter) went high into the air and out towards Monterey Bay as planned—even when the burn went outside its control lines. The residual drift smoke (the lighter, white smoke that has a smell equivalent to a campfire) is what was observed in the nearby Monterey County communities.

The discussion on the smoke progression has been divided into two subsections. Section 5.2.1 covers the prescribed burn operation when the fire was confined to Ranges 43–48 on October 24 (8:55–10:00 a.m.). Section 5.2.2 describes the smoke from when Evolution Road was breached (October 24, 10:00 a.m.) until the end of the of the October 25 contingency operations.

Each subsection contains two sets of photographs to chronicle the smoke progression: the first set was taken by an observation helicopter from various spots around the site and it shows the fire, smoke plume, and residual smoke; the second was taken from atop the Embassy Suites hotel in the city of Seaside and shows just the smoke plume. Each subsection contains a map showing the general smoke progression for that period of time (Figures 5-1 and 5-2).

A satellite image of the smoke dispersal, Figure 5-3, has been included at the end of section 5.2.2.2.

5.2.1 PRESCRIBED BURN OPERATION

The following photographs show the smoke progression during the prescribed burn operation on October 24 while the fire was contained within Ranges 43–48 (8:55 a.m.–10:00 a.m.).

5.2.1.1 Helicopter Photographs

Photograph 5-1—The smoke stayed low during the cooler-burning test fire (10-24-03, 8:58 a.m.)

Photographs 5-2, 5-3, and 5-4—As more ignition paths were laid down, the fire got hotter and the smoke plume began to rise at a shallow angle and then out towards Monterey Bay. (10-24-03, 9:06–9:08 a.m.)

Photograph 5-5—A close-up of the light, residual smoke (seen in the left background of Photographs 5-3 and 5-4) drifting over Seaside and Monterey (10-24-03, 9:06–9:08 a.m.)

Photograph 5-6—The smoke carrying high over Seaside out towards Monterey Bay (10-24-03, 9:21 a.m.).

Photographs 5-7 and 5-8—Fire continuing to build inside Ranges 43–48 with the smoke continuing to rise and carrying out to sea (10-24-03, 9:31 a.m.).

Photograph 5-9—The fire building heat in the middle of the site is rising high into the air, while the smoke from the smoldering test burn and the Evolution Road control line burn are carrying at slightly lower levels. There is some low-lying residual smoke present over Seaside (10-24-03, 9:38 a.m.).

Photograph 5-10—The smoke plume leveling off over Seaside (10-24-03, 9:42 a.m.).

5.2.1.2 Embassy Suite Photographs

Photograph Series 5-1—The smoke plume during the test fire and main ignitions (8:55–10:00 a.m.)

5.2.2 EVOLUTION ROAD BREACH AND CONTINGENCY OPERATIONS

5.2.2.1 Helicopter Photographs

Photographs 5-11—At this time, the fire had breached Evolution Road and was spreading towards the Seaside sites. The smoke plume was still high aloft, but the lighter residual smoke was affected by the erratic winds and hovered close to the ground as seen in this photograph taken near the Bayonet & Black Horse Golf Course in Seaside (10-24-03, 10:20 a.m.).

Photograph 5-12—A view of the smoke moving towards the bay from the General Jim Moore Boulevard–Eucalyptus Road intersection. By this time, an escape had been declared (10-24-03, 11:09 a.m.).

Photograph 5-13— A view of the smoke looking southwest towards the bay from behind the General Jim Moore Boulevard–Eucalyptus Road intersection (10-24-03, 12:20 p.m.).

Photograph 5-14—When the fire outside Ranges 43–48 ran into the brush-cut Seaside sites, it died down quickly and began to smolder, contributing additional low-lying drift smoke into the air (10-24-03, 12:53 p.m.)

Photograph 5-15—Sand City and Monterey began to clear by the early afternoon as the winds began to shift and push the drift smoke to the east (10-24-03, 1:20 p.m.).

Photograph 5-16—The onshore breeze began to take over in the mid-afternoon, gradually rotating the smoke plume to the east (10-24-03, 2:07 p.m.).

Photograph 5-17—By 3:00 p.m. the wind had completely shifted to the east, as demonstrated by the smoke in the background moving away from the Monterey Airport (10-24-03, 3:21 p.m.).

Photograph 5-18—As the sun began to set, Monterey Bay was clear as the winds continued to push the smoke east (10-24-03, 5:48 p.m.).

Photograph 5-19—With the sun beginning to heat up the surface on the morning of October 25 and the presence of an offshore breeze, hot spots around the burned areas ignited in the morning and the resulting smoke traveled low over Seaside en route to Monterey Bay (10-25-03, 8:27 a.m.).

Photograph 5-20—A view of the smoke from the General Jim Moore Boulevard–Eucalyptus Road intersection (10-25-03, 10:20 a.m.).

Photograph 5-21—Ignitions to burn out islands and pockets of unburned brush began around 12:40 p.m. with an offshore breeze. The smoke plume was able to rise to approximately 2,500 ft in the air before flattening out. By 1:00 p.m. the onshore breeze began taking over, rotating the plume to the southeast, as seen in this view of the fire burning near Orion Road. (10-25-03, 1:24 p.m.).

Photograph 5-22— During the onshore breeze, there were periods when the wind was calm, causing Monterey Bay to be blanketed by a smoky haze (10-25-03, 2:24 p.m.).

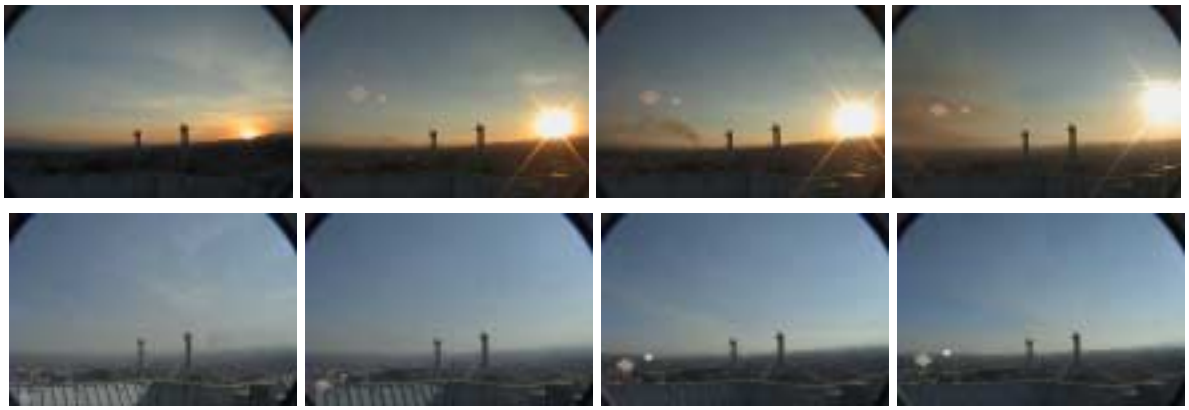
Photograph 5-23—A view of the smoky haze from the from the General Jim Moore Boulevard–Eucalyptus Road intersection, looking southeast towards the unintentionally burned area (10-25-03, 3:48 p.m.).

5.2.2.2 Embassy Suites Smoke Plume Photographs

Photograph Series 5-2—The plume when Evolution Road was breached, an escape was declared, when the fire died down in Seaside, and when the winds began to shift to the southwest (10:00 a.m.–1:00 p.m.)

Photograph Series 5-3—An onshore breeze rotated the smoke from the southwest to the east (1:00 p.m.–4:00 p.m.)

Photograph Series 5-4—The smoke continued to go east and began to dissipate as the fire was contained at Evolution Road (4:00 p.m.–7:00 p.m.)



Photograph Series 5-4—Hot spots ignited on the morning of October 25 as the sun heated up., The smoke stayed at around 200 to 500 ft over Seaside as it headed west (7:00 a.m.–12:30 p.m.).

Photograph Series 5-4—Ignitions to burn out pockets and islands of vegetation were started with an offshore breeze blowing the smoke to the west. The smoke rose to 2,500 ft before spreading horizontally. Twenty minutes after ignitions, the onshore breeze took and the smoke was pushed to the east until the evening (12:40 p.m.–6:30 p.m.).

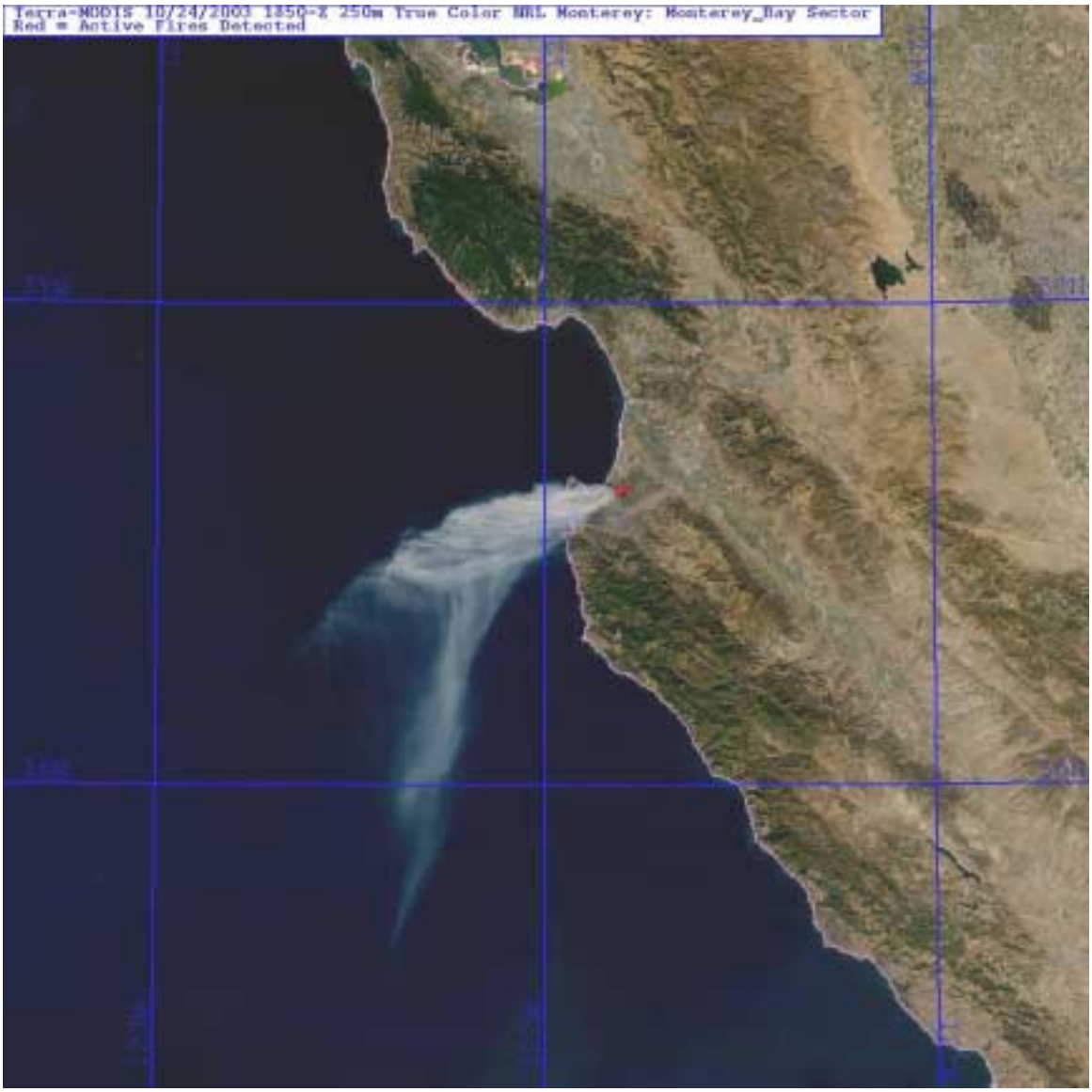


Figure 5-3—Satellite Image of Smoke Dispersal on October 24

5.3 SMOKE COMPLAINTS

The Army logged 91 complaints during the prescribed burn. Most of the complaints were received from the Army's hotline. Some callers noted difficulty breathing and eye irritation, while others were concerned about the effects on people with asthma. Many callers noted smoke and ash. Some of the calls did not pertain to smoke-related complaints.

The majority of the calls (90%) were received on October 24. Most of the calls (80%) came from residents in Carmel, Monterey, Pacific Grove, and Seaside. Table 5-1 provides a breakdown of where the complaints originated from (in order of number of complaints).

Table 5-1—Smoke Complaint Origin Breakdown

City	Number of Complaints
Carmel	27
Monterey	22
Seaside	14
Pacific Grove	9
Pebble Beach	2
Salinas	2
Del Rey Oaks	2
Marina	1
Ord Military Community	1
Watsonville	1
Outside Monterey County or Unidentified	10
Total	91

CHAPTER 6
REFERENCES

[1] Final, Record of Decision, Interim Action for Ordnance Explosive Sites Ranges 43–48, Range 30A, and Site OE-16, Former Fort Ord, California, September 2002.

[2] Final, Ranges 43–48 Prescribed Burn Plan, Former Fort Ord, California, prepared for U.S. Army Corps of Engineers, Sacramento District, Fire Stop, October 2002.

[3] Final, Ranges 43–48 2003 Prescribed Burn Support Plan, Former Fort Ord, California, prepared for U.S. Army Corps of Engineers, Sacramento District, Parsons, July 2003.

[4] Preliminary Draft, Ranges 43–48 Prescribed Burn Air Monitoring Report, Former Fort Ord, California, prepared for U.S. Army Corps of Engineers, Sacramento District, MACTEC, January 2004.

[5] Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California, U.S. Army Corps of Engineers, Sacramento District, April 1997.

[6] Draft Final, Revised Voluntary Relocation Plan, Former Fort Ord, Monterey, California, Interim Action Remedial Investigation/Feasibility Study, Creighton & Creighton Inc., July 2003.