

be repaired at the time of service restoration. The Southern California Gas Company (1994) reported 35 breaks in its natural gas transmission lines and 717 breaks in distribution lines. About 74% of its 752 leaks were corrosion related.

Natural gas leaks in the Southern California Gas Company service area resulted in three street fires, 51 structure fires (23 of these caused total ruin) and the destruction by fire of 172 mobile homes. In one incident, the earthquake severed a 22-inch transmission line and a motorist ignited the gas while attempting to restart his stalled vehicle. Response to this fire was impeded by the earthquake's rupture of a water main. Five nearby homes were destroyed. Elsewhere, one mobile home fire started when a ruptured transmission line was ignited by a downed power line. In many of the destroyed mobile homes, fires erupted when inadequate bracing let them fall from foundations, severing gas lines and igniting fires. There was a much greater incidence of mobile home fires (49.1 per thousand) than other structure fires (1.1 per thousand). Earthquake-induced fires greatly threaten Riverside County, in part due to the County's large number of mobile homes.

4.6.2 Earthquake-Induced Fire Scenarios for the Riverside County Area using HAZUS

HAZUS™, a standardized methodology for earthquake loss estimation based on a geographic information system (GIS), is a project of the National Institute of Building Sciences, funded by the Federal Emergency Management Agency (FEMA). HAZUS, and the earthquake threat to Riverside County, are discussed at length in Chapter 1 – Earthquake Hazards. This section reports on earthquake-induced fire loss estimation made with HAZUS.

Loss estimation is an invaluable tool, but must be used with discretion. Loss estimation results are best taken as broad indications of a disaster's severity. For example, a fire station with 60% functionality has clearly fared better than one at 30% functionality, but that 30% is probably equivalent to one at 20%.

Loss estimation is a new methodology. Our data and thus understanding of fires following earthquakes are limited. Furthermore, a fully accurate, fire-following-earthquake evaluation requires extensive knowledge of the level of readiness of local fire departments, as well as the types and availability (functionality) of water systems. For all these reasons, there will undoubtedly be future improvements in forecasting ability.

Based upon current data and best judgment, it is estimated that about 70% of all

earthquake-induced fire ignitions occur immediately, as the fire is discovered within a few minutes of the earthquake. The remaining ignitions occur about an hour to a day after the earthquake. A typical cause of later ignitions is the restoration of electric power. When power is restored, short circuits caused by the earthquake become energized and can start fires. Also, items which have overturned, fallen onto stove tops, etc., can ignite. If no one is present at the time electric power is restored, ignitions can grow to fires requiring fire department response.

HAZUS loss estimations were made using two scenario earthquakes, listed in Table 4-9 and described in Chapter 1. Two wind velocities were used for each scenario earthquake. A velocity of 30 miles per hour (mph) was assigned to evaluate fire spread as a result of Santa Ana winds. A value of 10 mph was used to model normal wind conditions.

Table 4-9: Scenario Earthquakes for Riverside County

| Event | Location | Size | Description |
|-----------------------------------|---|--------------------|---|
| Maximum Credible Earthquake (MCE) | San Andreas fault | M _w 7.9 | Based on a rupture of the entire segment between Cajon Pass and the Salton Sea (probably the worst-case scenario for Riverside County, see Chapter 1) |
| Maximum Probable Earthquake (MPE) | San Jacinto fault, San Jacinto Valley segment | M _w 6.9 | Rated most likely fault segment in southern California to produce a large earthquake (44% probability in 30 years, see Chapter 1) |

A summary of loss estimation results is presented in Table 4-10. Note that Santa Ana wind conditions cause a substantial, 4- to 6-fold increase in losses. For each scenario earthquake, the relative likelihood of emergency response facilities to be exposed to at least moderate damage is illustrated on Figures 4-4 and 4-5.

An estimate of County-wide fire station functionality is included in Table 4-10. Estimates for the functionality at each station in the HAZUS database are presented in Table 4-11. Here, functionality is based entirely on building damage due to estimated peak ground accelerations at each station. Note that the HAZUS loss estimation does not consider effects of reduced water pressure due to breaks in the water distribution system. These are expected to be widespread where ground failure occurs, such as due to fault rupture or liquefaction, and could further reduce functionality at some stations.

While the fire station database requires updating, the functionality estimates provide credible guidelines for response planning and exercises.

Insert Figure 4-4: Emergency Response Facility Damage Based on Mw 7.9 San Andreas Scenario Earthquake

Insert Figure 4-5: Emergency Response Facility Damage Based on Mw 6.9 San Jacinto Scenario Earthquake

**Table 4-10: Earthquake Induced Fire Losses in Riverside County
HAZUS Scenario Earthquakes**

| Event | No. of Ignitions | Population Exposed (Wind Velocity of 10 mph) | Population Exposed (Wind Velocity of 30 mph, Santa Ana Conditions) | Value Exposed (Wind Velocity 10 mph) | Value Exposed (Wind Velocity 30 mph, Santa Ana Conditions) | Fire Station Functionality* |
|--|------------------|--|---|--|---|-----------------------------|
| Mw 7.9 San Andreas Earthquake | 74 | 832 | 3,663 | \$50,713,000 | \$209,658,000 | 25% |
| Mw 6.9 San Jacinto Earthquake | 43 | 358 | 2,225 | \$18,640,000 | \$116,238,000 | 44% |
| *: estimate of County-wide fire station functionality at 24 hours after earthquake | | | | | | |

**Table 4-11: Estimated Functionality (in percent)
of County Fire Response Facilities
Based on Scenario Earthquakes at One Day After Event**

| NAME/LOCATION | San Jacinto M _w 6.9 | San Andreas M _w 7.9 |
|--|-----------------------------------|-----------------------------------|
| ANZA VOLUNTEER FIRE & RESCUE, 56520 HWY 371 | 36 | 30 |
| BANNING FIRE DEPARTMENT ALTERN, 172 N MURRAY ST | 30 | 7 |
| BANNING FIRE DEPARTMENT BUSINE, 3900 W WILSON ST | 27 | 8 |
| BEAUMONT FIRE DEPT BUSINESS OF, 628 MAPLE AVE | 20 | 9 |
| BLYTHE FIRE DEPT, 201 N COMMERCIAL ST | 100 | 72 |
| BLYTHE FIRE DEPT BUSINESS CALL, 201 COMMERCIAL ST | 100 | 70 |
| CALIFORNIA OFFICE OF EMERGENCY, 2524 MULBERRY ST | 18 | 15 |
| CORONA FIRE DEPT BUSINESS | 63 | 39 |
| DESERT HOT SPRINGS FIRE DEPT B, 65958 PIERSON BLVD | 77 | 6 |
| FIRE DEPT, BLYTHE | 100 | 70 |
| FIRE SPRINKLER SERVICE CO, RIVERSIDE | 19 | 15 |
| HEMET FIRE DEPARTMENT, 220 N CARMALITA ST | 10 | 22 |
| HEMET FIRE DEPARTMENT, 220 N JUANITA ST | 10 | 22 |
| HIGHGROVE VOLUNTEER FIRE DEPT, 910 W CENTER | 19 | 15 |
| HOME GARDENS FIRE STATION, 1148 E 6TH ST, CORONA | 58 | 36 |
| IDYLLWILD FIRE DEPT, 54160 MARANATHA DR | 87 | 68 |
| INDIAN WELLS FIRE DEPT BUS CAL, 44950 EL DORADO DR | 84 | 7 |
| INDIO FIRE DEPT FIRE STATION N, 43715 JACKSON ST | 91 | 6 |
| INDIO FIRE DEPT FIRE STATION N, 46621 MADISON AVE | 90 | 6 |
| LA QUINTA FIRE DEPT BUSINESS C, AVE 52 | 87 | 9 |
| LA QUINTA FIRE DEPT BUSINESS C, PGA WEST | 88 | 9 |
| LAKE TAMARISK , 43880 LAKE TAM. DR, DESERT CENTER | 99 | 26 |
| MORONGO FIRE DEPT, 11581 POTRERO RD, BANNING | 40 | 6 |

| | | |
|--|----|----|
| NORCO FIRE DEPT BUSINESS AND I, 3367 CORYDON AVE | 57 | 34 |
| PALM DESERT FIRE DEPT, 44400 TOWN CENTER WAY | 80 | 8 |
| PINE COVE FIRE DEPT, 24419 HWY 243, IDYLLWILD | 31 | 14 |
| RIVERSIDE FIRE DEPARTMENT EMER, PERRIS | 45 | 33 |
| RIVERSIDE FIRE, 20320 TEMESCAL CANYON RD, CORONA | 62 | 43 |
| RIVERSIDE FIRE, CAJALCO FI, 17650 CAJALCO RD PERRIS | 33 | 26 |
| RIVERSIDE FIRE, EDGEMONT, 22055 COTTONWOOD AVE, MORENO VALLEY | 18 | 17 |
| RIVERSIDE FIRE, 4080 LEMON ST, RIVERSIDE | 21 | 17 |
| RIVERSIDE FIRE DEPT EMERGENCY, 3601-9TH, RIVERSIDE | 21 | 16 |
| RIVERSIDE FIRE, 132 S SN JACINTO AVE, SAN JACINTO | 8 | 18 |
| RIVERSIDE FIRE, 24220 JUNIPER FLATS RD, HOMELAND | 19 | 25 |
| RIVERSIDE FIRE DEPT, 24919 MARION RDGE DR, IDYLLWILD | 31 | 14 |
| RIVERSIDE FIRE DEPT, 25175 FAIRVW AVE, HEMET | 15 | 27 |
| RIVERSIDE FIRE, 25730 SULTANAS RD, HOMELAND | 25 | 29 |
| RIVERSIDE FIRE DEPT FIRE STNS, 25954 STANFRD, HEMET | 15 | 27 |
| RIVERSIDE FIRE, 36850 STETSON AVE, HEMET | 15 | 26 |
| RIVERSIDE FIRE DEPT FIRE STNS, 37381 SAGE RD HEMET | 27 | 38 |
| RIVERSIDE FIRE, 44422 SAGE RD, AGUANGA | 47 | 50 |
| RIVERSIDE FIRE DEPT FIRE STNS, 56560 HWY 371, ANZA | 36 | 30 |
| RIVERSIDE FIRE DEPT FIRE STNS, 59200 MORRIS RANCH RD, MOUNTAIN CENTER | 51 | 17 |
| RIVERSIDE FIRE DEPT GLEN AVON, 10400 SAN SEVAINE WAY, MIRA LOMA | 43 | 24 |
| RIVERSIDE FIRE DEPT LAKE HILLS, 17452 LAKEPOINTE DR | 47 | 30 |
| RIVERSIDE FIRE, 9270 LIMONITE AVE, MIRA LOMA | 41 | 25 |
| RIVERSIDE FIRE DEPT PERRIS HDQ, 210 W SAN JACINTO | 31 | 28 |
| RIVERSIDE FIRE, RUBIDOUX F, 3590 RUBIDOUX BLVD | 24 | 17 |
| RIVERSIDE FIRE, 23770 SUNNYMEAD, MORENO VALLEY | 14 | 15 |

| | | |
|--|----|----|
| RIVERSIDE FIRE WEST RIVER, 7545 MISSION BLVD | 29 | 19 |
| RIVERSIDE FIRE WOODCREST, 17800 VAN BUREN BLVD | 31 | 23 |
| SAN JACINTO FIRE DEPARTMENT BU, 160 W 6TH ST | 8 | 19 |

4.7 Postfire Effects

Wildfires leave problems behind. An intense wildfire may destroy all vegetation; also, the organic material in the soil may be burned away or decompose into water-repellent substances that prevent water from percolating into the soil. As a result, even normal rainfall can cause exceptional erosion or flooding from a burned area; heavy rain can produce destructive debris flows.

In 1997, wildfires charred many areas of southern California, leaving them bare before the next winter's heavy El Niño rainfall. Of the 25 large southern California wildfires, ten produced debris flows after the first major winter storm, and flooding plagued eight other areas. Only four burn areas showed little erosion or runoff. This study has compiled digital databases to depict the relative importance of topography, vegetation conditions, and geologic engineering properties. These should be used to help mitigate post-fire debris flow hazards.

Fires can also hurt watersheds of Riverside County. The loss of ground-surface cover and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms. Erosion in turn impairs water quality.