# OIL AND GAS IN CALIFORNIA:

## WORKFORCE NEEDS ASSESSMENT

*for Production of the Monterey Formation*

MAY 2014

ECONOMIC AND POLICY ANALYSIS GROUP
Los Angeles County Economic Development Corporation

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## WORKFORCE NEEDS ASSESSMENT FOR PRODUCTION OF THE MONTEREY FORMATION

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The LAEDC Economic and Policy Analysis Group provides objective economic and policy research for public agencies and private firms. The group focuses on economic impact studies, regional industry analyses, economic forecasts and issue studies, particularly in workforce development, labor market analysis, transportation and infrastructure.

# Executive Summary

The San Joaquin Valley, a region in the Central Valley of California whose economic base has long been dependent on agricultural products and support activities, lies over the Monterey Shale formation, a vast oil reserve that is estimated to hold reserves three times those of the Bakken formation in North Dakota.

New or increased oil production activities are projected to add significant numbers of jobs to the Valley, many of which will be high-wage jobs suitable for candidates with a high school diploma and some directed training and which can be filled by residents of the Valley, a region that experiences persistently high rates of unemployment.

In this report, the Economic and Policy Analysis Group of the Los Angeles County Economic Development Corporation (LAEDC) conducts a workforce needs assessment of the San Joaquin Valley as it prepares for what may be an economic bonanza.

The findings of this report are as follows:

- With unemployment higher than the state and national averages, and educational attainment levels limiting the employment opportunities of residents, the prospect of increased or new production activity from the Monterey Shale formation is motivating thinking about preparing the resident workforce for the types of jobs that are projected to be added.
- A study conducted by Antonio Avalos and David Vera of California State University Fresno estimated that more than 195,000 jobs would be added in the San Joaquin Valley from an oil boom similar to that which North Dakota experienced.
- It is estimated that approximately 48,000 of these will be in construction and extraction occupations, 28,000 will be in transportation and material moving occupations and 26,000 will be in sales and office and administrative occupations.
- A number of programs currently offered in San Joaquin Valley are exemplary models of the types of programs that can be expanded to prepare the workforce for the industry, including the program offered by Taft Union High School Oil Technology Academy, a collaborative effort between the California Department of Education and local businesses, and PG&E facilitated programs.

- Other programs have been successfully introduced in other oil-producing states, including in Louisiana, Texas and North Dakota. Many involve collaboration between federal funding agencies such as the US Department of Labor and industry participants.

A summary of the potential strategies and model programs targeting differentiated segments of the existing and potential workforce is shown below. ❖

Exhibit E-1
Workforce Development Programs and Target Groups

| Model Program / Applicable Legislation | Minors / Young Adults | | Other Adults | | |
|---|---|---|---|---|---|
| | High School Students | At-Risk Youth | Less than High School | With HS Diploma or GED | Dis-located Workers |
| Taft Union HS | ✓ | | | | |
| Louisiana Job Corps / CCC | | ✓ | | | |
| Kaplan College | | | | ✓ | ✓ |
| Junior Colleges / Trade Schools | | | | ✓ | ✓ |
| TAACCCT | | | | ✓ | ✓ |
| WIA | | | ✓ | ✓ | ✓ |

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# 1 Introduction

The oil and gas industry has proven itself to be valuable to the California economy. Domestic extraction, production, refining and petroleum products manufacturing result in highly tradable products that are both consumed domestically and exported to satisfy global demand. As a result, the oil and gas industry is associated with high revenues, stable employment and high wage jobs.

The industry operates in close geographic proximity to wherever reserves are found—often in rural areas that face challenges in attracting and sustaining other industries. Employment opportunities provided by the industry and its related activities are often especially valued since their wages are typically higher than average wages in other industries.

The San Joaquin Valley, an area spanning eight counties in the Central Valley of California, lies over the Lower Monterey Shale formation, which together with the related Santos formation marks the nation's largest shale oil play.

While production activity from the Monterey Shale has occurred since the late 19th century, development of more sophisticated extraction techniques have enabled increased well production and lower extraction costs, making production from the Monterey Shale profitable and drawing considerable interest in future extraction activity.

The prospect of widespread production brings with it the prospect for job growth in a region that suffers from persistently high unemployment rates, lower levels of educational attainment and significant numbers of residents living below the poverty level.

Such job growth would not be limited to the oil and gas industry itself, as any increase in production will necessarily multiply across a wide range of industries, generating new employment opportunities for residents at all skill levels.

In this report, the Economic and Policy Analysis Group of the Los Angeles County Economic Development Corporation (LAEDC) conducts a workforce needs assessment for the San Joaquin Valley associated with potential increased production activity from the Monterey Shale formation. The report is presented in three parts.

Section 2 provides a demographic and labor force overview of the San Joaquin Valley, including current industry employment and occupational distribution to provide a baseline of existing conditions in the region.

Section 3 catalogs existing training and education programs related to the oil and gas industry, identifying several best practice programs underway elsewhere with potential for implementation in the San Joaquin Valley to help meet anticipated workforce needs.

Section 4 estimates projected workforce needs in the San Joaquin Valley, using forecasted employment gains produced by a study conducted by California State University Fresno in 2013, under a scenario of production growth similar to that observed in North Dakota's Bakken formation.

Using these projections as a backdrop, Section 4 also details occupations directly associated with the industry and provides a roadmap for cross-occupational and cross-industry workforce development. ❖

# 2 The San Joaquin Valley Labor Market Today

The San Joaquin Valley spans eight counties in the Central Valley of California, as shown in Exhibit 2-1. The area has a rich and diverse population with a wide range of skills and a wide industry base.

However, the Valley also faces several challenges that affect its workforce and economy, including persistently high levels of unemployment, low levels of educational attainment, low wages and significant numbers of residents living in poverty.

To assess the projected workforce needs of increased oil production activity, current conditions of the regional labor market are evaluated. Labor markets in any region are composed of two components parts: the supply of labor and the demand for labor. These are reviewed below.

## Labor Supply Conditions

The supply of labor is essentially determined by the characteristics of the resident population as well as of workers within commuting distance. Exhibit 2-2 displays selected demographic characteristics of the San Joaquin Valley in 2012, the latest year for which this data is available.

Exhibit 2-2
Demographic Characteristics 2012
San Joaquin Valley

| | |
|---|---|
| Total Population | 4,046,255 |
| Working age population (25 to 64 years) | 1,986,733 |
| *Share of working age population (%)* | *49.1* |
| | |
| Veteran population (18 years +) | 190,660 |
| Individuals below poverty level | 432,086 |
| *Individual poverty rate (%)* | *10.7* |
| | |
| Total households | 1,221,981 |
| Households below poverty level | 253,423 |
| *Household poverty rate (%)* | *20.7* |

Source: US Census Bureau, 2012 ACS 1-year estimates

Home to more than 4 million residents and 1.2 million households, the San Joaquin Valley represents more than 10 percent of the state overall, and is comparable to the combined population of San Diego and Orange counties.

Exhibit 2-1
San Joaquin Valley


Source: ESRI

With more than 20 percent of all households living below the poverty level at some point during the prior year and an individual poverty rate of almost 11 percent, the San Joaquin Valley appears in need of improved employment opportunities and stands to benefit from the potential job growth stemming from increased production from the Monterey Shale.

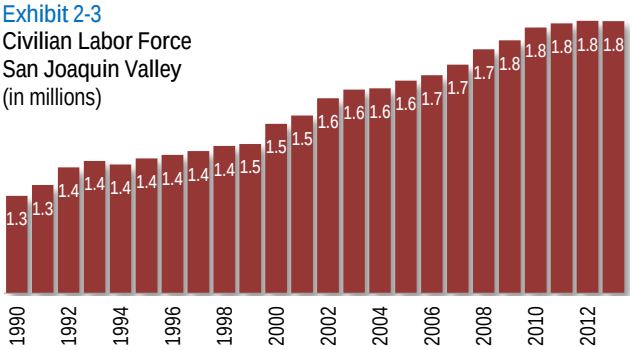
### *The Labor Force*

The supply of labor is dependent on the size of the population and on the percentage of that population that is willing and able to work. The labor force is the population of working-aged individuals (16 years and older) in an area who are currently employed or who are unemployed but still actively seeking work.

The California Employment Development Department (EDD) estimates the labor force in the San Joaquin Valley to be 1.8 million in 2013. The size of the labor force in the San Joaquin Valley from 1990 through 2012 is shown

in Exhibit 2-3. Since 2009, the size of the labor force in the San Joaquin Valley has hovered around 1.8 million.

Exhibit 2-3
Civilian Labor Force
San Joaquin Valley
(in millions)




Source: CA EDD

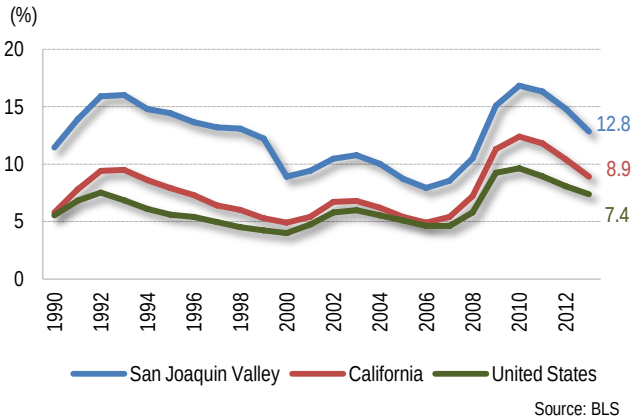
Individuals not actively looking for work are not counted as part of the labor force. These include students, retirees, institutionalized individuals, stay-at-home parents and discouraged workers, who have looked for a job in the past year, but stopped as a result of actual or perceived poor prospects.

## *Unemployment*

The unemployment rate measures the number of individuals who are unemployed and actively seeking work as a share of the total labor force.

The annual unemployment rate for the San Joaquin Valley from 1990 through 2013 is shown in Exhibit 2-4, compared to California and the US.

Exhibit 2-4
Unemployment Rates




Source: BLS

The unemployment rate in the Valley has been higher than that for the state and the nation for the entire period shown. From its lowest level at 7.9 percent in 2006, the unemployment rate in the Valley increased as a result of the Great Recession, reaching a peak of 16.8 percent in 2010. Since then, it has been on a downward trend and currently stands at 12.8 percent, still almost 4 percentage points higher than the state unemployment rate and almost 5.5 percent points higher than the national rate.

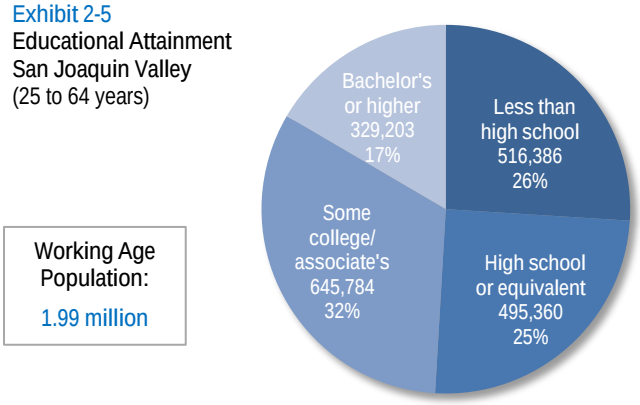
As the economy continues to improve, those discouraged and marginally-attached workers who previously left the labor force may return. Although this can negatively impact the unemployment rate, over the longer term it will lead to improved economic activity.

## *Educational Attainment*

Educational attainment is the highest level of education that individuals have achieved, and is considered to be one of the most important factors determining the economic well-being of a region. Areas with high rates of low educational attainment usually face challenges such as higher rates of unemployment and poverty and will therefore use higher levels of public services and resources.

There were almost 2 million residents aged 25 to 64 years in the San Joaquin Valley in 2012. Educational attainment of these working age individuals is shown in Exhibit 2-5.

Exhibit 2-5
Educational Attainment
San Joaquin Valley
(25 to 64 years)




Source: US Census Bureau, 2012 ACS 1-year estimates

More than 25 percent of residents in this age group have not earned a high school diploma (or equivalent) while additional 25 percent have graduated high school but have no other education. Only 17 percent of residents have earned a bachelor's degree or higher.

Data for the educational attainment of unemployed individuals as well as those not a part of the labor force in the San Joaquin Valley is shown in Exhibit 2-6.

Exhibit 2-6
Educational Attainment of the Non-Working
San Joaquin Valley 2012

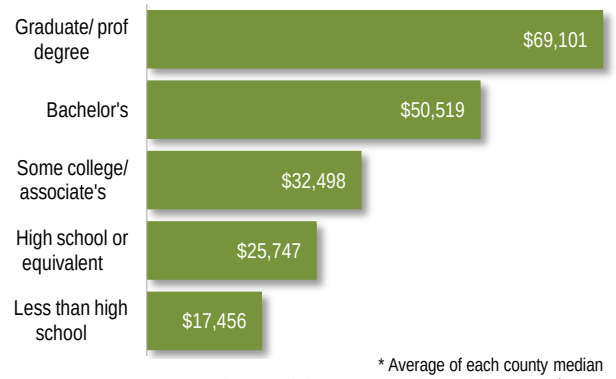
| | Population aged 25 to 64 years | |
|---|---|---|
| Educational Attainment | Unemployed | Not in Labor Force |
| Less than high school | 57,021 | 185,471 |
| High school or equivalent | 55,243 | 149,371 |
| Some college / AA | 56,499 | 165,099 |
| BA or higher / professional | 14,968 | 54,103 |
| TOTAL | 183,730 | 554,040 |

Source: US Census Bureau, 2012 ACS 1-year estimates

Approximately 60 percent of working age individuals (25 to 64 years) who are unemployed and actively seeking work in the Valley have a high school education (or equivalent) or less. Unemployed individuals who have earned a bachelor's degree or higher represent only eight percent of the cohort, suggesting this segment is the least vulnerable to employment interruption.

Exhibit 2-7 shows the median earnings by educational attainment for the population aged 25 years and over with earnings in 2012.

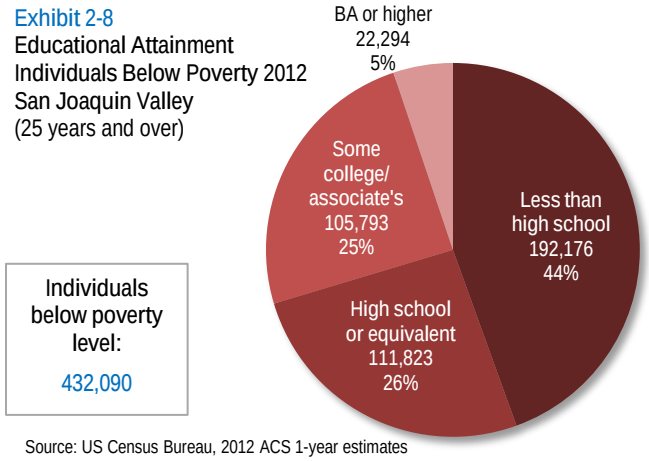
Exhibit 2-7
Earnings by Educational Attainment ($2012)
San Joaquin Valley
(25 years and over)




* Average of each county median
Source: US Census Bureau, 2012 ACS 1-year estimates

Since the correlation between educational attainment and earnings is evidently quite strong, the educational attainment of Valley residents living below the poverty level (including those who are working) would be expected to be weighted more heavily on the low end of the scale. The distribution of this population is shown in Exhibit 2-8.

Exhibit 2-8
Educational Attainment
Individuals Below Poverty 2012
San Joaquin Valley
(25 years and over)




Source: US Census Bureau, 2012 ACS 1-year estimates

Individuals with an education level of high school or less comprise 70 percent of those in this age group living below the poverty level, the majority of which (nearly 45 percent of the total) do not have a high school diploma (or equivalent). Those who have graduated high school but have no other education and those with some college or an Associate's degree each represent another 25 percent of individuals below poverty. Only 5 percent of individuals living in poverty have a bachelor's degree or higher.

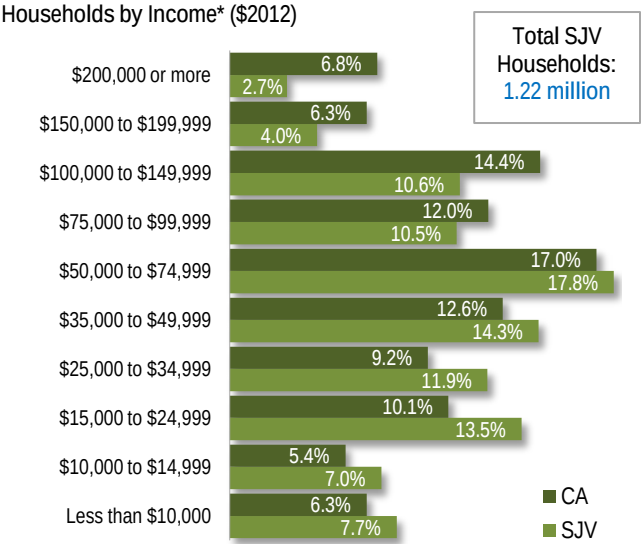
## *Income*

Largely as a consequence of lower levels of educational attainment of residents and the lack of high-paying jobs for these workers, per capita income in the San Joaquin Valley, estimated to be $20,550, is almost 28 percent lower than the California per capita income of $28,340.

Household income is a measure of all income (including non-job-related income such as transfer payments) for all members of the household, and includes the value of benefits. Median household income, the midpoint value of all household income levels within an area, in the San Joaquin Valley in 2012 was estimated to be $47,350, approximately 19 percent lower than the California median.

Exhibit 2-9 shows distribution of household income in the San Joaquin Valley and in the state of California.

Exhibit 2-9
Households by Income* ($2012)




Source: US Census Bureau, 2012 ACS, 1-year estimates

Over half of all households in the San Joaquin Valley earn less than $50,000 per year, and only 6.7 percent earn over $150,000 per year, compared to more than 13 percent of all households in the state.

The larger gap in per capita income than in household income between the Valley and the state implies that households are larger in the San Joaquin Valley than in the state overall. ❖

## Labor Demand Conditions

The other side of the labor market is demand for labor. The regional demand for labor is determined by current and projected industry needs and their occupational characteristics.

### *Current Industry Employment*

Current employment is evidence of existing demand for labor. This can be viewed through two prisms: the need for workers of all occupational types by businesses within separate industries, and the need for workers of specific occupational types across all industries. The industrial distribution of employment in the San Joaquin Valley in 2012 is shown in the Exhibit 2-10.

Exhibit 2-10
Industrial Profile
San Joaquin Valley 2012

| | Employment | Share of Total (%) | Annual Ave Wage |
|---|---|---|---|
| Ag, forestry, fish & hunting | 194,470 | 14.5 | $ 24,376 |
| Mining | 15,080 | 1.1 | 82,700 |
| Utilities | 53,630 | 4.0 | 48,882 |
| Construction | 98,240 | 7.3 | 47,987 |
| Manufacturing | 6,740 | 0.5 | 95,212 |
| Wholesale trade | 47,966 | 3.6 | 50,573 |
| Retail trade | 133,970 | 10.0 | 26,901 |
| Transportation & warehousing | 43,530 | 3.2 | 43,659 |
| Information | 11,730 | 0.9 | 58,522 |
| Finance & insurance | 26,950 | 2.0 | 54,286 |
| Real estate & rental | 14,800 | 1.1 | 36,624 |
| Professional, scientific technical | 34,810 | 2.6 | 52,849 |
| Management of companies | 11,080 | 0.8 | 68,318 |
| Administrative & waste services | 56,630 | 4.2 | 28,783 |
| Educational services | 17,740 | 1.3 | 35,187 |
| Health & social services | 131,280 | 9.8 | 50,183 |
| Arts, entertainment & recreation | 13,100 | 1.0 | 17,616 |
| Accommodation & food services | 88,640 | 6.6 | 14,870 |
| Other services | 66,040 | 4.9 | 25,577 |
| Government | 274,740 | 20.5 | 48,088 |
| TOTAL | 1,308,270 | 100.0 | $ 22,176 |

Source: CA EDD

The government sector (including local, state and federal agencies) is the largest industry by employment, accounting for approximately 21 percent of all jobs in the San Joaquin Valley in 2012.

The Valley has a significant farm industry, with almost 15 percent of area employment in the agriculture, forestry, fishing and hunting industry sector.

Retail trade is the third largest industry sector by employment, accounting for 10 percent of all jobs in the area followed by health and social services, construction and accommodation and food services.

Large industry sectors shown in Exhibit 2-10 can be disaggregated into their component industries, providing a more detailed picture of employment patterns. Exhibit 2-11 shows the 30 largest industries in the San Joaquin Valley as measured by employment in 2012.

As noted above, government was the largest provider of jobs in the region in 2012. Of the three levels of government, local government was the largest, supplying more than 185,000 jobs. Most of these jobs are involved in public education.

Exhibit 2-11
Industry Employment
San Joaquin Valley 2012

| NAICS | Industry Description | Jobs | Annual Ave Wage |
|---|---|---|---|
| 93300 | Local government | 185,127 | $ 46,616 |
| 11511 | Support for crop production | 111,370 | 21,213 |
| 72251 | Restaurants | 78,908 | 14,518 |
| 11133 | Non-citrus fruit and tree nut farming | 37,678 | 25,673 |
| 62211 | General and surgical hospitals | 36,743 | 63,477 |
| 93200 | State government | 32,302 | 54,738 |
| 93100 | Federal government | 28,856 | 64,214 |
| 45211 | Department stores | 23,647 | 19,256 |
| 44511 | Supermarkets / grocery | 23,030 | 27,399 |
| 62111 | Offices of physicians | 22,586 | 71,650 |
| 56132 | Temporary help services | 19,625 | 23,835 |
| 11212 | Dairy cattle & milk production | 15,272 | 31,593 |
| 62311 | Nursing care facilities | 13,019 | 29,605 |
| 31161 | Animal slaughtering / processing | 11,589 | 32,463 |
| 55111 | Mgmt of companies / enterprises | 10,700 | 69,865 |
| 49311 | General warehousing / storage | 10,363 | 43,543 |
| 31142 | Fruit / veg canning, pickling, etc. | 10,253 | 42,029 |
| 11121 | Vegetable / melon farming | 10,142 | 33,657 |
| 62121 | Offices of dentists | 8,815 | 42,764 |
| 21311 | Support activities for mining | 8,488 | 76,331 |
| 44111 | New car dealers | 8,078 | 48,239 |
| 62149 | Other outpatient care | 8,022 | 91,423 |
| 48412 | Gen freight trucking, long-distance | 7,511 | 43,874 |
| 44611 | Pharmacies / drug stores | 7,428 | 41,002 |
| 31151 | Dairy product mfg (not frozen) | 7,133 | 57,171 |
| 52211 | Commercial banking | 7,032 | 51,620 |
| 44411 | Home centers | 7,018 | 24,388 |
| 72111 | Hotels (not casino hotels) / motels | 6,679 | 17,974 |
| 48422 | Specialized trucking (no used gds) | 6,591 | 48,135 |
| 62331 | Community care facilities for elderly | 6,587 | 21,991 |
| | *Other industries* | *537,675* | *38,893* |
| TOTAL All Industries | | 1,308,270 | $ 22,176 |

Source: CA EDD

The largest private sector industry in terms of employment was support for crop production, providing 111,370 jobs. Reflecting the importance of agricultural production in the region, this industry includes such activities as cotton ginning, soil preparation, planting and cultivating, crop harvesting, postharvest crop activities, farm laborand farm management services.

The second largest private sector industry was restaurants, providing 78,908 jobs. This industry includes full-service restaurants, fast food outlets, snack bars and nonalcoholic drinking establishments, and is typically one of the largest industries in any region since it serves local populations.

Other significant private sector industries in the area include non-citrus fruit and tree nut farming, general

and surgical hospitals, department stores and supermarkets, offices of physicians and temporary help services, together providing more than 163,300 jobs.

## *Current Occupational Profile*

Occupations are commonly classified using the Standard Occupational Classification (SOC) system developed by the Bureau of Labor Statistics that sorts all workers into one of 840 detailed occupations with similar job duties, skills, education and training. These detailed occupations are not industry-specific but are common to many industries. For example, retail salespersons are employed in a full spectrum of industries.

Detailed occupations are aggregated into 23 major groups, which include broad descriptive categories such as production occupations, management occupations and business and financial operations occupations.

The occupational profile of the San Joaquin Valley is shown in Exhibit 2-12, with the median wage earned in California for each occupational group. These are the current occupations of workers holding jobs located in the Valley.

Because the survey period differs from the employment data in Exhibits 2-10 and 2-11, total employment numbers are not equal.

Exhibit 2-12
Occupational Profile
San Joaquin Valley 2013

| SOC | Occupational Group | Jobs | % of Total | Median Wage |
|---|---|---|---|---|
| 11-0000 | Management occupations | 48,760 | 3.9 | $ 108,920 |
| 13-0000 | Business / financial | 40,010 | 3.2 | 70,030 |
| 15-0000 | Computer / mathematical | 12,560 | 1.0 | 91,420 |
| 17-0000 | Architecture / engineering | 14,070 | 1.1 | 89,950 |
| 19-0000 | Life, physical, social science | 9,970 | 0.8 | 73,860 |
| 21-0000 | Community / social services | 24,270 | 2.0 | 46,240 |
| 23-0000 | Legal occupations | 5,220 | 0.4 | 97,930 |
| 25-0000 | Education, training / library | 96,310 | 7.8 | 52,120 |
| 27-0000 | Arts, entertainment, sports | 9,220 | 0.7 | 56,450 |
| 29-0000 | Healthcare practitioners | 64,070 | 5.2 | 81,340 |
| 31-0000 | Healthcare support | 31,870 | 2.6 | 30,640 |
| 33-0000 | Protective services | 35,280 | 2.8 | 43,130 |
| 35-0000 | Food preparation & serving | 98,320 | 7.9 | 19,490 |
| 37-0000 | Building /grounds maintnce | 34,390 | 2.8 | 24,680 |
| 39-0000 | Personal care & service | 27,280 | 2.2 | 22,570 |
| 41-0000 | Sales & related | 118,350 | 9.5 | 28,330 |
| 43-0000 | Office & administrative | 178,630 | 14.4 | 36,050 |
| 45-0000 | Farming, fishing & forestry | 118,410 | 9.5 | 18,640 |
| 47-0000 | Construction & extraction | 46,050 | 3.7 | 51,090 |
| 49-0000 | Installation, maint / repair | 48,700 | 3.9 | 46,000 |
| 51-0000 | Production | 71,070 | 5.7 | 29,290 |
| 53-0000 | Transport'n/ material moving | 107,180 | 8.6 | 28,860 |
| TOTAL | | 1,239,990 | 100.0 | $ 38,920 |

Source: BLS

The largest occupational group is office and administrative support, accounting for 14.4 percent of all jobs in the Valley. This is followed by farming, fishing and forestry occupations and sales and related occupations, each accounting for approximately 9.5 percent. The fourth largest occupational group, transportation and material moving occupations, accounted for 8.6 percent of all jobs.

Healthcare occupations, including practitioners and healthcare support occupations, accounted for 7.7 percent of jobs in the San Joaquin Valley.

Blue-collar occupations, such as those in farming, fishing and forestry, construction, mining, protective services, production and transportation, account for over a third (34.3 percent) of all jobs, a measure of how important these sectors are to the Valley's economy.

There is a wide diversity of occupations within each occupational group, representing a variety of detailed occupations that are employed across many industries. The thirty largest detailed occupations by employment in the San Joaquin Valley are displayed in Exhibit 2-13.

Exhibit 2-13
Occupational Detail
San Joaquin Valley 2013

| SOC | Occupational Group | Jobs | Median Wage |
|---|---|---|---|
| 45-2092 | Farmworkers / laborers | 101,950 | $ 18,510 |
| 41-2031 | Retail salespersons | 36,900 | 22,230 |
| 41-2011 | Cashiers | 34,770 | 20,600 |
| 53-7062 | Laborers / freight movers, hand | 28,310 | 23,950 |
| 35-3021 | Food prep / serving workers | 28,230 | 19,020 |
| 53-3032 | Heavy / tractor-trailer truck drivers | 23,350 | 40,460 |
| 43-9061 | Office clerks, general | 21,370 | 31,310 |
| 29-1141 | Registered nurses | 20,660 | 94,310 |
| 43-5081 | Stock clerks / order fillers | 17,990 | 23,560 |
| 11-1021 | General / operations managers | 16,660 | 104,460 |
| 25-2021 | Elementary teachers (not special ed) | 16,300 | 70,440 |
| 43-6014 | Secretaries / admin assts | 15,900 | 36,950 |
| 37-2011 | Janitors / cleaners (not maids) | 15,630 | 24,160 |
| 25-9041 | Teacher assistants | 15,370 | 29,280 |
| 35-3031 | Waiters / waitresses | 14,200 | 18,920 |
| 43-3031 | Bookkeeping / accounting clerks | 13,590 | 40,430 |
| 53-7064 | Packers / packagers, hand | 12,030 | 19,630 |
| 43-1011 | First-line sups, office / admin workers | 11,430 | 55,140 |
| 49-9071 | Maintenance / repair workers | 11,330 | 38,590 |
| 43-4051 | Customer service representatives | 11,240 | 36,490 |
| 41-1011 | First-line sups, retail sales workers | 11,070 | 39,560 |
| 25-3098 | Substitute teachers | 10,170 | 37,750 |
| 25-2031 | Secondary teachers (not spec/tech) | 10,160 | 69,030 |
| 35-2011 | Cooks, fast food | 10,020 | 18,890 |
| 31-1014 | Nursing assistants | 9,760 | 28,210 |
| 45-2041 | Graders / sorters, agricultural prods | 9,240 | 18,580 |
| 53-7051 | Industrial truck / tractor operators | 8,700 | 33,010 |
| 41-4012 | Sales reps (not tech prods) | 8,530 | 53,730 |
| 51-9111 | Package/ filling machine operators | 8,530 | 24,620 |
| 35-2021 | Food preparation workers | 8,200 | 19,550 |
| | *Other Occupations* | *678,400* | |
| TOTAL All Occupations | | 1,239,990 | $ 38,920 |

Source: BLS

Agriculture plays a large role in the San Joaquin Valley economy as evidenced by its sizeable share of total employment. Two of the largest detailed occupations are agricultural occupations. The largest—crop, nursery and greenhouse farmworkers and laborers—accounts for more than eight percent of total occupational employment in the area with 101,950 jobs in 2013.

The annual median wage in each of the largest five detailed occupation is less than $25,000 per year. These jobs account for almost 20 percent of San Joaquin Valley total occupational employment. ❖

# The Oil and Gas Industry in the San Joaquin Valley

The oil and gas industry has proven itself to be valuable to the California economy in that its employment has been more stable than other private industries as a whole. While it does react to contractions in the economy, the magnitude of these reactions are milder than those experienced by other private industries and employment in the industry has been marked by relative stability.

The industry is also attractive in terms of its relatively high wages, as shown in Exhibit 2-14. With the exception of fuel dealers, wages in each of the component industries listed exceed the average annual private sector wage in the state.

Exhibit 2-14
Oil and Gas Industry Wages
California 2012

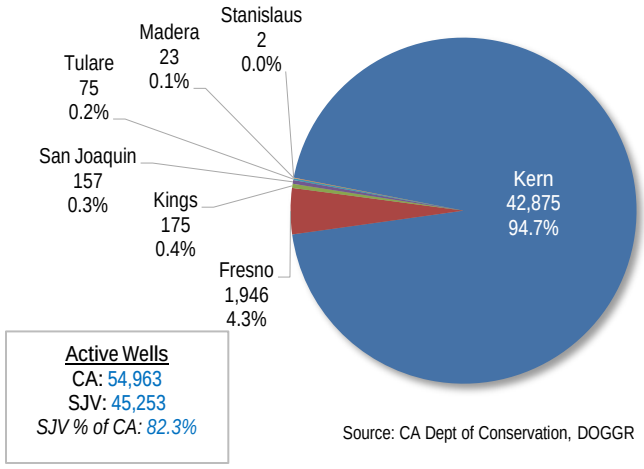
| NAICS | Industry | Ave Annual Wage |
|---|---|---|
| 211 | Oil and gas extraction | $ 235,946 |
| 213111 | Drilling oil and gas wells | 93,731 |
| 213112 | Support activities for oil and gas operations | 80,390 |
| 2212 | Natural gas distribution | 111,009 |
| 23712 | Oil and gas pipeline construction | 66,364 |
| 32411 | Petroleum refineries | 185,488 |
| 324191 | Petroleum lubricating oil and grease mfg | 65,693 |
| 333132 | Oil and gas field machinery and eqmt mfg | 74,610 |
| 4247 | Petroleum and petroleum prods wholesalers | 74,970 |
| 45431 | Fuel dealers | 47,946 |
| 486 | Pipeline transportation | 101,326 |
| Oil and Gas Industry | | $ 118,643 |
| All other private industries | | 55,830 |
| All private industries in CA | | $ 56,295 |

Note: Excludes non-employers and independent contractors
Source: CA EDD; Estimates by LAEDC

Production activity occurs across the state, but the majority is located in the Central Valley/Northern California sub-region. Approximately 78 percent of all active wells are in Kern County, which accounts for almost 72 percent of oil production and more than 63 percent of all gas production in the state.

Exhibit 2-15 displays the distribution of the 45,253 wells in the San Joaquin Valley by county.

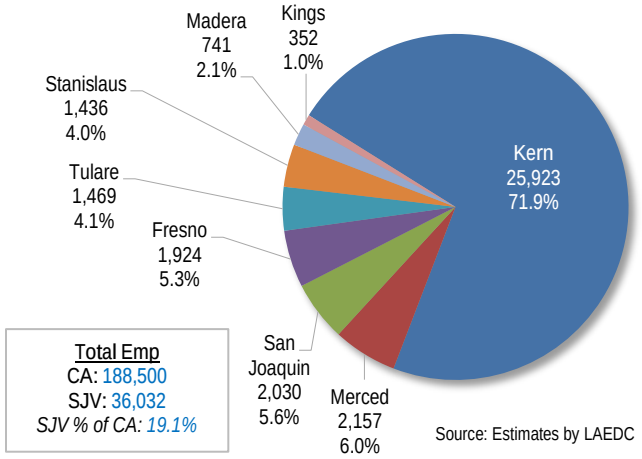
Exhibit 2-15
Active Wells in SJV by County 2012




Source: CA Dept of Conservation, DOGGR

Employment in oil and gas extraction, well drilling and support activities for oil and gas operations are related to the concentration of well activity and consequently is mostly found in Kern County. Distribution of employment by county in the San Joaquin Valley is shown in Exhibit 2-16.

Exhibit 2-16
Direct Oil and Gas Employment in SJV 2012




Source: Estimates by LAEDC

More than 19 percent of all state employment in the oil and gas industry occurs in the San Joaquin Valley. Much of this involved in drilling and extraction activities, pipeline construction and oilfield support activities.

Although Merced has no active wells within its county borders, almost 2,160 county residents work in the industry, many of whom are employed in extraction activities in neighboring counties. ❖

# 3 Training Programs for the Oil and Gas Industry Workforce

The oil and gas industry is characterized by a bimodal distribution of occupational skills. At one end of the distribution lie high-skilled, highly-educated petroleum and geophysical engineers and finance and business managers. At the other end of the distribution are construction and extraction workers and transportation workers—who may also be highly-skilled but who are less likely to be at the top end of the educational attainment ladder.

As the industry grows, its need for workers in both categories will intensify. However, the highly-educated occupations are more likely to be filled by candidates from anywhere in the nation, while other occupations will be filled by local residents who may be moving from another job (or occupation) or transitioning out of unemployment. Many of these new candidates may need training or skills upgrades specific to the industry. In recognition of existing training needs, there are several programs currently available in the San Joaquin Valley, which are reviewed here.

## Current Training Programs

Entry-level and lower-skilled jobs associated with the oil and gas industry traditionally have two tiers of training, both of which are primarily on-the-job. For example, positions such as derrick operators and roustabouts require as little as a few days or a few months of training, whereas other positions, such as unit operators or rotary drill operators, may require up to a year of working alongside an experienced employee, or completion of a recognized apprenticeship program.

For positions such as these, educational attainment has little to do with job preparedness. Rather, most jobs call for candidates with a high school diploma (or equivalent), and the educational attainment of a majority of low-skilled oil workers is less than or equal to such qualifications. This implies that employers are more likely to value transferable skills and experience than educational attainment for such positions.

In recent years, trade school and technical programs have started to form in and around areas of heavy extraction activity. These programs aim to reduce the time spent training on-the-job and create an occupation-ready workforce.

California currently hosts myriad vocational and technical schools, trade-based community college programs and employment-ready high school programs. The majority of these institutions focus on nursing and medical technology, criminal justice and paralegal, business and information technology. Although few oilfield-specific programs exist, many industrial technology programs are offered, which could be expanded to include oilfield topics and exercises.

At the high school level, four institutions in three counties of the San Joaquin Valley offer oilfield trade programs which aim to prepare students for direct employment or college-level education in the oil and gas industry. Kern County, as the highest producing county in the San Joaquin Valley, offers the only oilfield-specific training program at an adult educational institution in the entire region. ❖

# High School Training Programs in the San Joaquin Valley

It is important to note that low-skilled and entry-level oilfield occupations often do not require post-high school education. Hence applicable programs that exist in high school bring the potential workforce up to minimum qualifications by allowing students to earn their high school diploma while giving them a competitive edge and an ability to circumvent further training. This model expedites the training and hiring process and may assist in lowering unemployment among the youth. The following case studies provide examples of current exemplary programs.

## CASE STUDY 1:
## Taft Union High School | Oil Technology Academy

The City of Taft is an oil boom-town in Kern County, lying approximately 40 miles west of Bakersfield. As Standard Oil (now Chevron) slowly left Taft, the city fell into decline. Many of the city's residents had worked directly in oil-related occupations. As such, unemployment has been chronically above average.

In 2001, the Taft Union High School District collaborated with the California Department of Education and local businesses to create a first-of-its-kind petroleum career-based Oil Technology Academy at Taft Union High School. This program hoped to revitalize the Taft area by creating student interest in pursuing careers in the oil and gas industry. Education standards and requirements are set by the California Department of Education, and curriculum development is based on advice provided by university petroleum engineering departments and industry partners who sit on a steering committee for the academy. The California Department of Education provides grants for the program, which are then matched by local business partners either monetarily or with money in kind through program assistance. Local business partners often aid the program by supplying guest speakers, field trip destinations and volunteer events.

### *Admission and curriculum*

The program is designed to train students who either wish to enter the work force directly or continue on to college after high school. For this reason, courses are college preparatory, and consist of three periods of English, history, mathematics, or science. Fourth period classes are dedicated to the oil technology module. During each study unit, guest speakers from the industry are brought in to share their expertise and lead discussions about relevant issues. Prior to field trips, students must write a report detailing their research and current knowledge of the study topic. At the end of each unit, students attend field trips to working establishments that are provided by participating businesses. Following field trips, students must create and conduct PowerPoint presentations on the topic, and write follow-up reports and thank-you notes.

An influx of grant money allows for a student mentoring program by employees at local business partners which focuses largely on the business side of the oil industry, and teaches students self-marketing skills such as computer skills, resume writing, and public speaking. Throughout their education in the program, students are also encouraged to take on summer internships offered by local business partners.

In their freshman year, students must submit an application and undergo a screening and interview process before being admitted into the three year program. The program begins in their sophomore year with computer applications (including, for example, word processing, CAD, databases and presentation tools), careers, geology, exploration and drilling, engineering (such as a bridge building project) and alternative energy. Sophomore field trips have included visits to Occidental Petroleum's Elk Hills 3D visualization center and its control center, as well as one of the four Thums Islands drilling programs off the coast of Long Beach, California.

In their junior year, students study production, transportation and engineering. Here, a team project aims to present a formal debate on a controversial topic, such as hydraulic fracturing. Field trips have included visits to Aera Energy's steam injection production and water plant facilities and the San Joaquin Refinery at Bakersfield.

Senior year covers refining and environmental issues, and includes job shadowing one day each semester at an employer or academic area of the student's choosing. The last field trip has included a visit to Plains Exploration and Production Company's "Platform Irene," which is a production facility four miles off the coast of Santa Barbara. Seniors also become PASSPORT certified (industry safety, first aid, and CPR) during the year. Finally, seniors must compose a project that includes a written report, physical project and a final presentation.

***Placement results***

According to an October 2012 article in *Well Servicing Magazine*, over 300 students have graduated from the program between 2004 and 2012. Of these graduates, 66 percent continued their education at a college or technical school, 15 percent found jobs outside of the oil industry, 13 percent were employed directly in the oil industry and 6 percent joined the military.

***Lessons learned***

The Taft Union High School's Oil Technology Academy is a successful model for similar high school training programs. The program has been noticed by the American Association of Drilling Engineers (AADE), which has taken it on as the only high school in its Student Section (all other academic institutions here are colleges). Interested school district personnel from Oklahoma, Mississippi and Texas have used the academy as a model to build similar academies in their states.

Furthermore, the influence of this program can largely be seen in the efforts of other high school oil academies in California set up by Pacific Gas & Electric (PG&E), who joined with the California Department of Education to create five New Energy Academies in areas throughout the state. The company has pledged $1 million to make this program a success. All schools receive grants, customized workshops and access to education, as well as industry and government experts to assist in curriculum development. Each three-year program begins in sophomore year and ends in senior year, and each student who completes the three-year program in its entirety will receive $1,000.

Three of these programs exist within the San Joaquin Valley region, as described below.

## CASE STUDY 2:
## Edison High School, Fresno | Green Energy Program

Fresno's Edison High School is competitive due to its math, science, technology and engineering focus. The goals at this institution are to have 100 percent of its graduates accepted into a four-year university and be career-ready upon graduation. Rather than call its PG&E Program the New Energy Academy, it goes under the name The Green Energy Program, and focuses its curriculum on the highly-skilled side of the petroleum industry. Students in the program learn about the possibilities and difficulties of green energy sources such as nuclear, solar, wind, and hydroelectricity. However, even core courses have an element of green energy to them. The curriculum is hands-on, project-based, and requires productive teamwork in order to complete large tasks. Fresno's Edison High School received $100,000 from PG&E for classroom enhancement. Additionally, students also take part in overnight field trips and work with local partnering businesses.

## CASE STUDY 3:
## Independence High School, Bakersfield | New Energy Academy

The New Energy Academy program at Independence High School in Bakersfield is designed to bring together career technical education with academic curriculum in order to engage students in school-to-career pathways while maintaining A-G requirements. Here, students are trained for lower-skilled technical positions which PG&E have identified as being currently understaffed, such as: areas of instrumentation, automation, process control, and maintenance, fabrication of control systems, petroleum engineering and process control engineering. The school is partnered with the California Department of Education, PG&E, local industry partners and post-secondary educational institutions. The focus is on energy, environmental technology and utilities, and is not exclusively oil-related. Partnerships with local businesses provide field trips, mentoring, possible senior internships, and curriculum and lesson development. This particular program partners with twenty-four local businesses, including Berry Petroleum, Chevron, PG&E, and Robin's Enviroserv.

According to the school's website, the program requirements are similar to those in the Taft Union High School's Oil Technology Academy:

- Students meet A-G requirements, graduate at a rate higher than 90 percent, and are prepared for four-year colleges and universities.
- Students maintain a 90 percent or better attendance rate.
- Students complete integrated academic projects in math, English, science, and the career course related to energy, energy conservation, and/or energy technology.
- Students demonstrate employment knowledge from entry-level jobs to jobs needing advanced degrees.
- Students become involved in their community through projects, presentations, mentorships, internships, job shadowing and their CTE coursework.

### CASE STUDY 4:
### Venture Academy, Stockton | New Energy Academy

In Stockton, the Venture Academy (a charter school) offers its IMAGINEIT program to high school students, which emphasizes technology and career pathways through hands-on and project-based curriculum. Career focused courses (e.g. construction, welding, and design) are taught alongside core subjects. The school places a strong focus on conservation and green technology, and hosts the New Energy Academy. Here, the New Energy Academy aims to provide education on sustainability and perpetuating a "green economy" through a focus on real world applications of academic practices. ❖

## Post-Secondary, Trade School and Training Programs in the San Joaquin Valley

Though the Central Valley is home to many trade schools, technical institutes, community colleges, vocational schools, labor unions, colleges and universities, the opportunities for certification, training and apprenticeship in the oil and gas industry are largely found on the job.

Fresno and Kern counties are the primary sources of education and vocational training for the oil industry. Madera and San Joaquin counties lack any form of applicable educational facilities for the oil and gas industry. However, manufacturing and industrial technology programs can be found in almost every county in the San Joaquin Valley.

In Kern County, the Bakersfield campus of Kaplan College offers a Certificate of Completion (CC) course for Oil Field Operators. Students here learn about oil field equipment and instrumentation, systems involved in oil production, safety, health, and environmental standards, and professional development. This program is the most relevant to the oil and gas industry within the Central Valley.

Fresno plays host to two unions representing workers in the oil and gas industry with training and apprenticeship programs: the Fresno-Madera-Tulare-Kings CLC (which is an AFL-CIO affiliate) and the International Union for Operating Engineers Stationary Local 39. The former offers industrial operations apprenticeships, pipeline manufacturing training and machinist training, while the latter offers stationary engineers and boiler operators apprenticeships and training courses.

Community colleges and vocational schools within the Central Valley offer associate's degrees, certificates and courses in manufacturing and industrial technology fields. Manufacturing and industrial operations programs may not be directly applicable to the oil industry, but they may give prospective employees transferable skills and experience with heavy machinery, which may better prepare prospective oilfield employees for a job in the industry.

A complete list of the programs currently available in the San Joaquin Valley is presented in Exhibit A-1 in the Appendix. ❖

## Training Programs in Other Regions

As oil and gas producing states, North Dakota, Louisiana, and Texas have each created or used successful education and training models. While Louisiana combines high school education and oilfield training for at-risk and disadvantaged youth, Texas focuses on post-secondary courses at community colleges and universities. Similarly, North Dakota uses federally-funded grants for community college and trade adjustment assistance programs.

In September 2012, the US Department of Labor awarded $500 million to higher education institutions across the country under the Trade Adjustment Assistance Community College and Career Training grant program. This grant aims to expand programs in growing industries and to encourage geographic and

industry sector collaborations through the development of statewide and multistate college consortia.

Funds are provided to expand and improve the delivery of education and career training programs that can be completed in two years or less to workers eligible under the Trade Adjustment Assistance for Workers program, as well as other adults.

***Louisiana***

The Louisiana Job Corps Oilfield Training Program was created by the US Department of Labor in 1965 and applies to disadvantaged youth between the ages of sixteen and twenty-four. The program helps its members earn a high school diploma or GED, learn a trade, and find employment in the industry. Students can be trained in energy, welding, heavy equipment, and automotive technology. The program has an educational partnership with members of the oil and gas industry which allows it to train students in the basics of the industry and prepare them for entry-level positions. Part of this training includes the pursuit of certification for safety and operations, as well as internship opportunities. Students of this program are expected to be well-suited for the oil and gas industry, since their education and job training meet qualifications set out by companies in the industry.

***Texas***

As an oil-abundant state, Texas is home to a large number of education and training programs for prospective oil and gas industry workers. Technical colleges, as well as programs hosted at regional universities, offer in-class and hands-on training for broad or specialized aspects of the industry.

One such program is the Well Control Training Program at the University of Houston Victoria's (UHV) Petroleum Training Institute. UHV partners with the Petroleum College International to bring its curriculum and model to different areas of the state. Successful completion of this course results in a Certificate of Completion that is in accordance with the International Association of Drilling Contractors (IADC). The program conducts some training through a full-sized drilling and workover well simulator which provides hands-on learning.

Students at Texas' United High School's Oil and Gas Program are eligible for dual credit and course articulation with local community college courses.

***North Dakota***

In September 2013, the North Dakota Advanced Manufacturing Skills Training Initiative, led by North Dakota State College of Science, was awarded $2.7 million to invest in their advanced manufacturing program. The college is developing online modules so that full-time workers can earn a degree while maintaining employment. This program works with employers to incorporate on the job training as part of the course curriculum, while online theory courses reduce the time a worker must spend in the classroom.

The Training for Regional Energy in North Dakota (TREND) consortium consists of five community colleges that collaborate to address labor shortages in the state's energy sector by offering post-secondary certificate and credential programs that pursue the following strategies: to help students find jobs in oil and gas, transportation and building and construction trades in North Dakota; to support more flexible and technology-enabled learning; and to increase retention and placement through additional support services and career navigation. The Department of Labor is funding an integration and impact evaluation of TREND that will run through 2016.

North Dakota has also secured federal funding from the Department of Labor under the Workforce investment Act (WIA). WIA provides training assistance to low-income persons, welfare recipients and dislocated workers. In July 2012, the US Department of Labor awarded the $2 million "SkillBuildND" (SBND) grant to Job Search North Dakota under WIA. The purpose of SBND was to train unemployed, underemployed and dislocated Native Americans and veterans in construction and oil-related occupations. Between July 2012 and December 2013, SBND funded training for 211 individuals, some of whom also received compensation for transportation, food and lodging in order to maintain their occupation in an oil-related field. SBND also provides a job search interface that allows employment-seekers to search for oilfield apprenticeships and jobs that do not require previous experience in the industry.

North Dakota's Bismarck State College has teamed with community colleges in and outside of the area to allow for articulation of oil specific community college programs into their corresponding university degree programs. The National Energy Center of Excellence at Bismarck State College offers specialty technical programs online and in the classroom.

***Other Programs***

Lufkin Industries, an oilfield machinery manufacturing company, offers its customers instructor-led training courses on the operation of its products. These courses range in complexity from beginner to seasoned professional. Many other private companies offer safety training courses that follow the guidelines of OSHA, the American Petroleum Institute and the IADC.

OSHA itself offers many 10-, 30-, or 40-hour safety training courses that directly or indirectly apply to oilfield occupational hazards. Community colleges and private institutions host these courses, which are offered in the classroom or on-site. The IADC also provides training programs specific to oilfield occupations. ❖

## Training Strategy for Projected Industry Workforce Needs

In the San Joaquin Valley, there are several trade schools and post-secondary institutions providing educational and training services to regional residents, though many of them do not have programs specifically related to oilfield operations. Fresno, Kern, Kings, Merced, Stanislaus and Tulare counties each have some form of oilfield- or industrial technology-related educational or training programs offered by unions, trade schools, and/or post-secondary institutions. Madera and San Joaquin counties currently do not have oilfield, manufacturing or industrial technology programs.

Still, the San Joaquin Valley region overall will be largely underserved with the expansion of the oil and gas industry and the need for additional workers with occupational skills outlined in the following section.

***Capacity***

Existing oilfield programs in the state could conceivably be expanded and be used as a model for implementation of new programs in underserved counties. In addition, California could look to the experience of states such as Texas, Louisiana and North Dakota that have successfully leveraged federal and private funding to enlarge the scope and scale of their own educational modules and training programs. The infrastructure for much of this potential growth is largely already in place in California. For example, high schools, trade schools and post-secondary institutions are well-equipped to create and/or expand oilfield learning and training programs.

There is also a great deal of overlap in terms of campuses within the San Joaquin Valley. Many individual institutions host campuses in multiple counties. This institutional familiarity between counties could allow for the implementation of relevant programs in multiple communities. For example, Kaplan College's Bakersfield campus hosts the only post-secondary oilfield training program in the San Joaquin Valley. Graduates of this Oil Field Operations Course have directly applicable skills and experience in the field and earn a certificate of completion (CC). Since the course model and curriculum are already in place, its implementation in Kaplan College's Fresno and Modesto campuses could be easily replicated. Similarly, the manufacturing program at Fresno's Reedley College could be augmented to incorporate oilfield topics and be offered in its Clovis and Madera satellite locations.

The San Joaquin Valley College offers its Industrial Technology program in Fresno, Kern, Kings, Stanislaus and Tulare counties. By supplementing this program with course content relevant to oilfield operations, it can be standardized and distributed to each regional campus. Such an initiative would be an efficient use of existing infrastructure.

Targeting the youth is crucial to developing a robust workforce, especially for the oil and gas industry. Low-skilled occupations in the industry require workers to be physically fit and able to withstand long hours and harsh conditions. Additionally, individuals in this age range are more likely to be unemployed with limited job prospects and would benefit from exposure to specific industry

and career-track training. Moreover, it is becoming increasingly important among employers that workers have a high school diploma (or equivalent) and some form of transferable skills or prior training.

The Taft Union High School's Oil Technology Academy and PG&E's New Energy Academy can be used as models for high school oilfield programs that would create a subset of oilfield employment-ready youth.

Similar to Louisiana's Job Corps, the California Conservation Corps (CCC) is a program developed for disadvantaged or at-risk youth between the ages of 16 and 24. The CCC provides its members with the opportunities to earn a high school diploma, a GED certificate and class B or C driver's license while preparing them to enter the workforce. As the name suggests, the CCC focuses on conservation efforts (such as, for example, forestry, trail building and trail maintenance) and may not initially be open to expanding its program into oilfields. However, one such center, already well-established in Fresno, could use the Louisiana Job Corps Oilfield Training Program as a template to build upon. Partnerships with local businesses and increased governmental funding could be used to incentivize the CCC into developing such a program.

***Funding and partnerships***

Funding for the creation, augmentation, and/or expansion of oilfield programs in regional institutions could be secured through public and private grants, partnerships and assistance.

There exists significant potential for area high schools to team up with the Department of Education, Department of Labor and local businesses. Funding and support for specific industry-related programs would allow for their rapid development.

Evidence of the success of such public-private partnerships is visible at Taft Union High School's Oil Technology Program and PG&E's high school-level New Energy Academy, as well as North Dakota's TREND consortia and Job Service Training Programs. By taking advantage of Workforce Investment Act funding and Trade Adjustment Assistance Community College and Career Training grant, the San Joaquin Valley could find funding that would bolster existing programs and create the means for the projected needed expansion of workforce training programs.

Nevertheless, clearly the most important element of successful workforce development is the establishment of partnerships between educational institutions and local industry businesses. By working together, these partnerships can design programs that meet educational standards while reinforcing real-world occupational knowledge and skills. Such collaborative efforts have resulted in occupation-ready graduates with a clear direction and path to the oil and gas industry. ❖

# 4 Projected Workforce Needs

Understanding how industries are expected to grow or decline and estimating their job creation potential provides one aspect of the overall workforce needs. A more important aspect, however, is the composition of those expected jobs and their education and skills needs, in particular when projecting additional job growth in the oil and gas industry.

## Expected Job Growth

In 2013, Antonio Avalos and David Vera of California State University Fresno produced a report entitled *The Petroleum Industry and the Monterey Shale: Current Economic Impact and the Economic Future of the San Joaquin Valley* which forecast employment growth in the San Joaquin Valley related to potential production at the Monterey Shale formation. Exhibit 4-1 summarizes the estimates of potential incremental job gains through 2030 by county under an oil boom scenario as shown in the Avalos and Vera study.

Exhibit 4-1
Potential Incremental Job Gains by County 2030

| | Oil Boom Scenario |
|---|---|
| Fresno | 47,251 |
| Kern | 43,345 |
| Kings | 6,502 |
| Madera | 7,422 |
| Merced | 11,643 |
| San Joaquin | 31,904 |
| Stanislaus | 25,591 |
| Tulare | 22,025 |
| TOTAL San Joaquin Valley | 195,683 |

Source: Antonio Avalos and David Vera, *The Petroleum Industry and the Monterey Shale: Current Economic Impact and the Economic Future of the San Joaquin Valley*

The growth of industries in the region will precipitate the growth of particular occupations. The overall net growth of an occupation is a consequence of its contribution to industries that are growing and to industries that are declining. This may result in an occupation experiencing little or no growth as workers that had been employed in a failing industry shift to similar roles in industries that are growing, or as

workers in certain occupations are replaced with improved technologies or processes.

The projected employment growth attributable to new or increased production at the Monterey Shale formation will impact many occupations across a variety of industry sectors. Recent experience from increased production in North Dakota offers empirical evidence of the growth that could be expected to occur in the San Joaquin Valley. In North Dakota, available technology prior to the turn of the century limited access to the very large oil reserve known as the Bakken formation. However, hydraulic fracturing and horizontal drilling technologies have allowed increased access to the subterranean rock oil, resulting in a production boom in the area that began in 2007.

Exhibit 4-2 displays the employment growth in North Dakota from 2007 to 2013 by major occupational group. As these are aggregated across industries, the growth

includes not only those attributed to the oil and gas industry but to all industry growth in North Dakota.

Exhibit 4-2
Occupational Growth in North Dakota Between 2007 and 2013
By Major Occupational Group

| SOC | Occupational Group | Growth (%) |
|---|---|---|
| 47-0000 | Construction & extraction | 24.5% |
| 53-0000 | Transportation & material moving | 14.3% |
| 41-0000 | Sales & related | 6.8% |
| 43-0000 | Office & administrative support | 6.7% |
| 49-0000 | Installation, maintenance & repair | 6.4% |
| 11-0000 | Management | 5.7% |
| 51-0000 | Production | 4.7% |
| 13-0000 | Business & financial operations | 4.6% |
| 35-0000 | Food preparation & serving related | 4.5% |
| 29-0000 | Healthcare practitioners & technical | 4.3% |
| 25-0000 | Education, training & library | 2.9% |
| 17-0000 | Architecture & engineering | 2.3% |
| 39-0000 | Personal care & service | 2.1% |
| 31-0000 | Healthcare support | 1.9% |
| 37-0000 | Building & grounds cleaning & maintenance | 1.8% |
| 15-0000 | Computer & mathematical | 1.7% |
| 33-0000 | Protective service | 1.5% |
| 19-0000 | Life, physical & social science | 1.1% |
| 27-0000 | Arts, design, entertainment, sports & media | 0.6% |
| 45-0000 | Farming, fishing & forestry | 0.6% |
| 21-0000 | Community & social services | 0.5% |
| 23-0000 | Legal | 0.5% |
| TOTAL | | 100.0% |

Source: BLS

The major occupational groups with the largest increase in employment are construction and extraction occupations and transportation and material moving occupations, together representing almost 40 percent of all job growth over the period. These occupational groups are heavily employed in the oil and gas industry and therefore have experienced the fastest employment growth in North Dakota as a result of the boom in production activity.

High growth rates in relatively smaller occupational groups may result in a smaller number of incremental jobs than lower growth rates in larger occupational groups.

The growth in occupational employment in North Dakota is used to estimate the occupational distribution of the projected employment growth in San Joaquin Valley, using the incremental job gains produced by Avalos and Vera. These are presented in Exhibit 4-3.

Overall, Avalos and Vera estimate incremental job growth in San Joaquin Valley of almost 196,000 under a scenario of an oil production boom. Of these, it is estimated that almost 48,000 new jobs will be added in construction and extraction occupations, with an additional 28,000 jobs added in transportation and material moving occupations, and more than 26,000 jobs in sales and office occupations.

Exhibit 4-3
Projected Incremental Workforce Needs 2030
By Major Occupational Group
San Joaquin Valley

| SOC | Occupational Group | Jobs | % of Total |
|---|---|---|---|
| 11-0000 | Management occupations | 11,111 | 5.7% |
| 13-0000 | Business & financial | 9,071 | 4.6% |
| 15-0000 | Computer & mathematical | 3,399 | 1.7% |
| 17-0000 | Architecture & engineering | 4,526 | 2.3% |
| 19-0000 | Life, physical, social science | 2,234 | 1.1% |
| 21-0000 | Community & social services | 971 | 0.5% |
| 23-0000 | Legal occupations | 894 | 0.5% |
| 25-0000 | Education, training & library | 5,769 | 2.9% |
| 27-0000 | Arts, entertainment, sports | 1,107 | 0.6% |
| 29-0000 | Healthcare practitioners | 8,488 | 4.3% |
| 31-0000 | Healthcare support | 3,691 | 1.9% |
| 33-0000 | Protective services | 2,933 | 1.5% |
| 35-0000 | Food preparation & serving | 8,896 | 4.5% |
| 37-0000 | Building /grounds maintenance | 3,458 | 1.8% |
| 39-0000 | Personal care & service | 4,031 | 2.1% |
| 41-0000 | Sales & related | 13,228 | 6.8% |
| 43-0000 | Office & administrative | 13,111 | 6.7% |
| 45-0000 | Farming, fishing & forestry | 1,107 | 0.6% |
| 47-0000 | Construction & extraction | 47,933 | 24.5% |
| 49-0000 | Installation, maintenance / repair | 12,548 | 6.4% |
| 51-0000 | Production | 9,207 | 4.7% |
| 53-0000 | Transportation/ material moving | 27,971 | 14.3% |
| TOTAL | | 195,683 | 100.0% |

Sources: BLS; estimates by LAEDC

However, jobs across all occupational groups will be added, including management occupations, maintenance and repair occupations, healthcare occupations and food preparation and serving occupations as increased employment in the oil and gas industry stimulated demand for workers in other, mostly population-serving, industries.

Of course, each major occupational group is an aggregate of many detailed occupations, such as roustabouts, machinists, heavy truck and trailer drivers, laborers and so on. The top 25 detailed occupations (by number of projected incremental jobs) that are projected to be added in San Joaquin Valley are shown in Exhibit 4-4, along with the statewide median annual wage. These 25

occupations will account for almost half of all new job openings in all occupations.

The largest number of openings will be found in occupations related to the oil and gas industry, such as heavy and tractor-trailer truck drivers, oil and gas roustabouts, oil, gas and mining service unit operators and construction laborers. These four detailed occupations are projected to add almost 37,000 jobs.

Other detailed occupations with large numbers of projected openings include general and operations managers, first-line supervisors of construction and extraction workers and cashiers.

Exhibit 4-4
Projected Incremental Workforce Needs 2030
Top 25 Detailed Occupations
San Joaquin Valley

| SOC | | Incremental Jobs | Median Wage |
|---|---|---|---|
| 53-3032 | Heavy / tractor-trailer truck drivers | 16,647 | $ 40,460 |
| 47-5071 | Roustabouts, oil / gas | 7,206 | 33,380 |
| 47-5013 | Service unit operators, oil, gas / mining | 6,876 | 49,120 |
| 47-2061 | Construction laborers | 6,138 | 39,190 |
| 11-1021 | General / operations managers | 6,099 | 104,460 |
| 47-1011 | First-line sups, const/extraction workers | 5,303 | 73,770 |
| 41-2011 | Cashiers | 4,079 | 20,600 |
| 43-3031 | Bookkeeping / accounting clerks | 3,671 | 40,430 |
| 43-6014 | Secretaries / admins (not legal, med or exec) | 3,438 | 36,950 |
| 47-2111 | Electricians | 3,244 | 60,960 |
| 47-2073 | Operating engineers / const eqpmt | 3,030 | 66,570 |
| 29-1111 | Registered nurses | 2,933 | 95,137 |
| 41-2031 | Retail salespersons | 2,739 | 22,230 |
| 47-5011 | Derrick operators, oil & gas | 2,681 | 49,620 |
| 47-5012 | Rotary drill operators, oil & gas | 2,583 | 67,260 |
| 37-2012 | Maids / housekeeping cleaners | 2,273 | 22,110 |
| 41-1011 | First-line sups, retail sales workers | 2,214 | 39,560 |
| 53-7062 | Laborers / freight / material movers, hand | 2,020 | 23,950 |
| 49-3031 | Bus / truck mechanics & diesel engine specialists | 2,001 | 48,760 |
| 13-2011 | Accountants / auditors | 1,942 | 70,580 |
| 25-2031 | Secondary teachers (not spec/tech) | 1,865 | 69,030 |
| 51-4121 | Welders / cutters/ solderers / braziers | 1,845 | 38,560 |
| 39-9021 | Personal care aides | 1,845 | 21,310 |
| 31-1012 | Nursing aides / orderlies | 1,573 | 28,484 |
| 47-2152 | Plumbers / pipefitters / steamfitters | 1,573 | 57,440 |
| | *Other Occupations* | *99,865* | |
| TOTAL | | 195,683 | $ 38,920 |

Source: BLS; estimates by LAEDC

The occupations shown in Exhibit 4-4 represent projected incremental jobs across all industry sectors. As new or increased production occurs, jobs are not only expected to be added in production and extraction activity, but the economic activity associated with a growing region will require workers in a variety of fields, such as retail sales, restaurant services, hospitality, healthcare and education. These will all be supported, in essence, by the expected boom in the oil and gas industry. With job growth in many detailed occupations, workforce needs will be widespread and diverse. Furthermore, these projections are of new positions and do not include replacement needs as workers retire or otherwise leave the regional workforce. A complete list of all projected occupations is provided in Exhibit A-2 in the appendix. ❖

## Job Growth in the Oil and Gas Industry

The oil and gas industry itself employs a diverse range of occupations, including engineers, biologists, computer programmers, general laborers, lease operators, roustabouts and welders—to name a few. Many of the occupations that are employed in the oil and gas industry are also employed in other industries. For example, bookkeepers, receptionists and computer programmers work in many industries unrelated to oil and gas. The largest detailed occupations in the industry in California (by employment) are shown in Exhibit 4-5.

Exhibit 4-5
Top 20 Occupations in Oil & Gas and Support Activities in CA
( NAICS 2111 & 2131)

| SOC | | % of Total |
|---|---|---|
| 47-5071 | Roustabouts, Oil and Gas | 14.5% |
| 47-5013 | Service Unit Operators, Oil, Gas, and Mining | 10.7% |
| 47-5012 | Rotary Drill Operators, Oil and Gas | 6.5% |
| 17-2171 | Petroleum Engineers | 5.8% |
| 47-5081 | Helpers--Extraction Workers | 3.7% |
| 47-1011 | First-Line Supervisors of Construction Trades and Extraction Workers | 3.6% |
| 51-8093 | Petroleum Pump System Operators / Refinery Operators / Gaugers | 3.4% |
| 19-4041 | Geological and Petroleum Technicians | 3.3% |
| 51-4121 | Welders, Cutters, Solderers, and Brazers | 3.2% |
| 47-5011 | Derrick Operators, Oil and Gas | 2.9% |
| 53-7062 | Laborers / Freight, Stock / Material Movers, Hand | 2.7% |
| 19-2042 | Geoscientists, Except Hydrologists and Geographers | 2.6% |
| 13-1199 | Business Operations Specialists, All Other | 2.4% |
| 11-1021 | General and Operations Managers | 1.9% |
| 53-7072 | Pump Operators, Except Wellhead Pumpers | 1.9% |
| 17-2112 | Industrial Engineers | 1.8% |
| 47-2111 | Electricians | 1.6% |
| 29-9011 | Occupational Health and Safety Specialists | 1.4% |
| 47-2061 | Construction Laborers | 1.4% |
| 53-3032 | Heavy and Tractor-Trailer Truck Drivers | 1.4% |
| | *Other Occupations* | *23.2%* |
| TOTAL | Industries 2111 & 2131 | 100.0% |

Source: BLS

Here, the oil and gas industry is defined as oil and gas extraction and support activities for oil and gas (NAICS 2111 and 2131). Although there are other component industries in the oil and gas industry, these represent the largest component industries in oil and gas extraction.

## Occupational Pages

Some of the occupations in Exhibit 4-5 may not be suitable for industry workforce development intervention, such as, for example, electricians, who are employed in many industries, and occupational health and safety specialists, who will receive specialized training. There are other occupations related to the industry that are not listed in the top 20, such as mining and geological engineers and crane and tower operators.

The focus of the occupational analysis will be on occupations that are specific to the oil and gas industry and those which will benefit from workforce development programs. These are listed in Exhibit 4-6.

Exhibit 4-6
Targeted Occupations in Oil & Gas and Support Activities
( NAICS 2111 & 2131)

| SOC | Detailed Occupation | Projected Incremental Jobs |
|---|---|---|
| 11-1021 | General & Operations Managers | 6,099 |
| 17-2112 | Industrial Engineers | 194 |
| 17-2151 | Mining & Geological Engineers | 136 |
| 17-2171 | Petroleum Engineers | 660 |
| 19-2042 | Geoscientists (not Hydrologists/ Geographers) | 97 |
| 19-4041 | Geological and Petroleum Technicians | 233 |
| 47-1011 | First-Line Supervisors of Construction Trades & Extraction Workers | 5,303 |
| 47-5011 | Derrick Operators, Oil & Gas | 2,681 |
| 47-5012 | Rotary Drill Operators, Oil & Gas | 2,583 |
| 47-5013 | Service Unit Operators, Oil, Gas & Mining | 6,876 |
| 47-5071 | Roustabouts, Oil & Gas | 7,206 |
| 47-5081 | Helpers--Extraction Workers | 855 |
| 51-4121 | Welders, Cutters, Solderers and Brazers | 1,845 |
| 51-8092 | Gas Plant Operators | n/a |
| 51-8093 | Petroleum Pump System Operators and Gaugers | 194 |
| 53-3032 | Heavy and Tractor-Trailer Truck Drivers | 16,647 |
| 53-7021 | Crane and Tower Operators | 447 |
| 53-7073 | Wellhead Pumpers | 816 |
| 53-7072 | Pump Operators (not Wellhead) | 952 |

Source: Estimates by LAEDC

Together, these nineteen occupations account for approximately 28 percent of all projected new jobs in the San Joaquin Valley under a scenario of an oil production boom.

In the pages that follow, each of the occupations shown in Exhibit 4-6 is detailed as follows:

- *Description*, *entry requirements* and *core tasks* are outlined and detailed
- The highest level of *educational attainment* of current workers in this occupation is presented
- The *distribution* of workers in this occupation across industries in California
- *Annual wages* paid in 2013 for workers in this occupation in the counties of San Joaquin Valley (if employment exists) and in California
- A *crosswalk between work activities* performed in this occupation and in similar, related occupations
- *Other occupations* with similar skills, knowledge and abilities, as a potential source for projected workforce needs
- The *distribution* of workers in all related occupations across industries. ❖

# General and Operations Managers (SOC 11-1021)

*General and operations managers plan, direct or coordinate the operations of public or private sector organizations. Duties and responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one functional area of management or administration, such as personnel, purchasing, or administrative services. This classification excludes first-line supervisors.*

## Core Tasks:

- Oversee activities directly related to making products or providing services.
- Direct and coordinate activities of businesses or departments concerned with the production, pricing, sales, or distribution of product.
- Review financial statements, sales and activity reports, and other performance data to measure productivity and goal achievement and to determine areas needing cost reduction and program improvement.
- Manage staff, preparing work schedules and assigning specific duties.
- Direct and coordinate organization's financial and budget activities to fund operations, maximize investments, and increase efficiency.
- Establish and implement departmental policies, goals, objectives, and procedures, conferring with board members, organization officials, and staff members as necessary.
- Determine staffing requirements, and interview, hire and train new employees, or oversee those personnel processes.
- Plan and direct activities such as sales promotions, coordinate with other department heads as needed.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. General and operation managers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Professional, Scientific, & Tech Services (NAICS 541)
- Administrative & Support Services (NAICS 561)
- Merchant Wholesalers, Durable Goods (NAICS 423)

## Entry requirements:

- Bachelor's degree
- Less than five years exp
- No on-the-job (OTJ) training

**Jobs in SJV**
**16,660**
**in 2013**

## Major Occupational Group:

- 11-0000 Management Occupations

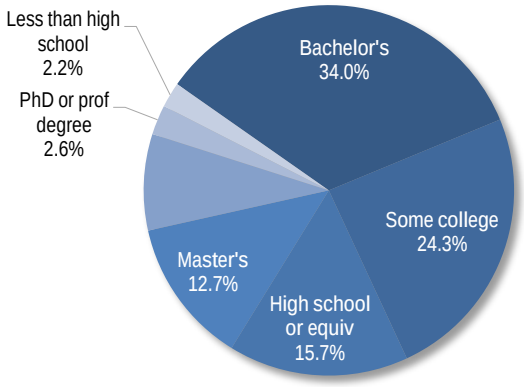
## Tools:

- Magnetic stripe readers and encoders
- Mobile phones
- Photocopiers
- Scanners
- Security cameras

## Technology:

- Accounting software
- Customer relationship management CRM
- Electronic mail software
- ERP software
- Internet browser software

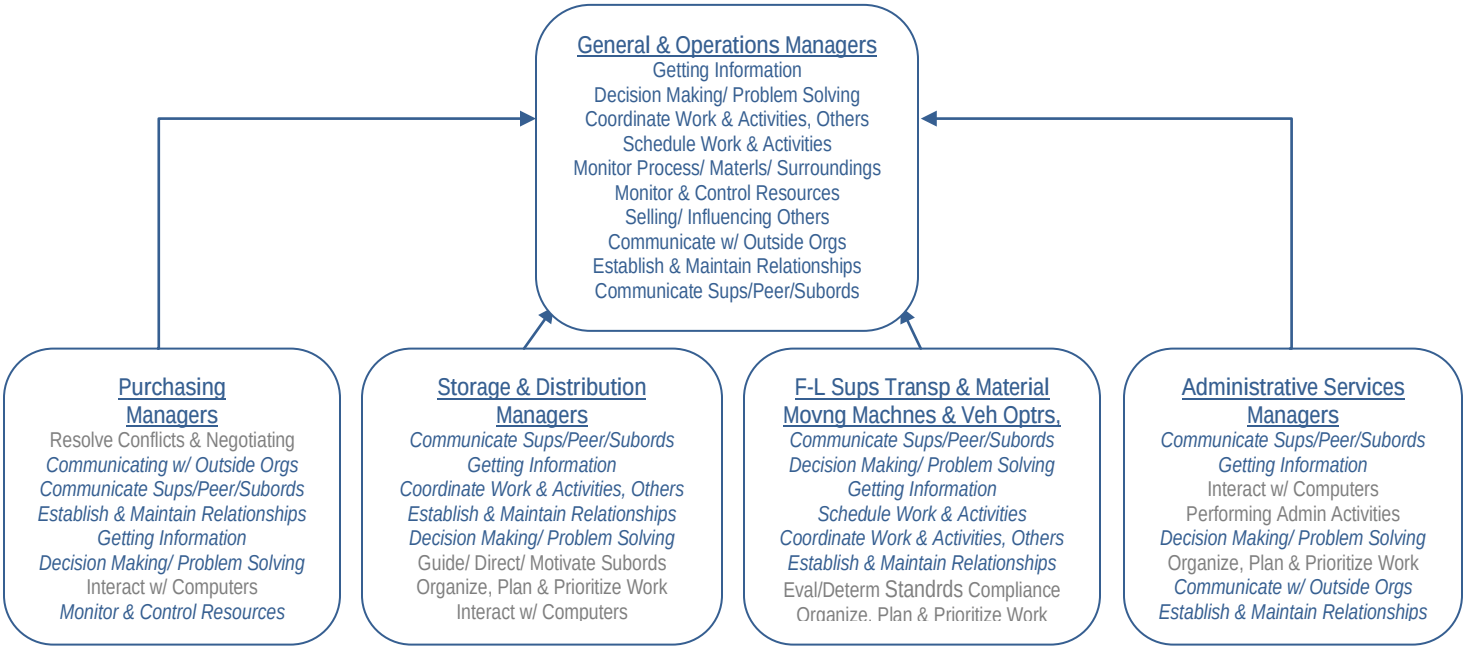
## Distribution of Educational Attainment




## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 63,120 | $ 86,230 | $ 118,280 |
| Kern County | 65,670 | 89,260 | 128,520 |
| Kings County | 53,710 | 75,780 | 113,470 |
| Madera County | 66,930 | 88,900 | 132,670 |
| Merced County | 59,880 | 83,500 | 110,220 |
| San Joaquin County | 64,420 | 88,370 | 126,670 |
| Stanislaus County | 64,340 | 83,570 | 116,390 |
| Tulare County | 60,860 | 81,910 | 116,500 |
| California | $ 72,500 | $ 107,400 | $ 162,800 |

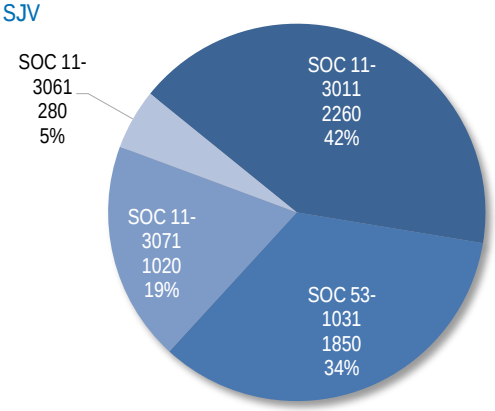
## Skills Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include managers of purchasing managers (SOC 11-3061), storage and distribution managers (SOC 11-3071.02), first-line supervisors of transportation and material moving-machines and vehicle operators (SOC 53-1031) and administrative services managers (SOC 11-3011). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



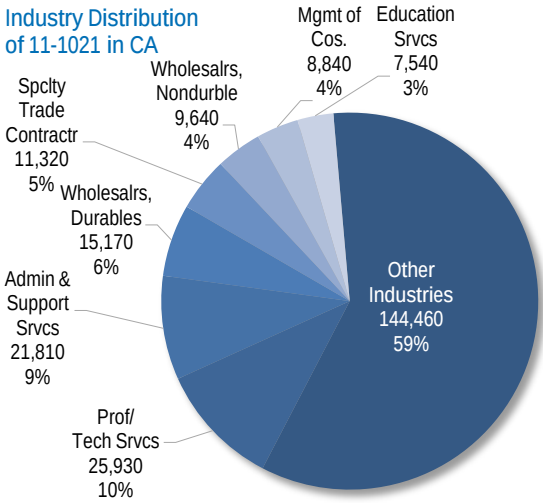

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 11-1021 | 11-3061 | 11-3071 | 53-1031 | 11-3011 |
|---|---|---|---|---|---|
| 236 | X | | | | X |
| 332 | X | X | | | |
| 334 | X | X | X | | |
| 423 | X | X | X | X | X |
| 424 | X | X | X | X | X |
| 425 | X | X | X | | |
| 541 | X | X | X | | X |
| 551 | X | X | X | X | X |
| 561 | X | X | | | X |
| 611 | X | X | | X | X |
| 621 | X | X | | | X |
| 624 | X | X | | X | X |
| 722 | X | X | | | |

Sources: BLS; LAEDC

Industry Distribution of 11-1021 in CA



# Industrial Engineers (SOC 17-2112)

*Design, develop, test, and evaluate integrated systems for managing industrial production processes, including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination.*

## Core Tasks:

- Plan and establish sequence of operations to fabricate and assemble parts or products and to promote efficient utilization.
- Review production schedules, engineering specifications, orders, and related information to obtain knowledge of manufacturing methods, procedures, and activities.
- Estimate production costs, cost saving methods, and the effects of product design changes on expenditures for management review, action, and control.
- Draft and design layout of equipment, materials, and workspace to illustrate maximum efficiency using drafting tools and computer.
- Coordinate and implement quality control objectives, activities, or procedures to resolve production problems, maximize product reliability, or minimize costs.
- Communicate with management and user personnel to develop production and design standards.
- Recommend methods for improving utilization of personnel, material, and utilities.
- Develop manufacturing methods, labor utilization standards, and cost analysis systems to promote efficient staff and facility utilization.
- Confer with clients, vendors, staff, and management personnel regarding purchases, product and production specifications, manufacturing capabilities, or project status.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Industrial engineers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Computer & Electronic Product Mfg. (NAICS 334)
- Professional, Scientific & Technical Services (NAICS 541)
- Transportation Equipment Manufacturing (NAICS 336)

### Entry requirements:

- Bachelor's degree
- No experience
- No OTJ training

**Jobs in SJV**
**890**
**in 2013**

### Major Occupational Group:

- 17-0000 Architecture & Engineering Occupations

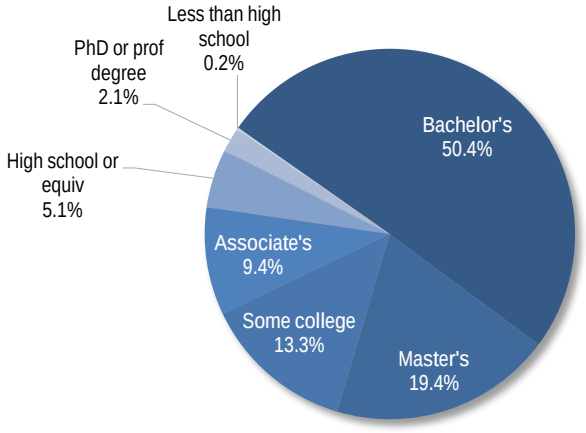
### Tools:

- Audiometers or accessories
- Laboratory benches
- Laboratory mechanical convection ovens
- Microphones
- Sound measuring apparatus or decibel meter

### Technology:

- Analytical or scientific software
- Computer aided design CAD software
- Development environment software
- Industrial control software
- Program testing software

### Distribution of Educational Attainment

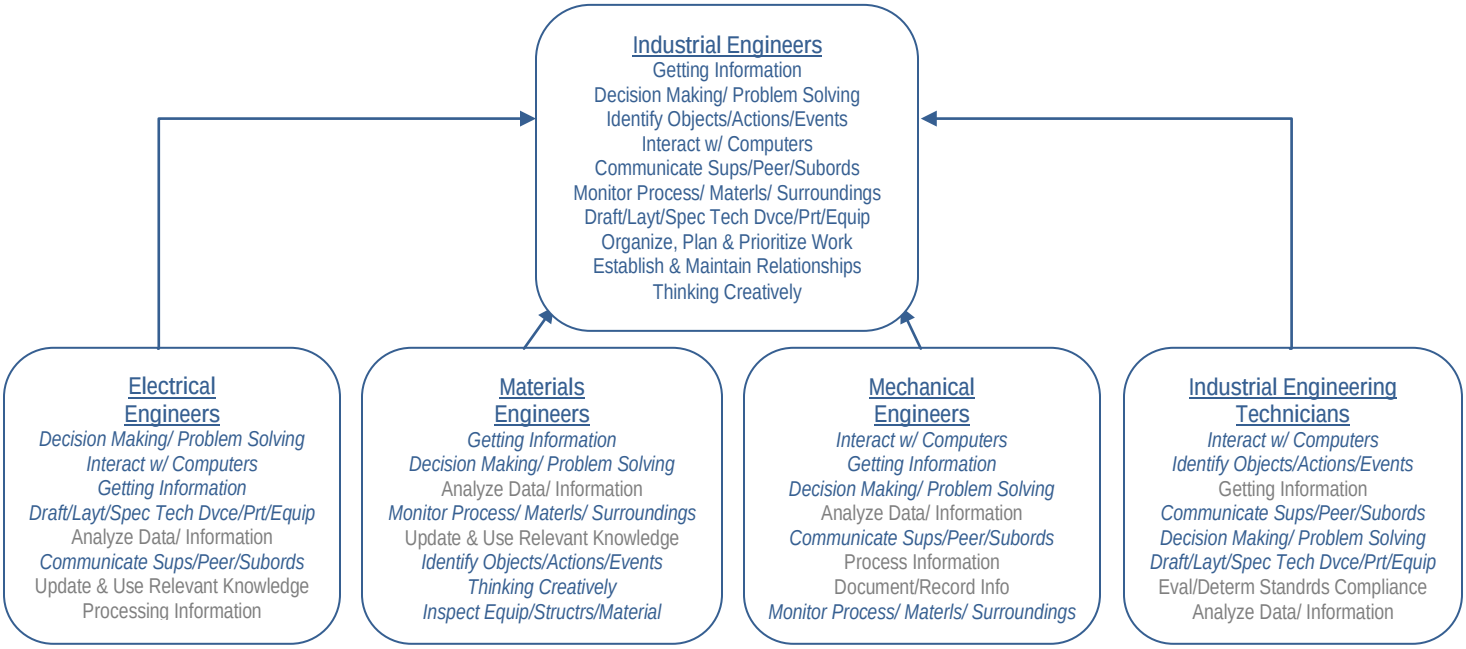



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 62,610 | $ 79,840 | $ 102,720 |
| Kern County | 87,500 | 107,360 | 133,440 |
| Kings County | | | |
| Madera County | | | |
| Merced County | 73,210 | 85,530 | 99,960 |
| San Joaquin County | 59,390 | 80,140 | 106,200 |
| Stanislaus County | 67,600 | 81,240 | 103,230 |
| Tulare County | 56,240 | 75,210 | 94,430 |
| California | $ 75,900 | $ 93,700 | $ 115,600 |

Source: BLS

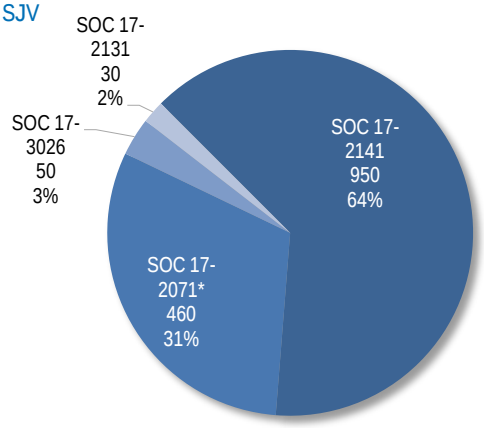
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include electrical engineers (SOC 17-2071), materials engineers (SOC 17-2131), mechanical engineers (SOC 17-2141) and industrial engineering technicians (SOC 17-3026). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

### Potential Trainable Workforce SJV



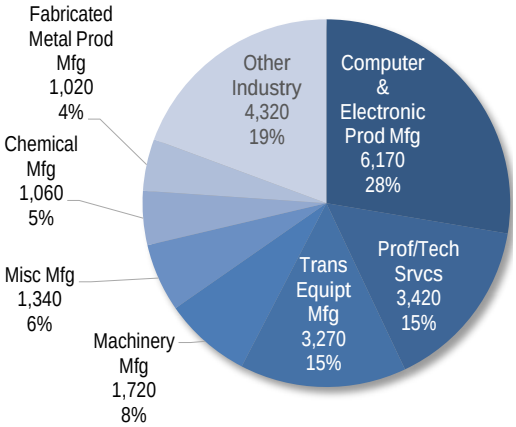

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 17-2112 | 17-2141 | 17-2071 | 17-3026 | 17-2131 |
|---|---|---|---|---|---|
| 221 | X | X | X | X | |
| 325 | X | X | | X | |
| 326 | X | X | | X | |
| 331 | X | X | | X | X |
| 332 | X | X | | X | X |
| 333 | X | X | X | X | X |
| 334 | X | X | X | X | X |
| 335 | X | X | X | X | |
| 336 | X | X | X | X | X |
| 339 | X | X | X | X | X |
| 423 | X | X | X | | |
| 541 | X | X | X | X | X |
| 561 | X | X | X | X | |

Sources: BLS; LAEDC

### Industry Distribution of 17-2112 in CA



# Mining & Geological Engineers, Including Mining Safety Engineers (SOC 17-2151)

*Conduct sub-surface surveys to identify the characteristics of potential land or mining development sites. May specify the ground support systems, processes and equipment for safe, economical, and environmentally sound extraction or underground construction activities. May inspect areas for unsafe geological conditions, equipment, and working conditions. May design, implement, and coordinate mine safety programs.*

## Core Tasks:

- Select locations and plan underground or surface mining operations, specifying processes, labor usage, and equipment that will result in safe, economical, and environmentally sound extraction of minerals and ores.
- Design, implement, and monitor the development of mines, facilities, systems, or equipment.
- Inspect mining areas for unsafe structures, equipment, and working conditions.
- Examine maps, deposits, drilling locations, or mines to determine the location, size, accessibility, contents, value, and potential profitability of mineral, oil, gas deposits.
- Select or develop mineral location, extraction, and production methods, based on factors such as safety, cost, and deposit characteristics.
- Prepare technical reports for use by mining, engineering, and management personnel.
- Monitor mine production rates to assess operational effectiveness.
- Prepare schedules, reports, and estimates of the costs involved in developing and operating mines.
- Lay out, direct, and supervise mine construction operations, such as construction of shafts and tunnels.
- Devise solutions to problems of land reclamation and water and air pollution, such as methods of storing excavated soil and returning exhausted mine sites to natural states.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Mining and geological engineers, including mining safety engineers, in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are two industry subsectors employing this occupation in California:

- Mining, Except Oil & Gas (NAICS 212)
- Professional, Scientific & Technical Services (NAICS

### Entry requirements:

- Bachelor's degree
- No experience
- No OTJ training

**Jobs in SJV**
**50**
**in 2013**

### Major Occupational Group:

- 17-0000 Architecture & Engineering Occupations

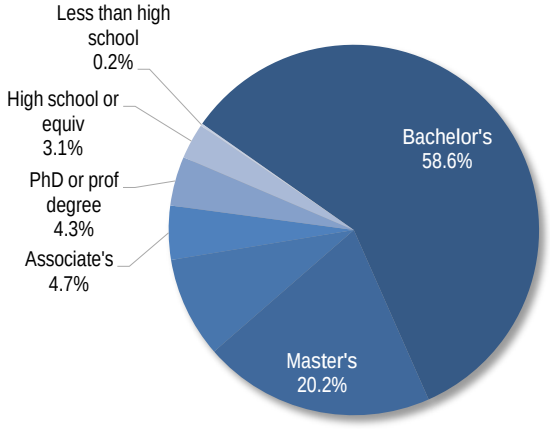
### Tools:

- Geological compasses
- Hammers
- Plotter printers
- Scanners — Computer scanners
- Tape measures

### Technology:

- Analytical or scientific software
- Computer aided design CAD software
- Data base user interface and query software
- Project management software
- Spreadsheet software

### Distribution of Educational Attainment

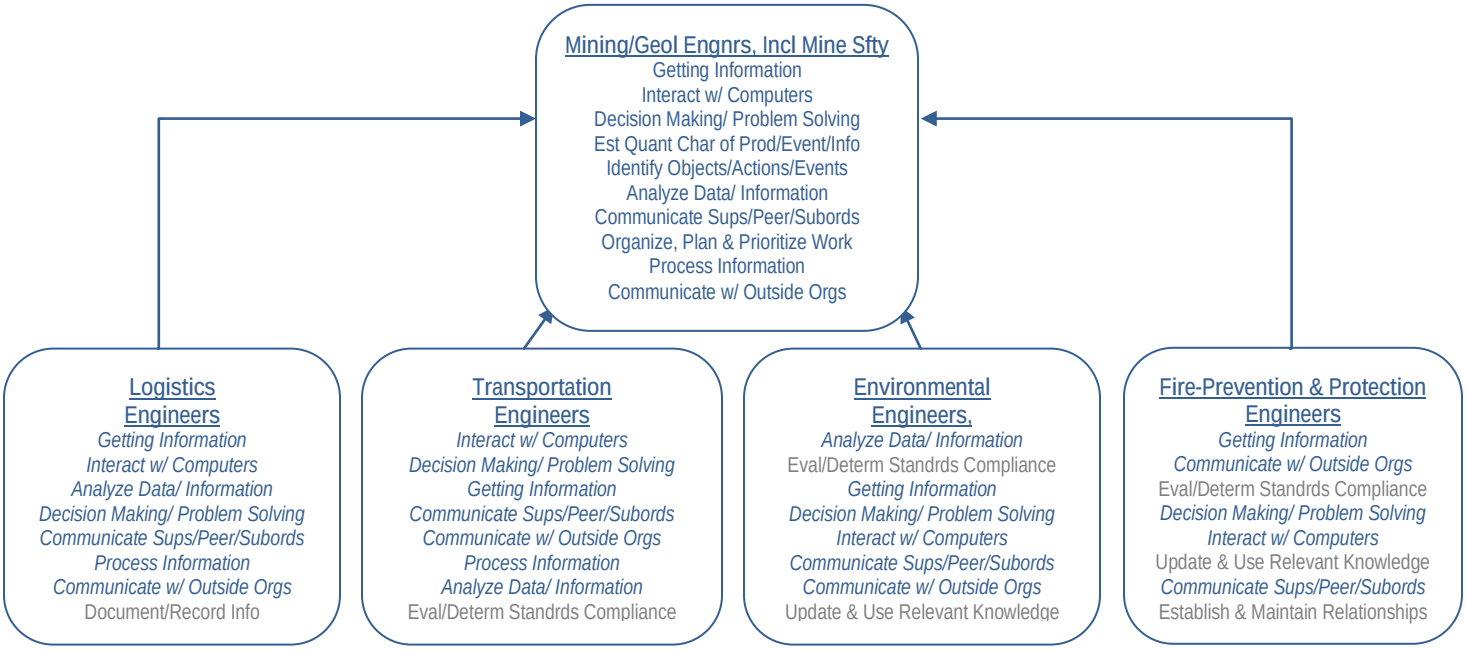



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 72,430 | $ 90,500 | $ 134,810 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 84,600 | $ 108,800 | $ 124,300 |

Source: BLS

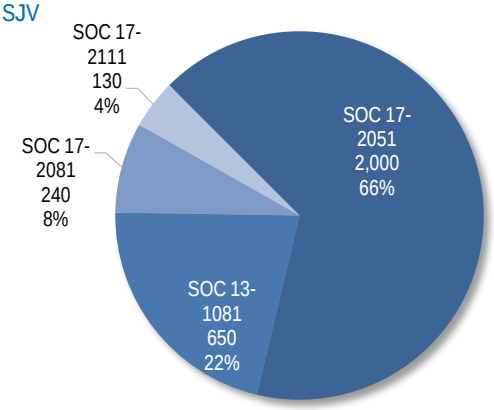
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include logistics engineers (SOC 13-1081.01), transportation engineers (SOC 17-2051.01), environmental engineers (SOC 17-2081) and Fire-Prevention and Protection Engineers (SOC 17-2111.02). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



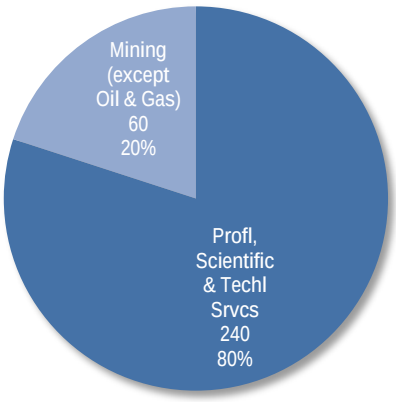

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 17-2151 | 17-2051 | 13-1081 | 17-2081 | 17-2111 |
|---|---|---|---|---|---|
| 212 | X | | | | |
| 221 | | X | X | X | X |
| 236 | | X | | | X |
| 237 | | X | | | X |
| 238 | | X | | | X |
| 325 | | | X | | X |
| 334 | | | X | X | X |
| 336 | | | X | | X |
| 339 | | | X | | X |
| 541 | X | X | X | X | X |
| 551 | | X | X | | X |
| 561 | | X | X | X | X |
| 562 | | X | | X | X |

Sources: BLS; LAEDC

Industry Distribution of 17-2151 in CA



# Petroleum Engineers (SOC 17-2171)

*Devise methods to improve oil and gas extraction and production and determine the need for new or modified tool designs. Oversee drilling and offer technical advice.*

## Core Tasks:

- Assess costs and estimate the production capabilities and economic value of oil and gas wells, to evaluate the economic viability of potential drilling sites.
- Develop plans for oil and gas field drilling, and for product recovery and treatment.
- Direct and monitor the completion and evaluation of wells, well testing, or well surveys.
- Analyze data to recommend placement of wells and supplementary processes to enhance production.
- Monitor production rates, and plan rework processes to improve production.
- Interpret drilling and testing information for personnel.
- Specify and supervise well modification and stimulation programs to maximize oil and gas recovery.
- Assist engineering and other personnel to solve operating problems.
- Confer with scientific, engineering, and technical personnel to resolve design, research, and testing problems.
- Coordinate the installation, maintenance, and operation of mining and oil field equipment.
- Maintain records of drilling and production operations.
- Write technical reports for engineering and management personnel.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Petroleum engineers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are four industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Utilities (NAICS 221)
- Petroleum & Coal Products Manufacturing (NAICS 324)

### Entry requirements:

- Bachelor's degree
- No experience
- No OTJ training

**Jobs in SJV**
**620**
**in 2013**

### Major Occupational Group:

- 17-0000 Architecture and Engineering Occupations

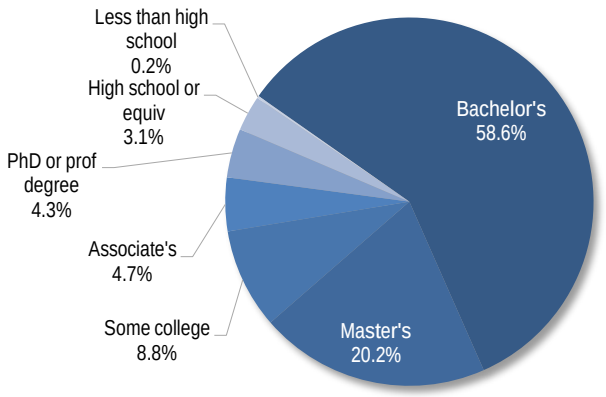
### Tools:

- Desktop computers
- Notebook computers
- Personal computers
- PDAs or organizers
- Scanners

### Technology:

- Analytical or scientific software
- Data base user interface and query software
- Electronic mail software
- Financial analysis software
- Project management software

### Distribution of Educational Attainment

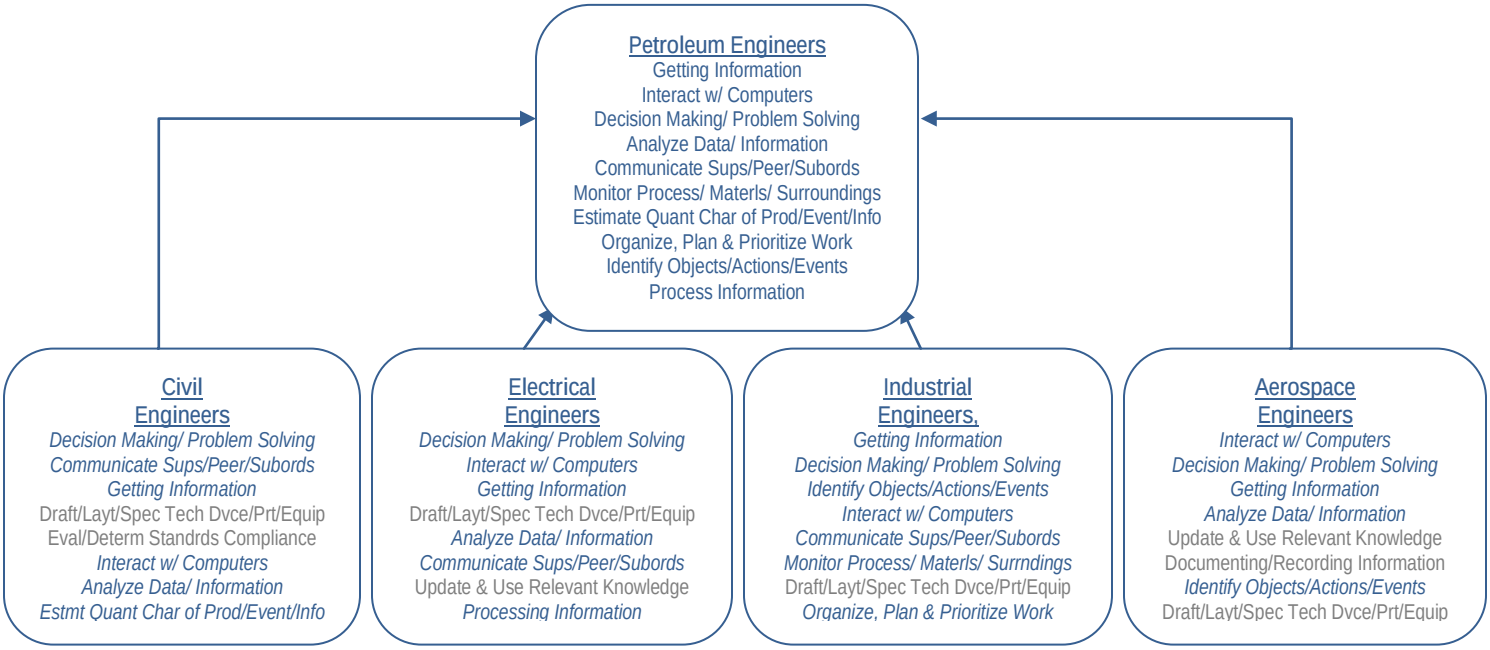



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 97,490 | $ 115,240 | $ 151,590 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 87,300 | $ 105,900 | $ 127,900 |

Source: BLS

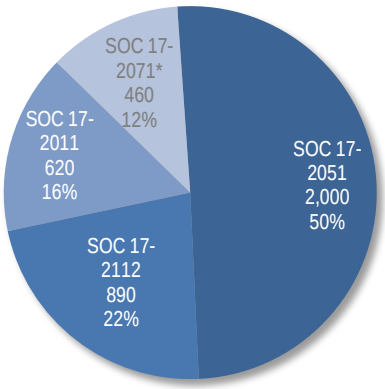
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include civil engineers (SOC 17-2051), electrical engineers (SOC 17-2071), industrial engineers (SOC 17-2112) and aerospace engineers (SOC 17-2011). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce
SJV



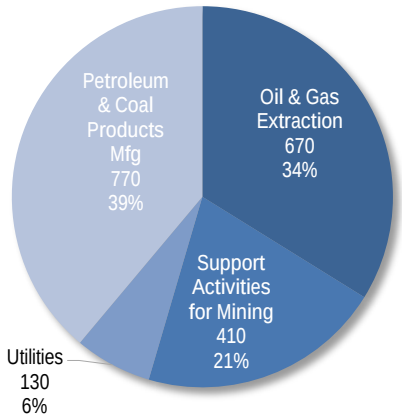

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 17-2171 | 17-2051 | 17-2112 | 17-2011 | 17-2071 |
|---|---|---|---|---|---|
| 211 | X | X | X | | |
| 213 | X | | | | |
| 221 | X | | X | | X |
| 238 | | X | | | X |
| 324 | X | | X | | |
| 333 | | | X | | X |
| 334 | | | X | X | X |
| 336 | | | X | X | X |
| 339 | | | X | | X |
| 541 | | X | X | X | X |
| 551 | | X | X | | X |
| 561 | | X | X | | X |
| 611 | | X | | X | |

Sources: BLS; LAEDC

Industry Distribution
of 17-2171 in CA



# Geoscientists, Except Hydrologists & Geographers (SOC 19-2042)

*Study the composition, structure, and other physical aspects of the Earth. May use geological, physics, and mathematics knowledge in exploration for oil, gas, minerals, or underground water; or in waste disposal, land reclamation, or other environmental problems. May study the Earth's internal composition, atmospheres, oceans, and its magnetic, electrical, and gravitational forces. Includes mineralogists, crystallographers, paleontologists, stratigraphers, geodesists, and seismologists.*

## Core Tasks:

- Analyze and interpret geological, geochemical, or geophysical information from sources such as survey data, well logs, bore holes, or aerial photos.
- Plan or conduct geological, geochemical, or geophysical field studies or surveys, sample collection, or drilling and testing programs used to collect data for research or application.
- Prepare geological maps, cross-sectional diagrams, charts, or reports concerning mineral extraction, land use, or resource management, using results of fieldwork or laboratory research.
- Analyze and interpret geological data.
- Investigate the composition, structure, or history of the Earth's crust through the collection, examination, measurement, or classification of soils, minerals, rocks, or fossil remains.
- Assess ground or surface water movement to provide advice regarding issues such as waste management, route and site selection, or the restoration of contaminated sites.
- Locate and estimate probable natural gas, oil, or mineral ore deposits or underground water resources, using aerial photographs, charts, or research or survey results.
- Locate and review research articles or environmental, historical, or technical reports.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. General and operation managers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are three industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Professional, Scientific & Technical Services (NAICS 541)
- Educational Services (NAICS 611)

### Entry requirements:

- Bachelor's degree
- No experience
- No OTJ training

**Jobs in SJV**
**240**
**in 2013**

### Major Occupational Group:

- 19-0000 Life, Physical and Social Science Occupations

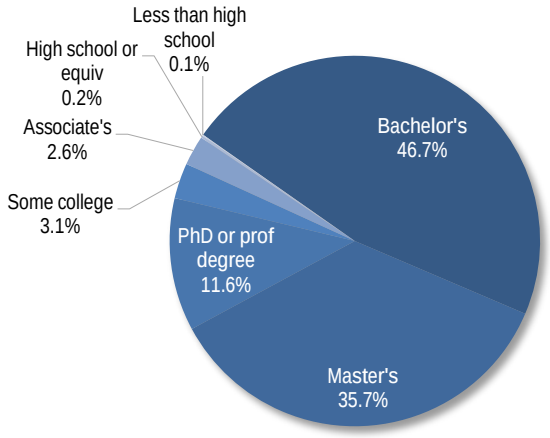
### Tools:

- Electromagnetic geophysical instruments
- Paramagnetic susceptibility analyzers
- Radar-based surveillance systems
- Soil core sampling apparatus
- Sonar

### Technology:

- Analytical or scientific software
- Computer aided design CAD software
- Data base user interface and query software
- Graphics or photo imaging software
- Map creation software

### Distribution of Educational Attainment

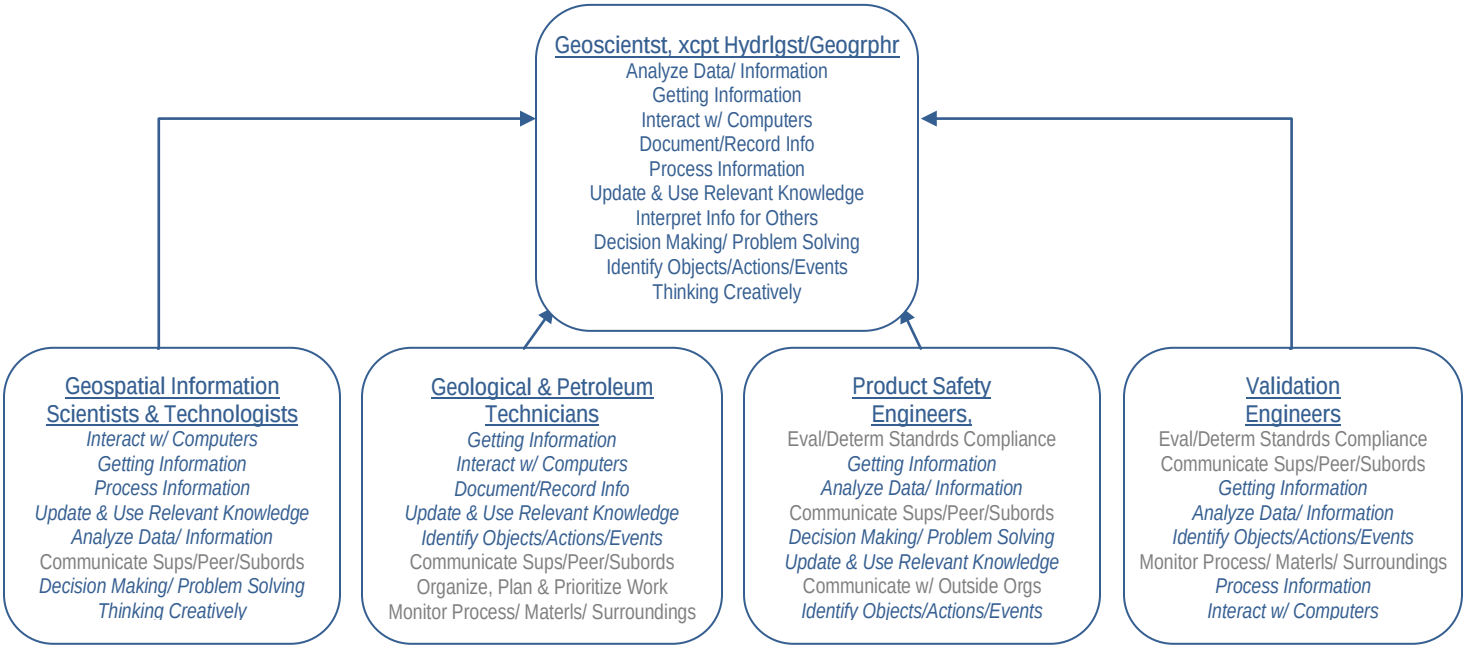



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 82,730 | $ 100,910 | $ 102,180 |
| Kern County | 106,210 | 130,520 | 172,800 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 69,800 | $ 95,800 | $ 111,700 |

Source: BLS

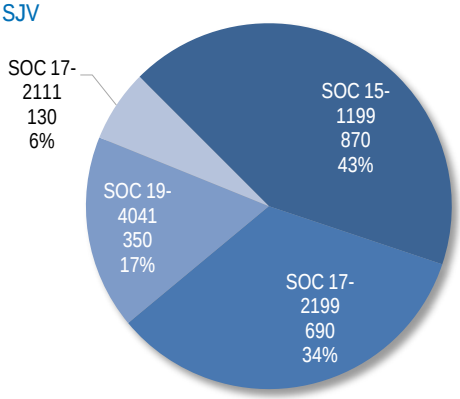
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include geospatial information scientists and technologists (SOC 15-1199.4), geological and petroleum technicians (SOC 19-4041), product safety engineers (SOC 17-2111.03) and validation engineers (SOC 17-2199.02). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



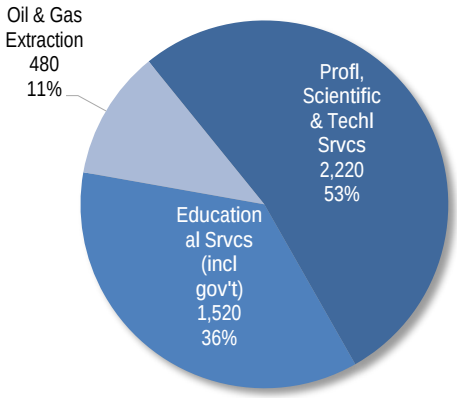

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 19-2042 | 15-1199 | 17-2199 | 19-4041 | 17-2111 |
|---|---|---|---|---|---|
| 211 | X | | | X | |
| 221 | | | X | | X |
| 325 | | X | X | | X |
| 332 | | | X | | X |
| 334 | | X | X | | X |
| 336 | | X | X | | X |
| 339 | | | X | | X |
| 423 | | X | X | | |
| 425 | | X | X | | |
| 517 | | X | X | | |
| 541 | X | X | X | X | X |
| 561 | | X | X | | X |
| 611 | X | X | X | | |

Sources: BLS; LAEDC

Industry Distribution of 19-2042 in CA



# Geological & Petroleum Technicians (SOC 19-4041)

*Assist scientists or engineers in the use of electronic, sonic, or nuclear measuring instruments in both laboratory and production activities to obtain data indicating potential resources such as metallic ore, minerals, gas, coal, or petroleum. Analyze mud and drill cuttings. Chart pressure, temperature, and other characteristics of wells or bore holes. Investigate and collect information leading to the possible discovery of new metallic ore, minerals, gas, coal, or petroleum deposits. his title represents a group of more specific occupations.*

## Core Tasks:

- Prepare notes, sketches, geological maps, or cross-sections.
- Read and study reports in order to compile information and data for geological and geophysical prospecting.
- Interview individuals, and research public databases in order to obtain information.
- Assemble, maintain, or distribute information for library or record systems.
- Test and analyze samples to determine their content and characteristics, using laboratory apparatus or testing equipment.
- Collect or prepare solid or fluid samples for analysis.
- Assemble, operate, and maintain field and laboratory testing, measuring, and mechanical equipment, working as part of a crew when required.
- Compile and record testing and operational data for review and further analysis.
- Adjust or repair testing, electrical, or mechanical equipment or devices.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Geological and petroleum technicians in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are three industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Professional, Scientific & Technical Services (NAICS 541)

## Entry requirements:

- Associate's degree
- No experience
- Moderate-term OTJ training

**Jobs in SJV**
**350**
**in 2013**

## Major Occupational Group:

- 19-0000 Life, Physical & Social Science Occupations

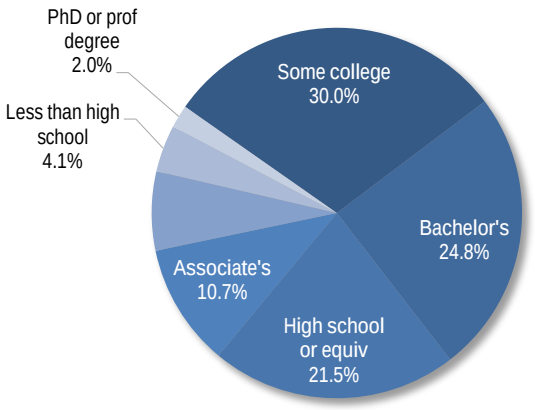
## Tools:

- Geological compasses
- Laboratory crushers or pulverizers
- Magnetometer geophysical instruments
- Soil core sampling apparatus
- Theodolites

## Technology:

- Analytical or scientific software
- Computer aided design CAD software
- Data base user interface and query software
- Graphics or photo imaging software
- Map creation software

## Distribution of Educational Attainment

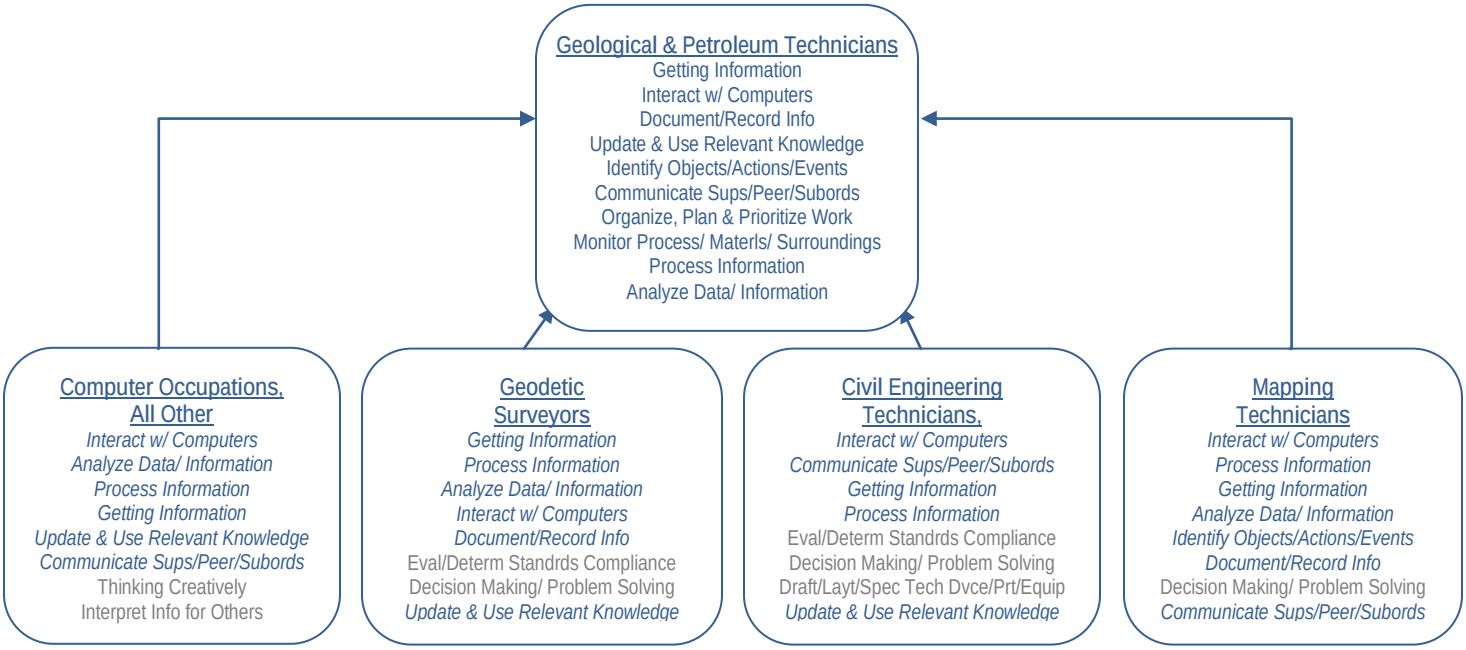



## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 43,110 | $ 57,620 | $ 73,140 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 41,900 | $ 68,700 | $ 103,000 |

Source: BLS

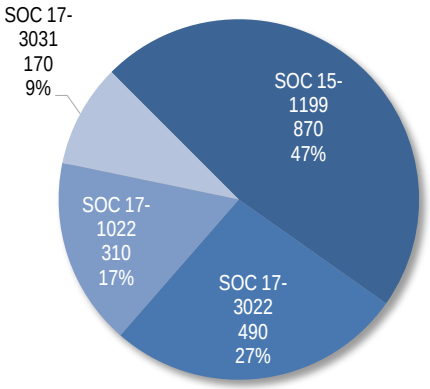
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include computer occupations, all other (SOC 15-1199), geodetic surveyors (SOC 17-1022.01), civil engineering technicians (SOC 17-3022) and mapping technicians (SOC 17-3031.02). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



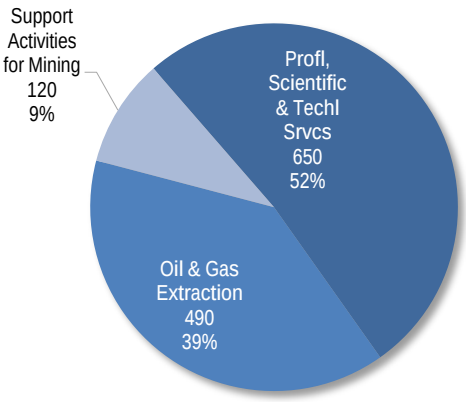

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 19-4041 | 15-1199 | 17-3022 | 17-1022 | 17-3031 |
|---|---|---|---|---|---|
| 211 | X | | | | |
| 213 | X | | | | |
| 221 | | | | | X |
| 236 | | | X | X | |
| 237 | | | X | X | |
| 511 | | X | | | |
| 518 | | X | | | |
| 519 | | X | | | |
| 524 | | X | | | |
| 541 | X | X | X | X | X |
| 551 | | X | | | |
| 561 | | X | X | | |
| 611 | | X | X | | |

Sources: BLS; LAEDC

Industry Distribution of 19-4041 in CA



# First-Line Supervisors of Construction Trades & Extraction Workers (SOC 47-1011)

*Directly supervise and coordinate activities of construction or extraction workers.*

### Entry requirements:
- HS diploma (or equiv)
- Five years or more exp
- No OTJ training

**Jobs in SJV**
**3,670**
**in 2013**

### Major Occupational Group:
- 47-0000 Construction & Extraction Occupations

### Tools:
- Levels
- Manlift or personnel lift
- Power saws
- Screwdrivers
- Trowels

### Technology:
- Calendar and scheduling software
- Data base user interface and query software
- Electronic mail software
- Project management software
- Spreadsheet software

## Core Tasks:

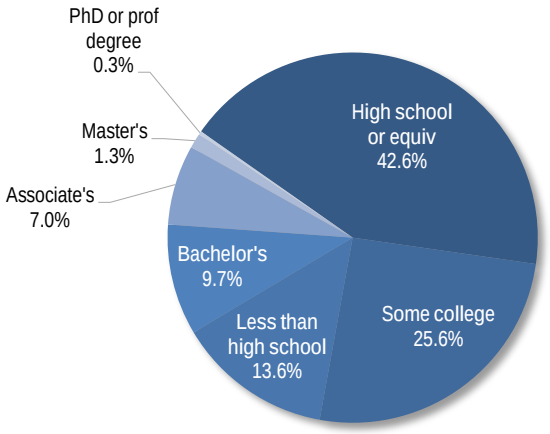
- Supervise, coordinate, or schedule the activities of construction or extractive workers.
- Read specifications, such as blueprints, to determine construction requirements or to plan procedures.
- Inspect work progress, equipment, or construction sites to verify safety or to ensure that specifications are met.
- Locate, measure, and mark site locations or placement of structures or equipment, using measuring and marking equipment.
- Coordinate work activities with other construction project activities.
- Assign work to employees, based on material or worker requirements of specific jobs.
- Estimate material or worker requirements to complete jobs.
- Confer with managerial or technical personnel, other departments, or contractors to resolve problems or to coordinate activities.
- Order or requisition materials or supplies.
- Analyze worker or production problems and recommend solutions, such as improving production methods or implementing motivational plans.
- Train workers in construction methods, operation of equipment, safety procedures, or company policies.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. First-line supervisors of construction trades and extraction workers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Construction of Buildings (NAICS 236)
- Specialty Trade Contractors (NAICS 238)
- Heavy & Civil Engineering Construction (NAICS 237)

### Distribution of Educational Attainment

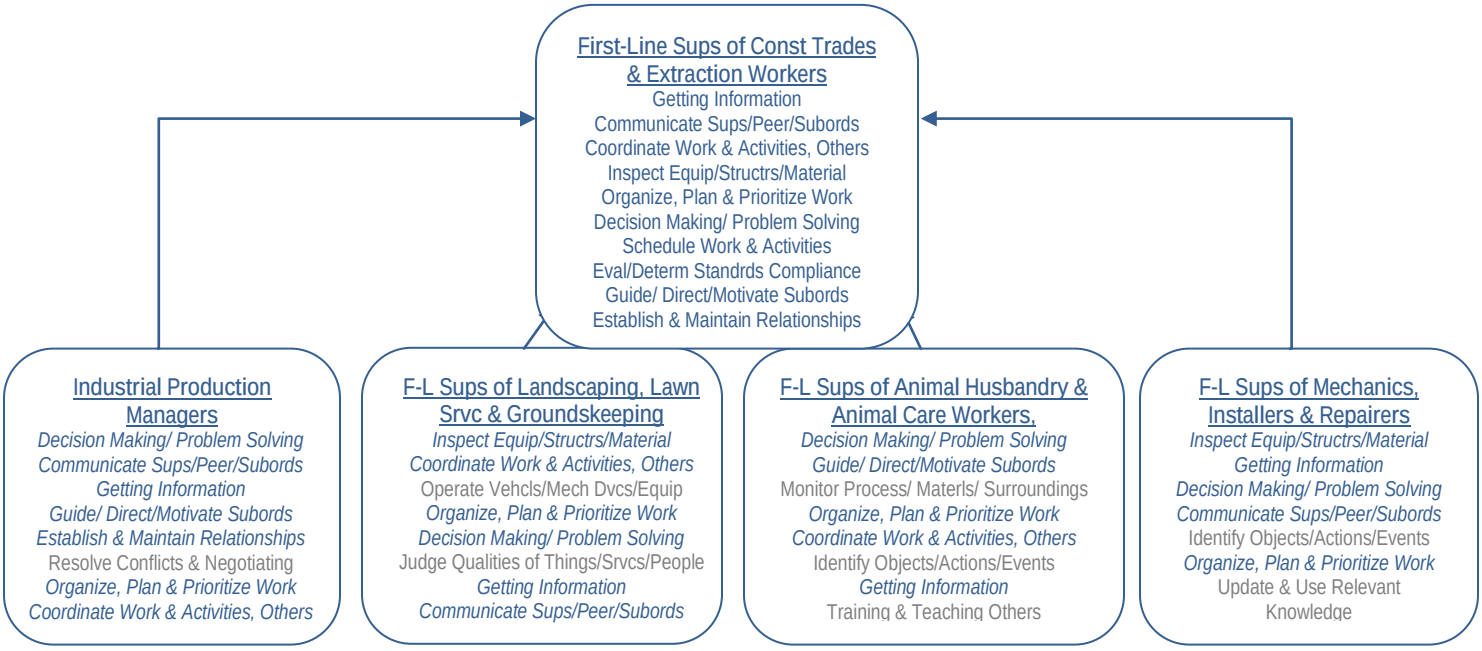



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 51,140 | $ 63,050 | $ 75,280 |
| Kern County | 50,130 | 64,660 | 84,750 |
| Kings County | 42,370 | 54,610 | 70,890 |
| Madera County | 50,700 | 56,890 | 70,420 |
| Merced County | 50,800 | 59,570 | 74,010 |
| San Joaquin County | 51,760 | 64,310 | 82,080 |
| Stanislaus County | 47,700 | 66,000 | 79,230 |
| Tulare County | 46,550 | 54,070 | 62,710 |
| California | $ 57,100 | $ 73,400 | $ 91,000 |

Source: BLS

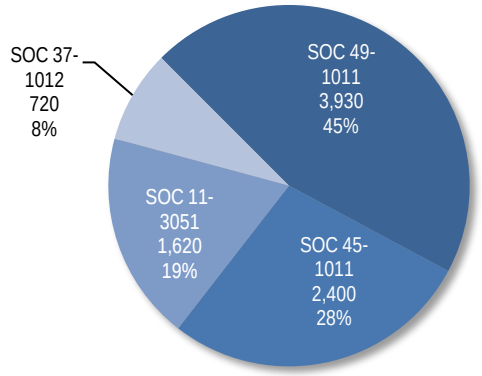
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include industrial production managers (SOC 11-3051), first-line supervisors of landscaping, lawn service and groundskeeping workers (SOC 37-1012), first-line supervisors of animal husbandry and animal care workers (SOC 45-1011.08) and first-line supervisors of mechanics, installers and repairers (SOC 49-1011). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



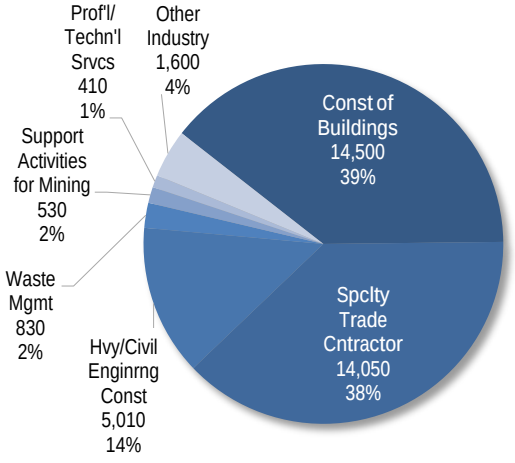

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-1011 | 49-1011 | 45-1011 | 11-3501 | 37-1012 |
|---|---|---|---|---|---|
| 211 | X | | | X | |
| 221 | X | X | | | |
| 237 | X | X | | | |
| 238 | X | X | | | |
| 311 | | X | X | X | |
| 312 | | | X | X | |
| 325 | | X | | X | |
| 424 | | | X | X | |
| 531 | X | X | | | X |
| 541 | X | X | | X | X |
| 561 | X | X | | | X |
| 611 | X | X | X | | X |
| 811 | X | X | | | |

Sources: BLS; LAEDC

Industry Distribution of 47-1011 in CA



# Derrick Operators, Oil & Gas (SOC 47-5011)

*Rig derrick equipment and operate pumps to circulate mud through drill hole.*

## Core Tasks:

- Inspect derricks, or order their inspection, prior to being raised or lowered.
- Inspect derricks for flaws, and clean and oil derricks to maintain proper working conditions.
- Control the viscosity and weight of the drilling fluid.
- Repair pumps, mud tanks, and related equipment.
- Set and bolt crown blocks to posts at tops of derricks.
- Listen to mud pumps and check regularly for vibration and other problems to ensure that rig pumps and drilling mud systems are working properly.
- Start pumps that circulate mud through drill pipes and boreholes to cool drill bits and flush out drill cuttings.
- Position and align derrick elements, using harnesses and platform climbing devices.
- Supervise crew members, and provide assistance in training them.
- Guide lengths of pipe into and out of elevators.
- Prepare mud reports, and instruct crews about the handling of any chemical additives.
- Clamp holding fixtures on ends of hoisting cables.
- Weigh clay, and mix with water and chemicals to make drilling mud, using portable mixers.
- String cables through pulleys and blocks.
- Steady pipes during connection to or disconnection from drill or casing strings.

## Entry requirements:

- Less than HS
- No experience
- Short-term OTJ training

**Jobs in CA**
**540**
**in 2013**
(SJV not disclosed)

## Major Occupational Group:

- 47-0000 Construction & Extraction Occupations

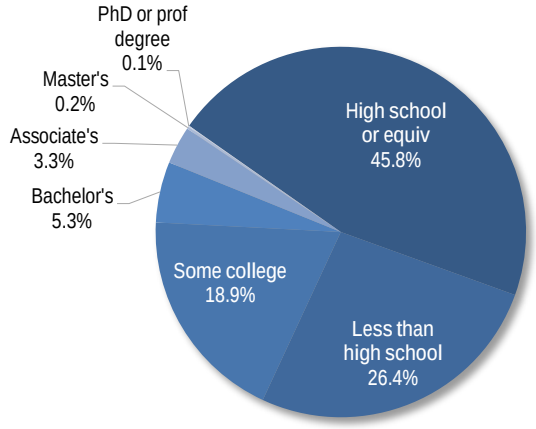
## Tools:

- Hammers
- Hoists
- Lifelines or lifeline equipment
- Mud manifolds
- Mud mixers
- Screwdrivers

## Technology:

- Data base user interface and query software
- Electronic mail software
- Spreadsheet software
- Word processing software

## Distribution of Educational Attainment




## Industry Distribution

There is no cross industry employment for oil and gas derrick operators in California. All employment for this occupation takes place in the support activities for mining industry subsector.

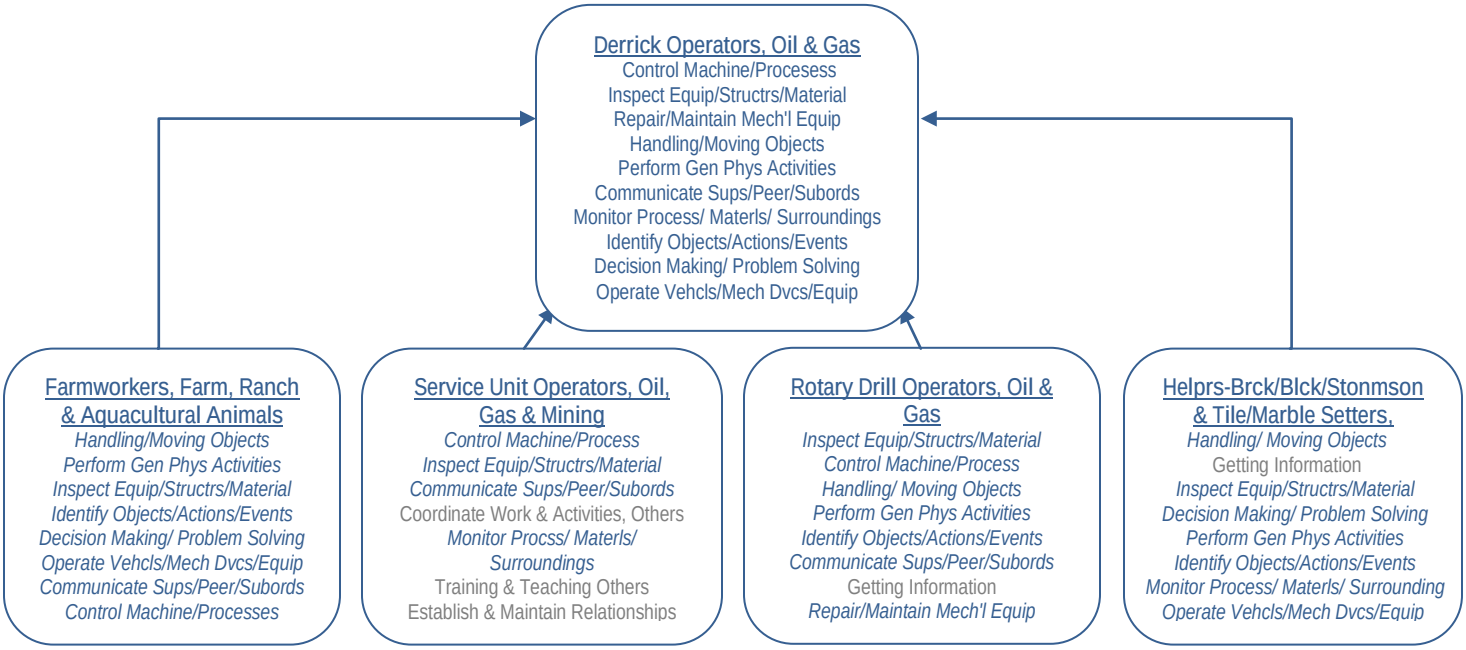
- Support Activities for Mining (NAICS 213)

## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 45,160 | $ 52,150 | $ 58,210 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 44,500 | $ 51,800 | $ 59,700 |

Source: BLS

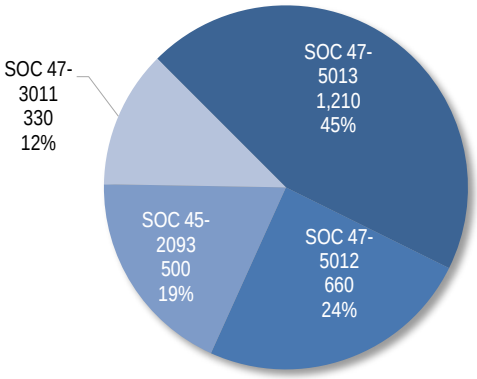
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include farmworkers, farm, ranch and aquaculture animals (SOC 45-2093), service unit operators, oil and gas and mining (SOC 47-5013), rotary drill operators, oil and gas (SOC 47-5012) and helpers – brickmasons, blockmasons, stonemasons and tile and marble setters (SOC 47-3011). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



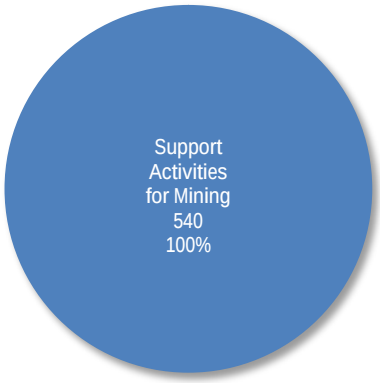

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-5011 | 47-5013 | 47-5012 | 45-2093 | 47-3011 |
|---|---|---|---|---|---|
| 115 | | | | X | |
| 211 | | X | X | | |
| 213 | X | X | X | | |
| 238 | | | | | X |
| 311 | | | | X | |
| 324 | | | X | | |
| 424 | | | | X | |
| 611 | | | | X | |

Sources: BLS; LAEDC

Industry Distribution of 47-5011 in CA



# Rotary Drill Operators, Oil & Gas (SOC 47-5012)

*Set up or operate a variety of drills to remove underground oil and gas, or remove core samples for testing during oil and gas exploration.*

## Core Tasks:

- Train crews, and introduce procedures to make drill work more safe and effective.
- Observe pressure gauge and move throttles and levers to control the speed of rotary tables, and to regulate pressure of tools at bottoms of boreholes.
- Count sections of drill rod to determine depths of boreholes.
- Push levers and brake pedals to control gasoline, diesel, electric, or steam draw works that lower and raise drill pipes and casings in and out of wells.
- Connect sections of drill pipe, using hand tools and powered wrenches and tongs.
- Maintain records of footage drilled, location and nature of strata penetrated, materials and tools used, services rendered, and time required.
- Maintain and adjust machinery to ensure proper performance.
- Start and examine operation of slush pumps to ensure circulation and consistency of drilling fluid or mud in well.
- Locate and recover lost or broken bits, casings, and drill pipes from wells, using special tools.
- Weigh clay, and mix with water and chemicals to make drilling mud.
- Direct rig crews in drilling and other activities, such as setting up rigs and completing or servicing wells.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Oil and gas rotary drill operators in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are three industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Petroleum & Coal Products Manufacturing (NAICS 324)

### Entry requirements:

- Less than HS
- No experience
- Short-term OTJ training

**Jobs in SJV**
**660**
**in 2013**

### Major Occupational Group:

- 47-0000 Construction & Extraction Occupations

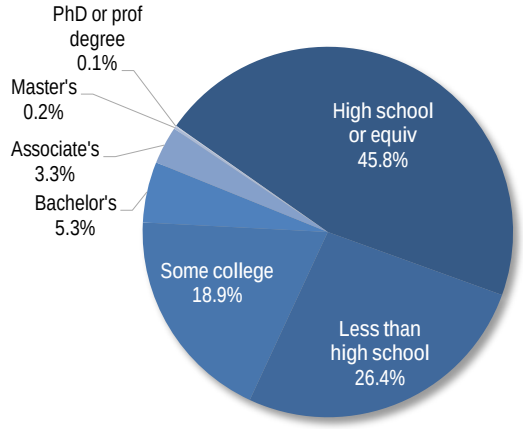
### Tools:

- Casing head spool
- Drawworks
- Drilling casings
- Mud mixers
- Safety harnesses or belts

### Technology:

- Analytical or scientific software
- Data base user interface and query software
- Industrial control software
- Spreadsheet software
- Word processing software

### Distribution of Educational Attainment

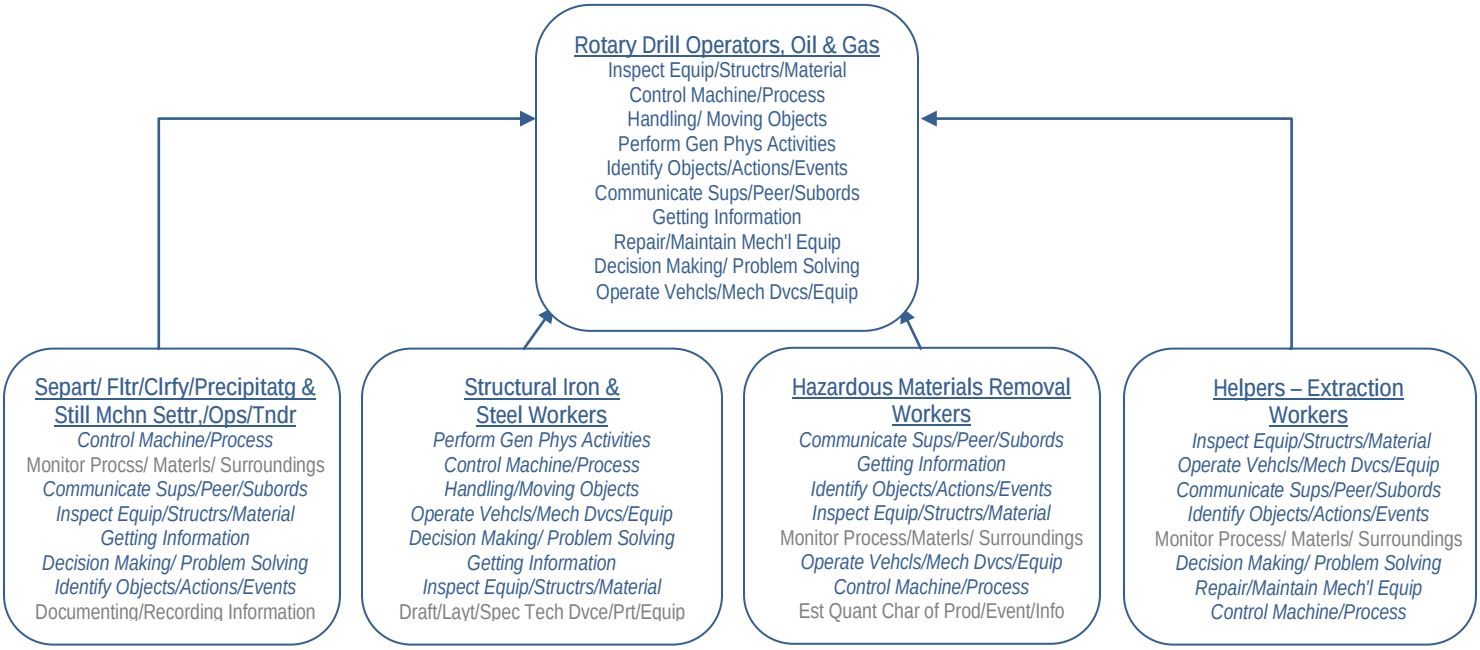



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 63,390 | $ 68,920 | $ 74,460 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 56,800 | $ 65,500 | $ 71,400 |

Source: BLS

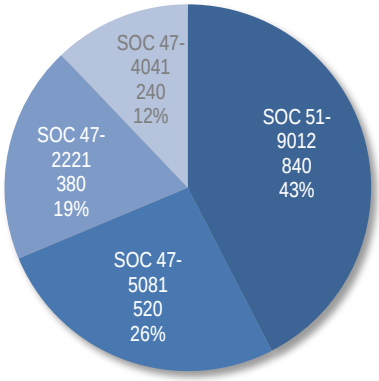
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include separating, filtering, clarifying, precipitating and still machine setters, operators and tenders (SOC 51-9012), structural iron and steel workers (SOC 47-2221), hazardous materials removal workers (SOC 47-4091) and helpers – extraction workers (SOC 47-5081). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



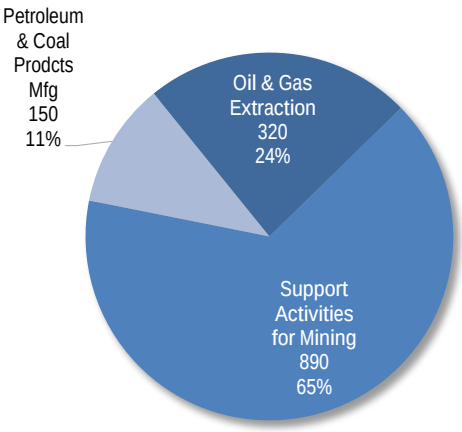

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-5012 | 51-9012 | 47-5081 | 47-2221 | 47-4041 |
|---|---|---|---|---|---|
| 115 | | X | | | |
| 211 | X | | | | |
| 212 | | | X | | |
| 213 | X | | X | | |
| 236 | | | | X | |
| 237 | | | X | X | |
| 238 | | | | X | |
| 311 | | X | | | |
| 312 | | X | | | |
| 324 | X | | | | |
| 332 | | | | X | |
| 561 | | X | | | X |
| 562 | | X | | | X |

Sources: BLS; LAEDC

Industry Distribution of 47-5012 in CA



# Service Unit Operators, Oil, Gas & Mining (SOC 47-5013)

*Operate equipment to increase oil flow from producing wells or to remove stuck pipe, casing, tools, or other obstructions from drilling wells. May also perform similar services in mining exploration operations. Includes fishing-tool technicians.*

**Entry requirements:**
- Less than HS
- No Experience
- Moderate-term OTJ training

**Jobs in SJV**
**1,210**
**in 2013**

**Major Occupational Group:**
- 47-0000 Construction & Extraction Occupations

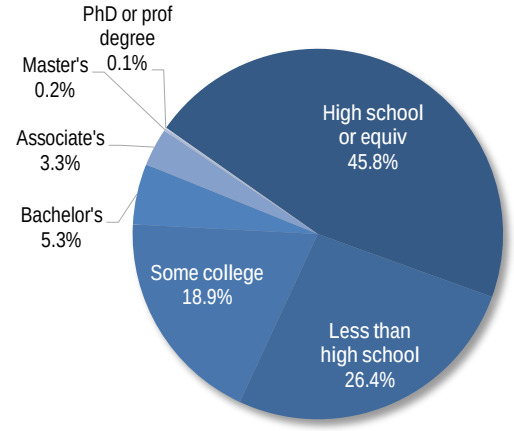
**Tools:**
- Hex keys
- Hoists
- Pipe handling equipment
- Screwdrivers
- Slickline chemical cutters

**Technology:**
- Analytical or scientific software
- Facilities management software
- Industrial control software
- Inventory management software
- Time accounting software

## Core Tasks:

- Maintain and perform safety inspections on equipment and tools.
- Operate controls that raise derricks or level rigs.
- Listen to engines, rotary chains, or other equipment to detect faulty operations or unusual well conditions.
- Prepare reports of services rendered, tools used, or time required, for billing purposes.
- Install pressure-control devices onto wellheads.
- Confer with others to gather information regarding pipe or tool sizes or borehole conditions in wells.
- Operate pumps that circulate water, oil, or other fluids through wells to remove sand or other materials obstructing the free flow of oil.
- Drive truck-mounted units to well sites.
- Interpret instrument readings to ascertain the depth of obstruction.
- Thread cables through derrick pulleys, using hand tools.
- Select fishing methods or tools for removing obstacles such as liners, broken casing, screens, or drill pipe.
- Close and seal wells no longer in use.

## Distribution of Educational Attainment




## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Oil, gas and mining service unit operators in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are two industry subsectors employing this occupation in California:

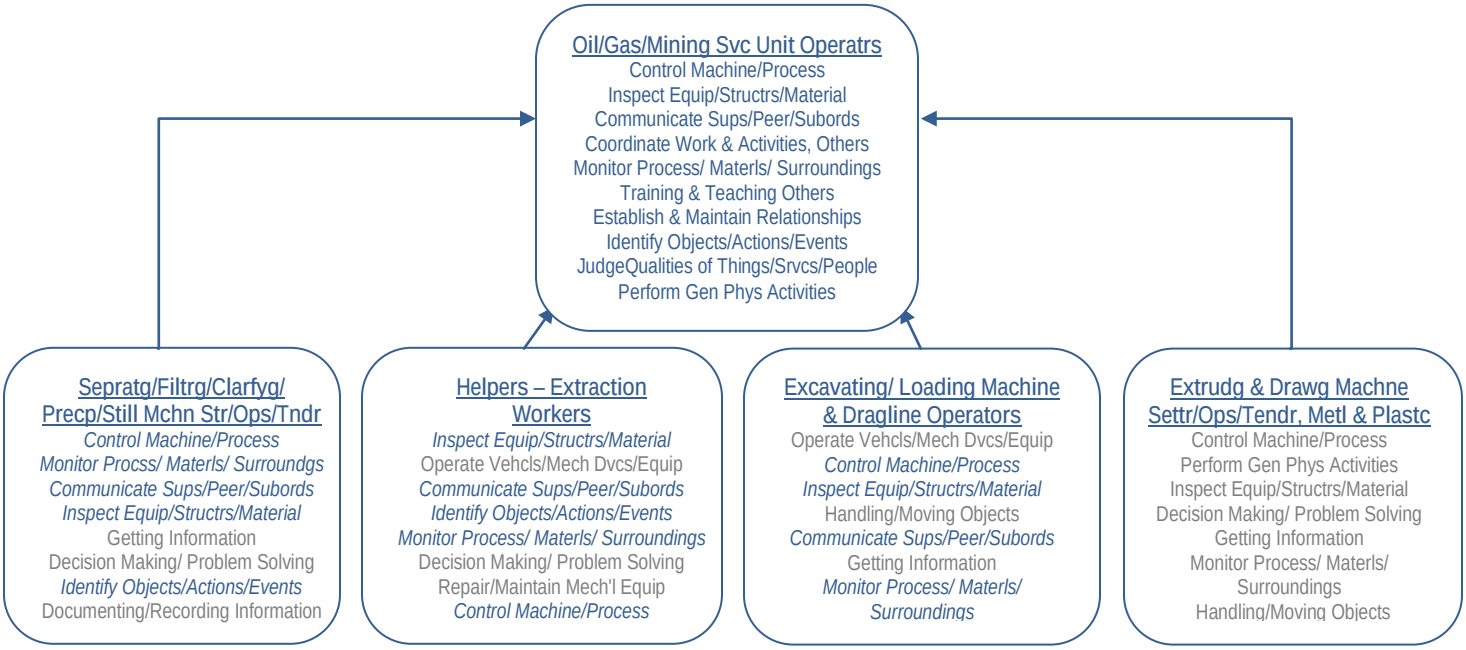
- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)

**Annual Wage Percentiles**

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 36,710 | $ 46,100 | $ 57,950 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 41,400 | $ 45,800 | $ 55,400 |

Source: BLS

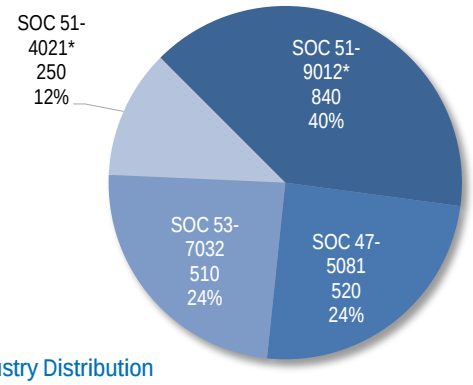
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include separating, filtering, clarifying, precipitating and still machine setters, operators and tenders (SOC 51-9012), helpers – extraction workers (SOC 47-5081), excavating and loading machine and dragline operators (SOC 53-7032) and extruding and drawing machine setters, operators and tenders, metal & plastic (SOC 51-4021). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



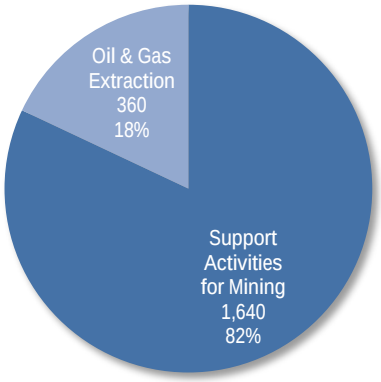

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-5013 | 51-9012 | 47-5081 | 53-7032 | 53-4021 |
|---|---|---|---|---|---|
| 115 | | X | | | |
| 211 | X | | | | |
| 212 | | | X | X | |
| 213 | X | | X | | |
| 237 | | | X | X | |
| 238 | | | | X | |
| 311 | | X | | | |
| 312 | | X | | | |
| 326 | | | | | X |
| 331 | | | | | X |
| 332 | | | | | X |
| 335 | | | | | X |
| 562 | | X | | X | |

Sources: BLS; LAEDC

Industry Distribution of 47-5013 in CA



# Roustabouts, Oil & Gas (SOC 47-5071)

*Assemble or repair oil field equipment using hand and power tools. Perform other tasks as needed.*

## Core Tasks:

- Keep pipe deck and main deck areas clean and tidy.
- Unscrew or tighten pipes, casing, tubing, and pump rods, using hand and power wrenches and tongs.
- Walk flow lines to locate leaks, using electronic detectors and by making visual inspections, and repair the leaks.
- Move pipes to and from trucks, using truck winches and motorized lifts, or by hand.
- Bolt together pump and engine parts.

## Entry requirements:

- Less than HS
- No experience
- Moderate-term OTJ training

**Jobs in SJV**
**2,760**
**in 2013**

## Major Occupational Group:

- 47-0000 Construction & Extraction Occupations

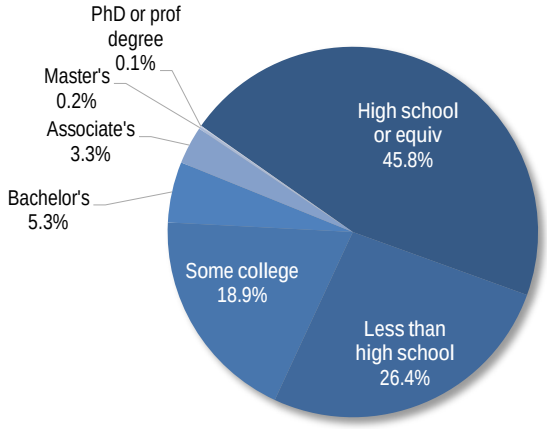
## Tools:

- Hoists
- Oxygen gas analyzers
- Power grinders
- Safety harnesses or belts
- Safety hooks

## Technology:

- Enterprise resource planning ERP software
- Inventory management software
- Office suite software
- Project management software
- Spreadsheet software

## Distribution of Educational Attainment




## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Oil and gas roustabouts in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are three industry subsectors employing this occupation in California:

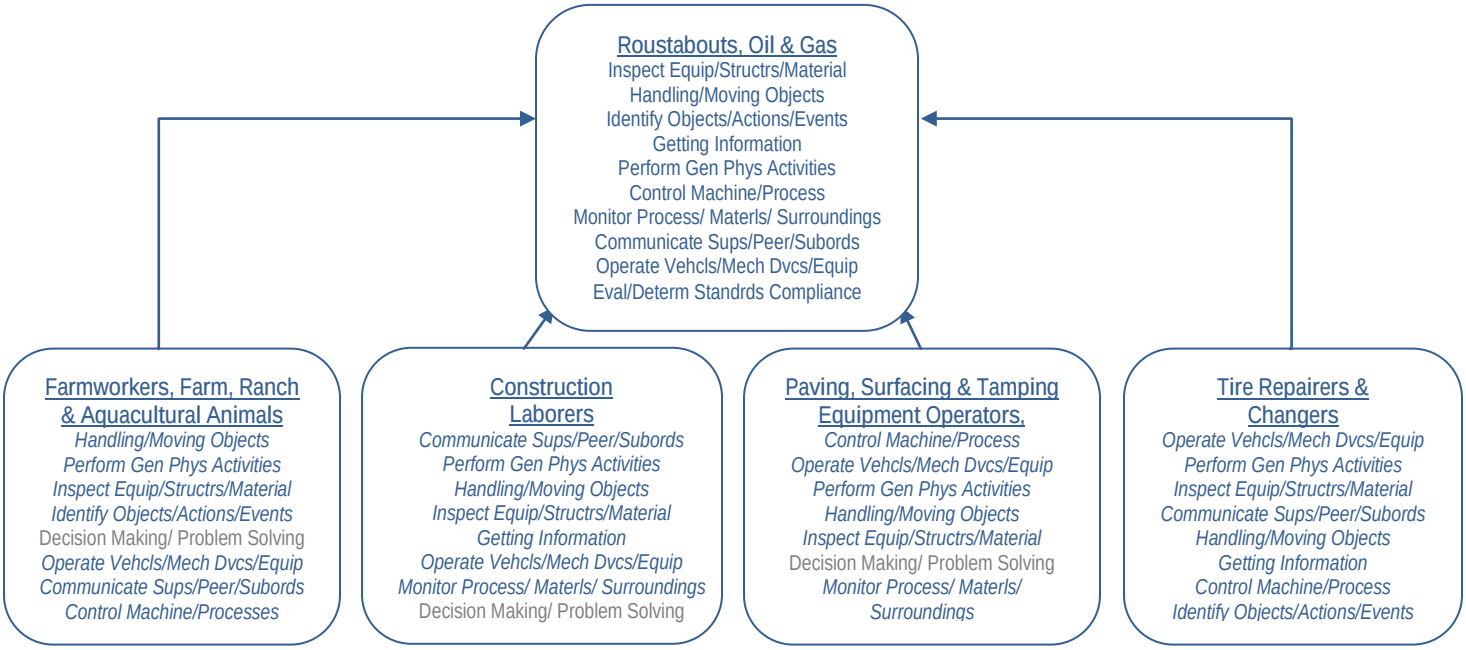
- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Heavy and Civil Engineering Construction (NAICS 237)

## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 23,370 | $ 30,990 | $ 38,090 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 27,100 | $ 33,200 | $ 43,300 |

Source: BLS

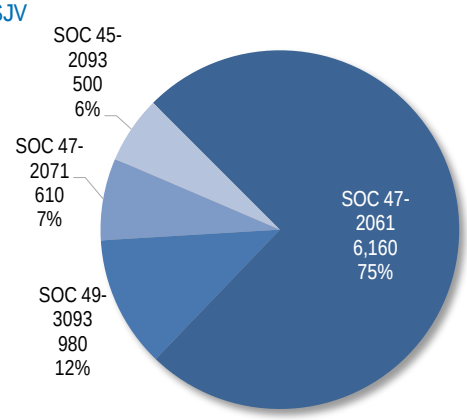
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include farmworkers, farm, ranch and aquacultural animals (SOC 45-2093), construction laborers (SOC 47-2061), paving, surfacing and tamping equipment operators (SOC 47-2071) and tire repairers and changers (SOC 49-3093). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



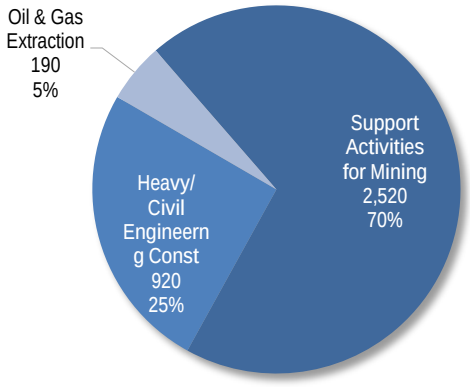

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-5071 | 47-2061 | 49-3093 | 47-2071 | 45-2093 |
|---|---|---|---|---|---|
| 115 | | | | | X |
| 211 | X | | | | |
| 213 | X | X | | | |
| 236 | | X | | | |
| 237 | X | X | | X | |
| 238 | | X | | X | |
| 311 | | | | | X |
| 424 | | | | | X |
| 441 | | | X | | |
| 452 | | | X | | |
| 484 | | | X | | |
| 561 | | X | X | | |
| 811 | | | X | | |

Sources: BLS; LAEDC

Industry Distribution of 47-5071 in CA



# Helpers – Extraction Workers (SOC 47-5081)

*Help extraction craft workers, such as earth drillers, blasters and explosives workers, derrick operators, and mining machine operators, by performing duties requiring less skill. Duties include supplying equipment or cleaning work area.*

## Core Tasks:

- Repair and maintain automotive and drilling equipment, using hand tools.
- Observe and monitor equipment operation during the extraction process in order to detect any problems.
- Drive moving equipment in order to transport materials and parts to excavation sites.
- Clean up work areas and remove debris after extraction activities are complete.
- Organize materials in order to prepare for use.
- Provide assistance to extraction craft workers such as earth drillers and derrick operators.
- Dismantle extracting and boring equipment used for excavation, using hand tools.
- Unload materials, devices and machine parts, using hand tools.

## Entry requirements:

- Less than HS
- No experience
- Short-term OTJ training

**Jobs in SJV**
**520**
**in 2013**

## Major Occupational Group:

- 47-0000 Construction & Extraction Occupations

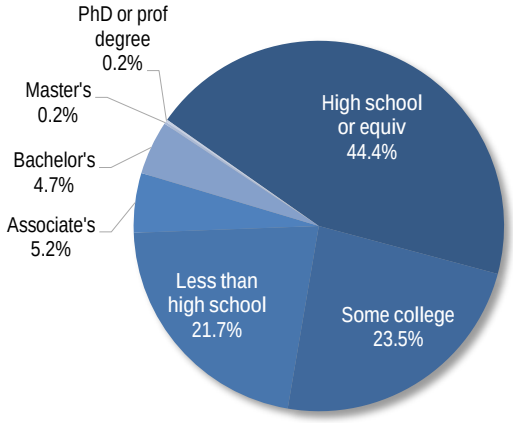
## Tools:

- Blasting caps
- Boring or sinking machinery
- Detonators
- Front end loaders
- Pneumatic rock drills
- Reamer blade
- Two way radios

## Technology:

- Data base user interface and query software
- Office suite software
- Spreadsheet software

## Distribution of Educational Attainment




## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Helpers – extraction workers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are three industry subsectors employing this occupation in California:

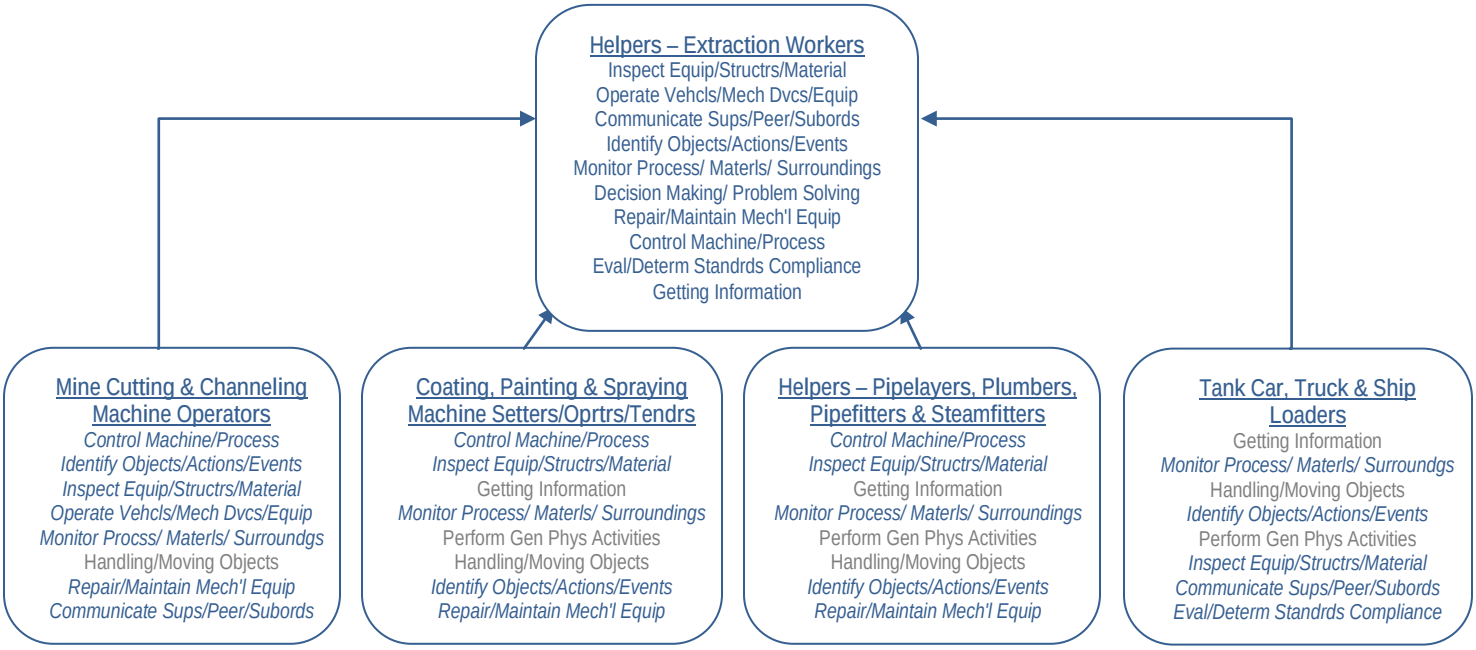
- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Heavy and Civil Engineering Construction (NAICS 237)

## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 31,580 | $ 46,980 | $ 53,410 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California (non-disclosed) | ** | ** | ** |

Source: BLS

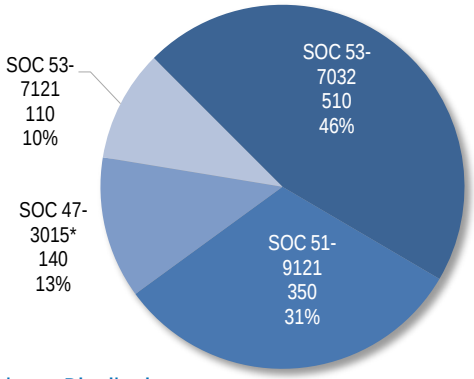
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include include coating, painting and spraying machine setters, operators and tenders (SOC 51-9121), excavating and loading machine and dragline operators (SOC 53-7032), helpers – pipelayers, plumbers, pipefitters and steamfitters (SOC 47-3015) and tank car, truck and ship loaders (SOC 53-7121). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



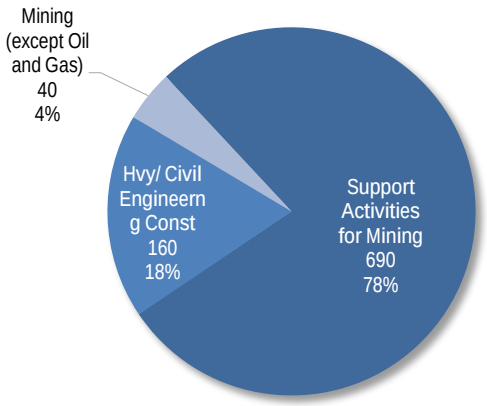

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 47-5081 | 53-7032 | 51-9121 | 47-3015 | 53-7121 |
|---|---|---|---|---|---|
| 212 | X | X | | | |
| 213 | X | | | | |
| 237 | X | X | | | |
| 238 | | X | | X | |
| 326 | | | X | | |
| 332 | | | X | | |
| 333 | | | X | | |
| 337 | | | X | | |
| 339 | | | X | | |
| 423 | | X | X | | |
| 484 | | | | | X |
| 488 | | | | | X |
| 562 | | X | | | |

Sources: BLS; LAEDC

Industry Distribution of 47-5081 in CA



# Welders, Cutters, Solderers & Brazers (SOC 51-4121)

*Use hand-welding, flame-cutting, hand soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.*

## Core Tasks:

- Weld components in flat, vertical, or overhead positions.
- Operate safety equipment and use safe work habits.
- Lay out, position, align, and secure parts and assemblies prior to assembly, using straightedges, combination squares, calipers, and rulers.
- Examine workpieces for defects and measure workpieces with straightedges or templates to ensure conformance with specifications.
- Recognize, set up, and operate hand and power tools common to the welding trade, such as shielded metal arc and gas metal arc welding equipment.
- Weld separately or in combination, using aluminum, stainless steel, cast iron, and other alloys.
- Clamp, hold, tack-weld, heat-bend, grind or bolt component parts to obtain required configurations and positions for welding.
- Select and install torches, torch tips, filler rods, and flux, according to welding chart specifications or types and thicknesses of metals.
- Ignite torches or start power supplies and strike arcs by touching electrodes to metals being welded, completing electrical circuits.
- Connect and turn regulator valves to activate and adjust gas flow and pressure so that desired flames are obtained.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Welders, cutters, solderers and brazers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Fabricated Metal Product Manufacturing (NAICS 332)
- Transportation Equipment Manufacturing (NAICS 336)
- Machinery Manufacturing (NAICS 333)

### Entry requirements:

- HS diploma (or equiv)
- No experience
- Moderate-term OTJ training

**Jobs in SJV**
**3,830**
**in 2013**

### Major Occupational Group:

- 51-0000 Production Occupations

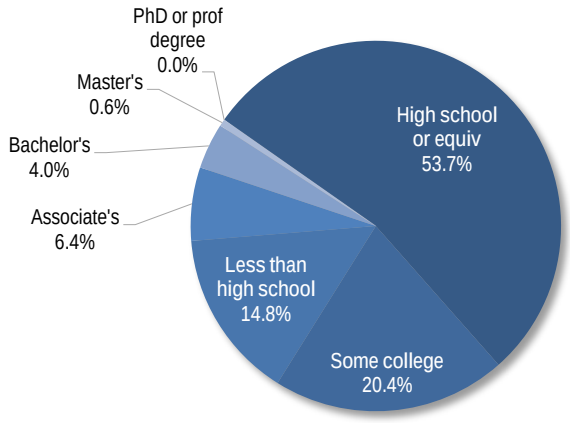
### Tools:

- Drill press or radial drill
- Electrode holder
- Gas welding or brazing or cutting apparatus
- Tungsten inert gas welding machine
- Welder torch
- Welding electrode

### Technology:

- Analytical or scientific software
- Calendar and scheduling software
- Computer aided design CAD software
- Data base user interface and query software

### Distribution of Educational Attainment

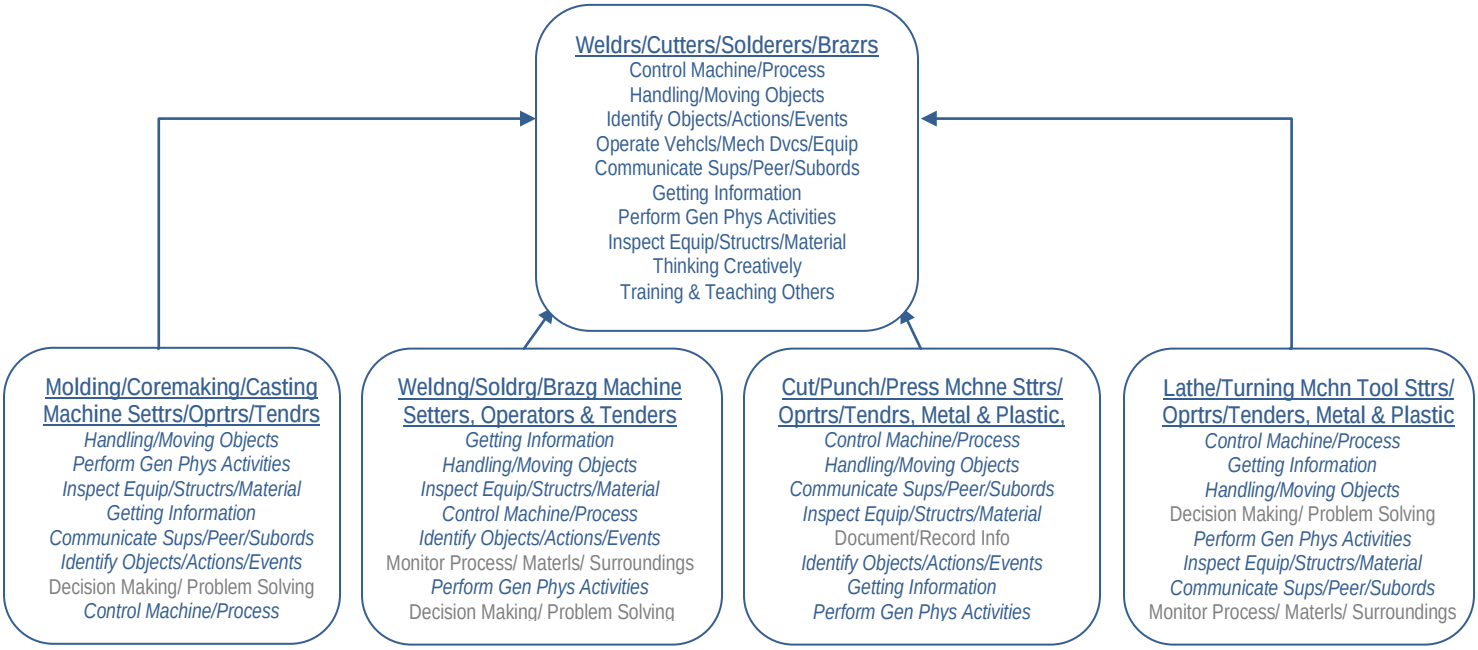



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 27,270 | $ 32,830 | $ 39,930 |
| Kern County | 33,740 | 50,630 | 68,160 |
| Kings County | 23,770 | 32,820 | 38,140 |
| Madera County | 29,250 | 34,950 | 40,720 |
| Merced County | 22,660 | 26,540 | 32,460 |
| San Joaquin County | 31,490 | 40,510 | 46,530 |
| Stanislaus County | 32,570 | 42,650 | 53,340 |
| Tulare County | 28,430 | 34,200 | 39,280 |
| California | $ 30,500 | $ 39,400 | $ 48,300 |

Source: BLS

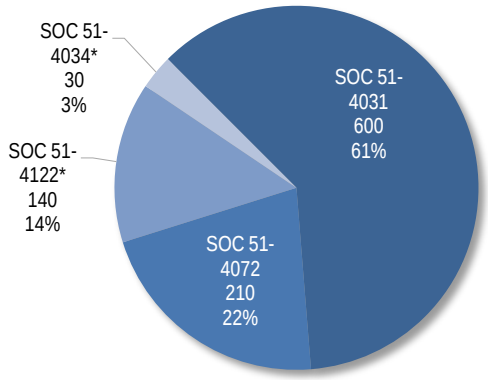
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include molding, coremaking and casting machine setters, operators and tenders (SOC 51-4072), welding, soldering and brazing machine setters, operators and tenders (SOC 51-4122), cutting, punching and press machine setters, operators and tenders, metal and plastic (SOC 51-4031) and lathe and turning machine tool setters, operators and tenders, metal and plastic (SOC 51-4034). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



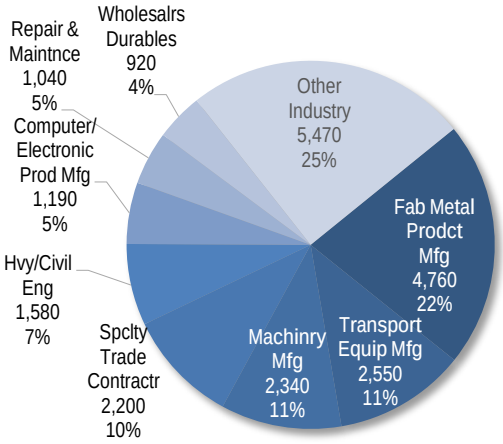

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 51-4121 | 51-4031 | 51-4072 | 51-4122 | 51-4034 |
|---|---|---|---|---|---|
| 237 | X | | | | |
| 238 | X | | | | |
| 326 | | X | X | | |
| 331 | X | X | X | | X |
| 332 | X | X | X | X | X |
| 333 | X | X | X | X | X |
| 334 | X | X | X | X | X |
| 335 | X | X | X | X | X |
| 336 | X | X | X | X | X |
| 337 | X | X | X | X | |
| 339 | X | X | X | X | X |
| 423 | X | X | | X | |
| 561 | X | X | X | | |

Sources: BLS; LAEDC

Industry Distribution of 51-4121 in CA



# Gas Plant Operators (SOC 51-8092)

*Distribute or process gas for utility companies and others by controlling compressors to maintain specified pressures on main pipelines.*

## Core Tasks:

- Monitor transportation and storage of flammable and other potentially dangerous products to ensure that safety guidelines are followed.
- Monitor equipment functioning, observe temperature, level, and flow gauges, and perform regular unit checks to ensure that all equipment is operating as it should.
- Control operation of compressors, scrubbers, evaporators, and refrigeration equipment to liquefy, compress, or regasify natural gas.
- Start and shut down plant equipment.
- Record, review, and compile operations records, test results, and gauge readings such as temperatures, pressures, concentrations, and flows.
- Adjust temperature, pressure, vacuum, level, flow rate, or transfer of gas to maintain processes at required levels or to correct problems.
- Clean, maintain, and repair equipment, using hand tools, or request that repair and maintenance work be performed.
- Collaborate with other operators to solve unit problems.
- Determine causes of abnormal pressure variances, and make corrective recommendations, such as installation of pipes to relieve overloading.
- Read logsheets to determine product demand and disposition, or to detect malfunctions.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. General and operation managers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are four industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Utilities (NAICS 221)
- Chemical Manufacturing (NAICS 325)
- Pipeline Transportation (NAICS 486)

## Entry requirements:

- HS diploma (or equiv)
- No experience
- Long-term OTJ training

**Jobs in CA**
**1,280**
**in 2013**
**(SJV not disclosed)**

## Major Occupational Group:

- 51-0000 Production Occupations

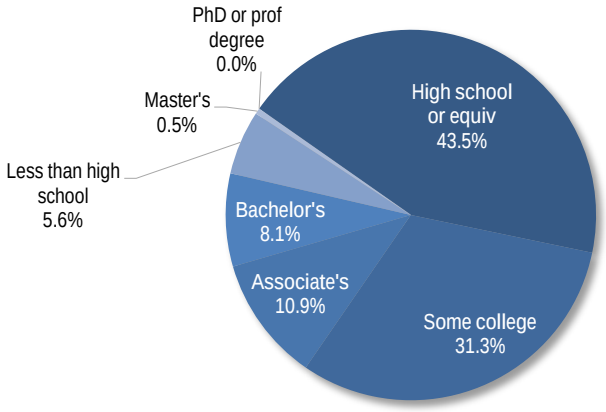
## Knowledge:

- Mechanical
- Public Safety and Security
- Production and Processing
- Computers and Electronics
- Customer and Personal Service

## Skills:

- Operation Monitoring
- Monitoring
- Operation and Control
- Critical Thinking
- Quality Control Analysis

## Distribution of Educational Attainment

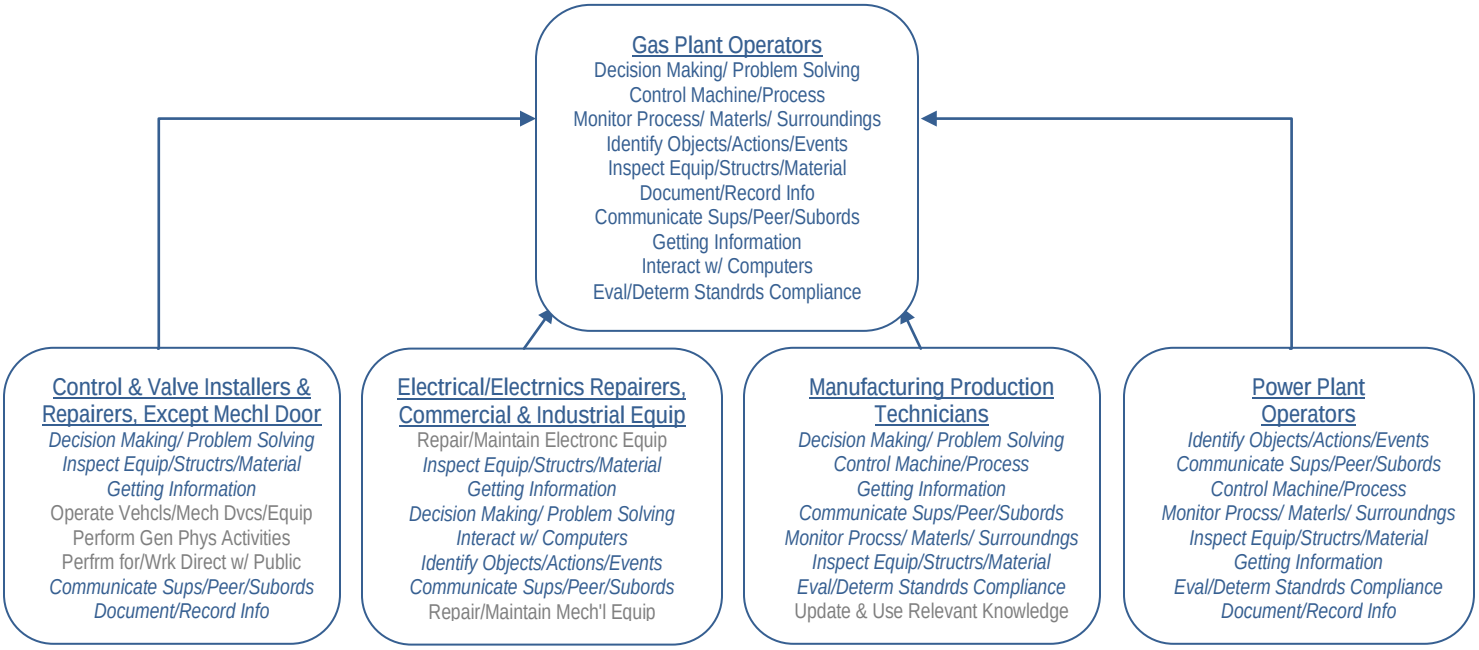



## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 67,590 | $ 76,230 | $ 86,940 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 66,500 | $ 74,600 | $ 85,300 |

Source: BLS

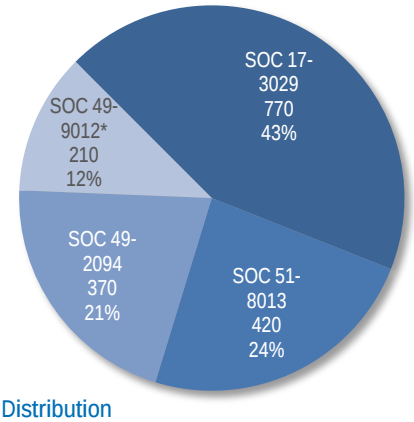
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include control and valve installers and repairers, except mechanical door (SOC 49-9012), electrical and electronic repairers, commercial and industrial equipment (SOC 49-2094), manufacturing production technicians (SOC 17-3029) and power plant operators (SOC 51-8013). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



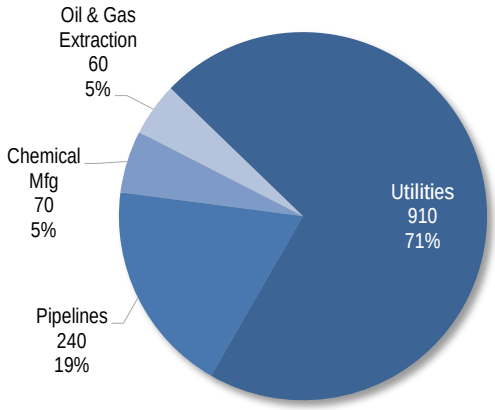

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 51-8092 | 17-3029 | 51-8013 | 49-2094 | 49-9012 |
|---|---|---|---|---|---|
| 211 | X | X | | | |
| 221 | X | X | X | X | X |
| 237 | | | | X | X |
| 238 | | | | X | |
| 325 | X | | | X | |
| 334 | | X | | X | |
| 336 | | X | | X | |
| 339 | | X | | X | |
| 423 | | | | X | X |
| 486 | X | | | | |
| 541 | | X | X | X | |
| 551 | | X | | | X |
| 561 | | X | X | X | |

Sources: BLS; LAEDC

Industry Distribution of 51-8092 in CA



# Petroleum Pump System Operators, Refinery Operators & Gaugers (SOC 51-8093)

*Operate or control petroleum refining or processing units. May specialize in controlling manifold and pumping systems, gauging or testing oil in storage tanks, or regulating the flow of oil into pipelines.*

## Core Tasks:

- Monitor process indicators, instruments, gauges, and meters to detect and report any possible problems.
- Start pumps and open valves or use automated equipment to regulate the flow of oil in pipelines and into and out of tanks.
- Control or operate manifold and pumping systems to circulate liquids through a petroleum refinery.
- Operate control panels to coordinate and regulate process variables such as temperature and pressure, and to direct product flow rate, according to process schedules.
- Signal other workers by telephone or radio to operate pumps, open and close valves, and check temperatures.
- Verify that incoming and outgoing products are moving through the correct meters, and that meters are working properly.
- Read automatic gauges at specified intervals to determine the flow rate of oil into or from tanks, and the amount of oil in tanks.
- Operate auxiliary equipment and control multiple processing units during distilling or treating operations, moving controls that regulate valves, pumps, compressors, and auxiliary equipment.
- Plan movement of products through lines to processing, storage, and shipping units, using knowledge of system interconnections and capacities.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. General and operation managers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are four industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Petroleum & Coal Products Manufacturing (NAICS 324)
- Pipeline Transportation (NAICS 486)

## Entry requirements:

- HS diploma (or equiv)
- No experience
- Long-term OTJ training

**Jobs in SJV**
**500**
**in 2013**

## Major Occupational Group:

- 51-0000 Production Occupations

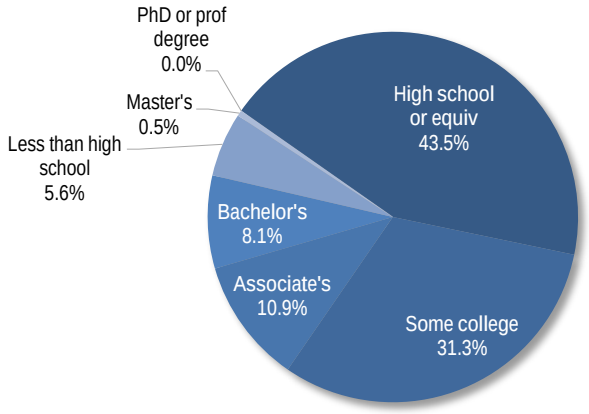
## Knowledge:

- Mechanical
- Mathematics
- Public Safety and Security
- Education and Training
- Computers and Electronics

## Skills:

- Operation Monitoring
- Monitoring
- Operation and Control
- Reading Comprehension
- Complex Problem Solving

## Distribution of Educational Attainment

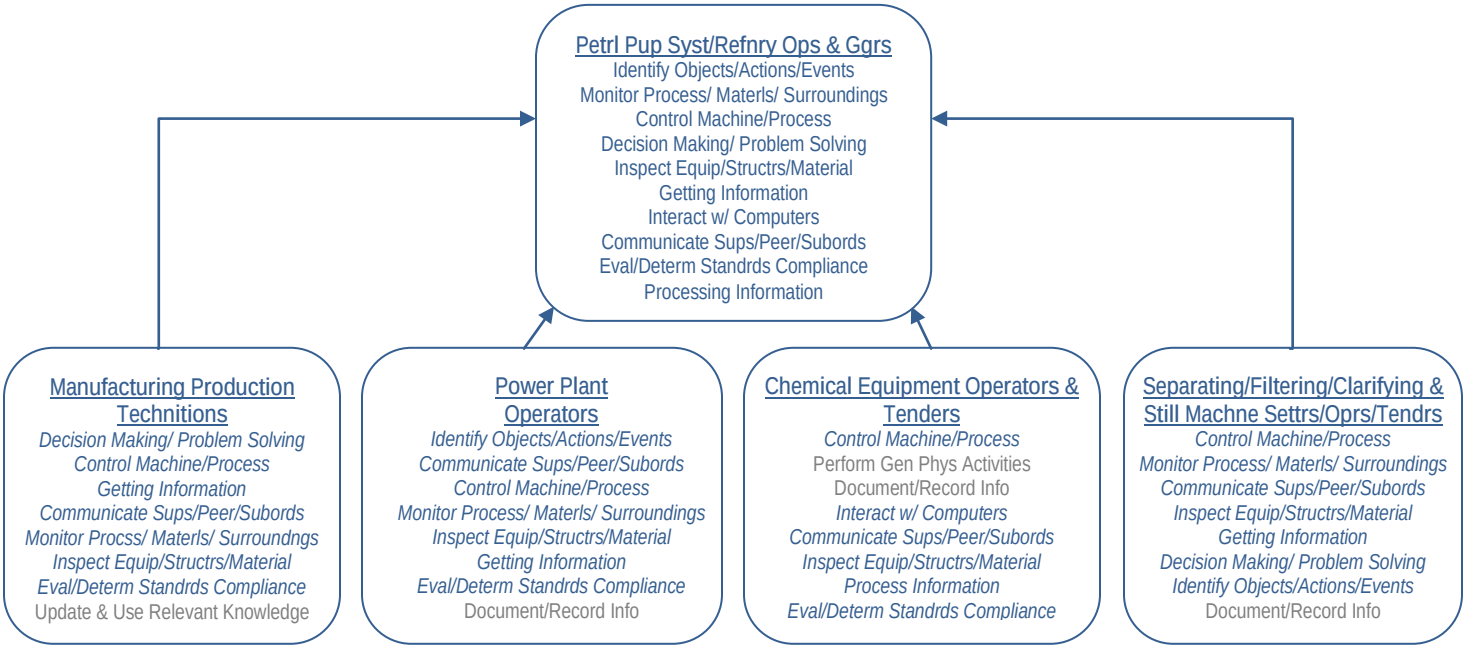



## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 50,590 | $ 59,630 | $ 69,000 |
| Kern County | 51,810 | 62,360 | 73,670 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 63,400 | $ 71,600 | $ 83,100 |

Source: BLS

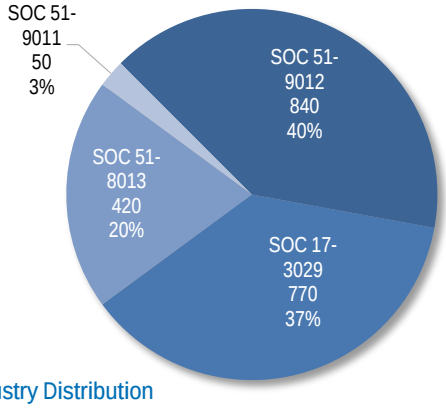
## Work Activities Match - Current Potential in the Local Workforce



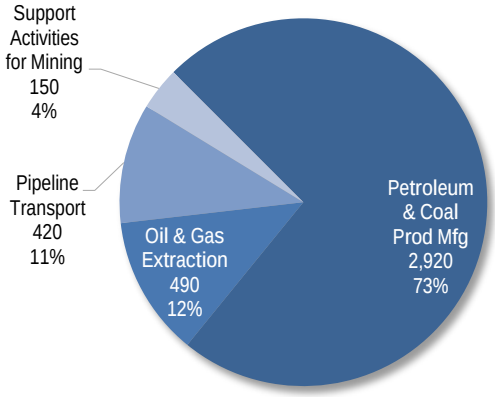

## Related Occupations

Other related occupations with similar skill sets include manufacturing production technicians (SOC 17-3029), power plant operators (SOC 51-8013), chemical equipment operators and tenders (SOC 51-9011) and separating, filtering, clarifying, precipitating and still machine setters, operators and tenders (SOC 51-9012). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

### Potential Trainable Workforce SJV




### Industry Distribution of 51-8093 in CA




## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 51-8093 | 51-9012 | 17-3029 | 51-8013 | 51-9011 |
|---|---|---|---|---|---|
| 115 | | X | | | |
| 211 | X | | X | | |
| 221 | | | X | X | |
| 311 | | X | | | |
| 312 | | X | | | |
| 324 | X | | | | |
| 325 | | X | | | X |
| 334 | | | X | | |
| 336 | | | X | | |
| 486 | X | | | | |
| 541 | | | X | X | X |
| 561 | | X | X | X | X |
| 622 | | | | X | |

Sources: BLS; LAEDC

# Heavy & Tractor-Trailer Truck Drivers (SOC 53-3032)

*Drive a tractor-trailer combination or a truck with a capacity of at least 26,000 pounds Gross Vehicle Weight (GVW). May be required to unload truck. Requires commercial drivers' license.*

## Core Tasks:

- Check vehicles to ensure that mechanical, safety, and emergency equipment is in good working order.
- Maneuver trucks into loading or unloading positions, following signals from loading crew and checking that vehicle and loading equipment are properly positioned.
- Collect delivery instructions from appropriate sources, verifying instructions and routes.
- Maintain logs of working hours or of vehicle service or repair status, following applicable state and federal regulations.
- Report vehicle defects, accidents, traffic violations, or damage to the vehicles.
- Secure cargo for transport, using ropes, blocks, chain, binders, or covers.
- Drive trucks to weigh stations before and after loading and along routes to document weights and to comply with state regulations.
- Drive trucks with capacities greater than 3 tons, including tractor-trailer combinations, to transport and deliver products, livestock, or other materials.
- Obtain receipts or signatures for delivered goods and collect payment for services when required.
- Inventory and inspect goods to be moved to determine quantities and conditions.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Heavy and tractor-trailer truck drivers in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Truck Transportation (NAICS 484)
- Wholesalers, Nondurable Goods (NAICS 424)
- Support Activities for Transportation (488)

### Entry requirements:

- Postsecondary nondegree
- No experience
- Short-term OTJ training
- Commercial DL

**Jobs in SJV**
**23,350**
**in 2013**

### Major Occupational Group:

- 53-0000 Transportation & Material Moving Occupations

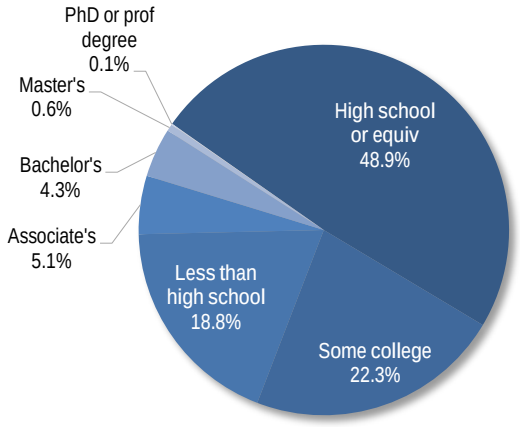
### Tools:

- Flatbed trailers
- Lifts
- Mobile phones
- Snowplow attachments
- Trailer hitches

### Technology:

- Analytical or scientific software
- Data base user interface and query software
- Inventory management software
- Materials requirements planning logistics and supply chain software
- Route navigation software

### Distribution of Educational Attainment

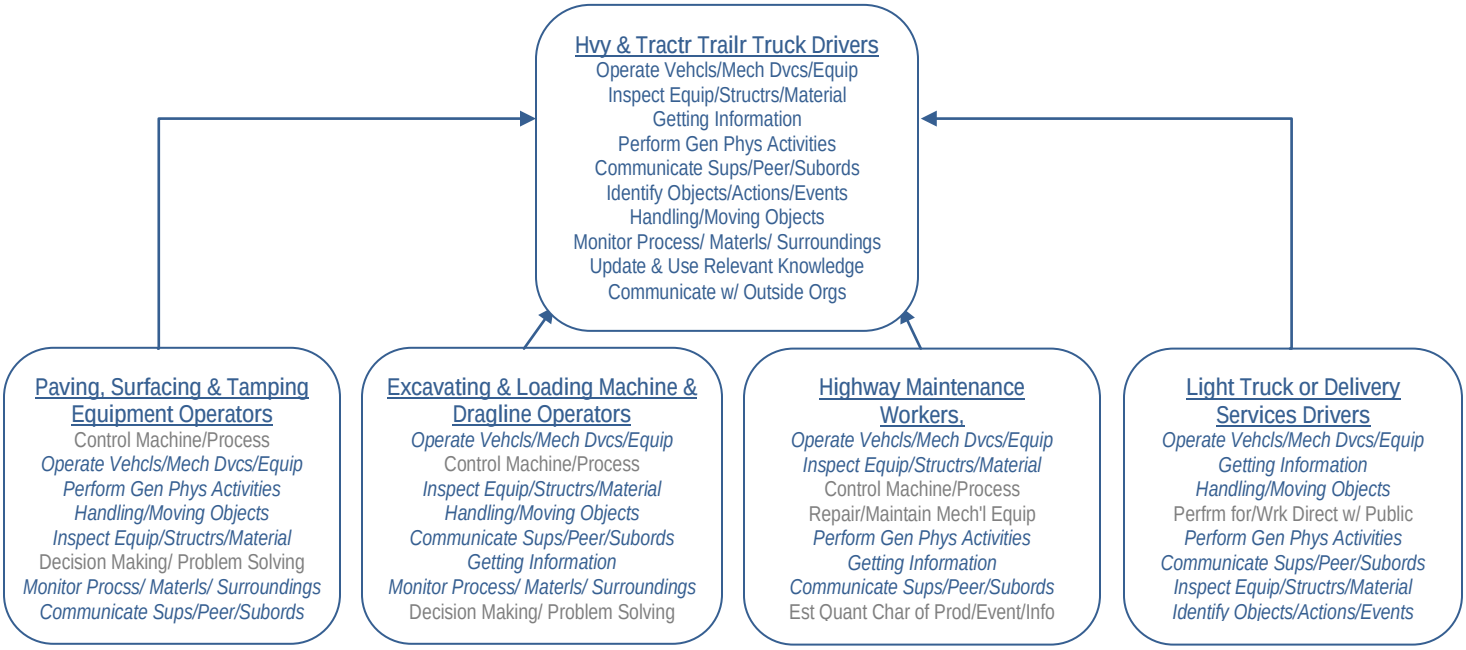



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 31,290 | $ 35,910 | $ 43,670 |
| Kern County | 33,540 | 38,970 | 47,530 |
| Kings County | 26,640 | 32,100 | 41,420 |
| Madera County | 33,280 | 41,090 | 49,590 |
| Merced County | 28,270 | 34,810 | 68,920 |
| San Joaquin County | 34,490 | 41,370 | 47,030 |
| Stanislaus County | 32,040 | 38,060 | 48,370 |
| Tulare County | 23,560 | 34,410 | 45,090 |
| California | $ 33,100 | $ 40,700 | $ 49,600 |

Source: BLS

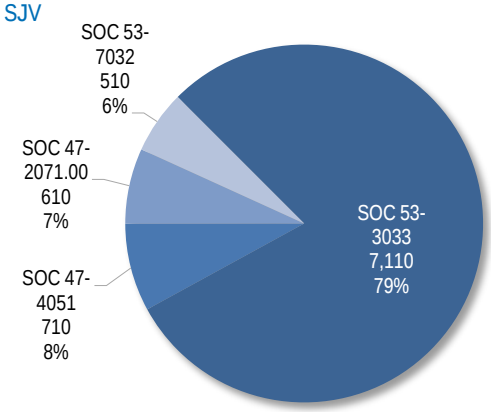
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include paving, surfacing, and tamping equipment operators, (SOC 47-2071), excavating and loading machine and dragline operators (SOC 53-7032), highway maintenance workers (SOC 47-4051) and light truck or delivery service drivers (SOC 53-3033). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

### Potential Trainable Workforce SJV



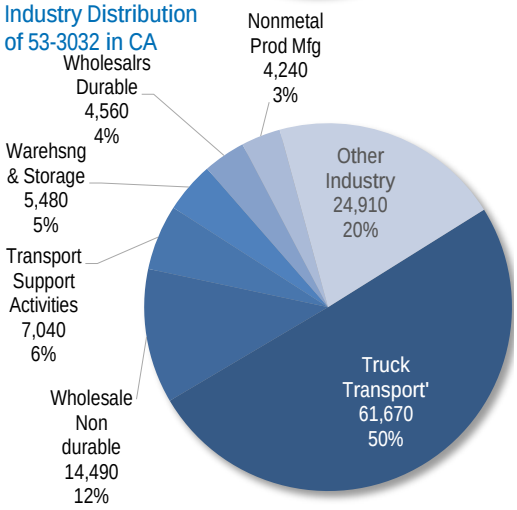

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 53-3032 | 53-3033 | 47-4051 | 47-2071 | 53-7032 |
|---|---|---|---|---|---|
| 115 | X | | | | |
| 212 | | | | | X |
| 237 | X | | X | X | X |
| 238 | X | X | | X | X |
| 311 | X | X | | | |
| 423 | X | X | | | X |
| 424 | X | X | | | |
| 444 | X | X | | | |
| 484 | X | X | | | |
| 493 | X | X | | | |
| 532 | X | X | | | |
| 562 | X | | | | X |
| 811 | X | X | | | |

Sources: BLS; LAEDC

### Industry Distribution of 53-3032 in CA



# Crane & Tower Operators (SOC 53-7021)

*Operate mechanical boom and cable or tower and cable equipment to lift and move materials, machines, or products in many directions.*

## Core Tasks:

- Determine load weights and check them against lifting capacities to prevent overload.
- Move levers, depress foot pedals, or turn dials to operate cranes, cherry pickers, electromagnets, or other moving equipment for lifting, moving, or placing loads.
- Inspect cables or grappling devices for wear and install or replace cables, as needed.
- Clean, lubricate, and maintain mechanisms such as cables, pulleys, or grappling devices, making repairs as necessary.
- Inspect and adjust crane mechanisms or lifting accessories to prevent malfunctions or damage.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Crane and tower operators in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. The three largest industry subsectors employing the largest numbers of this occupation in California are:

- Support Activities for Mining (NAICS 213)
- Specialty Trade Contractors (NAICS 238)
- Heavy & Civil Engineering Construction (NAICS 237)

## Entry requirements:

- HS diploma (or equiv)
- Less than five years exp
- Moderate-term OTJ training

**Jobs in SJV**
**600**
**in 2013**

## Major Occupational Group:

- 53-0000 Transportation & Material Moving Occupations

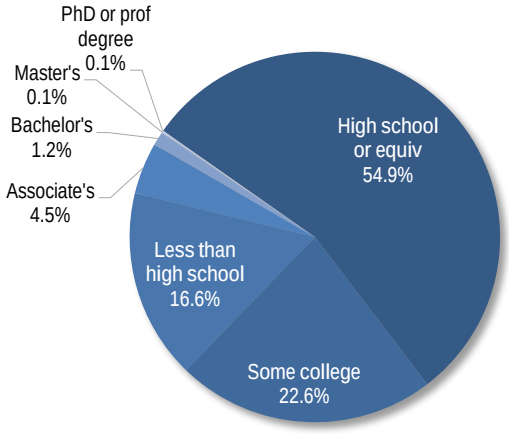
## Tools:

- Below the hook device
- Demolition equipment kits
- Hammers
- Lifting hooks
- Screwdrivers
- Tower cranes
- Track cranes

## Technology:

- Data base user interface and query software
- Industrial control software
- Inventory management software

## Distribution of Educational Attainment

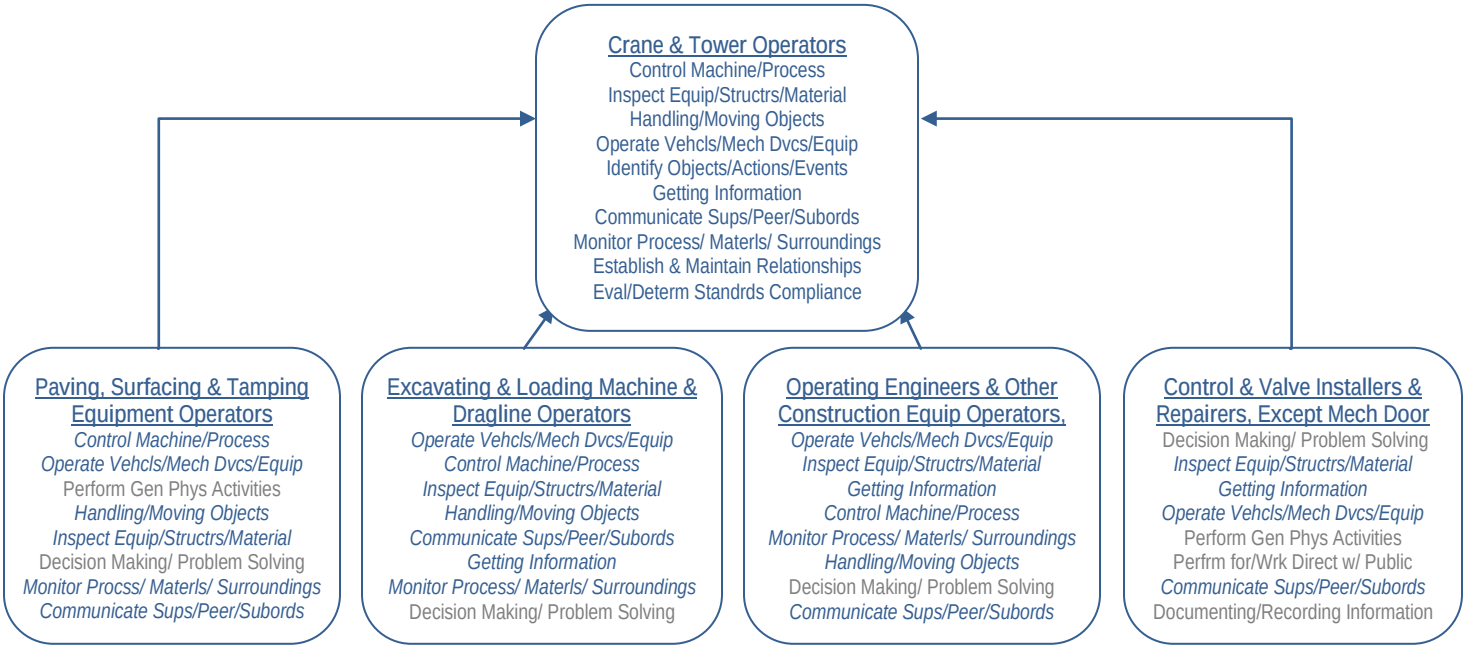



## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | $ 26,310 | $ 28,560 | $ 53,490 |
| Kern County | 48,780 | 54,180 | 59,680 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | 52,360 | 61,610 | 82,100 |
| Stanislaus County | | | |
| Tulare County | | | |
| | | | |
| California | $ 49,100 | $ 67,200 | $ 86,600 |

Source: BLS

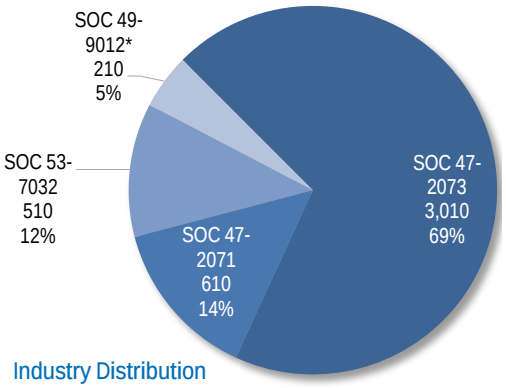
## Work Activities Match - Current Potential in the Local Workforce



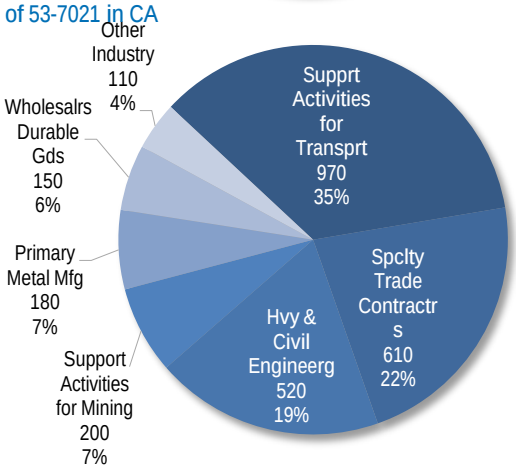

## Related Occupations

Other related occupations with similar skill sets include paving, surfacing and tamping equipment operators (SOC 47-2071), excavating and loading machine and dragline operators (SOC 53-7032), operating engineers and other construction equipment operators (SOC 47-2073) and control and valve installers and repairers, except mechanical door (SOC 49-9012). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

### Potential Trainable Workforce SJV




### Industry Distribution of 53-7021 in CA




## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 53-7021 | 47-2073 | 47-2071 | 53-7032 | 49-9012 |
|---|---|---|---|---|---|
| 212 | | X | | X | |
| 213 | X | X | | | |
| 221 | X | X | | | X |
| 236 | | X | | | |
| 237 | X | X | X | X | X |
| 238 | X | X | X | X | |
| 327 | X | X | | | |
| 331 | X | | | | |
| 423 | X | | | X | X |
| 424 | | | | | X |
| 488 | X | | | | |
| 551 | | | | | X |
| 562 | | X | | X | |

Sources: BLS; LAEDC

# Pump Operators, Except Wellhead Pumpers (SOC 53-7072)

*Tend, control, or operate power-driven, stationary, or portable pumps and manifold systems to transfer gases, oil, other liquids, slurries, or powdered materials to and from various vessels and processes.*

## Core Tasks:

- Monitor gauges and flowmeters and inspect equipment to ensure that tank levels, temperatures, chemical amounts, and pressures are at specified levels, reporting abnormalities as necessary.
- Record operating data such as products and quantities pumped, stocks used, gauging results, and operating times.
- Communicate with other workers, using signals, radios, or telephones, to start and stop flows of materials or substances.
- Tend vessels that store substances such as gases, liquids, slurries, or powdered materials, checking levels of substances by using calibrated rods or by reading mercury gauges and tank charts.
- Turn valves and start pumps to start or regulate flows of substances such as gases, liquids, slurries, or powdered materials.
- Plan movement of products through lines to processing, storage, and shipping units, using knowledge of interconnections and capacities of pipelines, valve manifolds, pumps, and tankage.
- Read operating schedules or instructions or receive verbal orders to determine amounts to be pumped.
- Clean, lubricate, and repair pumps and vessels, using hand tools and equipment.
- Collect and deliver sample solutions for laboratory analysis.

## Industry Distribution

The cross industry employment in this occupation represents the current number of jobs held by individuals with this particular skill set. Pump operators, except wellhead pumpers, in other industries are a potential workforce that can be tapped by providing retraining or additional training in order for these workers to acquire the necessary industry specific skills. There are four industry subsectors employing this occupation in California:

- Oil & Gas Extraction (NAICS 211)
- Support Activities for Mining (NAICS 213)
- Petroleum & Coal Products Manufacturing (NAICS 324)
- Chemical Manufacturing (NAICS 325)

### Entry requirements:

- Less than HS
- No experience
- Moderate-term OTJ training

**Jobs in SJV**
**210**
**in 2013**

### Major Occupational Group:

- 53-0000 Transportation & Material Moving Occupations

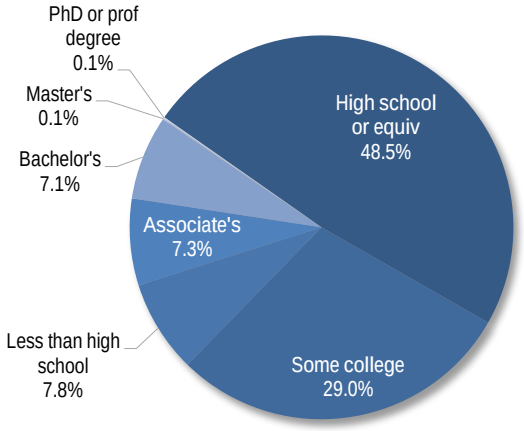
### Knowledge:

- Public Safety and Security
- Mechanical
- Production and Processing
- Computers and Electronics
- English Language

### Skills:

- Operation Monitoring
- Monitoring
- Critical Thinking
- Operation and Control
- Active Listening

### Distribution of Educational Attainment

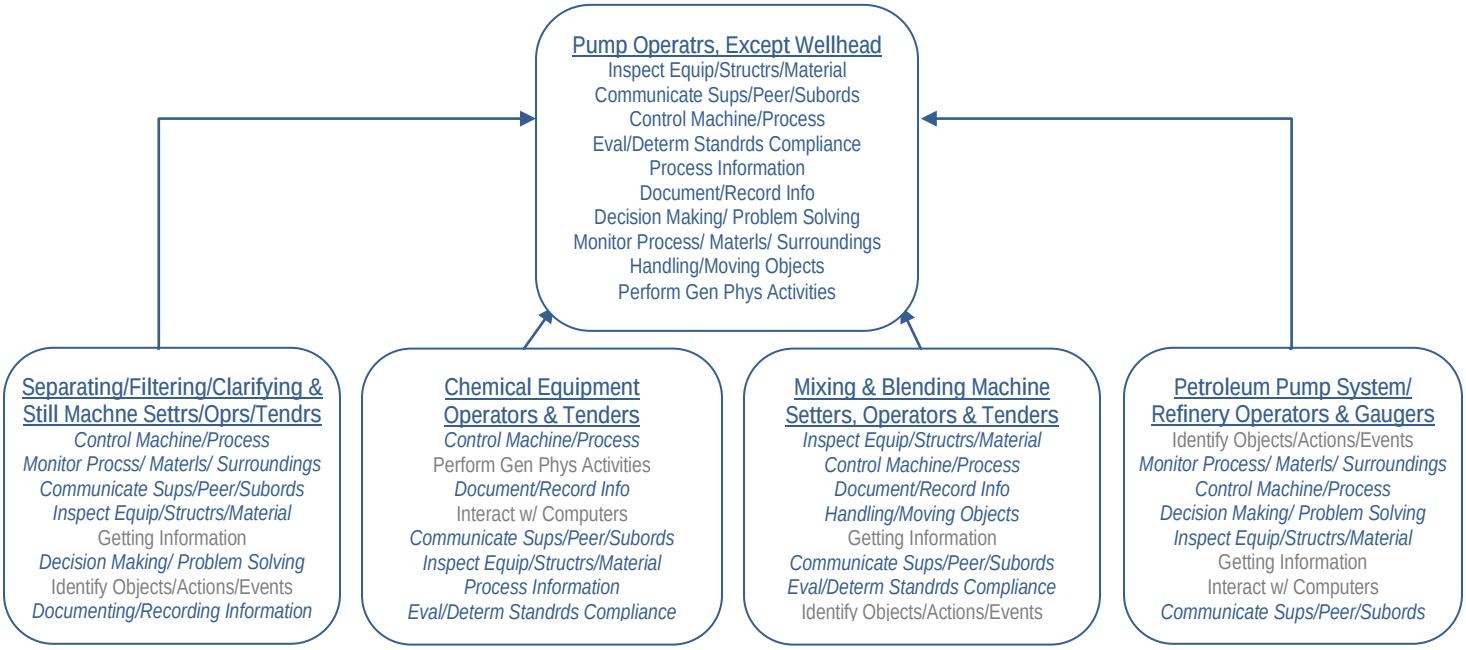



### Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 28,660 | $ 36,400 | $ 46,720 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 31,400 | $ 39,600 | $ 48,000 |

Source: BLS

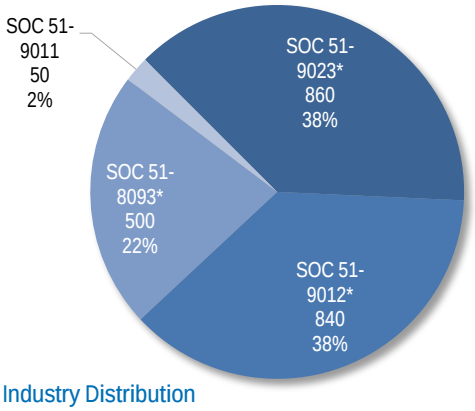
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include separating, filtering, clarifying, precipitating and still machine setters, operators and tenders (SOC 51-9012), chemical equipment operators and tenders (SOC 51-9011), mixing and blending machine setters, operators and tenders (SOC 51-9023) and petroleum pump system operators, refinery operators and gaugers (SOC 51-8093). Individuals with skills that are transferable to the oil and gas industry with retraining or additional training being offered hold these alternate occupations. The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

### Potential Trainable Workforce SJV



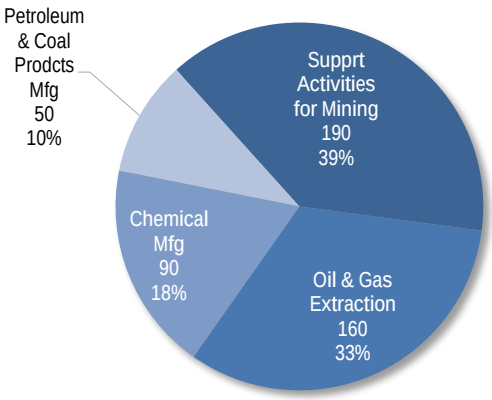

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 53-7072 | 51-9023 | 51-9012 | 51-8093 | 51-9011 |
|---|---|---|---|---|---|
| 115 | | | X | | |
| 211 | X | | | X | |
| 213 | X | | | X | |
| 311 | | X | X | | |
| 312 | | X | X | | |
| 324 | X | X | | X | |
| 325 | X | X | X | | X |
| 326 | | X | | | X |
| 327 | | X | | | |
| 424 | | X | X | | |
| 486 | | | | X | |
| 561 | | X | X | | X |
| 562 | | | X | | |

Sources: BLS; LAEDC

### Industry Distribution of 53-7072 in CA



# Wellhead Pumpers (SOC 53-7073)

*Operate power pumps and auxiliary equipment to produce flow of oil or gas from wells in oil field.*

## Core Tasks:

- Monitor control panels during pumping operations to ensure that materials are being pumped at the correct pressure, density, rate, and concentration.
- Operate engines and pumps to shut off wells according to production schedules, and to switch flow of oil into storage tanks.
- Perform routine maintenance on vehicles and equipment.
- Repair gas and oil meters and gauges.
- Unload and assemble pipes and pumping equipment, using hand tools.
- Attach pumps and hoses to wellheads.

## Industry Distribution

There is no cross industry employment for wellhead pumpers in California. All employment for this occupation takes place in the support activities for mining industry subsector.

- Support Activities for Mining (NAICS 213)

## Entry requirements:

- Less than HS
- Less than five years exp
- Moderate-term OTJ training

**Jobs in SJV**
**130**
**in 2013**

## Major Occupational Group:

- 53-0000 Transportation & Material Moving Occupations

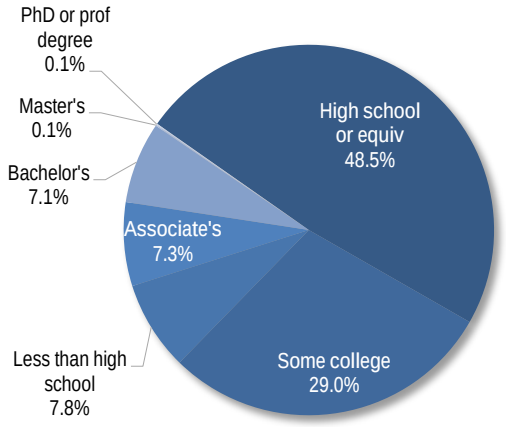
## Knowledge:

- Mechanical
- Mathematics
- Production and Processing
- Public Safety and Security

## Skills:

- Operation Monitoring
- Operation and Control
- Critical Thinking
- Monitoring
- Repairing
- Complex Problem Solving
- Equipment Maintenance

## Distribution of Educational Attainment

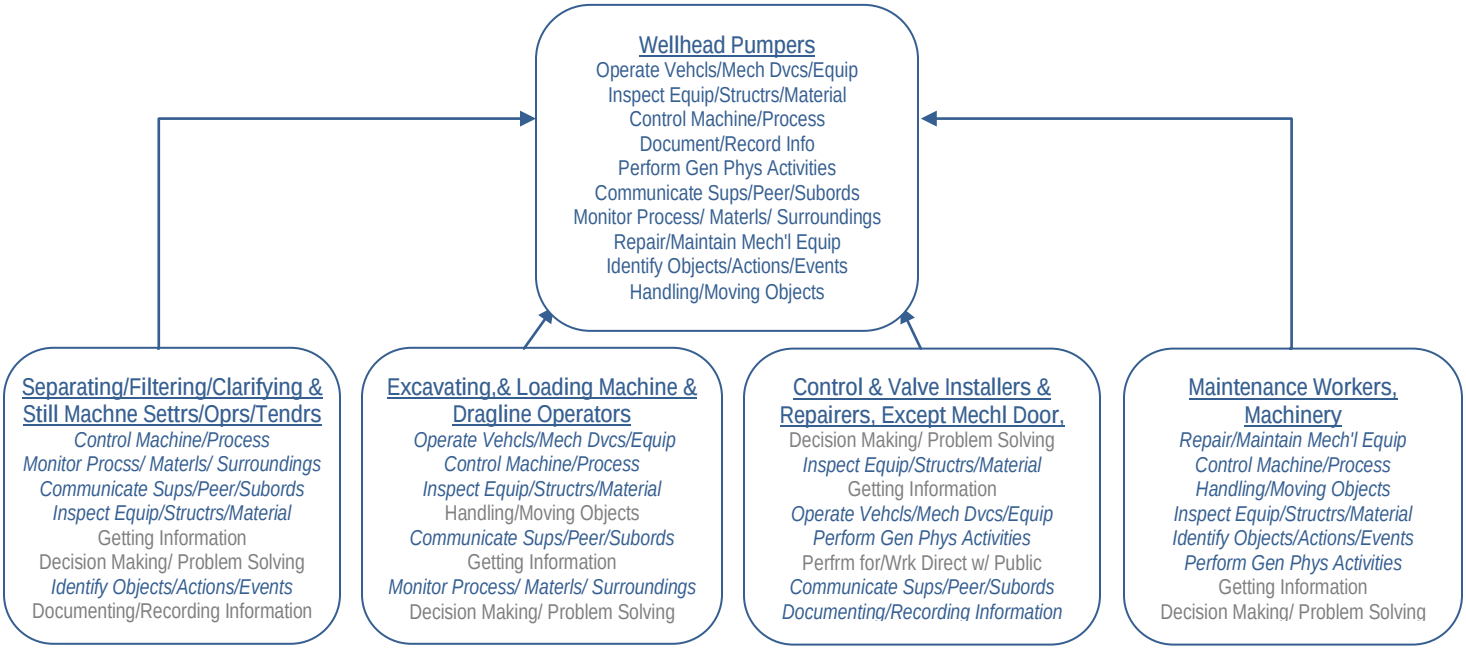



## Annual Wage Percentiles

| | 25 Percentile | Median | 75 Percentile |
|---|---|---|---|
| Fresno County | | | |
| Kern County | $ 36,620 | $ 46,170 | $ 53,970 |
| Kings County | | | |
| Madera County | | | |
| Merced County | | | |
| San Joaquin County | | | |
| Stanislaus County | | | |
| Tulare County | | | |
| California | $ 53,600 | $ 63,700 | $ 71,300 |

Source: BLS

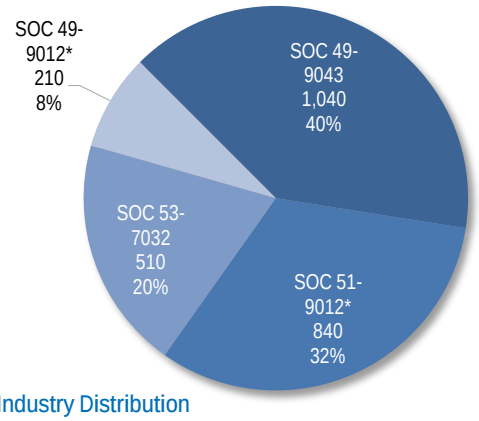
## Work Activities Match - Current Potential in the Local Workforce




## Related Occupations

Other related occupations with similar skill sets include separating, filtering, clarifying, precipitating and still machine setters, operators and tenders (SOC 51-9012), excavating and loading machine and dragline operators (SOC 53-7032), control and valve installers and repairers, except mechanical door (SOC 49-9012) and maintenance workers, machinery (SOC 49-9043). The chart displays the existing employment distribution for these selected occupations in the San Joaquin Valley.

Potential Trainable Workforce SJV



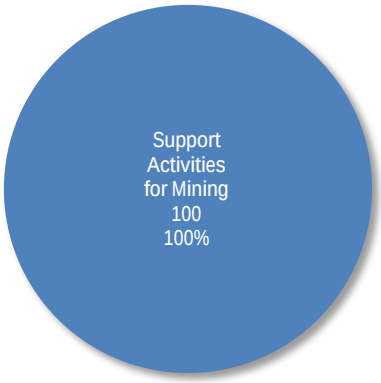

## Shared Skills Matrix

The matrix below identifies the industries that currently employ these related occupations in California.

| Industry | 53-7073 | 49-9043 | 51-9012 | 53-7032 | 49-9012 |
|---|---|---|---|---|---|
| 115 | | | X | | |
| 212 | | X | | X | |
| 213 | X | X | | | |
| 221 | | | | | X |
| 237 | | X | | X | X |
| 238 | | | | X | |
| 311 | | X | X | | |
| 312 | | X | X | | |
| 325 | | X | X | | |
| 326 | | X | | | |
| 423 | | X | | X | X |
| 424 | | | X | | X |
| 562 | | | X | X | |

Sources: BLS; LAEDC

Industry Distribution of 53-7073 in CA



# Appendix

## Additional Tables

Exhibit A-1
Current Union, Trade School and Post-Secondary Job Training Programs in the San Joaquin Valley

| County | Type of Institution | Institution | Programs Offered |
|---|---|---|---|
| Fresno | Union | Fresno-Madera-Tulare-Kings CLC | Classes offered for:<br>Construction, Industrial Operations Apprenticeships, Electrical and Instrumentation Technician, Industrial Maintenance Electrician, Industrial Pipefitter, Injection Molding Machine Setter, Machinist, Maintenance Mechanic, Metal Fabricator, Mold Maker, Pattern Maker, Tool and Die Maker |
| | Union | International Union Operating Engineers Stationary Local 39 | Stationary Engineers & Boiler Operators Apprenticeships & Training Centers |
| | Community College | Reedley College | Certificates offered for:<br>MIG Welder, TIG Welder, Innershield Welder, Stick Welder<br>Courses offered for:<br>Machinist, Machine Shop Supervisor, Job Shop Machinist, Maintenance Mechanic, CNC Operator, Manufacturer Assembler, CNC Programmer, General Welding Helper, CNC Set-up Person, Welder Fabricator, General Shop Helper, Aviation Maintenance Technology, and Automotive Technology |
| | Community College | Fresno City College | Courses offered for:<br>Automotive Technology, CAD, CAM, Construction, Electrical Systems Technology, Networking Computer Technician, and Welding |
| Fresno, Kings, Stanislaus, Tulare, Kern | Trade School | San Joaquin Valley College | Certificate and Associate's Degree offered in Industrial Technology |
| Kern | College | Bakersfield College | JSC offered for:<br>AudtoCAD, Blueprint Reading and Layout for Welders, Gas metal Arc/Gas Tungesten Arc Welding/Flux Core Arc Welding, and Shielded Metal Arc Welding: Automotive Technologies, Basic Machine Tool Operations - Lathe, Mill, Computer Numerical Control Programming<br>AS offered for:<br>Industrial Drawing, Industrial Technology, Welding, Automotive Technology, Biology, Chemistry, Electronics, Engineering, Physics, Manufacturing Technology<br>Certificate offered for:<br>Welding, Automotive Technology, Electronics, Manufacturing Technology |
| | College | Kaplan College - Bakersfield | Certificate of Completion in Oil Field Operator Course Includes Oil Field Equipment and Instrumentation, Oil Production Systems, Safety, Health, and Environmental Standards, Professional Development |
| | Community College | Cerro Coso | Certificate offered for:<br>Welding<br>AS offered for:<br>Engineering |
| | Community College | Porterville College | Certificates offered for:<br>Industrial Technology, Industrial Maintenance |
| Merced | Community College | Merced Community College | Certificate offered for:<br>Welding |
| Tulare | Trade School | College of the Sequoias - Tulare College Center | Courses offered for:<br>Welding |

Exhibit A-2
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Incremental Jobs | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 11-1011 | Chief Executives | 486 | 3 | >5 years | None | N/A |
| 11-1021 | General and Operations Managers | 6,099 | 4 | 1-5 years | None | $ 113,956 |
| 11-2021 | Marketing Managers | 136 | 3 | 1-5 years | None | 124,236 |
| 11-2022 | Sales Managers | 272 | 3 | 1-5 years | None | 109,024 |
| 11-2031 | Public Relations and Fundraising Managers | 19 | 3 | 1-5 years | None | 98,395 |
| 11-3011 | Administrative Services Managers | 622 | 7 | 1-5 years | None | 91,563 |
| 11-3021 | Computer and Information Systems Managers | 136 | 3 | >5 years | None | 133,082 |
| 11-3051 | Industrial Production Managers | 97 | 3 | 1-5 years | None | 93,595 |
| 11-3061 | Purchasing Managers | 78 | 3 | >5 years | None | 107,584 |
| 11-3071 | Transportation, Storage, and Distribution Managers | 97 | 7 | >5 years | None | 84,739 |
| 11-3121 | Human Resources Managers | 272 | 3 | 1-5 years | None | 111,163 |
| 11-3131 | Training and Development Managers | 58 | 3 | 1-5 years | None | 104,410 |
| 11-9021 | Construction Managers | 194 | 4 | >5 years | None | 103,141 |
| 11-9031 | Education Administrators, Preschool / Childcare | 117 | 3 | 1-5 years | None | 51,882 |
| 11-9032 | Education Administrators, Elementary and Secondary School | 58 | 2 | 1-5 years | None | 105,636 |
| 11-9033 | Education Administrators, Postsecondary | 427 | 3 | 1-5 years | None | 73,508 |
| 11-9041 | Architectural and Engineering Managers | 233 | 3 | >5 years | None | 141,356 |
| 11-9051 | Food Service Managers | 78 | 7 | 1-5 years | None | 47,011 |
| 11-9111 | Medical and Health Services Managers | 233 | 3 | None | None | 100,234 |
| 11-9121 | Natural Sciences Managers | 19 | 3 | >5 years | None | 133,118 |
| 11-9151 | Social and Community Service Managers | 97 | 3 | 1-5 years | None | 69,376 |
| 11-9199 | Managers, All Other | 1,282 | 7 | 1-5 years | None | 126,760 |
| 13-1022 | Wholesale and Retail Buyers, Except Farm Products | 97 | 7 | None | LT OJT | 50,174 |
| 13-1023 | Purchasing Agents (Not Wholesale / Retail / Farm Prods) | 175 | 7 | None | LT OJT | 60,511 |
| 13-1041 | Compliance Officers | 758 | 3 | None | MT OJT | 71,806 |
| 13-1078 | HR, Training, and Labor Relations Specialists, All Other | 758 | 3 | None | None | 69,732 |
| 13-1081 | Logisticians | 291 | 3 | 1-5 years | None | 78,249 |
| 13-1111 | Management Analysts | 758 | 3 | 1-5 years | None | 84,476 |
| 13-1121 | Meeting, Convention, and Event Planners | 253 | 3 | <1 year | None | 49,853 |
| 13-1141 | Compensation, Benefits, and Job Analysis Specialists | 388 | 3 | None | None | 58,934 |
| 13-1151 | Training and Development Specialists | 253 | 3 | None | None | 61,464 |
| 13-1161 | Market Research Analysts and Marketing Specialists | 1,204 | 3 | None | None | 58,174 |
| 13-1199 | Business Operations Specialists, All Other | 622 | 7 | <1 year | LT OJT | 65,220 |
| 13-2011 | Accountants and Auditors | 1,942 | 3 | None | None | 68,193 |
| 13-2031 | Budget Analysts | 39 | 3 | None | None | 76,782 |
| 13-2041 | Credit Analysts | 78 | 3 | None | None | 71,496 |
| 13-2051 | Financial Analysts | 136 | 3 | None | None | 86,197 |
| 13-2052 | Personal Financial Advisors | 408 | 3 | None | None | 58,137 |
| 13-2053 | Insurance Underwriters | 214 | 3 | None | MT OJT | 71,260 |
| 13-2071 | Credit Counselors | 116 | 3 | None | MT OJT | 45,416 |
| 13-2072 | Loan Officers | 253 | 7 | None | MT OJT | 71,294 |
| 13-2081 | Tax Examiners and Collectors, and Revenue Agents | 39 | 3 | None | MT OJT | N/A |
| 13-2082 | Tax Preparers | 214 | 7 | None | MT OJT | 33,479 |
| 13-2099 | Financial Specialists, All Other | 78 | 3 | None | MT OJT | 60,850 |
| 15-1121 | Computer Systems Analysts | 19 | 3 | None | None | 86,114 |
| 15-1132 | Software Developers, Applications | 544 | 3 | None | None | 94,358 |

Education: 1=Doctoral or professional degree; 2=Master's degree; 3=Bachelor's degree; 4=Associate's degree; 5=Postsecondary non-degree award; 6=Some college, no degree; 7=High school diploma or equivalent; 8=Less than high school; On-the-Job Training: I/R=Internship/Residency; APP=Apprenticeship; LT OJT=Long-term on-the-job training (more than one year); MT OJT=Moderate-term on-the-job training (1-12 months); ST OJT=Short-term on-the-job training (1 month or less)
Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 15-1133 | Software Developers, Systems Software | 855 | 3 | None | None | $ 108,273 |
| 15-1141 | Database Administrators | 58 | 3 | 1-5 years | None | 77,956 |
| 15-1142 | Network and Computer Systems Administrators | 136 | 3 | None | None | 76,433 |
| 15-1150 | Computer Support Specialists | 155 | 6 | None | MT OJT | 51,461 |
| 15-1179 | Information Security Analysts, Web Developers, and Computer | 932 | 3 | 1-5 years | None | 75,803 |
| 15-1799 | Computer Occupations, All Other | 466 | 3 | None | None | 77,806 |
| 15-2011 | Actuaries | 58 | 3 | None | LT OJT | 91,289 |
| 15-2031 | Operations Research Analysts | 78 | 3 | None | None | 81,974 |
| 15-2041 | Statisticians | 97 | 2 | None | None | 77,453 |
| 17-1012 | Landscape Architects | 78 | 3 | None | I/R | 69,845 |
| 17-1021 | Cartographers and Photogrammetrists | 78 | 3 | None | None | 78,249 |
| 17-1022 | Surveyors | 350 | 3 | None | None | 90,039 |
| 17-2011 | Aerospace Engineers | 194 | 3 | None | None | 117,348 |
| 17-2051 | Civil Engineers | 874 | 3 | None | None | 91,931 |
| 17-2071 | Electrical Engineers | 194 | 3 | None | None | 100,091 |
| 17-2111 | Health and Safety Engineers, Except Mining Safety Engineers | 19 | 3 | None | None | 93,334 |
| 17-2112 | Industrial Engineers | 194 | 3 | None | None | 92,369 |
| 17-2141 | Mechanical Engineers | 272 | 3 | None | None | 89,032 |
| 17-2171 | Petroleum Engineers | 660 | 3 | None | None | 96,034 |
| 17-3011 | Architectural and Civil Drafters | 117 | 4 | None | None | 49,869 |
| 17-3013 | Mechanical Drafters | 97 | 4 | None | None | 52,638 |
| 17-3021 | Aerospace Engineering and Operations Technicians | 117 | 4 | None | None | 66,036 |
| 17-3022 | Civil Engineering Technicians | 330 | 4 | None | None | 64,360 |
| 17-3023 | Electrical and Electronics Engineering Technicians | 117 | 4 | None | None | 62,997 |
| 17-3025 | Environmental Engineering Technicians | 19 | 4 | None | None | 58,584 |
| 17-3027 | Mechanical Engineering Technicians | 78 | 4 | None | None | 55,206 |
| 17-3029 | Engineering Technicians, Except Drafters, All Other | 505 | 4 | None | None | 62,294 |
| 19-1012 | Food Scientists and Technologists | 39 | 3 | None | None | 59,093 |
| 19-1029 | Biological Scientists, All Other | 369 | 1 | None | None | 77,630 |
| 19-2021 | Atmospheric and Space Scientists | 19 | 1 | None | None | 92,915 |
| 19-2031 | Chemists | 39 | 3 | None | None | 69,724 |
| 19-2041 | Environmental Scientists and Specialists, Including Health | 58 | 3 | None | None | 74,825 |
| 19-2042 | Geoscientists, Except Hydrologists and Geographers | 97 | 3 | None | None | 84,285 |
| 19-3039 | Psychologists, All Other | 19 | 2 | None | I/R | 104,754 |
| 19-3051 | Urban and Regional Planners | 58 | 2 | None | None | 77,053 |
| 19-4031 | Chemical Technicians | 58 | 4 | None | MT OJT | 43,179 |
| 19-4041 | Geological and Petroleum Technicians | 233 | 4 | None | MT OJT | 56,342 |
| 19-4091 | Environmental Science and Protection Technicians, Including | 272 | 4 | None | MT OJT | 52,550 |
| 19-4099 | Life, Physical, and Social Science Technicians, All Other | 194 | 4 | None | MT OJT | 45,355 |
| 21-1011 | Substance Abuse and Behavioral Disorder Counselors | 39 | 7 | None | MT OJT | 30,201 |
| 21-1013 | Marriage and Family Therapists | 97 | 2 | None | I/R | 48,951 |
| 21-1014 | Mental Health Counselors | 97 | 2 | None | I/R | 40,320 |
| 21-1019 | Counselors, All Other | 58 | 2 | None | None | 41,163 |
| 21-1023 | Mental Health and Substance Abuse Social Workers | 39 | 3 | None | None | 46,717 |
| 21-1029 | Social Workers, All Other | 39 | 3 | None | None | N/A |

Education: 1=Doctoral or professional degree; 2=Master's degree; 3=Bachelor's degree; 4=Associate's degree; 5=Postsecondary non-degree award; 6=Some college, no degree; 7=High school diploma or equivalent; 8=Less than high school; On-the-Job Training: I/R=Internship/Residency; APP=Apprenticeship; LT OJT=Long-term on-the-job training (more than one year); MT OJT=Moderate-term on-the-job training (1-12 months); ST OJT=Short-term on-the-job training (1 month or less)
Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 21-1091 | Health Educators | 39 | 3 | None | None | $ 43,796 |
| 21-1093 | Social and Human Service Assistants | 311 | 7 | None | ST OJT | 35,530 |
| 21-2021 | Directors, Religious Activities and Education | 58 | 3 | 1-5 years | None | 62,145 |
| 23-1011 | Lawyers | 330 | 1 | None | None | 156,963 |
| 23-2011 | Paralegals and Legal Assistants | 311 | 4 | None | None | 57,755 |
| 23-2093 | Title Examiners, Abstractors, and Searchers | 253 | 7 | None | ST OJT | 43,716 |
| 25-1022 | Mathematical Science Teachers, Postsecondary | 39 | 1 | None | None | 100,535 |
| 25-1032 | Engineering Teachers, Postsecondary | 350 | 1 | None | None | 111,303 |
| 25-1051 | Atmospheric, Earth, Marine, and Space Sciences Teachers, | 117 | 1 | None | None | 111,585 |
| 25-1063 | Economics Teachers, Postsecondary | 19 | 1 | None | None | 96,610 |
| 25-1081 | Education Teachers, Postsecondary | 39 | 1 | None | None | 70,437 |
| 25-1111 | Criminal Justice and Law Enforcement Teachers, | 19 | 1 | None | None | 89,058 |
| 25-1199 | Postsecondary Teachers, All Other | 233 | 2 | None | None | 67,017 |
| 25-2012 | Kindergarten Teachers, Except Special Education | 505 | 3 | None | I/R | 66,455 |
| 25-2031 | Secondary School Teachers, Except Special and | 1,865 | 3 | None | I/R | 64,087 |
| 25-2032 | Career/Technical Education Teachers, Secondary School | 19 | 3 | 1-5 years | I/R | 70,403 |
| 25-2052 | Special Education Teachers, Secondary School | 175 | 3 | None | I/R | 64,962 |
| 25-3021 | Self-Enrichment Education Teachers | 330 | 7 | 1-5 years | None | 49,573 |
| 25-3999 | Teachers and Instructors, All Other | 971 | 3 | None | None | 46,083 |
| 25-9031 | Instructional Coordinators | 78 | 2 | >5 years | None | 61,665 |
| 25-9041 | Teacher Assistants | 1,010 | 7 | None | ST OJT | 29,398 |
| 27-1011 | Art Directors | 58 | 3 | 1-5 years | None | 105,802 |
| 27-1024 | Graphic Designers | 214 | 3 | None | None | 56,078 |
| 27-2022 | Coaches and Scouts | 175 | 7 | None | LT OJT | 40,473 |
| 27-3012 | Public Address System and Other Announcers | 78 | 7 | None | ST OJT | 21,675 |
| 27-3042 | Technical Writers | 117 | 3 | 1-5 years | ST OJT | 78,710 |
| 27-3043 | Writers and Authors | 155 | 3 | None | LT OJT | 75,014 |
| 27-3091 | Interpreters and Translators | 272 | 3 | None | LT OJT | 58,016 |
| 27-4011 | Audio and Video Equipment Technicians | 39 | 5 | None | MT OJT | 47,298 |
| 29-1011 | Chiropractors | 19 | 1 | None | None | 72,821 |
| 29-1021 | Dentists, General | 58 | 1 | None | I/R | 120,922 |
| 29-1051 | Pharmacists | 39 | 1 | None | None | 129,577 |
| 29-1062 | Family and General Practitioners | 427 | 1 | None | I/R | 164,003 |
| 29-1066 | Psychiatrists | 155 | 1 | None | I/R | N/A |
| 29-1067 | Surgeons | 155 | 1 | None | I/R | N/A |
| 29-1071 | Physician Assistants | 39 | 2 | None | None | 97,666 |
| 29-1111 | Registered Nurses | 2,933 | 4 | None | None | 85,178 |
| 29-1122 | Occupational Therapists | 427 | 2 | None | None | 87,868 |
| 29-1123 | Physical Therapists | 253 | 1 | None | None | 87,316 |
| 29-1124 | Radiation Therapists | 19 | 4 | None | None | 89,085 |
| 29-1126 | Respiratory Therapists | 272 | 4 | None | None | 67,606 |
| 29-1127 | Speech-Language Pathologists | 272 | 2 | None | None | 86,209 |
| 29-1131 | Veterinarians | 78 | 1 | None | None | 88,170 |
| 29-1199 | Health Diagnosing and Treating Practitioners, All Other | 39 | 2 | None | None | 54,076 |

Education: 1=Doctoral or professional degree; 2=Master's degree; 3=Bachelor's degree; 4=Associate's degree; 5=Postsecondary non-degree award; 6=Some college, no degree; 7=High school diploma or equivalent; 8=Less than high school; On-the-Job Training: I/R=Internship/Residency; APP=Apprenticeship; LT OJT=Long-term on-the-job training (more than one year); MT OJT=Moderate-term on-the-job training (1-12 months); ST OJT=Short-term on-the-job training (1 month or less)
Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 29-2011 | Medical and Clinical Laboratory Technologists | 214 | 3 | None | None | $ 79,046 |
| 29-2021 | Dental Hygienists | 19 | 4 | None | None | 100,378 |
| 29-2032 | Cardiovascular Technologists and Technicians | 97 | 4 | None | None | 54,940 |
| 29-2033 | Radiologic Technologists and Technicians | 175 | 4 | None | None | 64,603 |
| 29-2041 | Emergency Medical Technicians and Paramedics | 408 | 5 | None | None | 27,477 |
| 29-2051 | Dietetic Technicians | 39 | 7 | None | MT OJT | 31,463 |
| 29-2052 | Pharmacy Technicians | 369 | 7 | None | MT OJT | 37,115 |
| 29-2054 | Respiratory Therapy Technicians | 19 | 4 | None | MT OJT | 46,181 |
| 29-2055 | Surgical Technologists | 214 | 5 | None | None | 46,658 |
| 29-2056 | Veterinary Technologists and Technicians | 97 | 4 | None | None | 35,146 |
| 29-2061 | Licensed Practical and Licensed Vocational Nurses | 602 | 5 | None | None | 50,213 |
| 29-2071 | Medical Records and Health Information Technicians | 253 | 5 | None | None | 35,860 |
| 29-2099 | Health Technologists and Technicians, All Other | 58 | 5 | None | ST OJT | 37,368 |
| 29-9011 | Occupational Health and Safety Specialists | 486 | 3 | None | MT OJT | 74,268 |
| 29-9012 | Occupational Health and Safety Technicians | 194 | 7 | None | MT OJT | 43,594 |
| 29-9091 | Athletic Trainers | 58 | 3 | None | None | 52,456 |
| 31-1012 | Nursing Aides, Orderlies, and Attendants | 1,573 | 5 | None | None | 26,078 |
| 31-1013 | Psychiatric Aides | 78 | 7 | None | ST OJT | 25,464 |
| 31-2011 | Occupational Therapy Assistants | 58 | 4 | None | None | 64,758 |
| 31-2021 | Physical Therapist Assistants | 97 | 4 | None | None | 57,548 |
| 31-2022 | Physical Therapist Aides | 58 | 7 | None | MT OJT | 26,426 |
| 31-9011 | Massage Therapists | 175 | 5 | None | None | 33,630 |
| 31-9091 | Dental Assistants | 194 | 5 | None | None | 32,631 |
| 31-9099 | Healthcare Support Workers, All Other | 1,457 | 7 | None | ST OJT | 35,247 |
| 33-1011 | First-Line Supervisors of Correctional Officers | 291 | 7 | 1-5 years | MT OJT | N/A |
| 33-1012 | First-Line Supervisors of Police and Detectives | 58 | 7 | 1-5 years | MT OJT | N/A |
| 33-1021 | First-Line Supervisors of Fire Fighting and Prevention Workers | 39 | 5 | 1-5 years | None | N/A |
| 33-1099 | First-Line Supervisors of Protective Service Workers, All Other | 136 | 7 | 1-5 years | None | 42,519 |
| 33-3011 | Bailiffs | 78 | 5 | None | LT OJT | N/A |
| 33-3012 | Correctional Officers and Jailers | 486 | 7 | None | MT OJT | N/A |
| 33-3031 | Fish and Game Wardens | 19 | 7 | None | ST OJT | 39,294 |
| 33-3051 | Police and Sheriff's Patrol Officers | 97 | 7 | None | MT OJT | N/A |
| 33-9032 | Security Guards | 1,146 | 7 | None | ST OJT | 24,286 |
| 33-9092 | Lifeguards, Ski Patrol, Other Recreational Protective Services | 272 | 7 | None | ST OJT | 28,753 |
| 33-9099 | Protective Service Workers, All Other | 311 | 7 | None | ST OJT | 38,583 |
| 35-1011 | Chefs and Head Cooks | 97 | 7 | 1-5 years | None | 38,618 |
| 35-1012 | First-Line Supervisors of Food Preparation and Serving Workers | 1,127 | 7 | 1-5 years | None | 27,326 |
| 35-2011 | Cooks, Fast Food | 58 | 8 | None | ST OJT | 18,684 |
| 35-2012 | Cooks, Institution and Cafeteria | 369 | 8 | None | ST OJT | 27,206 |
| 35-2014 | Cooks, Restaurant | 699 | 8 | <1 year | MT OJT | 22,428 |
| 35-2021 | Food Preparation Workers | 1,399 | 8 | None | ST OJT | 19,148 |
| 35-3011 | Bartenders | 641 | 8 | None | ST OJT | 19,222 |
| 35-3022 | Counter Attendants, Cafeteria, Food Concession, and Coffee | 253 | 8 | None | ST OJT | 19,217 |
| 35-3031 | Waiters and Waitresses | 1,301 | 8 | None | ST OJT | 18,868 |
| 35-3041 | Food Servers, Nonrestaurant | 1,146 | 8 | None | ST OJT | 22,908 |

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Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 35-9011 | Dining Room and Cafeteria Attendants and Bartender Helpers | 602 | 8 | None | ST OJT | $ 18,753 |
| 35-9021 | Dishwashers | 1,049 | 8 | None | ST OJT | 18,891 |
| 35-9031 | Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop | 58 | 8 | None | None | 19,251 |
| 35-9099 | Food Preparation and Serving Related Workers, All Other | 97 | 8 | None | ST OJT | 18,646 |
| 37-1011 | First-Line Supervisors of Housekeeping and Janitorial Workers | 738 | 7 | 1-5 years | None | 38,123 |
| 37-1012 | First-Line Supervisors of Landscaping, Lawn Service, and | 19 | 7 | 1-5 years | None | 51,920 |
| 37-2011 | Janitors and Cleaners, Except Maids / Housekeeping Cleaners | 117 | 8 | None | ST OJT | 22,747 |
| 37-2012 | Maids and Housekeeping Cleaners | 2,273 | 8 | None | ST OJT | 21,507 |
| 37-3012 | Pesticide Handlers, Sprayers, and Applicators, Vegetation | 291 | 7 | None | MT OJT | 42,933 |
| 37-3019 | Grounds Maintenance Workers, All Other | 19 | 7 | None | ST OJT | 28,571 |
| 39-1011 | Gaming Supervisors | 116 | 7 | 1-5 years | None | 39,149 |
| 39-1021 | First-Line Supervisors of Personal Service Workers | 97 | 7 | 1-5 years | None | 42,570 |
| 39-2021 | Nonfarm Animal Caretakers | 272 | 8 | None | ST OJT | 21,252 |
| 39-3012 | Gaming and Sports Book Writers and Runners | 10 | 7 | None | ST OJT | 39,135 |
| 39-3019 | Gaming Service Workers, All Other | 97 | 7 | None | MT OJT | 20,677 |
| 39-3091 | Amusement and Recreation Attendants | 291 | 8 | None | ST OJT | 20,789 |
| 39-5092 | Manicurists and Pedicurists | 78 | 5 | None | None | 18,893 |
| 39-5094 | Skincare Specialists | 78 | 5 | None | None | 28,943 |
| 39-6011 | Baggage Porters and Bellhops | 388 | 7 | None | ST OJT | 21,042 |
| 39-7011 | Tour Guides and Escorts | 117 | 7 | None | MT OJT | 20,337 |
| 39-9011 | Childcare Workers | 544 | 7 | None | ST OJT | 24,194 |
| 39-9021 | Personal Care Aides | 1,845 | 8 | None | ST OJT | 21,261 |
| 39-9041 | Residential Advisors | 136 | 6 | <1 year | ST OJT | 31,194 |
| 39-9099 | Personal Care and Service Workers, All Other | 39 | 7 | None | ST OJT | 22,909 |
| 41-1011 | First-Line Supervisors of Retail Sales Workers | 2,214 | 7 | 1-5 years | None | 41,071 |
| 41-1012 | First-Line Supervisors of Non-Retail Sales Workers | 447 | 7 | >5 years | None | 66,994 |
| 41-2011 | Cashiers | 4,079 | 8 | None | ST OJT | 20,017 |
| 41-2031 | Retail Salespersons | 2,739 | 8 | None | ST OJT | 21,849 |
| 41-3011 | Advertising Sales Agents | 117 | 7 | None | MT OJT | 52,892 |
| 41-3031 | Securities, Commodities, and Financial Services Sales Agents | 136 | 3 | None | MT OJT | 85,939 |
| 41-3099 | Sales Representatives, Services, All Other | 1,049 | 7 | None | ST OJT | 56,454 |
| 41-4011 | Sales Reps, Wholesale / Manufacturing, Technical / Scientific | 330 | 3 | None | MT OJT | 74,270 |
| 41-4012 | Sales Reps, Wholesale / Manufg, Except Tech / Scien Prods | 1,068 | 7 | None | MT OJT | 55,429 |
| 41-9021 | Real Estate Brokers | 58 | 7 | 1-5 years | None | 92,302 |
| 41-9022 | Real Estate Sales Agents | 913 | 7 | None | LT OJT | 34,481 |
| 41-9099 | Sales and Related Workers, All Other | 78 | 7 | None | MT OJT | 36,378 |
| 43-1011 | First-Line Supervisors of Office and Administrative Support | 311 | 7 | 1-5 years | None | 56,230 |
| 43-3021 | Billing and Posting Clerks | 369 | 7 | None | ST OJT | 35,095 |
| 43-3031 | Bookkeeping, Accounting, and Auditing Clerks | 3,671 | 7 | None | MT OJT | 38,918 |
| 43-3051 | Payroll and Timekeeping Clerks | 78 | 7 | None | MT OJT | 43,787 |
| 43-3099 | Tellers | 136 | 7 | None | ST OJT | 26,033 |
| 43-4031 | Court, Municipal, and License Clerks | 136 | 7 | None | MT OJT | N/A |
| 43-4051 | Customer Service Representatives | 505 | 7 | None | ST OJT | 35,296 |
| 43-4061 | Eligibility Interviewers, Government Programs | 175 | 4 | None | MT OJT | N/A |

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Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 43-4081 | Hotel, Motel, and Resort Desk Clerks | 466 | 7 | None | ST OJT | $ 22,388 |
| 43-4141 | New Accounts Clerks | 19 | 7 | None | ST OJT | 32,558 |
| 43-4161 | Human Resources Assistants, Except Payroll and Timekeeping | 291 | 7 | None | ST OJT | 42,899 |
| 43-4171 | Receptionists and Information Clerks | 272 | 7 | None | ST OJT | 27,400 |
| 43-5032 | Dispatchers, Except Police, Fire, and Ambulance | 855 | 7 | None | MT OJT | 36,392 |
| 43-5041 | Meter Readers, Utilities | 39 | 7 | None | ST OJT | 39,441 |
| 43-5051 | Postal Service Clerks | 253 | 7 | None | ST OJT | 53,834 |
| 43-5061 | Production, Planning, and Expediting Clerks | 816 | 7 | None | MT OJT | 47,683 |
| 43-5081 | Stock Clerks and Order Fillers | 738 | 8 | None | ST OJT | 22,677 |
| 43-5111 | Weighers, Measurers, Checkers, and Samplers, Recordkeeping | 117 | 7 | None | ST OJT | 24,071 |
| 43-6014 | Secretaries / Administrative Assistants, Except Legal/Med/Exec | 3,438 | 7 | None | ST OJT | 36,040 |
| 43-9041 | Insurance Claims and Policy Processing Clerks | 311 | 7 | None | MT OJT | 35,065 |
| 43-9051 | Mail Clerks and Mail Machine Operators, Except Postal Service | 39 | 7 | None | ST OJT | 28,069 |
| 43-9071 | Office Machine Operators, Except Computer | 58 | 7 | None | ST OJT | 25,789 |
| 43-9081 | Proofreaders and Copy Markers | 19 | 3 | None | MT OJT | 45,244 |
| 45-1011 | First-Line Supervisors of Farming, Fishing, Forestry Workers | 78 | 7 | 1-5 years | None | 47,692 |
| 45-2011 | Agricultural Inspectors | 233 | 3 | None | MT OJT | N/A |
| 45-2091 | Agricultural Equipment Operators | 524 | 7 | 1-5 years | ST OJT | N/A |
| 45-2092 | Farmworkers and Laborers, Crop, Nursery, and Greenhouse | 155 | 8 | None | ST OJT | 19,156 |
| 45-4011 | Forest and Conservation Workers | 117 | 7 | None | MT OJT | 16,900 |
| 47-1011 | First-Line Supervisors of Construction / Extraction Workers | 5,303 | 7 | >5 years | None | 72,615 |
| 47-2011 | Boilermakers | 97 | 7 | None | APP | 86,379 |
| 47-2031 | Carpenters | 1,010 | 7 | None | APP | 52,267 |
| 47-2042 | Floor Layers, Except Carpet, Wood, and Hard Tiles | 14 | 7 | None | MT OJT | 49,046 |
| 47-2044 | Tile and Marble Setters | 19 | 8 | None | LT OJT | 41,979 |
| 47-2051 | Cement Masons and Concrete Finishers | 1,496 | 8 | None | MT OJT | 46,838 |
| 47-2061 | Construction Laborers | 6,138 | 8 | None | ST OJT | 37,396 |
| 47-2071 | Paving, Surfacing, and Tamping Equipment Operators | 505 | 7 | None | MT OJT | 60,595 |
| 47-2073 | Operating Engineers / Other Construction Equipment Operators | 3,030 | 7 | None | MT OJT | 78,266 |
| 47-2082 | Tapers | 19 | 8 | None | MT OJT | 45,410 |
| 47-2111 | Electricians | 3,244 | 7 | None | APP | 62,283 |
| 47-2121 | Glaziers | 427 | 7 | None | APP | 54,780 |
| 47-2132 | Insulation Workers, Mechanical | 660 | 8 | None | ST OJT | N/A |
| 47-2141 | Painters, Construction and Maintenance | 97 | 8 | None | MT OJT | 36,240 |
| 47-2151 | Pipelayers | 194 | 7 | None | ST OJT | 45,998 |
| 47-2152 | Plumbers, Pipefitters, and Steamfitters | 1,573 | 7 | None | APP | 55,746 |
| 47-2161 | Plasterers and Stucco Masons | 10 | 8 | None | LT OJT | 43,450 |
| 47-2171 | Reinforcing Iron and Rebar Workers | 19 | 7 | None | APP | 43,560 |
| 47-2181 | Roofers | 272 | 8 | None | ST OJT | N/A |
| 47-2211 | Sheet Metal Workers | 563 | 7 | None | APP | 46,442 |
| 47-2221 | Structural Iron and Steel Workers | 388 | 7 | None | APP | 53,846 |
| 47-3013 | Helpers--Electricians | 19 | 7 | None | ST OJT | 30,886 |
| 47-3014 | Helpers--Painters, Paperhangers, Plasterers, Stucco Masons | 10 | 8 | None | ST OJT | 23,385 |
| 47-3019 | Helpers—Construction Trades | 19 | 8 | None | ST OJT | 27,371 |
| 47-4011 | Construction and Building Inspectors | 175 | 7 | >5 years | MT OJT | 82,197 |
| 47-4031 | Fence Erectors | 97 | 7 | None | MT OJT | 35,741 |

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Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs Education | Entry Level Needs Work Exp | On-the-Job Training to Attain Competency | Median Annual Wage | |
|---|---|---|---|---|---|---|---|
| 47-4041 | Hazardous Materials Removal Workers | 19 | 7 | None | MT OJT | $ 38,867 | |
| 47-4051 | Highway Maintenance Workers | 991 | 7 | None | MT OJT | 60,347 | |
| 47-4061 | Rail-Track Laying and Maintenance Equipment Operators | 39 | 7 | None | MT OJT | N/A | |
| 47-4099 | Construction and Related Workers, All Other | 253 | 7 | None | MT OJT | 40,444 | |
| 47-5011 | Derrick Operators, Oil and Gas | 2,681 | 8 | None | ST OJT | 67,226 | |
| 47/5012 | Rotary Drill Operators, Oil and Gas | 2,583 | 8 | None | ST OJT | N/A | |
| 47-5013 | Service Unit Operators, Oil, Gas, and Mining | 6,876 | 8 | None | MT OJT | 62,404 | |
| 47-5021 | Earth Drillers, Except Oil and Gas | 39 | | None | ST OJT | 45,072 | None |
| 47-5071 | Roustabouts, Oil and Gas | 7,206 | 8 | None | MT OJT | N/A | |
| 47-5081 | Helpers – Extraction Workers | 855 | 8 | None | None | N/A | |
| 47-5099 | Extraction Workers, All Other | 991 | 8 | None | None | N/A | |
| 49-1011 | First-Line Supervisors of Mechanics, Installers, and Repairers | 1,282 | 7 | 1-5 years | None | 69,999 | |
| 49-2011 | Computer, Automated Teller, and Office Machine Repairers | 58 | 5 | None | None | 41,127 | |
| 49-2092 | Electric Motor, Power Tool, and Related Repairers | 97 | 5 | None | LT OJT | 40,066 | |
| 49-2093 | Electrical / Electronics Installers / Repairers, Transportation Eq | 155 | 5 | None | LT OJT | 68,340 | |
| 49-2094 | Electrical / Electronics Repairers, Commercial, Industrial Equipt | 505 | 5 | None | LT OJT | 55,667 | |
| 49-2097 | Electronic Home Entertainment Equipment Installers / Repairers | 155 | 5 | None | None | 30,803 | |
| 49-3021 | Automotive Body and Related Repairers | 291 | 7 | None | MT OJT | 38,806 | |
| 49-3023 | Automotive Service Technicians and Mechanics | 1,068 | 7 | None | LT OJT | 36,989 | |
| 49-3031 | Bus and Truck Mechanics and Diesel Engine Specialists | 2,001 | 7 | None | LT OJT | 51,730 | |
| 49-3042 | Mobile Heavy Equipment Mechanics, Except Engines | 1,204 | 7 | None | LT OJT | 60,630 | |
| 49-3053 | Outdoor Power Equipment and Other Small Engine Mechanics | 330 | 7 | None | MT OJT | 36,638 | |
| 49-3093 | Tire Repairers and Changers | 311 | 7 | None | MT OJT | 29,686 | |
| 49-9012 | Control / Valve Installers / Repairers, Except Mechanical Door | 252 | 7 | None | MT OJT | 67,109 | |
| 49-9041 | Industrial Machinery Mechanics | 1,437 | 7 | None | LT OJT | 55,982 | |
| 49-9043 | Maintenance Workers, Machinery | 1,068 | 7 | None | MT OJT | 36,752 | |
| 49-9044 | Millwrights | 311 | 7 | None | LT OJT | 47,758 | |
| 49-9051 | Electrical Power-Line Installers and Repairers | 194 | 7 | None | LT OJT | 86,428 | |
| 49-9062 | Medical Equipment Repairers | 58 | 4 | None | MT OJT | 51,974 | |
| 49-9069 | Precision Instrument and Equipment Repairers, All Other | 97 | 4 | None | LT OJT | 67,051 | |
| 49-9071 | Maintenance and Repair Workers, General | 699 | 7 | None | MT OJT | 38,369 | |
| 49-9097 | Signal and Track Switch Repairers | 78 | 5 | None | MT OJT | N/A | |
| 49-9098 | Helpers--Installation, Maintenance, and Repair Workers | 311 | 7 | None | MT OJT | 25,307 | |
| 49-9099 | Installation, Maintenance, and Repair Workers, All Other | 39 | 7 | None | MT OJT | 34,690 | |
| 51-1011 | First-Line Supervisors of Production and Operating Workers | 563 | 5 | 1-5 years | None | 51,218 | |
| 51-2022 | Electrical and Electronic Equipment Assemblers | 350 | 7 | None | ST OJT | 27,392 | |
| 51-2099 | Assemblers and Fabricators, All Other | 1,107 | 7 | None | MT OJT | 25,925 | |
| 51-4011 | Computer-Controlled Machine Tool Operators, Metal and Plastic | 175 | 7 | None | MT OJT | 33,773 | |
| 51-4041 | Machinists | 777 | 7 | None | LT OJT | 36,099 | |
| 51-4111 | Tool and Die Makers | 97 | 7 | None | LT OJT | 47,854 | |
| 51-4121 | Welders, Cutters, Solderers, and Brazers | 1,845 | 7 | <1 year | MT OJT | 34,959 | |
| 51-4122 | Welding, Soldering, / Brazing Machine Setters, Operators, | 58 | 7 | None | MT OJT | 35,408 | |
| 51-4193 | Plating / Coating Machine Setters, Operators, Tenders, Metal | 39 | 7 | None | MT OJT | 29,232 | |
| 51-5112 | Printing Press Operators | 622 | 7 | None | MT OJT | 34,118 | |
| 51-6011 | Laundry and Dry-Cleaning Workers | 583 | 8 | None | ST OJT | 20,309 | |
| 51-6031 | Sewing Machine Operators | 58 | 8 | None | ST OJT | 19,274 | |

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Sources: Estimates by LAEDC; Education and skills requirements from BLS

Exhibit A-2 (cont'd)
Projected Incremental Workforce Needs 2030 by Occupation
San Joaquin Valley

| SOC Code | Occupational Title | Total Openings | Entry Level Needs | | On-the-Job Training to Attain Competency | Median Annual Wage |
|---|---|---|---|---|---|---|
| | | | Education | Work Exp | | |
| 51-7041 | Sawing Machine Setters, Operators, and Tenders, Wood | 39 | 7 | None | ST OJT | $ 23,253 |
| 51-8021 | Stationary Engineers and Boiler Operators | 58 | 7 | None | LT OJT | 62,298 |
| 51-8031 | Water and Wastewater Treatment Plant and System Operators | 369 | 7 | None | LT OJT | 74,433 |
| 51-8093 | Petroleum Pump System Operators, Refinery Operators, | 194 | 7 | None | LT OJT | 74,884 |
| 51-8099 | Plant and System Operators, All Other | 39 | 7 | None | LT OJT | 60,728 |
| 51-9023 | Mixing and Blending Machine Setters, Operators, and Tenders | 233 | 7 | None | MT OJT | 30,846 |
| 51-9061 | Inspectors, Testers, Sorters, Samplers, and Weighers | 78 | 7 | None | MT OJT | 34,469 |
| 51-9081 | Dental Laboratory Technicians | 78 | 7 | None | MT OJT | 37,886 |
| 51-9111 | Packaging and Filling Machine Operators and Tenders | 1,185 | 7 | None | MT OJT | 22,422 |
| 51-9123 | Painting, Coating, and Decorating Workers | 39 | 7 | None | MT OJT | 23,283 |
| 51-9192 | Cleaning, Washing, Metal Pickling Equipment Operators and | 117 | 8 | None | MT OJT | 22,390 |
| 51-9199 | Production Workers, All Other | 175 | 7 | None | MT OJT | 30,887 |
| 53-1021 | First-Line Supervisors of Helpers, Laborers, and Material | 680 | 7 | 1-5 years | None | 45,457 |
| 53-1031 | First-Line Supervisors of Transportation / Material-Moving | 816 | 7 | 1-5 years | None | 58,739 |
| 53-2012 | Commercial Pilots | 58 | 5 | None | None | 81,809 |
| 53-2021 | Air Traffic Controllers | 97 | 4 | None | LT OJT | N/A |
| 53-2022 | Airfield Operations Specialists | 19 | 7 | None | LT OJT | 55,259 |
| 53-3011 | Ambulance Drivers / Attendants, Except Emergency Medical | 272 | 7 | None | MT OJT | 28,957 |
| 53-3032 | Heavy and Tractor-Trailer Truck Drivers | 16,647 | 7 | 1-5 years | ST OJT | 41,482 |
| 53-3033 | Light Truck or Delivery Services Drivers | 1,515 | 7 | None | ST OJT | 29,793 |
| 53-3041 | Taxi Drivers and Chauffeurs | 777 | 8 | None | ST OJT | 22,159 |
| 53-3099 | Motor Vehicle Operators, All Other | 19 | 7 | None | ST OJT | 25,241 |
| 53-6099 | Transportation Workers, All Other | 252 | 7 | None | ST OJT | N/A |
| 53-7021 | Crane and Tower Operators | 447 | 8 | None | ST OJT | 32,424 |
| 53-7032 | Excavating and Loading Machine and Dragline Operators | 524 | 8 | 1-5 years | MT OJT | 47,954 |
| 53-7051 | Industrial Truck and Tractor Operators | 583 | 8 | <1 year | ST OJT | 35,449 |
| 53-7061 | Cleaners of Vehicles and Equipment | 932 | 8 | None | ST OJT | 19,515 |
| 53-7062 | Laborers and Freight, Stock, and Material Movers, Hand | 2,020 | 8 | None | ST OJT | 23,147 |
| 53-7063 | Machine Feeders and Offbearers | 58 | 8 | None | ST OJT | 23,412 |
| 53-7072 | Pump Operators, Except Wellhead Pumps | 952 | 7 | None | MT OJT | N/A |
| 53-7073 | Wellhead Pumpers | 816 | 7 | None | MT OJT | N/A |
| 53-7121 | Tank Car, Truck and Ship Loaders | 155 | 8 | None | ST OJT | 24,142 |

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Sources: Estimates by LAEDC; Education and skills requirements from BLS

# Study Authors

***Christine Cooper, Ph.D.***
*Vice President, Economic and Policy Analysis*

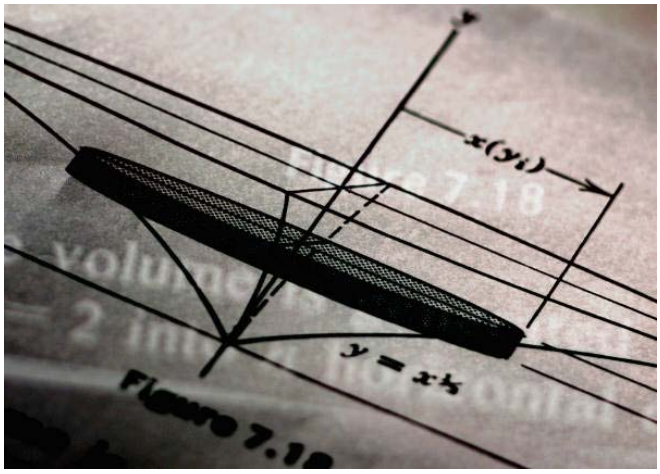
Dr. Cooper leads the Economic and Policy Analysis Group whose work involves research in regional issues such as economic impact studies, regional industry analysis and forecasts, workforce development analysis, and issue studies related to the *L.A. County Strategic Plan for Economic Development.* Her fields of expertise include development economics, environmental economics, regional analysis and urban sustainability.

Prior to joining the LAEDC, Dr. Cooper was a co-founder of a start-up company in Hong Kong concentrating on equity transactions software and computer accessories manufacturing, which expanded production into the special economic zone of Shenzhen, China and distributed products throughout the United States and Asia. With her business partner, she also established the first authorized Apple Computer retailer in China. She has been a lecturer at California State University, Long Beach and at the Pepperdine Graziadio School of Business and Management.

Dr. Cooper is a citizen of the United States and Canada. She earned a Bachelor of Arts in Economics from Carleton University in Ottawa, Canada, and a Ph.D. in Economics from the University of Southern California. With funding from the National Science Foundation, she earned a Graduate Certificate in Environmental Sciences, Policy and Engineering. Her current research includes industry cluster determination and performance in the regional economy, commuting and job allocation patterns, and workforce development issues.

***Shannon M. Sedgwick***
*Associate Economist*

In her current capacity as an Associate Economist at the LAEDC, Ms. Sedgwick develops subject-specific information and data interpretation for economic impact, demographic, transportation, industry and issue studies. She performs research, data collection and organization, analysis and report preparation. Her work focuses on demographics, industry clusters and workforce development in the form of occupational analysis. Ms. Sedgwick is also proficient at conducting geospatial analysis and has experience working with IMPLAN.




Ms. Sedgwick joined the LAEDC team in June of 2008 as an Economic Research Assistant for the Kyser Center for Economic Research. In that role she assisted both Economic Research and the Consulting Practice of the LAEDC with data collection and research, managing multiple data sets covering the State of California, Southern California, its counties and their sub-regions. In addition to writing sections of LAEDC's Economic Forecasts, she was responsible for the *Business Scan* containing a collection of Los Angeles County economic indicators; the annual *L.A. Stats*, containing the most frequently requested statistics for Los Angeles and its surrounding counties; and was a regular contributor to the weekly economic newsletter, *e-Edge.*

Before joining the LAEDC, Ms. Sedgwick managed an industrial and steel supply company located in the Inland Empire. There she identified and targeted a diverse customer base, and analyzed product and customer patterns in the local industrial market to successfully increase revenues.

A Southern California native, Ms. Sedgwick received her Bachelor of Arts in Economics from the University of Southern California (USC) with a minor in Architecture. She has been a member of the national and the Los Angeles Chapter of the National Association for Business Economics (NABE) since 2008.

***Somjita Mitra, Ph.D.***
*Economist*

Somjita Mitra joined the Economic and Policy Analysis Group as an Economist in June 2013. She is involved in planning, designing and conducting research and

analysis for consulting clients and local businesses and governments, as well as for LAEDC's internal departments. Her focus is in regional analysis, economic impact studies and the industrial and occupational structure of local economies.

Before joining the LAEDC, Dr. Mitra was an Economist for a local economic research and litigation consulting company evaluating economic damages, estimating lost profits, identifying key economic issues and developing necessary analytical and empirical frameworks. Prior to this, Dr. Mitra was a Project Director for a consumer research firm in Los Angeles where she managed projects that identified and analyzed key market issues for small, local firms as well as multinational corporations.

Dr. Mitra received her Bachelor of Arts in Economics and Political Science from the University of California, Los Angeles and her Master of Arts in Politics, Economics and Business as well as her Ph.D. in Economics from Claremont Graduate University. Dr. Mitra enjoys volunteering in the local community and is actively involved in both women's welfare and animal rescue organizations.

***Wesley DeWitt***
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Wesley DeWitt joined the LAEDC as a research intern in October 2012, returning as a research assistant in April 2014. His current research interests are in geographic information sciences (GIS) and workforce development.

Mr. DeWitt received his Bachelor of Arts in Economics and Environmental Science and Policy from California State University, Long Beach, and is currently pursuing a Master of Science in GIS. ❖


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