

Natural Disaster Survey Report

"TUNNEL" WILDFIRE

OAKLAND-BERKELEY HILLS

OCTOBER 20-23, 1991

**U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Western Region
Salt Lake City, Utah**

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LIST OF ACRONYMS

AFOS	Automation of Field Offices and Services (Computer and communication system)
AFFIRMS	Administrative and Forest Fire Information Retrieval and Management System
BAPSU	Bay Area Public Service Unit
ECC	Emergency Command Center
EDIS	Electronic Digital Information System
FWU	Fire Weather Unit
GMT	Greenwich Mean Time
km	Kilometer
LFM	Limited Fine Mesh (NWS Prediction model)
mb	Millibar
MIC	Meteorologist in Charge
MOS	Model Output Statistics
MPH	Miles Per Hour
NFDRS	National Fire Danger Rating System
NGM	Nested Grid Model (NWS Prediction model)
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NWR	NOAA Weather Radio
NWS	National Weather Service
NWWS	NOAA Weather Wire Service
OES	Office of Emergency Services
QPF	Quantitative Precipitation Forecast
RAWS	Remote Automatic Weather Station
SMT	Supervisory Meteorological Technician
SPS	Special Weather Statement
SSD	Scientific Services Division
WRH	Western Region Headquarters (NWS)
WSFO	Weather Service Forecast Office
WSO	Weather Service Office

PREFACE

On October 20-23, 1991 the disastrous "Tunnel" fire charred over 1800 acres in the urban-wildland interface in the Oakland-Berkeley area of central California. Strong winds and low relative humidities were major influences in the fire's extreme behavior and rapid spread. The fire was responsible for 25 fatalities, 150 persons injured, and over 5000 left homeless. With direct and indirect costs in excess of \$ 1.6 billion, this was the most costly urban-wildland fire in the nation's history.

The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), Western Region Headquarters (WRH), appointed a Regional Survey Team to review the meteorological services provided in support of the "Tunnel" fire. The survey teams primary objective were to examine the effectiveness of NWS warning and forecast procedures, and to examine ways services could be improved. The survey team consisted of Mr. David W. Goens (Team Leader), Applied Services Meteorologist, Meteorological Services Division (MSD), WRH; Mr. Terry D. Marsha, Meteorologist in Charge (MIC), Weather Service Office (Fire Weather), Salem, Oregon; and Dr. Timothy W. Barker, Meteorologist, Scientific Services Division (SSD), WRH.

Mr. Goens and Dr. Barker met with Dr. Thomas Potter (Western Region Director), Mr. Kenneth Mielke (Chief SSD, WRH), and Mr. Richard Douglas (Deputy Chief MSD, WRH) on October 23, 1990 to review the event and plan survey strategy. Mr. Goens and Mr. Marsha then travelled to Sacramento, CA, on the afternoon of October 23rd, and Dr. Barker travelled to San Francisco on October 24th. An outgoing briefing on preliminary survey results was provided to Roger Pappas, MIC, Weather Service Office (WSO) Sacramento on October 25, and to Weather Service Forecast Office (WSFO) San Francisco Deputy MIC Roger Williams on October 28.

The survey team wishes to recognize the dedication of Mr. Milo Radulovich, Lead Fire Weather Forecaster, WSO Sacramento, Mr. Norman Hoffmann (Area Manager/MIC) and Mr. Roger Williams (Deputy MIC) WSFO San Francisco. These gentlemen were not on duty the day the fire exploded. However, they returned to work as soon as they were aware of the situation and worked long hours providing direct and indirect support to the fire suppression efforts. The professional work ethic and dedication to duty demonstrated by these gentlemen provides a positive image for the National Weather Service.

The survey team also wishes to express its appreciation to the personnel of WSFO San Francisco and WSO Sacramento for their complete support of the survey team. Their cooperative spirit and freely sharing of information were invaluable in the situation analysis and subsequent preparation of this report.

EXECUTIVE SUMMARY

The Oakland-Berkeley Hills area, adjacent to the San Francisco Bay, is normally influenced by a moist westerly flow characterized by high humidities and light winds. The week prior to the fire, an off-shore (easterly) flow pattern developed as high pressure settled over the Great Basin east of the Sierra Nevada mountains. This pattern produced record high temperatures (92 degrees on October 20 in Oakland which is 23 degrees above normal) and abnormally low relative humidities in the Bay area.

One of the most dangerous wildland fire situations in central and southern California involves a significant winter freeze that kills and damages vegetation, followed by a dry summer and a late season strong east wind event. The second most costly fire in the nation's history destroyed 623 homes in the Oakland-Berkeley Hills under similar conditions in 1923. In 1970, another fire in the Oakland Hills destroyed 20 homes under like conditions. These homes were rebuilt, but 18 were again destroyed in the 1991 "Tunnel" fire!

During December 1990 a record arctic outbreak killed or damaged a significant amount of vegetation in the Oakland Hills. Vegetation affected included ornamental species, some natural brush (i.e. Bottle Brush), and tree species including Monterey Pine and Eucalyptus. These species become highly flammable and extremely volatile when dead, dormant, or under moisture stress. Compounding this dangerous scenario, was a five year drought in California.

The abundant fuels resulting from the dead and drought-stressed vegetation combined with the dry northeasterly winds to provide necessary conditions for a major fire disaster on the morning of October 20, 1991. Fire control organizations throughout central California were aware of the dangerous fire potential. Initial attack forces had been placed into a high state of readiness and aerial retardant aircraft contracts renewed the previous week.

The fire control agencies' readiness and heightened awareness was due in part to the WSO Sacramento Fire Weather Unit. Daily weather briefings during the week prior to the fire kept fire control officials apprised of the potentially dangerous fire weather situation. RED FLAG WARNINGS were issued with a lead time in excess of 24 hours, accurately forecasting the onset of the dangerous hot, dry, and windy conditions. As the fire evolved, active coordination between WSO Sacramento and WSFO San Francisco contributed to the effectiveness of the NWS support.

The following is a summary of significant findings resulting from this survey. A more complete and comprehensive list of findings and recommendations is included later in this report.

1. **Finding:** WSO Sacramento and WSFO San Francisco provided and effective forecast and warning service during this event. Emergency services officials were kept well informed with timely and accurate forecasts, warnings, and statements which were updated as necessary. Media contacts were handled in a timely and professional manner.

2. **Finding:** NWS weather briefings and outlooks provided to California Department of Forestry (CDF) personnel during the week prior to the disastrous fire were instrumental in the CDF's decisions to maintain a high level of readiness and to order additional retardant aircraft.

3. **Finding:** The collocation of WSO Sacramento and the CDF State Fire Operations Center contributed to the effectiveness of the NWS's support to this incident. The routine, daily interaction between NWS and CDF fire managers promotes a high level of confidence in, and utilization of NWS fire weather products and services.

4. **Finding:** The first RED FLAG WARNING issued by WSO Sacramento on the morning forecast Saturday October 19 could have been preceded by a RED FLAG WATCH on Friday October 18. Environmental factors were critical, and forecast models and a local study (Sigma Index) indicated high winds and low humidities. These conditions were reflected in the forecast and briefings, but the forecaster elected to hold off on the WATCH.

5. **Finding:** WSO Sacramento's published RED FLAG criteria need to be reviewed and updated. Current criteria are too vague.

6. **Finding:** It is not clear whether WSO Sacramento's fire weather zones include urban areas in the Oakland-San Francisco Bay region. Local instructions need to be updated to clearly define forecast areas.

7. **Finding:** Sacramento fire weather forecasts are not disseminated on AFOS. Therefore, WSFO San Francisco forecasters were not aware a RED FLAG forecast had been issued on October 19 that covered their public service area.

8. **Finding:** There was no direct communication or coordination between the WSFO and the mobile unit forecaster while he was on site supporting the fire.

9. **Finding:** There was limited real time weather observation data available from the fire area. Some of the available data was in a format that was not clearly understood and utilized by forecasters at WSFO San Francisco.

10. **Finding:** Some San Francisco WSFO Bay Area Public Service Unit (BAPSU) personnel were unsure of what should be covered in special weather statements for this unique event.

11. **Finding:** The spotter network in the Bay Area was not well developed.

12. **Finding:** Alameda County OES interacted effectively with WSFO San Francisco during the fire.



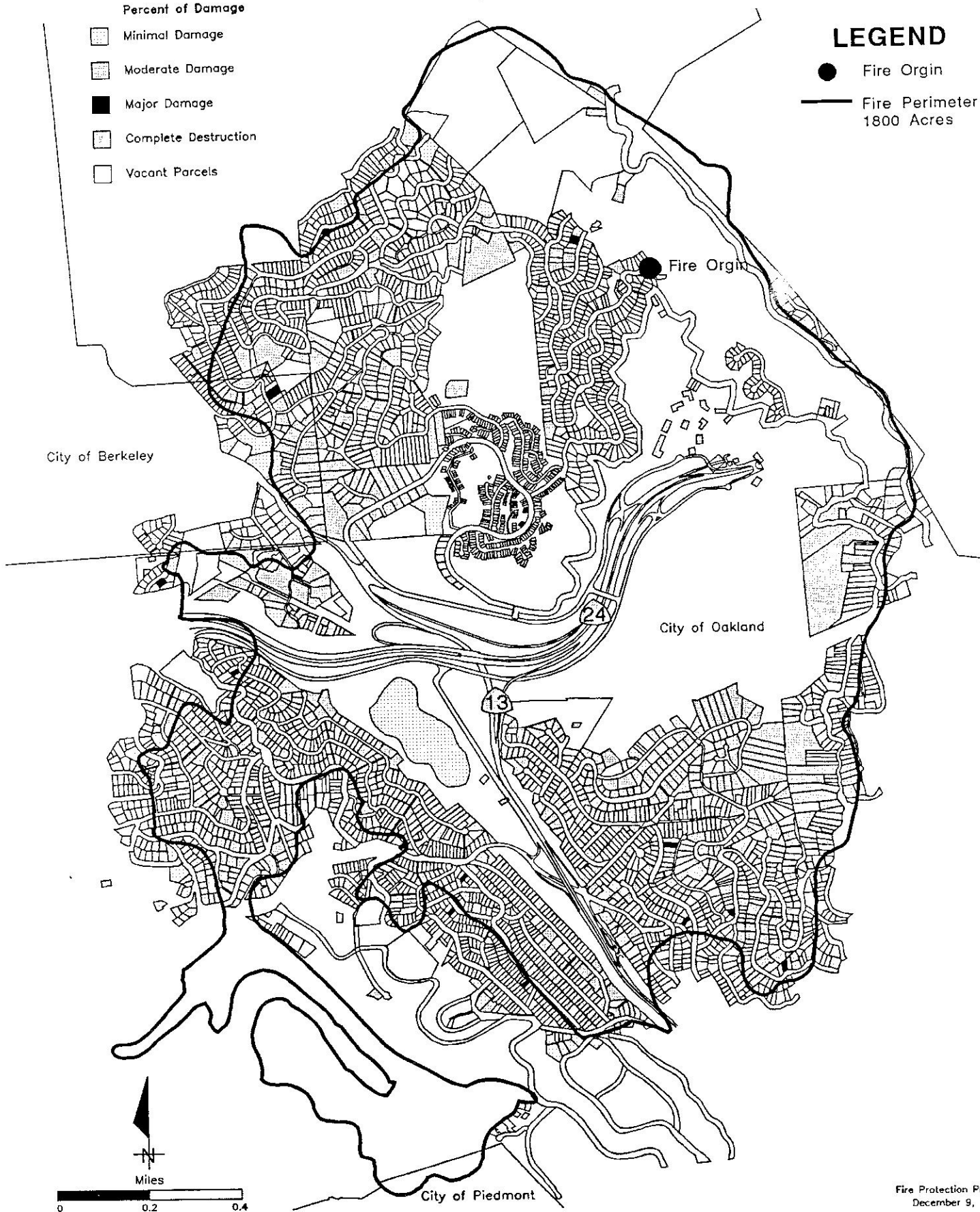
Figure 1

Oakland/Berkeley Hills Tunnel Incident

Damage Assessment

- Percent of Damage
- Minimal Damage
 - Moderate Damage
 - Major Damage
 - Complete Destruction
 - Vacant Parcels

- ### LEGEND
- Fire Origin
 - Fire Perimeter
 - 1800 Acres



Fire Map Figure 1A

DESCRIPTION AND IMPACT OF THE "TUNNEL" FIRE

Overview

The "Tunnel" fire began at approximately 10:53 a.m. Sunday October 20, 1991 near the Caldecott Tunnel (Figure 1). Gusty northeast winds of 20-25 mph blew embers from an undetermined source into dried vegetation and onto wood shake roofs. The fire was quickly fanned into an raging conflagration that was not controlled until 8:00 a.m. Wednesday morning, October 23, 1991.

Prior to containment, the fire would leave twenty-five people dead, 150 injured, and at least 5,000 homeless. There were 3,354 single family dwellings destroyed with an average cost of \$360,000 for a total loss of \$1,207,440,000. In addition, 456 apartments and 2,000 automobiles were consumed. Estimated damages to public utilities (gas, electric, telephone, cable-TV) were in excess of \$20,000,000. Direct and indirect fire suppression costs were estimated at \$54,356,000 and estimated repair to public facilities (roads, parks, etc.) were \$5,794,000. After the fire was out, an erosion control plan was implemented at an estimated cost of \$5,000,000, and the Soil Conservation Service undertook a \$1,700,000 seeding project to mitigate damage to watersheds in the burn area. With a combined estimated cost of \$ 1.6 billion, this was the most costly urban wildland fire in the Nation's history!

METEOROLOGICAL DISCUSSION

A strong upper-level ridge along the West Coast during the week of October 13-19, 1991 produced warm temperatures and no precipitation over northern California. Figure 2 shows the 500mb height analysis on Friday evening, October 18th. The strong subsidence induced by this ridge slowly decreased the depth of the marine layer along the coastal areas of the state. This erosion introduced drier and warmer air along the coastal areas and produced warming that lowered surface pressures along the coast. This lowering of surface pressure along the California Coast induced an increasing north to northeast pressure gradient across northern California during the weekend of October 19th and 20th.

Figure 3 shows the surface pressure pattern on Friday evening, October 18th. The pressure gradient between the San Francisco Bay area and northern California or northern Nevada was 4mb or less at this time. Figure 4 shows the surface pressure 24 hours later on Saturday evening, October 19th. The surface pressure along the California coast had dropped by 6mb or more since Friday, and the pressure gradient between the San Francisco Bay area and northern California/northern Nevada had increased to 8-10mb. The surface pressure difference between San Francisco and Reno (about 270 km apart) was 6.3mb at this time and winds over the highest peaks of the coastal ridges between Sacramento and Oakland were reaching 30 mph.

The Oakland radiosonde ascent on Saturday evening (Figure 5) shows the very dry conditions induced by the subsidence, as well as a low level maximum (18kts) in the northeasterly wind at 4000 feet (approximately 900mb). The 18 degree dewpoint depression at the surface (versus 30 degree dewpoint depressions aloft) shows that there was a slight influence of marine air left near the surface.

During the night, some marine air at the surface seeped eastward to near Oakland, but very dry conditions aloft continued and the easterly winds increased (Figure 6). Surface pressures continued to fall at most northern California coastal stations during the night and by 8:00 a.m. the pressure difference between San Francisco and Reno reached its highest value of 11.4mb.

Comparing the 500mb height contours on Sunday morning (Figure 7) with Friday night (Figure 2) indicates that lowering heights over Baja California contributed to a more north to northeasterly flow at upper levels over northern California. Thus, the upper level flow veered and increased support to the winds induced by the low level pressure gradient. Winds over the peaks of the coastal ridges between San Francisco and Sacramento were sustained in the 40-50 mph range with gusts up to 60 mph.

The shallow layer of marine air near the surface in Oakland broke up at about 11:00 a.m. At this time the surface wind speed increased dramatically, the temperature rose 13 degrees in one hour (breaking the high temperature record for the day), and the dewpoint temperature dropped 9 degrees. This coincided with the initial blowup of the main fire complex.

The surface pressure gradient began relaxing during the day Sunday (October 20) as surface pressures in the northern Rockies and Great Basin fell as a surface low formed along the British Columbia Coast by Sunday evening (Figure 8). This development was in response to a upper level short wave in the Gulf of Alaska that is evident in the 500mb height contour map for Sunday Evening shown in Figure 9.

Even though the support for northeasterly winds was decreasing during the day, the strong winds continued in Oakland into the evening. The Sunday evening radiosonde ascent (Figure 10) revealed that the strongest winds were effectively at the surface, and that the marine layer was virtually nonexistent. Winds at mountaintop level had steadily decreased during the day.

The pressure gradient continued to weaken during the night Sunday and early Monday. Surface winds in the Bay area weakened considerably during this time and eventually turned to the northwest by Monday morning. The developing low pressure moving into the Pacific Northwest changed the pressure gradient to southwesterly by Monday night (Figure 11) and the cool, moist marine layer invaded the fire area during the day.

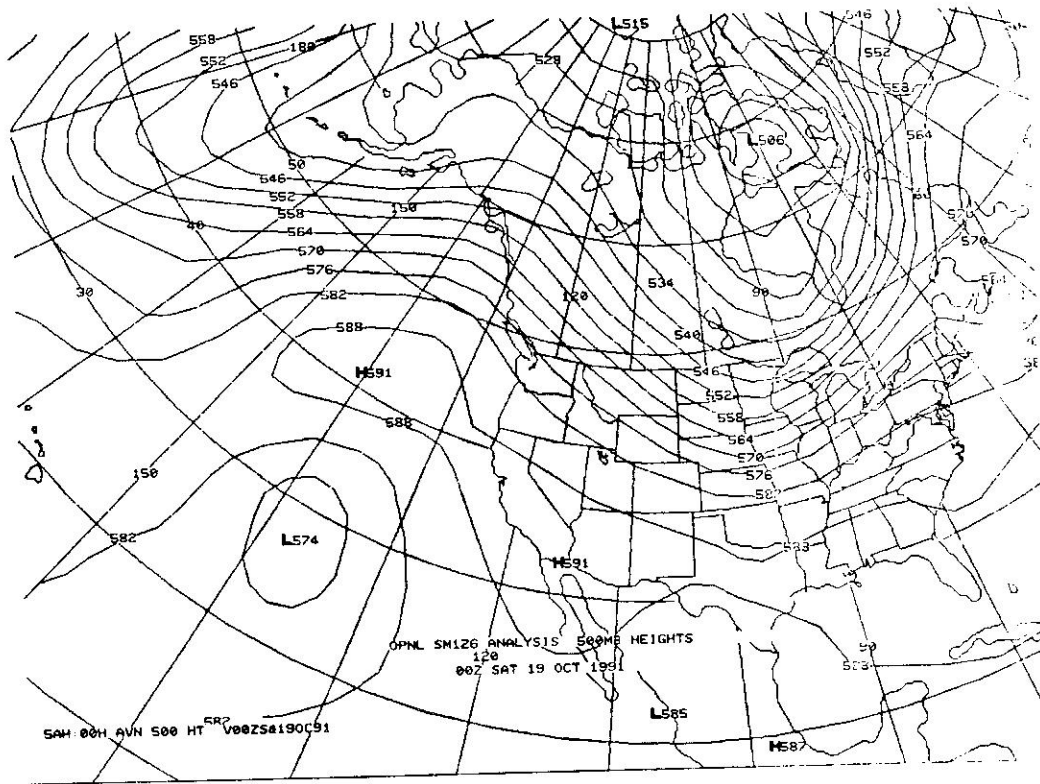


Figure 2 - 500mb Heights, 00 GMT Oct. 19, 1991

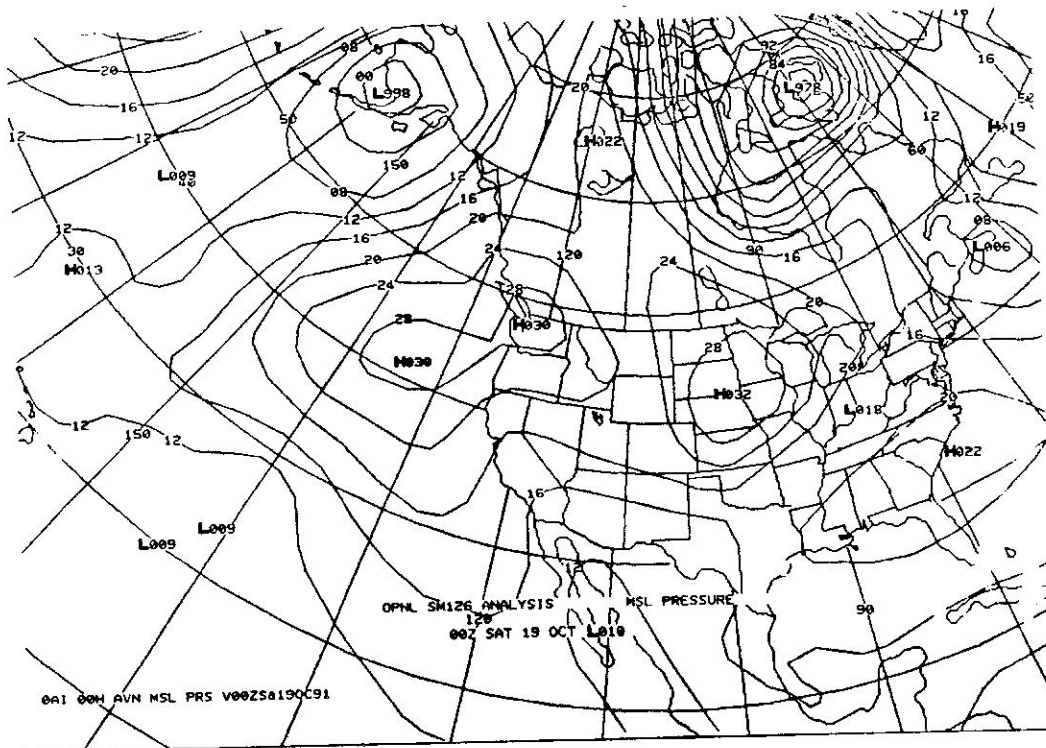


Figure 3 - Surface Pressure, 00 GMT Oct. 19, 1991

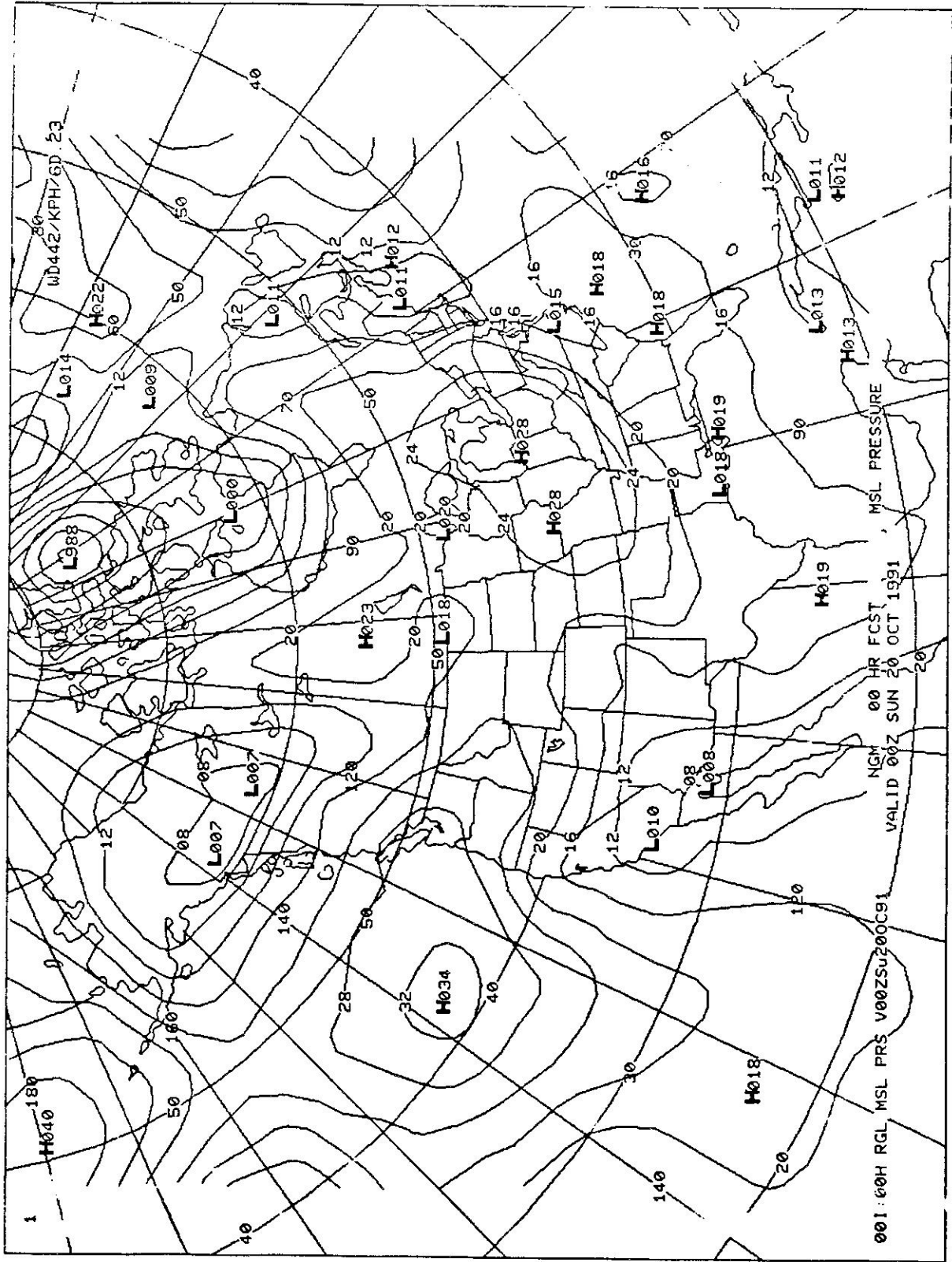


Figure 4 - Surface Pressure, 00 GMT Oct. 20, 1991

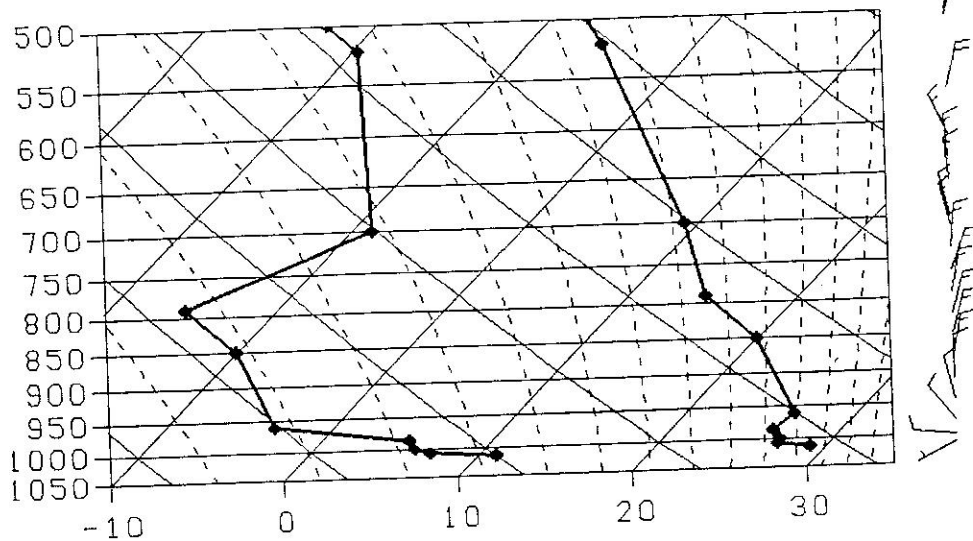


Figure 5 - Oakland Sounding, 00 GMT Oct. 20, 1991

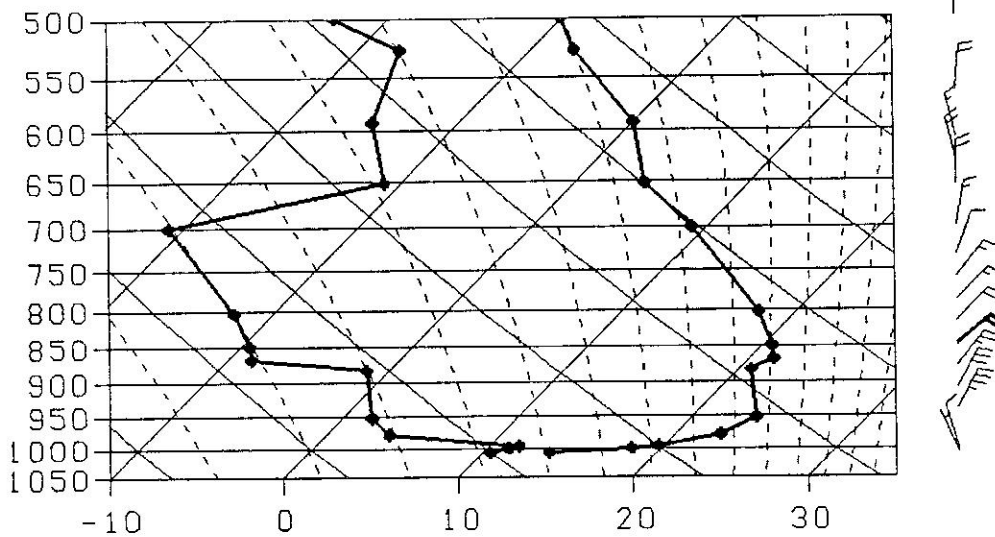


Figure 6 - Oakland Sounding, 12 GMT Oct. 20, 1991

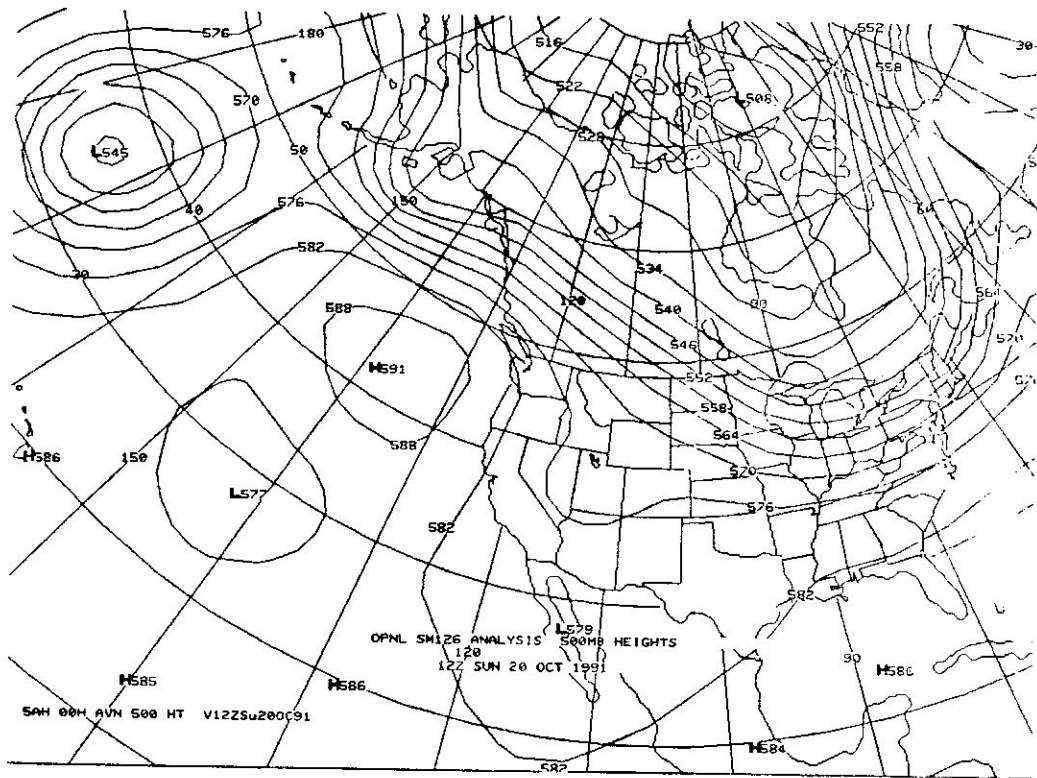


Figure 7 - 500mb Heights, 12 GMT Oct. 20, 1991

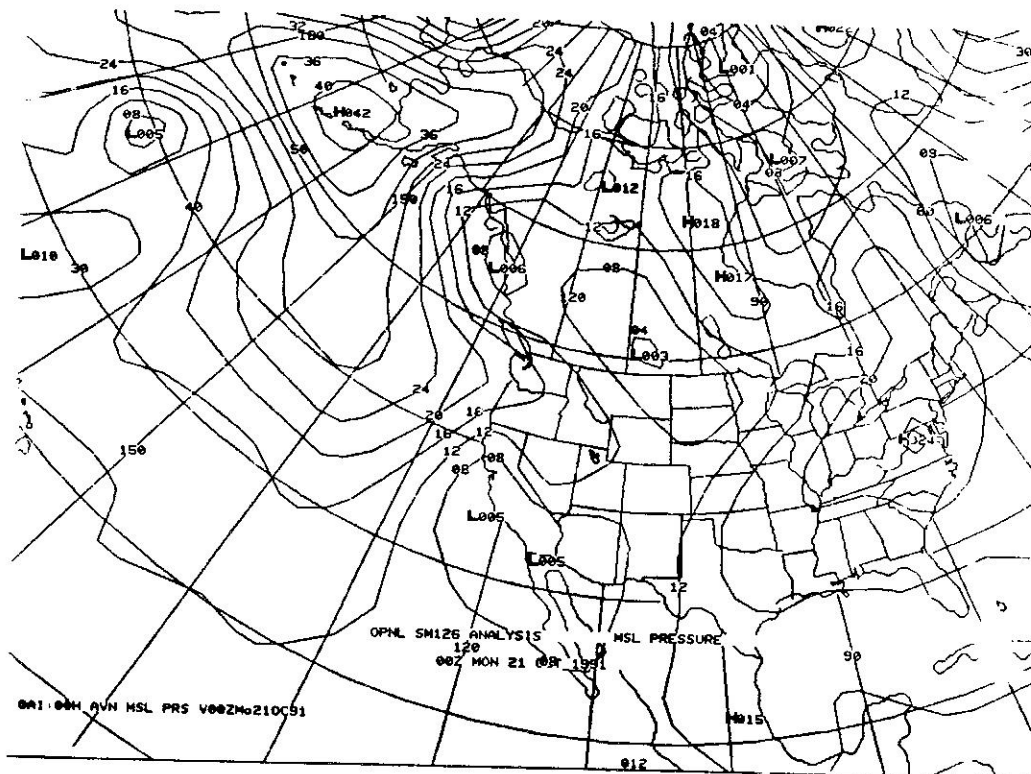


Figure 8 - Surface Pressure, 00 GMT Oct. 21, 1991

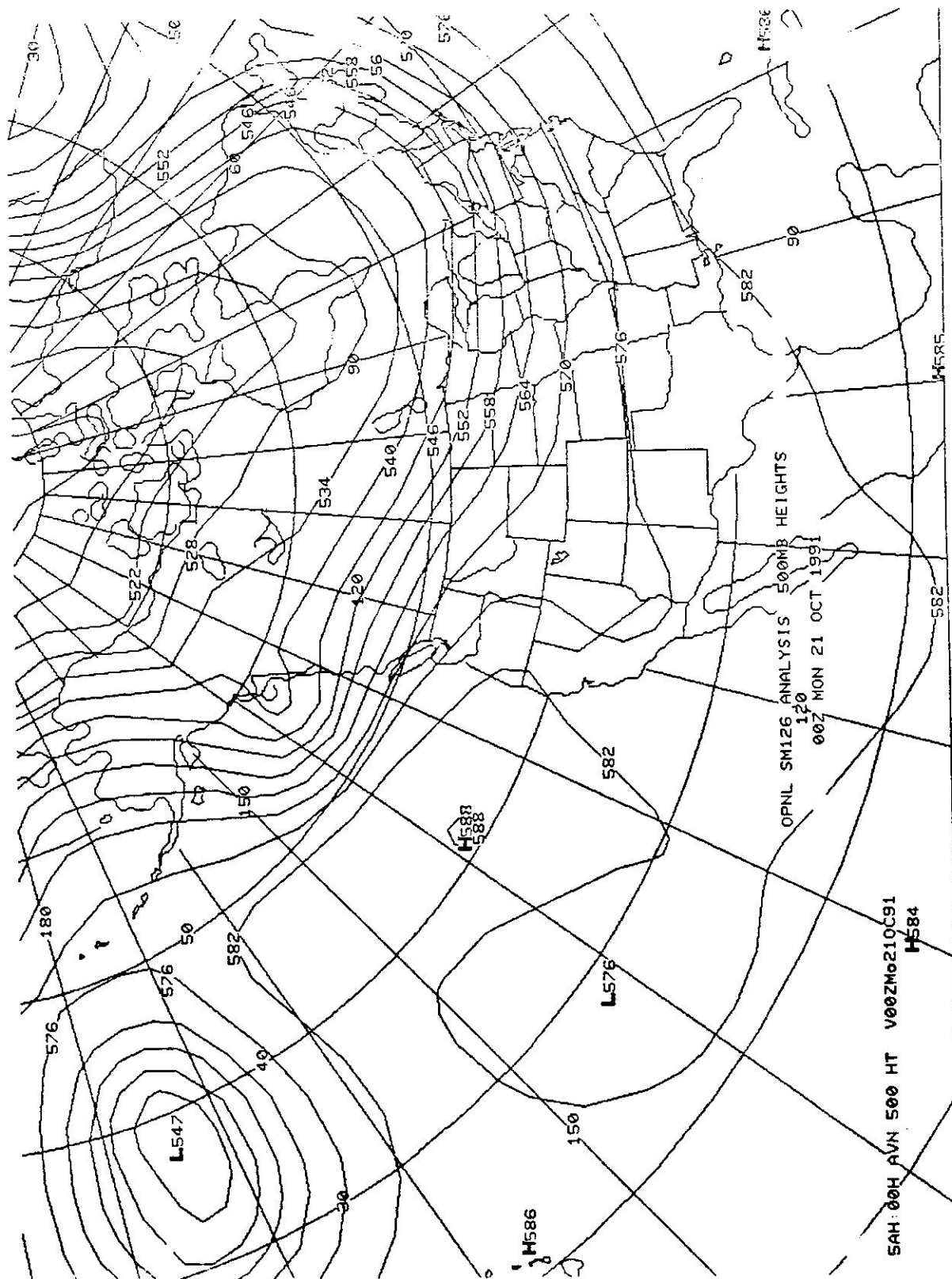


Figure 9 - 500mb Heights, 00 GMT Oct. 21, 1991

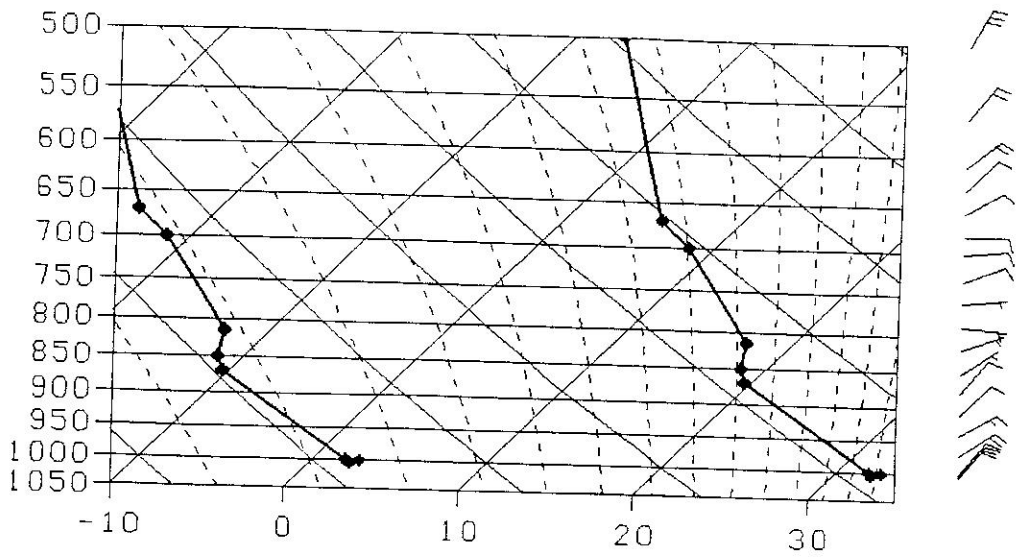


Figure 10 - Oakland Sounding, 00 GMT Oct. 21, 1991

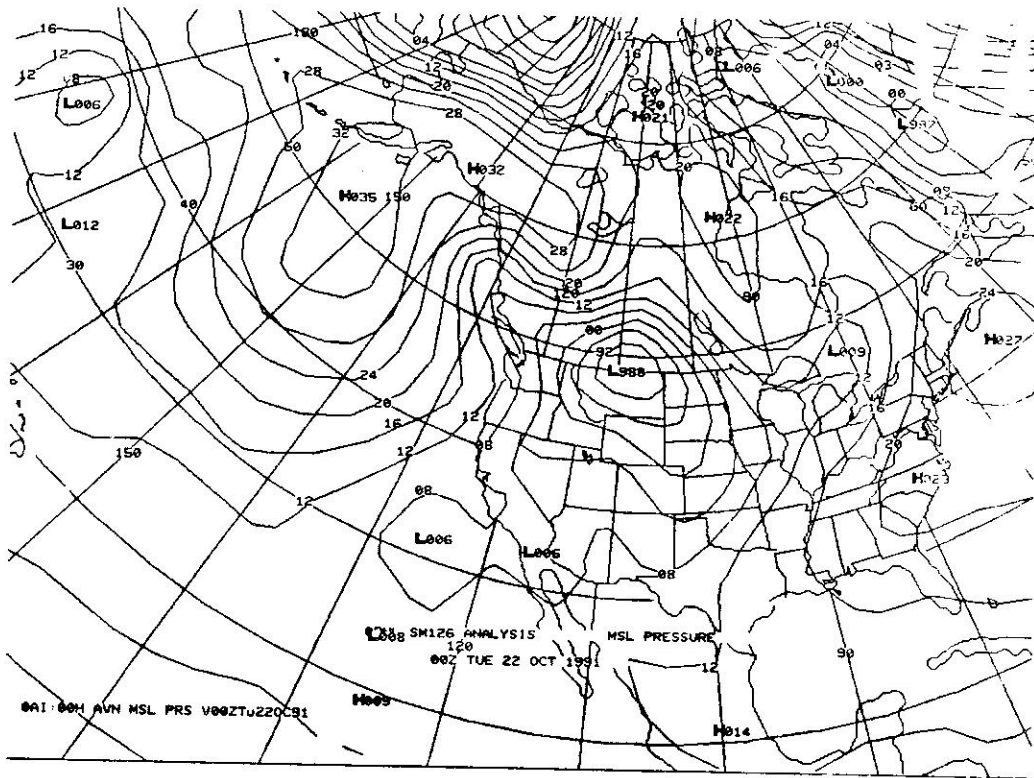


Figure 11 - Surface Pressure, 00 GMT Oct. 22, 1991

SUMMARY OF WARNING SERVICES

Overview

The forecast and warning services provided prior to and during the event were very good with only minor exceptions. Coordination between fire weather forecasters and staff at WSO Sacramento and lead forecasters at WSFO San Francisco was commendable. A team effort provided the wildland and urban fire protection agencies, as well as emergency services personnel, with timely and consistent weather information. A Sacramento local fire weather forecast aid (the SIGMA INDEX) indicated the potential for strong northeast winds nearly 48 hours in advance. This was a key aid as Sacramento forecasters briefed the fire control agencies and issued "RED FLAG WARNINGS" for the fire area 24 hours in advance of the event.

During the course of the survey, internal and external products used to produce forecasts and warnings were reviewed. This section will provide an overview of the numerical guidance as well as local forecast aids used by WSFO and WSO forecasters during this event. A summary of all public and fire weather products issued is contained in Appendix D.

Analysis of Numerical Guidance

Synoptic scale numerical guidance provided by the National Meteorological Center (NMC) was very good during this event. Figure 12 shows the 24 hour forecast of sea level pressure isobars valid on Sunday evening, October 20. The Nested Grid Model (NGM) did not forecast the development of the surface low along the British Columbia coast by this time, and consequently was a little too strong with the pressure gradient across northern California. Nonetheless, the surface low along the California coast and higher pressures over the Pacific Northwest were well placed and certainly highlighted the strong surface wind potential. Longer range guidance for this period was equally good at identifying the surface low along the coast and higher pressure over the Pacific Northwest.

Boundary layer wind forecasts from the NGM for midday Sunday and early Monday morning are shown in Figures 13 and 14. The trend of decreasing wind speeds Sunday night was ultimately correct. The "perfect prog" guidance from the NMC models for specific locations during this event were particularly valuable. Figure 15 shows the LFM "perfect prog" guidance for San Francisco from the Saturday evening run. North-northeast surface winds increasing to 15 knots were forecast, as well as very strong subsidence. The "FD" winds from the Saturday night run of the Aviation Model indicated that 3000 foot winds would increase over Oakland early Sunday morning, and was very valuable guidance for forecasters (not shown).

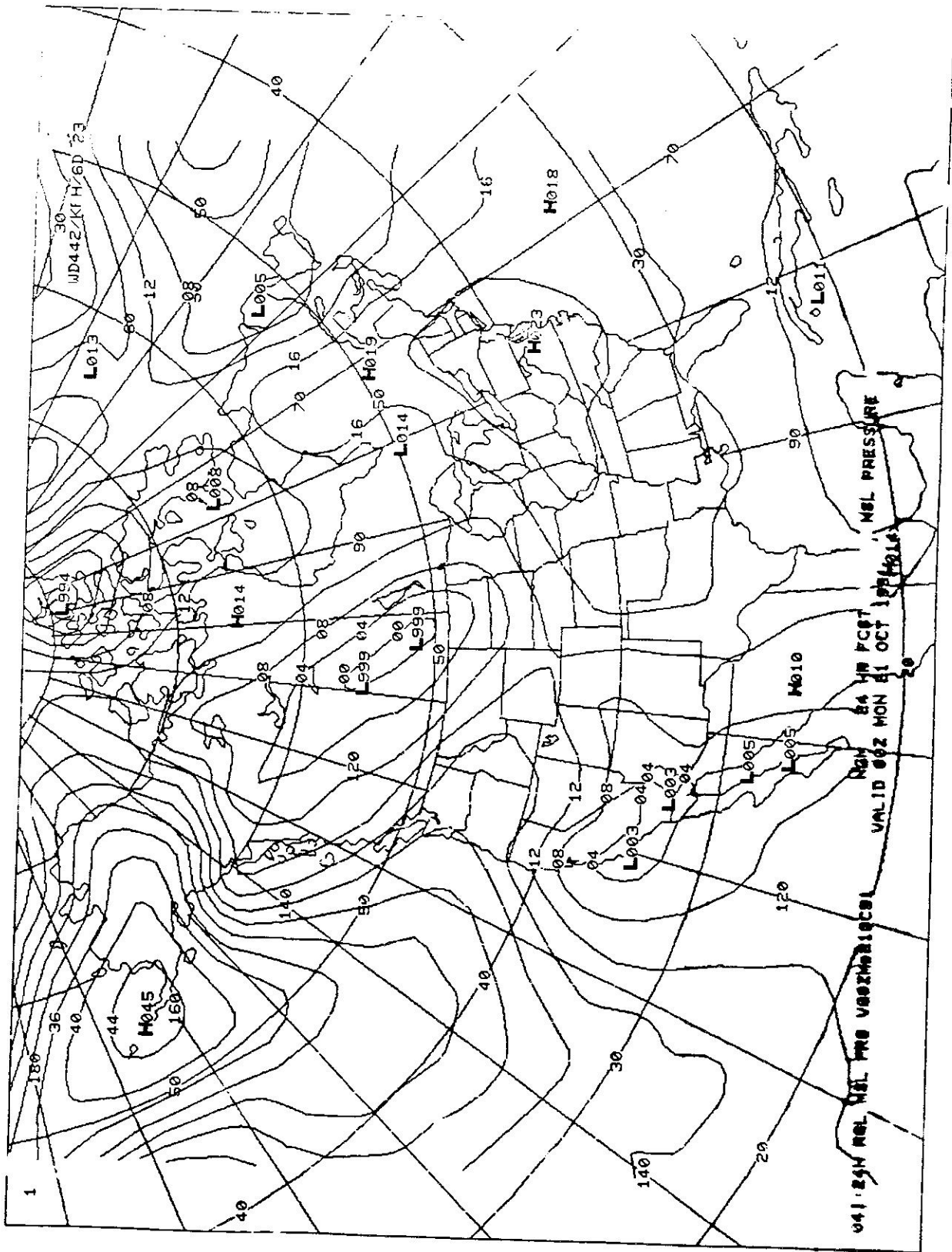


Figure 12 - Surface Pressure, 24 hr Forecast,
VT 00 GMT Oct. 21, 1991

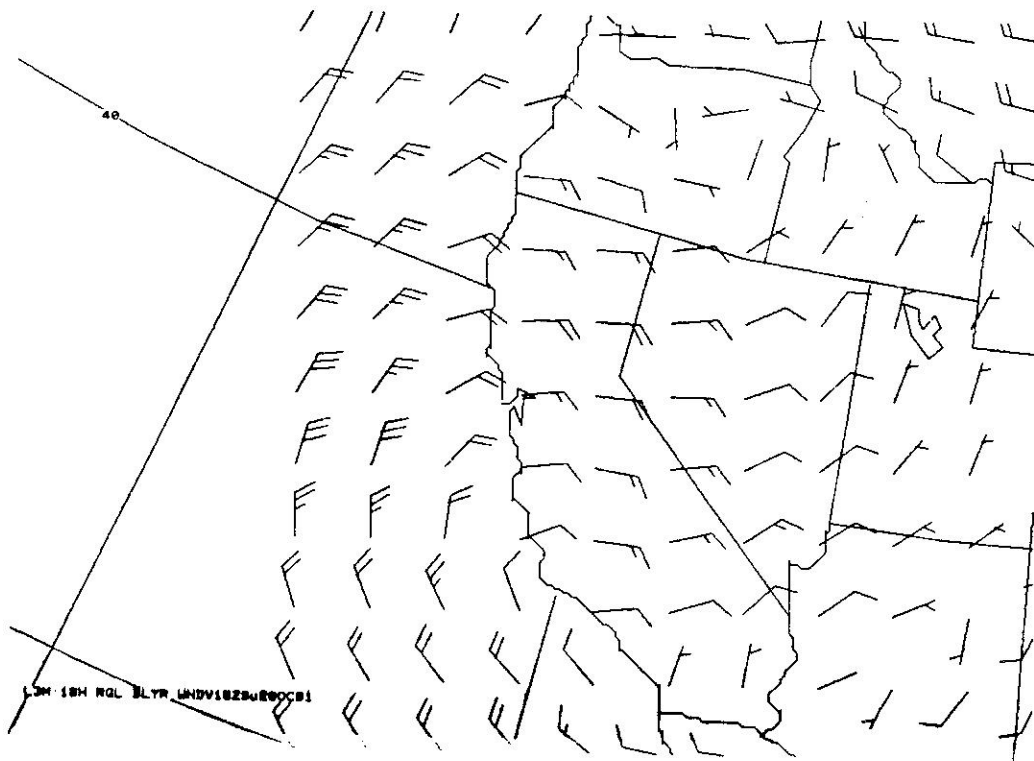


Figure 13 - Boundary Level Wind Forecast,
VT 18 GMT Oct. 20, 1991

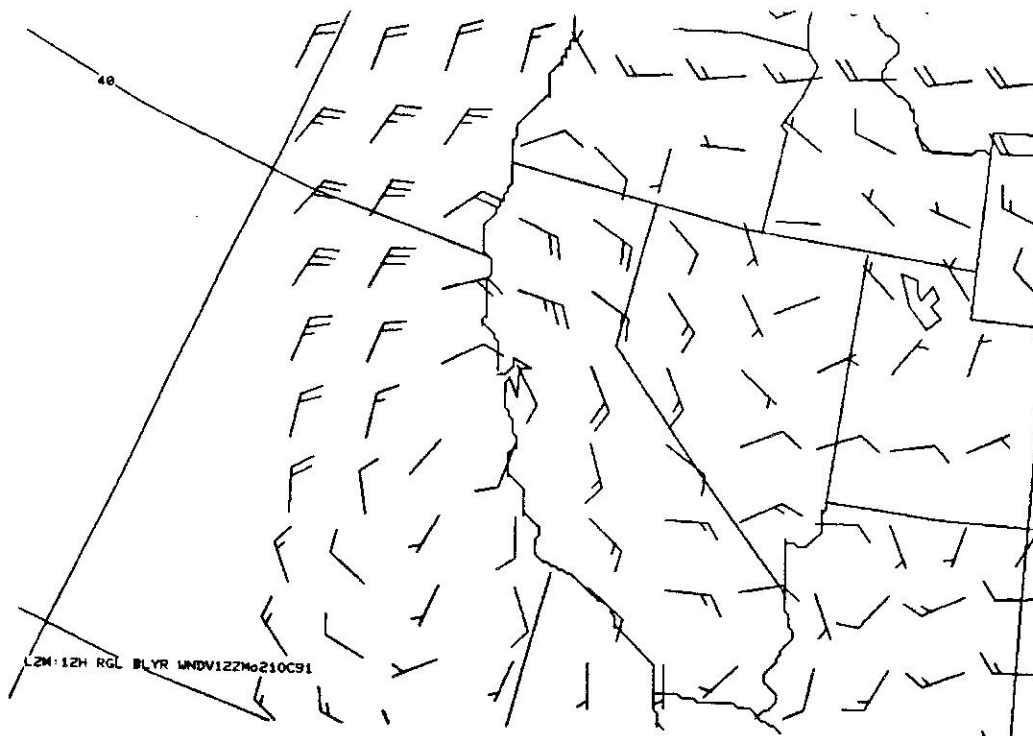


Figure 14 - Boundary Level Wind Forecast,
VT 18 GMT Oct. 21, 1991

NMCFRH73
FOUS73 KWBC 200000
OUTPUT FROM LFM 00Z OCT 20 91
STA RH R1R2R3 VVLI HHDDFF TBPSPTT
SFO 23 271726 ///12 760408 9813///
06 22 271730 -1811 763315 9913000
12 21 261827 -1311 760115 0008000
18 19 231918 -1411 750115 0209000
24 18 201914 -0610 753613 0406000
30 17 192012 -1210 760212 0406000
36 19 202310 00411 750406 0404000
42 22 222613 -0310 741202 0304000
48 25 282914 00810 732506 0101000

Figure 15 - LFM FRH 73, 00 GMT Oct. 20, 1991

NMCFPCOAK
FOUS12 KWBC 200227
OAK W
POP06 2 10 5 5 0 0 0
POP12 5 0 10
QPF06 000/1 000/1 000/1 00X/1 000/1 000/1 0 10
QPF12 000X/1 000X/1 000X/1
TSTM 0 0 000X/1
MX/MN 83 0 0
TEMP 63 59 55 56 70 78 79 68 62 58 56 56 64 70 71 63 53
DEWPT 53 50 47 47 53 52 52 51 51 48 47 49 54 54 55 53
WIND 3105 3401 3108 3009 3005 3204 2302 2906
CLDS 9100/1 9100/1 7300/1 8300/1 7201/1 6102/1 5312/1 6211/1
CIG 000009 000009 000009 000009 000009 001108 000109 000109
VIS 000009 000009 000118 000019 000009 000119 001118 000119
C/V 6/6 6/6 6/6 6/6 6/6 6/6 6/6 6/6
OBVIS 91X0/1 91X0/1 72X0/1 91X0/1 91X0/1 91X0/1 83X0/1 92X0/1

Figure 16 - Oakland LFM MOS, 00 GMT Oct. 20, 1991

NMCFPCOAK
FOUS12 KWBC 201444
OAK W
POP06 2 5 0 5 5 5 5
POP12 2 5 5 5
QPF06 000/1 000/1 000/1 000/1 000/1 000/1 5 20
QPF12 000X/1 000X/1 000X/1
TSTM 0 0 000X/1
MX/MN 54 73 0
TEMP 66 75 76 66 63 59 57 56 63 69 70 61 58 57 56 55 69
DEWPT 51 49 50 48 49 47 46 47 52 51 52 52 53 52 51 50
WIND 2006 2910 0904 3004 2104 2808 2903 2801
CLDS 8300/1 8200/1 8200/1 7112/1 5311/1 6201/1 5213/1 4114/4
CIG 000009 000009 000009 000108 000109 000109 00121 01216
VIS 000019 000019 000019 000018 001117 000118 000 000118
C/V 6/6 6/6 6/6 6/6 6/6 6/6 6/6 6/6
OBVIS 92X0/1 91X0/1 91X0/1 81X1/1 73X1/1 82X0/1 8. 0/1 81X1/1

Figure 17 - Oakland LFM MOS, 12 GMT Oct. 20, 1991

It is disappointing that statistical guidance from the Limited-area Fine Mesh (LFM) model's Model Output Statistics (MOS) was not very helpful. MOS wind guidance for Oakland from the Saturday night model run did not forecast surface winds speeds greater than nine knots (Figure 16). Furthermore, MOS indicated wind directions from the west-northwest throughout the day on Sunday. The "perfect prog" model output from the LFM had north-northeast winds at 15 knots during the same period that MOS had winds north-northwest at one knot (compare Figures 15 and 16). The MOS high temperature forecast for Oakland of only 83 degrees was nine degrees too low and dewpoint forecasts in the upper 40s were about 8 degrees too high. We can only speculate that such a case, with winds strong enough to break up the marine layer, was rare among the cases used to develop the MOS equations. NGM MOS guidance was better, but still did not depict the strength of the winds very well.

MOS guidance from the Sunday morning LFM run, when extremely high pressure gradients already existed, did not forecast strong easterly winds or a breakup of the marine layer (Figure 17). Only a weak four knot easterly wind Sunday night hinted at the situation. Meanwhile three hourly MOS temperatures were too low and dewpoints too high. Forecasters recognized the overwhelming evidence supporting strong easterly winds and warm temperatures in the Bay Area and improved upon the statistical guidance.

Locally Generated Guidance..The SIGMA INDEX:

The "SIGMA" index is a local forecast aid used by the Sacramento Fire Weather Unit (FWU) to assess the potential low level wind direction and strength. It is a summation of six different surface pressure gradients. A negative value indicates off shore flow, positive value on shore flow. As SIGMA becomes more negative, off shore winds (north, northeast or east) become more likely. Off shore flow is usually hot and dry during October. The most negative values observed in the past two years were in the -30 to -36 range, and resulted in the issuance of RED FLAG WATCHES or WARNINGS. The trend of this index is monitored and recorded daily by the Sacramento FWU.

SATURDAY MORNING, 10/19/91 - 24-30 HOURS BEFORE EVENT

Morning SIGMA index had become increasingly negative, -25.9 compared to -14.2 the previous day. Sacramento FWU determined that synoptic features were becoming increasingly favorable for a significant "north wind" event. Wind reports at 9 a.m. from two local representative sites showed N-NE winds; Mt Diablo NE 22G37 mph, and Mission Ridge N-NE 25G31 mph.

At 9:30 a.m., a RED FLAG WARNING was issued for the Diablo Range south of Mt Diablo to Los Banos, with a RED FLAG WATCH for the remainder of the Sacramento fire weather district.

There are no Remote Automatic Weather Stations (RAWS) or National Fire Danger Rating (NFDRS) sites in the fire area to verify forecasts. Livermore (approximately 25 miles southeast of the fire area) reported north winds 10-20 mph with gusts into the low 20's during the afternoon and relative humidity values in the single digits.

SUNDAY, 10/20/91 - DAY FIRE STARTED

The morning SIGMA index was -37.2. This was the most negative SIGMA value that had been observed in the previous two years. Winds at 9 a.m. on Mt Diablo were NE 37 mph with peak winds reported to as high 58 mph. Winds on Mission Ridge were NE 37 mph with peak winds to 48 mph. The RED FLAG WARNING was extended to include the entire Sacramento fire weather district.

MONDAY, 10/21/91 - SECOND DAY OF THE FIRE

The SIGMA index had become much less negative by Monday morning (-14.0). This was reflected in the 8 a.m. winds at Mt Diablo (NW 4 mph) and Mission Ridge (WSW 3 mph). RED FLAG WARNINGS were cancelled on the 9:30 a.m. routine Fire Weather Forecasts.

General Summary of Warning Service

The warning and advisory services provided by WSO Sacramento and WSFO San Francisco for this event were very good with only minor exceptions. Land management and emergency services personnel were kept well informed with telephone and face-to-face briefings. The following products and services were especially useful in providing this effective forecast and warning service:

1. On Friday October 18th, with falling SIGMA values and consistent NMC/WSFO guidance, Sacramento FWU began mentioning brisk east winds, warming, and very dry conditions expected for the next few days in their routine Fire Weather Forecasts. At this point, a RED FLAG WATCH could have been issued, however the forecaster chose to defer this and look at the situation on Saturday. Information on the developing situation was integrated into briefings to the CDF Emergency Communications Center (ECC) Operations Officers.
2. Sacramento FWU forecasters briefed Mr. Jim Bliss, Deputy Chief Fire Control Operations, California Department of Forestry during the week prior to the "Tunnel" fire on the hot and dry conditions expected to persist. Based on these briefings, Mr. Bliss extended contracts on two aerial retardant aircraft. When RED FLAG Warnings were issued on Saturday October 19, two more air tankers were brought back on contract.

3. The RED FLAG WARNING issued Saturday morning October 19 set the tone for fire suppression preparedness activities by federal, state, and local fire control agencies. The forecast and warning was disseminated by the CDF Santa Clara Ranger Unit over the agency radio network to all outlying districts including the Oakland Fire Department. Because the routine forecasts and warnings are not disseminated on AFOS, WSFO San Francisco was not aware the WARNING had been issued.

4. WSFO San Francisco issued zone and local forecasts at 3 a.m., Sunday October 20th highlighting record heat and strong winds in the East Bay hills. These forecasts were well coordinated with appropriate WSO's.

5. Mr. Tony Martini, Weather Service/Radar Specialist WSO Sacramento issued a Special Weather Statement (SFOSPSSAC) at 3 a.m. Sunday morning October 20. This SPS noted "Record or near record heat along with gusty north winds..."

6. Sacramento Fire Weather Forecaster Jeanne Hoadley expanded the RED FLAG WARNING for the entire Sacramento Fire Weather District on Sunday morning. The Sacramento CDF ECC duty officer was briefed at 8:00 a.m. At 1245 PDT the ECC duty officer called Ms. Hoadley and informed her of a major fire in the Oakland Hills. Ms. Hoadley was unsure at first whether the fire was in Sacramento's jurisdiction because of its location in the urban area. At least one local fire weather district map excluded the urban San Francisco - Oakland areas from Sacramento's jurisdiction. Jeanne called WSFO San Francisco (Keith Ewing) and discussed the wind situation. Jeanne then issued a "Spot Forecast" for the fire, disseminating it to CDF Region 1 Headquarters at Santa Rosa who forwarded it to the Santa Clara Ranger Unit.

7. The San Francisco Bay Area Public Service Unit (BAPSU) issued two Special Weather Statements (SFOSPSSFO) on Sunday October 20. The first at 2:50 p.m. (by Hamilton) which addressed record high temperatures and strong northerly winds. The second statement was issued at 8:40 p.m. (by Hui) and discussed strong northeast winds, but noted winds were expected to diminish during the night. Because of the unique character of this major conflagration, the BAPSU personnel were unsure of what to include in their statements.

8. After learning of the conflagration, Sacramento Lead Fire Weather Forecaster Milo Radulovich returned to work at 5:00 p.m. on Sunday October 20. Milo issued the second Spot Forecast for the fire at 6:15 p.m. This forecast was disseminated to the Santa Clara Ranger Unit through CDF Region 1. Milo coordinated with WSFO San Francisco forecaster John Plankington and provided a briefing to Sacramento CDF ECC at 11:00 p.m.

9. WSFO lead forecaster Jan Null issued special forecasts for the Alameda County Office of Emergency Services at 3:30 a.m. and 6:15 a.m. on Monday October 21. Coordination with Sacramento FWU insured the continuity of the forecasts.
10. Mr. Radulovich briefed the CDF Director and fire staff at 4:00 a.m. on Monday October 21. An updated Spot Forecast for the fire was issued at 6:00 a.m. The RED FLAG WARNING was continued for the fire area but it was noted that the winds would be diminishing during the day with a transition to cooler, more moist conditions.
11. A CDF Type 1 Incident Management Team had been dispatched to the fire on Sunday afternoon, October 20. A request for on site meteorological support was submitted by the team upon dispatch. This request got lost in the dispatch system and was not received by the Sacramento FWU until 7:15 a.m. Monday October 21. Mr. Radulovich departed two hours later (9:00 a.m.) for the Incident Command Base at Alameda Naval Air Station. Upon arrival, Milo presented a briefing to Planning Section Chief Mr. John Teie. Milo remained on site providing support until Tuesday evening October 22. Although Milo used guidance products prepared by WSFO San Francisco, he did not contact the WSFO directly and coordinate the forecasts. Milo's forecasts agreed well with the guidance issued by the WSFO.
12. Because the fire was so devastating (it denuded much of 1800 acres), there was significant concern for local flooding and mud slides in the event of heavy rainfall. The California Office of Emergency Services requested the WSFO San Francisco provide special Quantitative Precipitation Forecasts (QPF) to aid in the reclamation and flood mitigation efforts. This service was begun October 24 and continued through the fall and winter.

SUMMARY OF DISSEMINATION

Emergency management, the media, and the public receive fire weather and public service warnings, forecasts, and statements through a variety of dissemination systems. Some weaknesses were identified in the methods of dissemination of fire weather products to city and county officials.

Administrative and Forest Fire Information Retrieval and Management System (AFFIRMS) - The AFFIRMS system is WSO Sacramento's primary means of disseminating routine fire weather forecasts. AFFIRMS is a time share computer system provided by the land management agencies. This system stores fire weather observations and forecasts, and generates fire danger rating outputs. WSO Sacramento inputs the routine forecast twice daily and non routine spot forecasts on demand. Non routine spot forecast requests are normally received by telephone. Upon receipt, the Sacramento forecaster will give the requestor a time when the spot forecast will be available in AFFIRMS. The CDF accesses the routine forecasts via computer at 10 a.m. and 4 p.m. The forecasts are downloaded to the CDF distribution net which includes the Office of Emergency Services (OES) computer (Appendix B). In addition, the forecasts are stored on the CDF PRIME computer in Riverside. All city and county fire departments have direct access to the forecasts through dial access to the PRIME computer.

The OES Warning Center disseminates NWS fire weather forecasts narratives through the Emergency Digital Information System (EDIS) (Appendix B). OES Fire and Rescue retrieves the fire weather forecasts from the CDF network and receives hard copies of all watches and warnings from WSFO San Francisco from the EDIS system.

The CDF Ranger Units broadcast fire weather forecasts twice daily over their radio network, and urban fire departments are thereby able to receive the forecasts. The Santa Clara Ranger Units broadcast of the initial RED FLAG WARNING on Saturday October 19 was monitored by an Oakland Fire Department off-duty shift commander. The off-duty officer called the on-duty shift commander and recommended additional fire patrol units for Sunday October 20. The on duty shift commander contacted the Oakland Regional Parks office for additional weather information, and on Sunday morning received a copy of the current RED FLAG WARNING from the CDF Santa Clara Ranger Unit.

NOAA Weather Wire Service (NWWS) - All public forecast and warning products were uplinked directly from the WSFO San Francisco to the NWWS. Sacramento fire weather forecasts and warnings are not routine NWWS products. No outages of the system occurred during the event. There are currently eleven subscribers in the San Francisco/Oakland area (Appendix C) including two radio stations,

two television stations, two newspapers, one news service, and one private meteorological firm. Jeanne Hoadley was briefing the ECC duty officer on Sunday when KCBS Radio, one of the NWS subscribers, called the ECC with questions on the weather and fire danger. KCBS subsequently broadcast a "RED FLAG WARNING" the morning of the fire. It is likely that this information was received by way of the Sacramento CDF ECC.

Weather Radio (NWR) - Forecasts and special statements issued by WSFO San Francisco were issued in a timely manner on the San Francisco NWR system. Fire Weather Forecasts are not disseminated by NWR. The Sacramento NWR coverage does not reach the fire area.

NAWAS - WSFO San Francisco did not disseminate any weather information related to the fire event on NAWAS. WSO's in California do not have direct access to NAWAS. If NAWAS had been available to WSO Sacramento, it would have allowed Alameda county more positive access to fire weather forecasts and advisory services.

Telefax - Telefax was used twice by WSFO San Francisco to send special fire related forecasts to Alameda County OES. Telefax was also used twice by WSO Sacramento to send Spot Forecasts to the Santa Clara Ranger Unit.

Telephone - WSFO Area Manager Norm Hoffmann and his Deputy MIC Roger Williams provided several telephone briefings on the weather situation to Bay Area television and newspapers on Sunday afternoon October 20. Mr. Tony Martini, Weather Service Specialist Sacramento, provided telephone briefings on Monday morning (October 21) to two Bay Area television stations (KRON CH 4, San Francisco and KPIX CH 5, San Francisco). Ms. Jeanne Hoadley also provided briefings on Monday October 21 to two newspapers, the Sacramento Bee and the Contra Costa News. The telephone was used extensively for coordination between WSO Sacramento and WSFO San Francisco as well as for media and operational briefings. As in all disaster situations, the telephone was an integral component of the dissemination and coordination network. No unusual problems were apparent.

AFOS - No AFOS problems were noted during this event at either WSFO San Francisco or WSO Sacramento.

PREPAREDNESS ACTIVITIES

WSFO San Francisco - Alameda County Office of Emergency Services in San Leandro was visited on September 25, 1991 by Roger Williams, Deputy MIC WSFO San Francisco and Jan Null, Lead Forecaster WSFO San Francisco. OES personnel were briefed on the weather watch/warning responsibilities of the WSFO. The availability of special forecasts for HAZMAT or other natural disaster events was discussed, and the capabilities and availability of on-site forecast service was explained. These contacts were significant as Alameda County OES was aware of the services available and contacted WSFO San Francisco for special forecast support during the early morning of Monday October 21.

WSO Sacramento - The California Department of Forestry Region 1 headquarters at Santa Rosa was visited during spring preparedness activities by both Mr. Radulovich and Ms. Hoadley. A meeting with key personnel from all CDF Regions and Ranger Units was held in Redding, CA in May 1991 to coordinate procedures and the annual Operating Plan. CDF personnel involved in this incident were fully aware of all NWS products and services and no problems were experienced in interpreting or disseminating NWS forecasts and warnings.

USER RESPONSE

Direct user response to NWS products and services was highly complimentary. The "Tunnel Fire" was primarily wind driven with the majority of damage occurring in a relatively short time. The most active burning phase was coincident with the period of strongest winds, from the time of origin around 11:00 a.m. Sunday through 11:30 p.m. Sunday night.

Through the first six hours of the conflagration, the management of the incident was the responsibility of the Oakland Fire Department. As in most major disasters there was little time for pro-active support during the initial few hours of activity. During this period the Sacramento FWU was very responsive, providing personal briefings to the CDF ECC duty officer and issuing the first spot forecast to the Santa Clara Ranger Unit.

Following are summaries of persons contacted and their comments:

1. Mr. Bill Teie, CDF Deputy Director for Fire Control, Sacramento, CA.

Mr. Teie has primary responsibility for fire control operations throughout California, including cooperative fire control activities with county and municipal fire departments. Bill told the survey team, "The Sacramento Fire Weather Forecasts for this incident were excellent. The dry, windy, RED FLAG conditions were accurately forecast well in advance and through the life of the incident. The onset of the marine air intrusion which effectively aided suppression and control were also accurately forecast."

2. Mr. Jim Bliss, Deputy Chief, Fire Control Operation, CDF, Sacramento, CA.

Mr. Bliss is responsible for day-to-day fire suppression preparedness throughout the state, as well as overall coordination of ongoing suppression activities. Mr. Bliss has the highest confidence in NWS fire weather support as evidenced by his ordering fire retardant aircraft brought back on contract a week ahead of the Tunnel Fire. This decision was based on briefings by Sacramento FWU forecasters on the persistence of hot and dry conditions.

3. Mr. Ernie Saldivar, CDF ECC Duty Officer, Sacramento, CA.

Mr. Saldivar was also highly complimentary of the fire weather support prior to and during the "Tunnel" fire Incident. The Sacramento FWU kept Ernie up to date with unsolicited and on-call briefings as the event evolved.

4. Wayne Mitchell, CDF Fire Behavior/Fire Intelligence Officer, Sacramento, CA.

Mr. Mitchell was a member of the Incident Management Team assigned to the "Tunnel" fire. Wayne was not interviewed directly, but his comments were relayed through Ernie Saldivar's interview. The on-site support to the Incident Management Team was excellent, even though the resource order for Mr. Radulovich was unaccountably delayed in the system. By the time Mr. Radulovich arrived on site the winds had diminished, the effects of the marine influence were dominate, and the fire was nearly contained. Early support to the incident was with Spot Forecasts from WSO Sacramento. Those forecasts, and the ones provided by Mr. Radulovich after he arrived on site, were accurate and provided invaluable input to the team's management decisions.

5. Lloyd Darrington and Chuck Young, State of California, OES, Sacramento, CA.

Both Mr. Darrington and Mr. Young expressed total satisfaction with support received from both WSFO San Francisco and WSO Sacramento during the incident.

6. Mike McGee, Alameda County OES Fire and Rescue, Mutual Aid Coordinator, San Leandro, CA.

Mr. McGee's section had no direct contact with the NWS during the incident. NWS forecasts from both San Francisco and Sacramento were received on the state distribution system, and Mr. McGee expressed satisfaction with these products.

7. Terry Glitten, Alameda County OES, Oakland, CA.

Terry expressed belief that the September 25 meeting of OES coordinators with NWS representatives (R. Williams and J. Null) was critical. Contacts with the NWS were fresh in everyone's mind with a heightened awareness of products and services available. Routine forecasts received over the California law enforcement teletype system were very useful. Special forecasts requested from WSFO San Francisco were sent by telefax and were extremely useful.

8. Prof. John Monteverdi, San Francisco State University:

Prof. Monteverdi proved again to be an ardent supporter of the NWS. John had heard comments by the Oakland Fire Chief saying that the kind of winds observed during the fire run were "freaks" and that weather forecasters had no hope of predicting them. John came to the forecasters defense, making it known that such winds were common under these meteorological circumstances, and had been accurately forecast by the NWS.

FINDINGS AND RECOMMENDATIONS

The following findings and recommendations determined by the Survey Team are meant to highlight the strengths and identify any weakness in the NWS's support to the Oakland-Berkeley urban-wildland interface "Tunnel" wildfire.

1. **Finding:** The overall forecast and warning services provided by WSO Sacramento (Fire Weather) and WSFO San Francisco were excellent. Emergency services officials were kept well informed with timely and accurate forecasts, warnings, and statements which were updated as necessary. Media contacts were handled professionally and all references to the NWS in the media were very positive.
2. **Finding:** The briefing provided by Mr. Radulovich to the California Department of Forestry Emergency Command Center during the week prior to the disastrous fire was especially significant. This briefing and forecast of continued unusually hot and dry conditions triggered the fire organizations to maintain a high level of readiness and to order additional retardant aircraft.
3. **Finding:** The collocation of WSO Sacramento and the CDF State Fire Operations Center promotes a very high level of confidence in NWS fire weather products and services by this important user group. Personal contacts with users on a daily basis heighten awareness and sensitivity of NWS personnel to wildland fire potential and needs of the fire control agencies. This in turn promotes a higher level of utilization of NWS products and services by this key user group due to their increased confidence in the personnel providing these important services.
4. **Finding:** WSO Sacramento's morning forecast Saturday October 19 included the first RED FLAG WARNING for the fire area, and a RED FLAG WATCH for the remainder of the district. It was apparent on Friday October 18 that environmental factors were critical, and forecast models and a local study (SIGMA Index) indicated high winds and low humidities would persist. These conditions were discussed in Fridays forecasts and briefings, but the forecaster elected to hold off on the WATCH. Because of the critical fire danger level, a RED FLAG WATCH could have been issued on Friday October 18.
5. **Finding:** The RED FLAG criteria published in WSO Sacramento's current operating plan indicates wind threshold values of "...sustained 25 mph or more...". The RED FLAG Warning issued on Saturday October 19 indicated maximum winds expected were in the range of 20 to 25 mph, so technically did not meet the published threshold criteria. Observed winds were gusting in excess of 30-35 mph so the RED FLAG was certainly justified.

Recommendation: WSO Sacramento must review their RED FLAG criteria and procedures prior to the 1992 fire season and update if necessary. ROML W-26-82 "Red Flag Event Policy and Procedures" (Filed with WSOM D-06) is being updated to include the fact that RED FLAG criteria should be a combination of environmental (fuels/fire danger) as well as meteorological conditions. This updated ROML will provide more specific guidelines for establishing RED FLAG criteria.

In addition, Sacramento delineates their RED FLAG WATCH/WARNINGS by reference to geographical land marks. This could lead to confusion for someone unfamiliar with the area (such as a fire team from out of the area). This could be easily clarified by referencing both the zone number and the geographical landmarks in the RED FLAG header.

6. **Finding:** Fire Weather zone maps in the 1991 California Fire Weather Operating Plan indicate all areas of the state are covered by a fire weather zone. The CDF Santa Clara Ranger Unit has a cooperative agreement with the Oakland Fire Department for mutual aid support for fires within the urban-wildland interface and assumes the Sacramento Fire Weather Forecast does include the urban area. Some local maps on file at WSO Sacramento indicate that the urbanized areas of San Francisco and Oakland are not included in the local fire weather zone. This led to confusion when the first spot forecast request for the Tunnel Fire was received. The forecaster on duty was not sure at first whether she was supposed to make a forecast for this area. After coordination with WSFO Lead Forecaster, she did respond to the request from the Santa Clara Ranger Unit.

Recommendation: Sacramento Fire Weather Forecasts are special use products, intended to provide weather support to all fire control agencies for suppression and pre-suppression activities. The forecasts cover a geographic area, and demographics are not a consideration when establishing zone boundaries. It is understood that most structural fires in urban areas will not require "Spot Forecast" support for suppression. However, the urban areas in and around San Francisco should not be excluded from either routine or special fire weather forecasts. This point must be clarified and included in the operations next fire season.

7. **Finding:** Because Sacramento fire weather forecasts are not disseminated on AFOS, WSFO San Francisco forecasters were not aware a RED FLAG forecast had been issued that covered their public service area.

Recommendation: The WSFO should be notified when Sacramento issues a RED FLAG forecasts. After January 1993, all fire weather forecasts will be routinely available on AFOS when a new dissemination method now under development is implemented.

8. **Finding:** There was no communication or coordination between the WSFO and the mobile unit forecaster while he was on site supporting the fire.

Recommendation: Whenever an ATMU forecaster is dispatched to an incident (fire), both the host WSO and WSFO should be informed and coordination established as soon as possible after the forecaster arrives on site. This is imperative to ensure continuity between special products issued on site and public/special forecasts issued by the host WSO and WSFO.

9. **Finding:** There was very limited observational data available from the fire area for tracking and verifying actual temperature, humidity, and winds prior to and during the event. Forecasters on duty at WSFO San Francisco had only recently become aware of the availability of Remote Automatic Weather Stations (RAWS) in the area, and some were unaware of how to access and use the data. Other mountain top wind sensors in the area were very useful, but access to these data is not very convenient.

Recommendation: WSFO forecasters need to become familiar with available RAWS data, and develop methods for accessing and displaying this information. Fire Weather (FIREWORKS) programs that access and display this data are available. In addition, a more user friendly system of accessing mountaintop wind sensors maintained by non-governmental sources should be developed.

10. **Finding:** Some Bay Area Public Service Unit (BAPSU) personnel were unsure of what should be covered in special weather statements for this unique event.

Recommendation: The SMT of the BAPSU should ensure assigned personnel are aware of appropriate content and proper procedures for special weather statements of all kinds. Future drills could include examples of unique events such as fires and resulting dense smoke. Chapter C-44 is being revised with expected issuance in the summer of 1992. This chapter will provide guidance for non-precipitation weather hazards such as smoke.

11. **Finding:** A well developed spotter network in the Bay Area could have provided useful real time weather information during the evolution of this event.

Recommendation: WSFO San Francisco should continue to work on developing their spotter network as human resources and funds are available.

12. **Finding:** Alameda County OES was very aware of the NWS's support capability and commitment, due primarily to a September 25 meeting with WSFO San Francisco personnel. One positive benefit was the effective inter-agency communication that resulted during this event.

Recommendations: WSFO San Francisco should continue their efforts to meet with and brief other county OES's in their forecast area. Enhanced OES awareness, communications, and positive interactions between the WSFO and Alameda County can be used as examples of potential benefits.

Appendix A

Personnel on Duty During the Event

WSO Sacramento	October 18-22	
Friday Oct. 18	00-08 Radar	Noxon
	08-16 Radar/Public	Clark
	16-24 Radar	Hartley
	0730-1530 Fire Wx/AG	Radulovich
Saturday Oct. 19	00-08 Radar	Martini
	08-16 Radar/Public	Honton
	16-24 Radar	Hartley
	0730-1530 Fire Wx/AG	Radulovich
Sunday Oct. 20	00-08 Radar	Martini
	08-16 Radar/Public	Noxon
	16-24 Radar	Hartley
	0730-1630 Fire Wx/AG	Hoadley (10T)
	1700-2330 Fire Support	Radulovich (6.50T)
Monday Oct. 21	00-08 Radar	Martini
	08-16 Radar	Cronin
	16-24 Radar	Honton
	0730-1530 Fire Wx/AG	Hoadley
	0430-2400 ATMU Support	Radulovich
	0730-1530 AG/Fire WX	Nordberg
	0730-1530 QPF/Public	Clark
Tuesday Oct. 22	00-08 Radar	Martini
	08-16 Radar	Cronin
	16-24 Radar	Honton
	0730-1530 Fire Wx/AG/QPF	Clark
	0000-1800 ATMU Support	Radulovich

Appendix A Continued

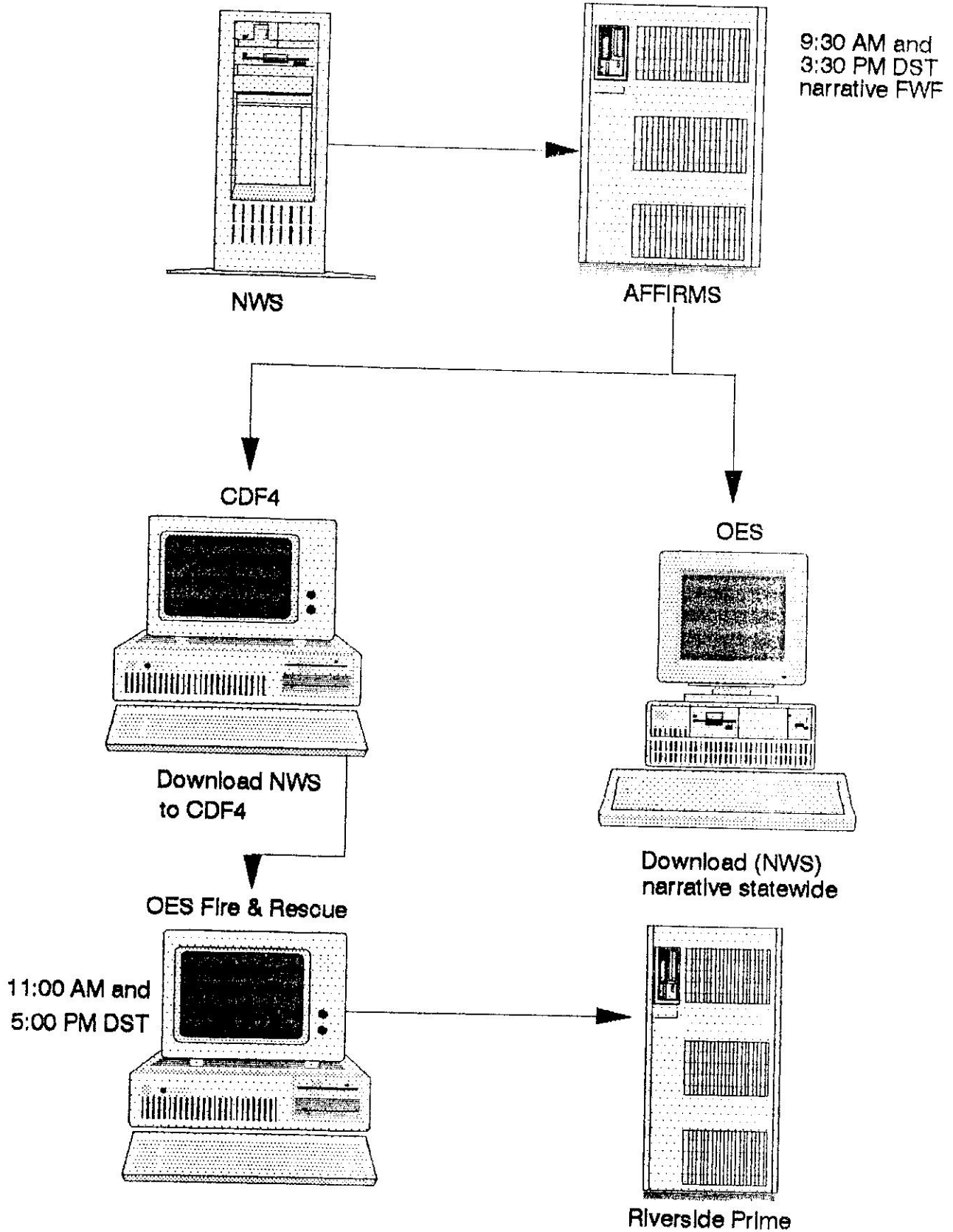
Personnel on Duty During the Event

WSFO San Francisco

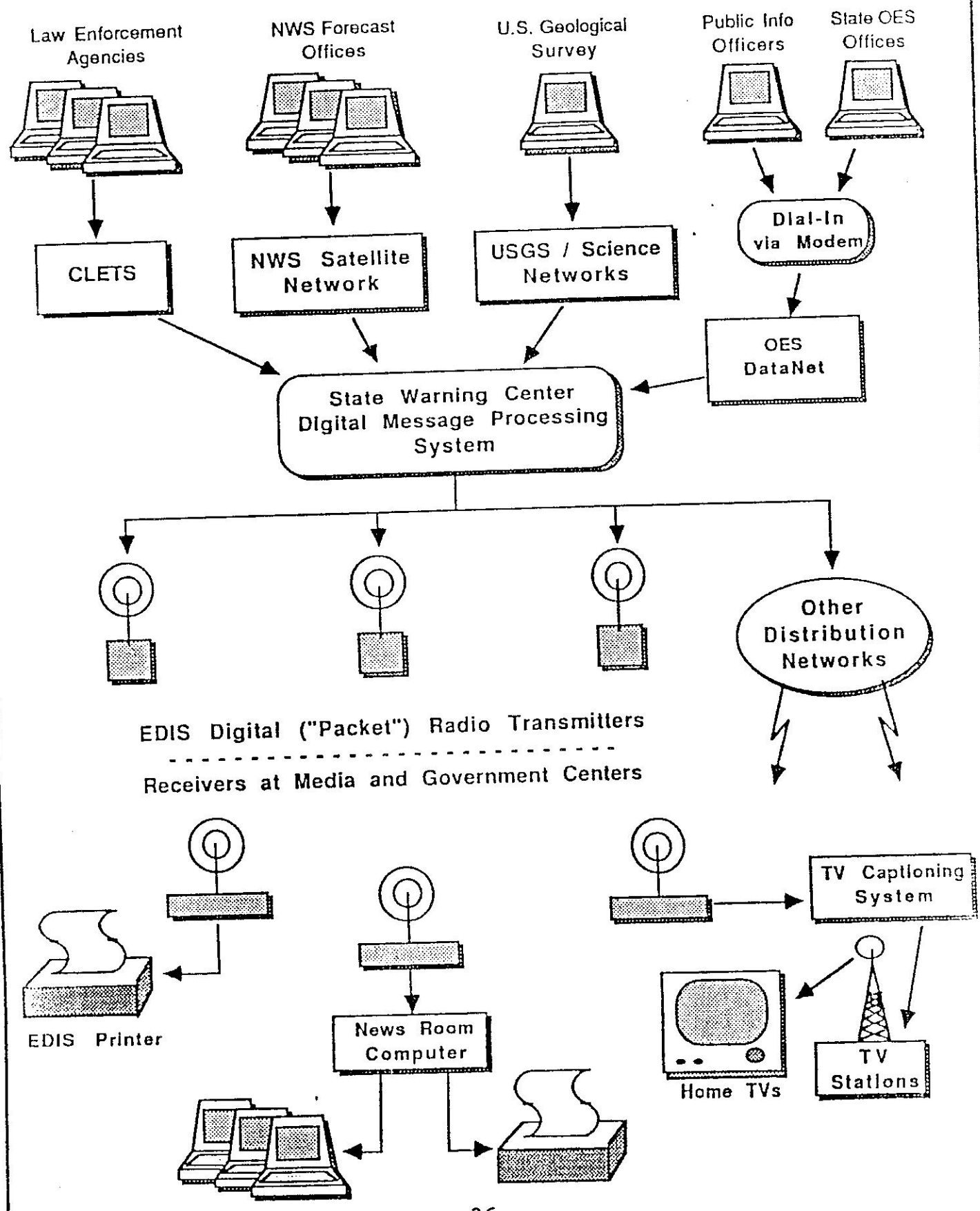
	<u>Oct 20</u>	<u>Oct 21</u>	<u>Oct 22</u>
00-08 Lead Forecaster	Heller	Null	Null
Aviation	Pucevich	Thomas	Thomas
Marine	Gerst	Gerst	Gerst
BAPSU	Hamilton	Rorke	Rorke
08-16 Lead Forecaster	Ewing/Wagner	Wagner	
Aviation	Wagner/Hackel	Pericht	
Aviation South	Hackle/Baca	Hackle/Baca	
Marine	Cross		
BAPSU	Adkins (OIC), Atkinson/Pi	Lapari/Atkinson Hamilton	
16-24 Lead Forecaster	Plankinton	Plankinton	
Aviation	Markkanen/Baca	Markkanen/Baca	
Marine	Gerst	Berst	
BAPSU	Hui/Pi	Pi/Hamilton	

Note: AM Hoffmann and DMIC Williams worked from approximately 2 p.m. until 5 p.m. on Oct. 20, primarily handling media calls

NWS- Composes fire weather forecasts and uploads to AFFIRMS



EDIS System Diagram



EDIS

Existing Receiver Sites (Bay Area)

Media

Bay City News Service
KCBS Radio
KFBK Radio (Sacto.)
KGO-TV
KNBR Radio
KPIX-TV
KSAN Radio
Traffic Central

Government

CA OES HQ (Sacto.)
CA OES Region II
City of Fremont
City of Martinez
County of Santa Clara
National Weather
Service (S.F.)

Private

Campbell Union High School District
Hewlett-Packard
Stanford Linear Accelerator Center

(As of June 1991)



Appendix C

NOAA Weather Wire Subscribers
San Francisco - Oakland Area

Amdahl Corporation
Bay City News Service
Golden West Meteorology
KABL AM and FM
KCBS Radio
KRON TV
KTVU TV
Fred Meyer
Pacific Gas and Electric
San Francisco Examiner
San Jose Mercury News

Appendix D
Public and Fire Weather Products

SFOLFPSFO
TTAA00 KSFO 200947
CAZ002-201630-

SAN FRANCISCO BAY AREA FORECAST
NATIONAL WEATHER SERVICE SAN FRANCISCO CA
330 AM PDT SUN OCT 20 1991 ...DO NOT USE AFTER 930 AM SUNDAY

...RECORD OR NEAR RECORD HIGH TEMPERATURES TODAY...

.TODAY...PATCHY MORNING COASTAL FOG...OTHERWISE SUNNY...AND WARM.
HIGHS FROM THE UPPER 70S AT THE BEACHES...TO NEAR 90 AROUND THE BAY.
WEST WIND 10 TO 20 MPH...EXCEPT GUSTY NORTHEAST WIND 15 TO 30 MPH IN
THE EAST BAY HILLS.

.TONIGHT...COASTAL FOG AND LOW CLOUDS INCREASING AND SPREADING
LOCALLY INTO THE BAY...OTHERWISE FAIR. LOWS FROM THE UPPER 40S TO
THE MID 50S. WEST WIND 10 TO 20 MPH...DECREASING OVERNIGHT.

.MONDAY...MORNING COASTAL FOG EXTENDING LOCALLY INLAND...OTHERWISE
SUNNY. COOLER WITH HIGHS FROM THE UPPER 60S AT THE BEACHES...TO THE
70S AND LOWER 80S AROUND THE BAY.

SAN FRANCISCO 87 55
SFO AIRPORT 84 52

SAN RAFAEL 90 50
OAKLAND 85 56

PAGE 01

SFOLFPSFO
TTA000 KSFO 201603
CAZ002-202230-

SAN FRANCISCO BAY AREA FORECAST
NATIONAL WEATHER SERVICE SAN FRANCISCO CA
9.30 AM PDT SUN OCT 20 1991 ...DO NOT USE AFTER 3.30 PM SUNDAY

...RECORD OR NEAR RECORD HIGH TEMPERATURES TODAY...

.TODAY...SUNNY AND WARM WITH HIGHS UPPER 60S AND 70S ALONG THE OCEAN TO THE 80S TO AROUND 90S AROUND THE BAY. GUSTY NORTHEAST WIND 15 TO 35 MPH IN THE EAST BAY HILLS...OTHERWISE VARIABLE WIND TO 15 MPH.

.TONIGHT...CLEAR THIS EVENING. INCREASING FOG AND LOW CLOUDS ALONG THE COAST AND LOCALLY INLAND LATER TONIGHT. LOWS IN THE 50S. VARIABLE WIND TO 15 MPH.

.MONDAY...COASTAL FOG AND LOW CLOUDS EXTENDING LOCALLY INLAND DURING THE MORNING. OTHERWISE SUNNY AND COOLER. HIGHS FROM THE 60S NEAR THE OCEAN TO THE 70S TO LOWER 80S AROUND THE BAY.

SAN FRANCISCO 87 55
SFO AIRPORT 84 53
REDWOOD CITY 89 53

SAN RAFAEL 90 52
OAKLAND 85 56
FREMONT 88 53

PAGE 01

SFOLFPSFO
TTAA00 KSFO 201930 AMD
CAZ002-202230-

SAN FRANCISCO BAY AREA FORECAST...AMENDED...
NATIONAL WEATHER SERVICE SAN FRANCISCO CA
12.30 AM PDT SUN OCT 20 1991 ...DO NOT USE AFTER 3.30 PM SUNDAY

...RECORD OR NEAR RECORD HIGH TEMPERATURES TODAY...

.TODAY...SUNNY AND WARM WITH HIGHS UPPER 60S AND 70S ALONG THE OCEAN
TO THE 80S TO AROUND 90S AROUND THE BAY. GUSTY NORTHEAST WIND 15 TO
35 MPH IN THE EAST BAY HILLS...OTHERWISE VARIABLE WIND TO 15 MPH.

.TONIGHT...CLEAR THIS EVENING. INCREASING FOG AND LOW CLOUDS ALONG
THE COAST AND LOCALLY INLAND LATER TONIGHT. LOWS IN THE 50S.
VARIABLE WIND TO 15 MPH.

.MONDAY...COASTAL FOG AND LOW CLOUDS EXTENDING LOCALLY INLAND DURING
THE MORNING. OTHERWISE SUNNY AND COOLER. HIGHS FROM THE 60S NEAR THE
OCEAN TO THE 70S TO LOWER 80S AROUND THE BAY.

SAN FRANCISCO 88 55
SFO AIRPORT 86 53
REDWOOD CITY 90 53

SAN RAFAEL 90 52
OAKLAND 89 56
FREMONT 88 53

PAGE 01
PAGE 01

(OAO KSFO 202212
CAZ002-210430-

SAN FRANCISCO BAY AREA FORECAST
NATIONAL WEATHER SERVICE SAN FRANCISCO CA
3.30 PM PDT SUN OCT 20 1991 ...DO NOT USE AFTER 9.30 PM SUNDAY

.TONIGHT...CLEAR THIS EVENING EXCEPT FOR AREAS OF SMOKE VICINITY OF OAKLAND AND SAN FRANCISCO. INCREASING FOG AND LOW CLOUDS ALONG THE COAST LATER TONIGHT. LOWS IN THE 50S. GUSTY NORTHEAST WIND TO 35 MPH IN THE EAST BAY HILLS AND LOCAL NORTHEAST WIND TO 20 MPH ELSEWHERE...OTHERWISE LIGHT WIND. WIND DECREASING DURING THE NIGHT.
.MONDAY...COASTAL FOG AND LOW CLOUDS EXTENDING LOCALLY INLAND... OTHERWISE SUNNY AND MUCH COOLER. HIGHS FROM THE 60S ALONG THE OCEAN TO THE UPPER 60S AND 70S AROUND THE BAY. WEST WIND 10 TO 25 MPH IN THE AFTERNOON.
.MONDAY NIGHT...COASTAL CLOUDS AND FOG SPREADING INLAND...OTHERWISE CLEAR. LOWS UPPER 40S AND 50S.
.TUESDAY...MORNING CLOUDS AND FOG CLEARING TO NEAR THE COAST BY MIDDAY...OTHERWISE PARTLY CLOUDY. COOLER WITH HIGHS IN THE 60S ALONG THE COAST TO THE MID 60S AND 70S AROUND THE BAY.

PAGE 01

500 LCL
FLW
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SFOSPSSFO
TTAA00 KSFO 202200
CAZ002-210600-
SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE SAN FRANCISCO, CA
250 PM PDT SUN OCT 20 1991

...STRONG NORTHERLY WINDS BLOW OVER THE EAST BAY...

...RECORD HIGH TEMPERATURES TODAY AROUND THE BAY...

GUSTY WINDS AND RECORD HIGH TEMPERATURES ARE OCCURRING IN THE SAN FRANCISCO BAY REGION. THESE CONDITIONS HAVE COMBINED TO PRODUCE DANGEROUS FIRE CONDITIONS...ESPECIALLY OVER THE EAST BAY HILLS AND THE NORTH BAY.

STRONG HIGH PRESSURE OVER OREGON AND NEVADA...ALONG WITH WEAK LOW PRESSURE OFF THE CENTRAL CALIFORNIA COAST...HAVE COMBINED TO PRODUCE STRONG OFFSHORE WINDS OVER THE SAN FRANCISCO BAY AREA...ESPECIALLY OVER THE EAST BAY HILLS AND THE NORTHERN BAY COUNTIES.

AT 2PM PDT...THE OAKLAND INTERNATIONAL AIRPORT REPORTED SUSTAINED WINDS TO NEAR 30 MPH...AND THE AIRPORT IN HAYWARD REPORTED GUSTS TO NEAR 35 MPH. THESE WINDS ARE ESPECIALLY STRONG OVER HIGHER TERRAIN. WIND SENSORS ATOP MT DIABLO CLOCKED WIND GUSTS TO 34 MPH FROM THE NORTHEAST. EARLIER TODAY...THE GUSTS ATOP MT DIABLO REACHED 52 MPH. ON MISSION PEAK...IN LEVIN PARK NEAR FREMONT...WINDS ARE GUSTING FROM THE NORTH AT 30 MPH. IN THE NORTH BAY...ATOP MT TAMALPAIS...WINDS ARE SOMEWHAT LIGHTER BUT BLOWING FROM THE NORTH-NORTHEAST AT 22 MPH. FORT FUNSTON...ALONG THE COAST NEAR SAN FRANCISCO...IS REPORTING GUSTY SOUTHEAST WINDS TO 20 MPH.

SEVERAL RECORD HIGH TEMPERATURES HAVE BEEN TIED OR SET TODAY THROUGHOUT PORTIONS OF THE SAN FRANCISCO BAY AREA...

CITY	NEW RECORD	OLD RECORD
SAN FRANCISCO DOWNTOWN	87 TIED	87 1887
SAN FRANCISCO AIRPORT	87	85 1939
OAKLAND MUSEUM	88	82 1975
OAKLAND AIRPORT	91	85 1964
MOFFETT NAVAL AIR STATION	90	84 1975

ADDITIONAL TEMPERATURE RECORDS MAY BE BROKEN AS ADDITIONAL DATA BECOMES AVAILABLE LATER THIS AFTERNOON.

GUSTY NORTHEAST WINDS TO 35 MPH WILL CONTINUE TO BLOW THROUGH THE EVENING OVER THE HIGHER TERRAIN...BUT WILL SIGNIFICANTLY DIMINISH OVERNIGHT. MUCH COOLER TEMPERATURES ARE EXPECTED ON MONDAY AND TUESDAY AS A FRONTAL SYSTEM FROM THE PACIFIC NORTHWEST MOVES SOUTH INTO NORTHERN AND CENTRAL CALIFORNIA MONDAY NIGHT AND TUESDAY.

PAUL HAMILTON
FORECASTER
BAY AREA PUBLIC SERVICE UNIT

*SPS:
BAPSA
Ap A*

TTAA00 KSFO 210344
CAZ002-211200-
SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE SAN FRANCISCO, CA
040 PM PDT SUN OCT 20 1991

...STRONG NORTHEAST WINDS CONTINUED TO BLOW OVER THE
BAY AREA HILLS...

DUE TO A STRONG HIGH PRESSURE OVER NEVADA...ALONG WITH WEAK LOW
PRESSURE ALONG THE CENTRAL CALIFORNIA COAST...GUSTY WINDS ARE STILL
BLOWING AT THE HIGHER ELEVATIONS OF THE COASTAL HILLS IN THE SAN
FRANCISCO BAY. THESE STRONG WINDS COMBINED WITH THE WARM AND DRY
CONDITIONS ARE HAMPERING THE ONGOING FIRE-FIGHTING EFFORT.

AT 8 PM PDT...WIND SENSORS ATOP MT DIABLO AND MISSION PEAK...IN
LEVINE PARK NEAR FREMONT ARE STILL REPORTING NORTH-NORTHEAST WIND TO
25 MILES AN HOUR WITH GUSTS OVER 30 MILES AN HOUR. IN THE NORTH
BAY...ATOP MT TAMALPAIS...WINDS ARE SOMEWHAT LIGHTER AND BLOWING FROM
THE NORTH AT 16 MILES AN HOUR. MOST OF THE STATIONS AROUND THE BAY
AREA AT SEA LEVEL HAVE REPORTED WEAK NORTH TO NORTHEAST WINDS TO
10 MILES AN HOUR.

THESE GUSTY NORTH-NORTHEAST WINDS ARE EXPECTED TO SIGNIFICANTLY
DIMINISH OVERNIGHT. COOLER TEMPERATURES ARE EXPECTED ON MONDAY AS
FOG REDEVELOPS ALONG THE COAST AND SPREADS DAMPER MARINE AIR INTO THE
BAY.

HUI/BAY AREA PUBLIC SERVICE UNIT FORECASTER



SFOSPSF0
TTAA00 KSFO 210956
CAZ002-211700-
SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE SAN FRANCISCO, CA
300 AM PDT MON OCT 21 1991

...SEABREEZE RETURNS TO BAY AREA...

SURFACE AIR PRESSURE FIELDS HAVE REVERSED THIS MORNING ALONG THE
CENTRAL CALIFORNIA COAST WHICH WILL LEAD TO A RETURN OF THE SEABREEZE
THIS AFTERNOON.

AT 3 AM PDT...WIND ATOP MT DIABLO HAVE CALMED TO SOUTH AT 7 MPH. IN
THE NORTH BAY...ATOP MT TAMALPAIS...WINDS REMAIN FROM THE NE AT 7
MPH. ALL WIND SENSORS IN THE BAY AREA SHOW A DRAMATIC REDUCTION OF
SPEED FROM THE SUNDAYS AFTERNOONS VELOCITIES.

THE WINDS WILL REMAIN LIGHT AND VARY IN DIRECTION UNTIL THIS
AFTERNOON WHEN THE SEABREEZE WILL RETURN. EXPECT A COOL...MOIST WEST
WIND BLOWING TO 20 KNOTS.

RORKE/BAY AREA PUBLIC SERVICE UNIT FORECASTER



WINDS ALL STATE. STILL WARM INTERIORS WITH NOT MUCH LOW CLOUD OR FOG ON COASTAL UNITS.

ENDMJR

SACRAMENTO FIRE WX FCST/ PORTIONS CDF REGION 1/ 0930 PDT OCT 19 1991

RED FLAG WARNING FOR LAKE-NAPA UNITS AND DIABLO RANGE SOUTH OF MT DIABLO TO LOS BANOS

RED FLAG WATCH FOR REMAINDER OF UNITS...
DISCUSSION...WARNING UP FOR STRONGER NORTHERLY WINDS AND LOWERING HUMIDITIES. WATCH UP FOR SAME THING BUT ADVENT TONIGHT AND SUNDAY MORNING. STRONG HIGH IN OREGON AND GT BASIN KICKING IN STRONGER WINDS AND LOWER MOISTURE ALL NORTHERN CALIF. RED FLAG WARNING UP OUT OF REDDING DISTRICT THIS MORNING AS WELL. PATTERN TO HOLD INTO MONDAY MORNING THEN SWITCH AROUND AS NEW TROUGH COMES INTO COAST. . STILL WINDY FIRST OF WEEK BUT FROM SOUTHWEST.

SAN MATEO-SANTA CRUZ/SANTA CLARA R.U.'S (ZONES 545 THRU 550)

TODAY.....WEATHER: MOSTLY SUNNY
TEMPERATURES: UP 3 TO 5 DEG.
RELATIVE HUMIDITY: DOWN 4 TO 8%.
PEAK/RIDGE WINDS: N TO NE 10 TO 15 GUST TO 25 SANTA CLARA EAST PORTION
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 15 ON EAST TO NORTH ASPECTS 1

**RED FLAG
WARNING**

TONIGHT....WEATHER: FAIR
TEMPERATURES: UP 2 TO 4 DEG
RELATIVE HUMIDITY: DOWN 4 TO 8
PEAK/RIDGE WINDS: E TO NE 10 TO 20 GUSTY TO 25
LOWER LEVEL WINDS : DRAINAGE 2 TO 5
INVERSIONS: WEAKER
LAL 1

SUNDAY.....WEATHER: MOSTLY SUNNY
TEMPERATURES: UP 2 TO 5 DEG.
RELATIVE HUMIDITY: DOWN 3 TO 8%.
PEAK/RIDGE WINDS: NM TO NE 15 TO 25 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 20 ON EAST TO NORTH ASPECTS
LAL 1

LAKE-NAPA/SONOMA R.U.'S/MARIN COUNTY/COASTAL AREA SOUTH OF GUALALA

TODAY.....WEATHER: FAIR AND WARM
TEMPERATURES: UP 2 TO 6 DEG.
RELATIVE HUMIDITY: DOWN 4 TO 8%
PEAK/RIDGE WINDS: NE TO NM 15 TO 25 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 15-20 ON NORTH TO EAST ASPECTS

TONIGHT....WEATHER: FAIR
TEMPERATURES: UP 2 TO 4 DEG
RELATIVE HUMIDITY: DOWN 3 TO 6%
PEAK/RIDGE WINDS: E TO NE 15 TO 20 GUSTY TO 25
LOWER LEVEL WINDS: DRAINAGE 2 TO 5
INVERSIONS: WEAKER
LAL 1

SUNDAY.....WEATHER: FAIR AND WARM

*See Routine
Fuel Fat
Appendix D*

RED FLAG WARNING FOR LAKE-NAPA UNITS AND DIABLO RANGE SOUTH OF MT DIABLO TO LOS BANOS

RED FLAG WATCH FOR REMAINDER OF UNITS...
DISCUSSION...WARNING UP FOR STRONGER NORTHERLY WINDS AND LOWERING HUMIDITIES.
WATCH UP FOR SAME REASON BUT ADVENT TONIGHT AND SUNDAY MORNING. STRONG HIGH
IN OREGON AND GT BASIN KICKING IN STRONGER WINDS AND LOWER MOISTURE ALL
NORTHERN CALIF. RED FLAG WARNING UP OUT OF REDDING DISTRICT THIS MORNING AS
WELL. PATTERN TO HOLD INTO MONDAY MORNING THEN SWITCH AROUND AS NEW TROUGH
COMES INTO COAST. MUCH COLDER AIR WITH TROUGH BUT STILL VERY WINDY ALL
UPNITS FROM SOUTHWEST .

SAN MATEO-SANTA CRUZ/SANTA CLARA R.U.'S (ZONES 545 THRU 550)

TONIGHT...WEATHER: FAIR
TEMPERATURES: UP 2 TO 4 DEG
RELATIVE HUMIDITY: DOWN 4 TO 8%
PEAK/RIDGE WINDS: E TO NE 10 TO 20 GUSTY TO 25
LOWER LEVEL WINDS : DRAINAGE 2 TO 4
INVERSIONS: WEAKER
LAL 1

SUNDAY...WEATHER: MOSTLY SUNNY
TEMPERATURES: UP 2 TO 5 DEG.
RELATIVE HUMIDITY: DOWN 3 TO 8%.
PEAK/RIDGE WINDS: NM TO NE 15 TO 25 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 20 ON EAST TO
NORTH ASEPTS
LAL 1

LAKE-NAPA/SONOMA R.U.'S/MARIN COUNTY/COASTAL AREA SOUTH OF GUALALA

TONIGHT...WEATHER: FAIR
TEMPERATURES: UP 2 TO 4 DEG
RELATIVE HUMIDITY: DOWN 3 TO 6%
PEAK/RIDGE WINDS: E TO NE 15 TO 20 GUSTY TO 25
LOWER LEVEL WINDS : DRAINAGE 2 TO 5
INVERSIONS: WEAKER
LAL 1

SUNDAY...WEATHER: FAIR AND WARM
TEMPERATURES: UP 2 TO 3 DEG.
RELATIVE HUMIDITY: DOWN 3 TO 5%
PEAK/RIDGE WINDS: NE TO N 15 TO 30 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 20 ON N TO NE
ASPECTS
LAL 1

ZONE 561...EAST OF BLUE RIDGE FROM STONYFORD TO VACAVILLE

TONIGHT...WEATHER: FAIR.
TEMPERATURES: UP 2 TO 4 DEG.
HUMIDITIES: DOWN 3 TO 5%.
PEAK/RIDGE WINDS: N TO NE 15 TO 30 GUSTY
LOWER LEVEL WINDS : DRAINAGE 2 TO 6.
INVERSIONS: WEAKER
LAL 1

SUNDAY...WEATHER: MOSTLY SUNNY.
TEMPERATURES: UP 2 TO 4 DEG.

RED FLAG WARNING

Red Flag Watch

ENDJLH

SACRAMENTO FIRE WX FCST/ PORTIONS CDF REGION 1/ 1430 PDT OCT 20 1991

...RED FLAG WARNING FOR GUSTY NORTH WINDS AND LOW HUMIDITIES THROUGH SUNSET
TONIGHT....

DISCUSSION...STRONG NORTH WIND GRADIENT WEAKENING VERY SLOWLY. MT DIABLO AND
MISSION RIDGE GUSTING TO 35 MPH AT 2PM. EAST BAY WINDS GENERALLY STEADY AT
AROUND 20 MPH. WINDS SHOULD DROP OFF OVERNIGHT AND AIRMASS IS COOLING SO WILL
ALLOW RED FLAG WARNING TO EXPIRE AT SUNSET. EXPECT SOME INCREASE IN MARINE
LAYER MONDAY MORNING AS UPSTREAM TROF BEGINS TO PUSH IN FROM THE NORTHWEST.
TROF WILL COME IN TUESDAY NIGHT BRINGING HIGH CLOUDS AND COOLER TEMPS BUT
ONLY A SLIGHT CHANCE FOR RAIN.

SAN MATEO-SANTA CRUZ/SANTA CLARA R.U.'S (ZONES 545 THRU 550)

TONIGHT....WEATHER: FAIR
TEMPERATURES: DOWN 2 TO 4 DEG
RELATIVE HUMIDITY: UP 3 TO 5%
PEAK/RIDGE WINDS: E TO NE 10 TO 20 GUSTY TO 25
LOWER LEVEL WINDS : DRAINAGE 2 TO 4
INVERSIONS: WEAKER
LAL 1

MONDAY.....WEATHER: MOSTLY SUNNY
TEMPERATURES: DOWN 3 TO 5 DEG.
RELATIVE HUMIDITY: UP 5 TO 10%.
PEAK/RIDGE WINDS: NW TO NE 10 TO 20.
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12
LAL 1

RED FLAG
WARNING

LAKE-NAPA/SONOMA R.U.'S/MARIN COUNTY/COASTAL AREA SOUTH OF GUALALA

TONIGHT....WEATHER: FAIR EXCEPT FOR PATCHY FOG NEAR THE COAST.
TEMPERATURES: DOWN 3 TO 5 DEG.
RELATIVE HUMIDITY: UP 4 TO 8 %.
PEAK/RIDGE WINDS: E TO NE 10 TO 20 GUSTY TO 25
LOWER LEVEL WINDS: DRAINAGE 2 TO 5
INVERSIONS: WEAKER
LAL 1

MONDAY.....WEATHER: FAIR AFTER PATCHY MORNING FOG.
TEMPERATURES: DOWN 3 TO 5 DEG.
RELATIVE HUMIDITY: UP 4 TO 8%
PEAK/RIDGE WINDS: NE TO N 10 TO 20 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

ZONE 561...EAST OF BLUE RIDGE FROM STONYFORD TO VACAVILLE

TONIGHT....WEATHER: FAIR.
TEMPERATURES: DOWN 2 TO 4 DEG.
HUMIDITIES: DOWN 4 TO 8%.
PEAK/RIDGE WINDS: N TO NE 15 TO 25 GUSTY
LOWER LEVEL WINDS : DRAINAGE 2 TO 6.
INVERSIONS: WEAKER
LAL 1

RED FLAG
WARNING

MONDAY.....WEATHER: SUNNY.
TEMPERATURE: DOWN 3 TO 5 DEG.
RELATIVE HUMIDITY: UP 4 TO 8%.

ENDM2N

SACRAMENTO FIRE WX FCST/ PORTIONS CDF REGION 1/ 0930 PDT OCT 21 1991

...CANCELLING RED FLAG WARNING THIS MORNING. STILL VERY LOW RH. BUT GRADIENT AND THEREFORE WIND DECREASING...

DISCUSSION...STRONG NORTH WIND GRADIENT CONTINUES TO GRADUALLY RELAX. MT DIABLO AND MISSION RIDGE GUSTS ALL BELOW 10 MPH AT 8AM. FOG CREEPING IN SLOWLY ALONG THE COAST. MARINE AIR IS IN THRU THE GOLDEN GATE AND PAST ANGEL ISLAND. BUT HASN'T HIT THE CARQUEZ STRAITS. ALSO LAYER IS VERY SHALLOW...LESS THAN 600'. EXPECT MARINE AIR TO SLOWLY FILTER IN TOWARDS EAST BAY HILLS AND MARINE LAYER TO GRADUALLY DEEPEN SO THAT BY EARLY TO MID AFTERNOON IT'LL BE TO 1000'. INCOMING TROF WILL BE WEAK WITH VERY LITTLE CLOUDS ASSOCIATED. COOLER AIR AND INCREASED MARINE AIR BUT LITTLE OR NO CHANCE OF RAIN.

SAN MATEO-SANTA CRUZ/SANTA CLARA R.U.'S (ZONES 545 THRU 550)
TODAY.....WEATHER: MOSTLY SUNNY

TEMPERATURES: DOWN 3 TO 5 DEG.
RELATIVE HUMIDITY: UP 5 TO 10%.
PEAK/RIDGE WINDS: NW TO NE 10 TO 20.
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

TONIGHT....WEATHER: FAIR

TEMPERATURES: DOWN 4 TO 8 DEG
RELATIVE HUMIDITY: UP 10 TO 20%.
PEAK/RIDGE WINDS: SW TO NW 5 TO 10 GUSTY TO 20
LOWER LEVEL WINDS : DRAINAGE 2 TO 4
INVERSIONS: WEAKER
LAL 1

TUESDAY....WEATHER: MOSTLY SUNNY

TEMPERATURES: DOWN 5 TO 10 DEG.
RELATIVE HUMIDITY: UP 10 TO 25%.
PEAK/RIDGE WINDS: SW TO NW 10 TO 20.
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

LAKE-NAPA/SONOMA R.U.'S/MARIN COUNTY/COASTAL AREA SOUTH OF GUALALA
TODAY.....WEATHER: FAIR AFTER PATCHY MORNING FOG AT COAST.

TEMPERATURES: DOWN 5 TO 8 DEG.
RELATIVE HUMIDITY: UP 5 TO 15%
PEAK/RIDGE WINDS: NE TO N 10 TO 20 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

TONIGHT....WEATHER: FAIR EXCEPT FOR EXCEPT FOG ALONG THE COAST.

TEMPERATURES: DOWN 5 TO 8 DEG.
RELATIVE HUMIDITY: UP 8 TO 15 %.
PEAK/RIDGE WINDS: SW TO NW 10 TO 20 GUSTY TO 25
LOWER LEVEL WINDS: DRAINAGE 2 TO 5
INVERSIONS: WEAKER
LAL 1

TUESDAY....WEATHER: FEW HIGH CLOUDS.

TEMPERATURES: DOWN 8 TO 15 DEG.
RELATIVE HUMIDITY: UP 10 TO 20%
PEAK/RIDGE WINDS: S TO SW 10 TO 20 GUSTY
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

ZONE 561...EAST OF BLUE RIDGE FROM STONYFORD TO VACAVILLE
TODAY.....WEATHER: SUNNY.

TEMPERATURE: DOWN 5 TO 8 DEG.
RELATIVE HUMIDITY: UP 8 TO 18%.
PEAK/RIDGE WINDS: SW TO NW 10 TO 20.
LOWER LEVEL WINDS : UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 12.
LAL 1

SPECIAL FCST FOR CDF EAST BAY WILDFIRE 20 OCT 1991 1315 PDT

14/-91

DISCUSSION: STRONG NORTHERLY WIND GRADIENT IS WEAKENING SLOWLY. PEAK WIND DOWN AT MISSION RIDGE AND MOUNT DIABLO FROM 50 TO 60 MPH AT 9 AM TO 30 TO 35 AT 1 PM. LOWER LEVEL WINDS AT OAKLAND AIRPORT STEADY AT 20 MPH AND HAYWARD 15 GUSTING TO 25. LOOK FOR WINDS TO CONTINUE TO DAY BUT SLOWLY DIMINISH THEN TAPER OFF OVERNIGHT. WINDS SHOULD BEGIN SHIFT TO THE SOUTHWEST MONDAY AS TROF APPROACHES.

TODAY...SUNNY...HOT AND WINDY...MAX TEMP IN THE MID 90S. MIN R.H. 10 TO 15%. SITE WINDS NE 15 TO 25 MPH WITH OCCASIONAL HIGHER GUSTS. PEAK RIDGE WINDS NE 15 TO 25 GUSTY TO 35.

TONIGHT...FAIR AND MILD. MIN TEMP IN THE 50S. MAX R.H. 35 TO 40%. SITE WINDS NE 10 TO 20 BECOMING DRAINAGE 3 TO 5 GUSTY TO 10 BY DAYBREAK. PEAK RIDGE WINDS N TO NE 10 TO 20 GUSTY TO 25.

MONDAY...MOSTLY SUNNY. COOLER AND LESS WINDY. MAX TEMP IN THE LOWER 80S. MIN R.H. 20 TO 25%. SITE WINDS UPSLOPE/UPCANYON 4 TO 8 GUSTY TO 15 ON EAST ASPECTS. PEAK/RIDGE WINDS NE TO NW 10 TO 20 GUSTY TO 25.

OUTLOOK TUESDAY...INCREASING CLOUDINESS WITH A SLIGHT CHANCE FOR SHOWERS. COOLER AND MORE HUMID. RIDGE LEVEL WINDS SOUTHWEST 15 TO 25 GUSTY TO 35.

COMMAND:

SAC
Fert Mend
FortFire
Apache A

RED FLAG WARNING

142-91

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SPECIAL POST FOR CDF "OAKLAND HILLS WILDFIRE" NO. 142-91 1815PDT 20 OCT
1991

TO: MORGAN HILL HQS. SANTA CLARA RANGER UNIT

DISCUSSION...FIRE AREA CONTINUES UNDER...RED FLAG WARNING...SINCE YESTERDAY
MORNING. STRONG HIGH IN EASTERN PACIFIC HAS EXTENSION INTO GT BASIN AREA.
NORTHEAST TO EAST WIND GRADIENT STARTED BUILDING ON 19TH AND GREW STRONGEST
THIS MORNING. IT IS NOW STARTING TO SLACKEN BUT NORTHEAST TO EAST WINDS STILL
EXPECTED TO HOLD THRU THE NIGHT. SLACKENING OF SPEEDS IS EXPECTED ESPECIALLY
AFTER MIDNIGHT IN THE FIRE AREA. NO FOG OR LOW CLOUD CAN BE EXPECTED
TONIGHT. FIRST CHANCE AT MARINE AIR COOLING AND WESTERLY WINDS NOT UNTIL
MONDAY AFTERNOON AND NIGHT.

TONIGHT...CONTINUED NORTHEAST TO EAST WINDS 20 TO 30 MPH LOCALLY STRONGER TO
35 THEN ABATING SLOWLY TO 15 TO 20 MPH GUSTY TO 25. WIND BY MORNING STILL
NORTHEAST TO EAST WITH MUCH LOWER SPEEDS TO 15-25MPH...LOCALLY STRONGER FIRE
INDUCED WIND GUSTS AND SQUIRRELY DIRECTIONS TONIGHT THRU MORNING.

PEAK/RIDGE HUMIDITIES IN THE SINGLE DIGITS TO MID TEENS. LOWER SLOPES
(WESTERLY AND SOUTHERLY ASPECTS) IN THE LOW TO MID TEENS RISING TO NEAR 20%
AFTER MIDNIGHT.

MONDAY...MORNING WINDS STILL NORTHEAST TO EAST 10 TO 20 GUSTY. CHANGING
DURING THE MIDAFTERNOON TO UPSLOPE/UPCANYON 8 TO 12 GUSTY LOCALLY TO 15-20.
COOLER TEMPERATURE ON WEST FACING LOWER SLOPES BY EVENING AS MARINE AIR
TRICKLES IN. HUMIDITIES STAYING IN THE TEENS TO NEAR 20% MORNING THEN
INCREASING BY EVENING TO WEST FACING SLOPE BOTTOMS. PEAK/RIDGE HUMIDITIES
STAYING BELOW 20% DURING THE DAY. MAX TEMP IN THE MID 70S LOWER SLOPES AND IN
THE MID 80S PEAKS AND RIDGES.

INVERSIONS: WEAK DRAINAGE INVERSIONS AFTER 0400. BREAKING MID MORNING.
OUTLOOK TUESDAY...MUCH COOLER. DEEP MARINE AIR TO RIDGE LEVEL. CONTINUING
WINDY BUT OUT OF THE WEST AND SOUTHWEST.

ENDMJR
FILE

RED FLAG WARNING

...RED FLAG WARNING CONTINUES THRU THIS AFTERNOON....

SPECIAL FCST FOR CDF "OAKLAND HILLS WILDFIRE" NO. 144-91 0600PDT 21 OCT 1991

TO: MORGAN HILL HQS. SANTA CLARA RANGER UNIT

DISCUSSION...FIRE AREA CONTINUES UNDER...RED FLAG WARNING...TODAY TO BE TRANSITIONAL DAY FROM THE STRONG NORTHEAST WINDS TO MUCH LIGHTER NORTH TO NORTHEAST WINDS OVER FIRE AREA. HUMIDITIES STAYING VERY LOW ALL DAY UNTIL FIRST MARINE AIR REACHES FIRE AREA LATE THIS AFTERNOON AND EVENING ON WEST AND SOUTHWEST WINDS. SOME RELIEF CAN BE EXPECTED AT THAT TIME FROM HIGHER MOISTURE IN THE LOWEST PORTIONS OF THE FIRE. RIDGE LINE WINDS AT 12-2000FT STILL LIGHT NORTHERLY THRU FIRST PART OF NIGHT WITH LOW HUMIDITIES.

TODAY...DECREASING WINDS STILL NORTHEAST TO EAST 10 TO 15 GUSTY TO 20 AT TIMES AT PEAK/RIDGE LEVELS. CHANGING DURING THE LATE AFTERNOON TO UPSLOPE/UPCANYON 8 TO 12 GUSTY LOCALLY 15-20 UNDER INCREASING HUMIDITIES IN THIN MARINE AIR.

COOLER TEMPERATURE ON WEST FACING LOWER SLOPES BY EVENING AS MARINE AIR MOVES INTO AREA. HUMIDITIES STAYING IN THE TEENS TO NEAR 20% MORNING THEN INCREASING BY THIS EVENING ON WEST ASPECTS. PEAK/RIDGE HUMIDITIES STAYING BELOW 20% DURING THE DAY. MAX TEMP NEAR 80. LOWER SLOPES AND IN THE MID 60S PEAKS AND RIDGES. TEMPS COOLING AFTER EARLY AFTERNOON.

INVERSIONS: BREAKING INVERSIONS AROUND 1000PDT THIS MORNING
OUTLOOK TUESDAY...MUCH COOLER. DEEP MARINE AIR TO RIDGE LEVELS. CONTINUED WINDY BUT OUT OF THE WEST AND SOUTHWEST WITH GUSTINESS TO 15-25MPH.

ENDMJR

SACRAMENTO FIRE WEATHER

MOBILE UNIT FORECAST

LOCATION OF MU: ALAMEDA NAS



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
DAY OF WEEK & DATE: MONDAY 21 OCT 91

NAME OF FIRE: TUNNEL

FORECASTER: MILO RADULOVICH

FORECAST NO: 1

TIME RELEASED: 1530 PDT

WEATHER DISCUSSION: PATTERN HAS SWITCHED TO A TROUGH. COLDER..HIGHER HUMIDITIES AND WINDY THRU THE NEXT 24 -48 Hours. NO LONGER ANY DANGER OF NORTHEAST WINDS RECURRING. WEAK FRONT MOVING THRU AREA AS A DRY FRONT. BETTER CHANCE AT WETTER PATTERN ABOUT FRIDAY.

PERIOD COVERED AND DAY: TONIGHT AND TUESDAY.. 21/1800-22/0600PDT

WEATHER CONDITIONS: COLDER..HIGHER HUMIDITIES AND WINDY. MARINE AIR INTO FIRE AREA ..TOPS AROUND 1000FT.

WINDS: BELOW 1000FT: WEST TO SOUTHWEST 10 to 20 MPH. GUSTY DURING THE NIGHT.

ABOVE 1000FT: WEST TO SOUTHWEST 8 TO 12 MPH GUSTY THRU MIDNIGHT TO 15 MPH. DECREASING WINDS BECOMING DRAINAGE 3 to 6 after 2400.

TEMPERATURE:

MIN TEMPERATURES AT WESTERN PERIMETER IN THE UPPER 50S.

MIN TEMPERATURES AT RIDGE LEVEL IN THE MID 60S.

HUMIDITY:

MAXIMUM HUMIDITY NEAR 70% BY MORNING.
PEAK/RIDGE MAXIMUM HUMIDITY NEAR 50%.

FUEL MOISTURE: RISING IN MARINE AIR BY 10-15%. OUTSIDE OF MARINE AIR..ABOVE 1000FT RIsing by ABOUT 5-10%.

AIRCRAFT OPERATIONS:

WEATHER OUTLOOK: DEEPER MARINE AIR TUESDAY COVERING RIDGELINE..TOPS AROUND 1500-2000ft TUESDAY AFTERNOON. CONTINUED WINDY FROM SOUTHWEST AND WEST ALL AREA.

PRESENT WEATHER:

LOCATION: BASE CAMP

TEMPERATURE: 74 DEG. HUMIDITY: 50 %

FUEL MOISTURE: _____

WIND: W-SW / 10 G 15 MPH



NEXT FORECAST WILL BE ISSUED AT: 22/0600

FIRE WEATHER FORECAST

FORECAST NO. 2

NAME OF FIRE: TUNNEL PREDICTION FOR: DAY SHIFT

UNIT: SACRAMENTO MOBILE UNIT SHIFT DATE: 22 OCTOBER 1991

TIME AND DATE
FORECAST ISSUED: 22/0500PDT SIGNED: MILJ. RADULOVICH
Fire Weather Meteorologist

WEATHER DISCUSSION: WINTER TYPE PATTERN FORMING THRU END OF WEEK.
WINDY...COLDER ...HIGHER HUMIDITIES ALL AREA THRU WEEKEND.

BEST CHANCE FOR PRECIP IS FRIDAY AND SATURDAY FOR THE FIRE SITE.

WEATHER FORECAST

WEATHER: CLOUDY TO PARTLY CLOUDY. COOL. WINDY IN MARINE AIR. TOPS OF
MARINE AIR AROUND 4000FT. CHANCE FOR DRIZZLE ABOVE 500FT THIS MORNING.

TEMPERATURES: MAXIMUMS IN THE MID TO UPPER 60S.
MINIMUMS THIS MORNING IN THE MID 50S.

HUMIDITY: MAXIMUM THIS MORNING IN THE 80 TO 90% RANGE FROM MIDSLOPE TO
RIDGELINE
MINIMUM EARLY AFTERNOON IN THE 55-65% RANGE
CHANCE FOR DRIZZLE THIS MORNING ABOVE 500FT TO RIDGELINE

20 FT/EYE-LEVEL WINDS: SOUTH TO SOUTHWEST 10 TO 20MPH AND GUSTY.

RIDGETOP - SW TO W 15 TO 25 MPH GUSTY TO 30 THIS AFTERNOON.

SLOPE/VALLEY -UPCANYON UPSLOPE AT MINIMUM. MARINE AIR WINDS DOMINANT.

STABILITY/INVERSION: VERY STABLE UP TO 4000FT. UNSTABLE ABOVE. TOPS OF
MARINE AIR AND LOW CLOUD NEAR 4000FT. BASES AROUND 12-
1500FT.

OUTLOOK FOR NEXT SHIFT
LOW CLOUD AND COOL HUMID CONDITIONS CONTINUING. LESS WINDY.

EXTENDED FORECAST: THURSDAY THRU SATURDAY...GOOD CHANCE FOR RAIN SHOWERS
FRIDAY THRU SATURDAY MORNING. CLEARING SATURDAY AFTERNOON LEAVING LOW CLOUD
OVER FIRE AREA. CHANCE FOR NORTHERLY WINDS LATE SATURDAY.

OBSERVED WEATHER: 22/0730
CLOUDY AND COOL. TEMPERATURE 62 HUMIDITY 64% WIND SW 10 GUSTY

FIRE WEATHER FORECAST

FORECAST NO. --3--

NAME OF FIRE: TUNNEL PREDICTION FOR: NIGHT SHIFT

UNIT: SACRAMENTO MOBILE UNIT SHIFT DATE: 22-23 OCTOBER 1991

TIME AND DATE SIGNED: MILO J. RADULOVICH
FORECAST ISSUED: 22/1600PDT Fire Weather Meteorologist

WEATHER DISCUSSION: FALL-WINTER TYPE PATTERN CONTINUES EVOLVING. TODAY'S LOW MARINE AIR CLOUDINESS WILL THIN OUT WEDNESDAY. UPPER LEVEL TROUGH TO BRING GOOD CHANCE FOR WETTING PRECIP FRIDAY AND SATURDAY. (MORE THAN .1 INCH)

CLOSEST PRECIP AS OF 1500 IS WEST OF REDDING WHERE SHOWERS ARE BEING REPORTED.

WEATHER FORECAST

WEATHER: CONTINUED CLOUDY TONIGHT OVER FIRE SITE. COOL AND LESS WINDY. SPOTTY DRIZZLE. HIGH HUMIDITY BELOW 4000FT. DRIER ABOVE BUT ANOTHER LAYER OF HIGHER CLOUDINESS.

TEMPERATURES:

MINIMUMS IN THE MIDDLE 50S

HUMIDITY:

RISING TO NEAR 90% AFTER MIDNIGHT ABOVE 500FT TO THE RIDGELINE. BELOW 500FT R.H. IN THE LOW 70% RANGE.

MINIMUM EARLY EVENING IN THE 55-65% RANGE
CHANCE FOR DRIZZLE DURING NIGHT TO THE RIDGELINE.

20 FT/EYE-LEVEL WINDS: WEST TO SOUTHWEST 8 TO 15 GUSTY TO 20

RIDGETOP - SW TO W 15 TO 25 MPH WITH DECREASING GUSTINESS

SLOPE/VALLEY -NOT MUCH DRAINAGE FLOW DUE TO DEEP MARINE AIR

STABILITY/INVERSION: VERY STABLE UP TO 4000FT. IN MARINE AIR. TOPS OF MARINE AIR AND LOW CLOUD NEAR 4000FT.

OUTLOOK FOR NEXT SHIFT PARTLY CLOUDY AND CONTINUED COOL. LESS WINDY.
DIRECTION MORE WEST TO NORTHWEST LOWER AFTERNOON HUMIDITIES BY 10-15%

EXTENDED FORECAST: THURSDAY THRU SATURDAY...GOOD CHANCE FOR RAIN SHOWERS FRIDAY THRU SATURDAY MORNING. CHANCE FOR LINGERING SHOWERS ALONG RIDGELINE SATURDAY AFTERNOON.